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THE ASSESSMENT OF THE RICE FIELD SUSTAINABILITY IN JAVA BASE ON REGIONAL SPATIAL USE PLANNING (RSUP)

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Abstract

The sustainability of the rice field in Java as the main rice producer land in Indonesia is induced by the rice field conversion into settlement and industrial areas due to increase of population. These conversions cause decreasing of both quantity and quality of the land. As mentioned in the Government Act Number 26/2007 concerning the Spatial Use Planning (SUP), the goal of SUP is to protect spatial use function of the land and to prevent negative impacts to the environment as a result of unproper land management. The objective of this study is to assess the consistency of governmental policies in implementing the Act Number 26/2007 to achieve the rice field sustainability on the basis of agro-ecological concept. By using the GIS modelbase, the rice field agro-ecological zones which are proposed as the standard rice field areas for the benchmark of the sustainable rice field agriculture management system are synthesized from the spatial database of land system, land cover, agro-climate, irrigation condition, social and economic data from the administration boundary layers. The results of this study show that the governmental policies from non-agricultural sector in allocating the area status of the settlement areas as presented at the provincial regional spatial planning map (RTRW map) have not been fully consistent with the regulations as stated in Act Number 26/2007 for protecting a productive rice field function as the national rice producer. The potential loss of the rice production which is caused by the implementation of the rice field conversion into settlement areas and is allocated to the productive rice field agro-ecological zones is predicted 3.5 million tons per year.

Keywords: rice field agro-ecological zone, spatial use management, GIS modelbase, land conversion

Introduction

Background

In conjunction with the increase of population, the rice fields in Java as the main rice producer land in Indonesia tend to decrease periodically. Due to increase of population, the rice field is converted into settlement and industrial area, resulting in the biophysical, social, and economical problems. FAO (1996) stated that the pressure on land due to the increase of population causes the decrease of both the land quantity and quality. As stated by Isa (2006), the agricultural land conversion into non-agriculture is the majpr factor faced by agricultural sector. The assessment that was conducted by Tambunan (2008) shows that the current rice field conversion in Java has reached 59.7 % for settlements and 21.8% for industrial areas, and central business districts. Ironically, the rice field conversion occurs at the central areas of the rice producer which are commonly close to the main road and high ways. Sumaryanto *et al.* (2001) reported that the rice field conversion results in the decrease of the national food security and farmer income, the increase of poor people, the degradation of local community rice farming culture, and the uselessness of investments.

The problems of the rice field sustainability in Java induced by the land conversion as the consequences of the increase of population have made policy makers both from executive and legislative power give a serious attention. The serious concern of these policy makers to the sustainable national development has been indicated by the existence of Act Number 5/1960 concerning the Agrarian Basic Regulation which regulates the land ownerships. In 1992, cooperating with the

legislative power, the government produced the Act Number 24/1992 which regulates the spatial use management. This Act Number 24/1992 was then revised into the Act Number 26/2007. Since 2008, the government has also made the draft of the specific act which protects the productive land, namely The Protection of Sustainable Agricultural Land for Crops (RUU-PLPPB).

The existence of those various regulations, however, has not given the guarantee of the protection of the rice field sustainability in Java from the threat of the land conversion. The trend of the rice field conversion into settlements and industrial areas even increases. Currently, the efforts to prevent the rice field sustainability from the threat of the land conversion have not been optimal. It seems that the Department of Agriculture is the only one sector that has to be responsible in protecting the rice field sustainability. This assessment is based on the existence of high way construction planning along the northern coastal areas (Kompas, November 17, 2008). The development of this high way construction plan will potentially convert the productive rice fields in the districts of Purwakarta, Subang, Indramayu, Cirebon, Brebes, Tegal, Pemalang, Pekalongan, Batang, Kendal, Semarang, Boyolali, Sragen, Karanganyar, Ngawai, Nganjuk, and Mojokerto. This high way construction plan indicates that the non-agricultural sectors are not serious in maintaining the rice field sustainability. Isa (2006) stated that there is a strong indication to convert the rice fields through the mechanism of the provincial or district regional spatial planning.

To support the goal of RUU-PLPPB in maintaining the national food security, the rice fields in Java should be mapped by considering their potential production and carrying capacity. Nurwadjed *et al.* (2009) reported that the rice field carrying capacity was spatially measured on the basis of the rice field agro-ecological zones. In their study, the rice field agro-ecological zone is defined as the rice field area which has the similarity to land qualities and potential rice production. According to the experts (Gliesmann, 200; Altieri, 1989, 2002; Dalgaard et al., 2003), the primary aim of the agro ecology study is to achieve the sustainable agriculture. Because of its characteristic in reflecting the rice field carrying capacity and potential production, the rice field agro-ecological zone map is useful for a benchmark in establishing the rice field standard and a tool in coordinating among sectors as well as monitoring the implementation of the provincial regional spatial use planning which supports the achievement of the national food security.

Objective

The objective of this study is to assess the consistency of governmental policies in implementing the Act Number 26/2007 to achieve the rice field sustainability on the basis of the agro-ecological concept. The results are expected to be used as inputs for spatial land use planning in establishing the sustainable rice fields in Java.

Methodology

This study uses the Geographic Information System (GIS) modelbase for zoning the rice field agro ecology as conducted by Nurwadjed *et al.* (2009). In this model, the rice field agro-ecological zone is defined as an available land which has the similarity to land qualities and potential rice production. The rice field agro-ecological zones (RFAEZs) are synthesized from the spatial database of land system, land cover, agro-climate, irrigation condition, social and economic data from the administration boundary layers. The spatial thematic database was developed by the GIS software of ArcGis version 9.2.

In this GIS modelbase, the analysis of the land suitability for wetland rice (*Oriza Sativa, L*) uses the method that is developed by FAO (1976) and CSR/FAO Staff (1983). The land suitability is classified into 4 classes, namely S_1 (highly suitable), S_2 (moderately suitable), S_3 (marginally suitable), and N (not suitable). Each class land suitability was then classified based on the water availability shown by the Oldeman agroclimate and irrigation condition. The results of the land suitability classification were then overlaid with the area status compiled from RTRW and forest status. The criteria for delineating the rice field agro-ecological zones are presented in Table 1.

Table 1. The Criteria of Rice Field Agro-ecological Zoning

No.	Agro-ecological Zone	Land Suitability	Irrigation Condition	Area Status	Cropping Intensity (Per Year)
1.	A (S_1/ IP 300)	S_1	Good	Cultivated Land	3xPS
2.	B (S_1/IP 200)	S_1	Moderate	Cultivated Land	2xPS, 1xPL
3.	C (S_1/IP 100)	S_1	Scarce/Bad	Cultivated Land	1xPS, 2xPL
4.	D (S_2 /IP 300)	S_2	Good	Cultivated Land	3xPS
5.	E (S_2 /IP200)	S_2	Moderate	Cultivated Land	2xPS, 1xPL
6.	F (S_2 /IP 100)	S_2	Scarce/Bad	Cultivated Land	1xPS, 2xPL
7.	G (S_3/IP 300)	S_3	Good	Cultivated Land	3xPS,
8.	H (S_3/IP200)	S_3	Moderate	Cultivated Land	2xPS, 1xPL
9.	I (S_3/IP100)	S_3	Scarce/Bad	Cultivated Land	1xPS, 2xPL
10.	J (N/IP100)	N	Rainfed	Non Cultivated Land	Not used

Notes : Cultivated land: an established area which has a primary function for cultivation by regarding potential natural resource, human resource, and anthropogenic resource (Act No 26/2007), PS=wetland rice, PL=arable crops, Good irrigation: water debit > 10 l/sec/km^2,, Moderate irrigation: water debit 2.5-10 l/sec/km^2, Bad irrigation: water debit < 2.5 l/sec/km^2, The cropping intensity is aasigned to the paddy variety of Ciherang or IR64 which has the growing period of 100-125 days.

Results and Discussion

Rice Field Agro-ecological Zone Distribution

Based on the GIS modelbase developed by Nurwadjed et al. (2009), the rice field area of 3,569,828 ha in Java interpreted from the Landsat ETM imageries of May 2005 can be grouped into 8 RFAEZs. Except zone J (N/IP100), the areas of 7 RFAEZs are 3,147,393 ha (88%), which are mostly distributed in the fluvial and volcanic land form origin to have the fertile soils formed by the volcanic parent materials. Zone J (N/IP100) with the area of 422,436 (12%) is distributed at the unsuitable lands for wetland rice due to the topographic, agro climatic, and/or soil nutrient availability factors. Based on the BPS data (2003-2008) from the selected samples at the sub-district areas and the field surveys, the average total rice production per year at the 7 RFAEZs is 24,068,821 tons/year. By considering their distribution at the suitable land and cultivated areas, the 7 RFAEZs which have the areas of 3,147,393 ha with the total rice production of 24,068,821 tons/year are useful for the benchmark in establishing the sustainable standard rice fields. The establishment of the 7 RFAEZs for the sustainable standard rice fields meets with the Governmental Regulation Number 26/2008 concerning the National Regional Spatial Planning (RTRWN) of chapter 66, point which regulates the criteria of allocating the cultivated areas for agriculture should consider the land suitability.

Spatial Use Pattern at RSUP

The implementation of spatial use management, according to Rustiadi *et al.* (2008), is conducted through 3 steps, namely 1) spatial use planning, 2) implementation of spatial use, and 3) monitoring of spatial use. The regional spatial use planning (RTRW) is the production of general spatial use planning in a region (national, province, and district/city). Based on the provincial RTRW mapped by Department of Public Works (2003), the spatial use patterns at the provinces as the rice producers in Java (Banten, West Java, Central Java, D.I Yogyakarta, and East Java), as illustrated in Figure 3a, consist of the cultivated areas

(11,019,142 ha, 83 %), protected areas (1,089,978 ha, 8 %), and settlement areas (1,098,841 ha, 9 %). According to the Governmental Regulation Number 26/2008 concerning the National Regional Spatial Use Planning (RTRWN) Chapter 64, cultivated areas are allocated for production forest (chapter 64), agriculture (chapter 66), fishery (chapter 67), mining (chapter 68), industry (chapter 69), tourism (chapter 70), and settlement (chapter 71). This study shows that the spatial use patterns are dominated by the cultivated areas (83 %), while the protected and settlement areas are almost equal. Both of them are less than 10 %. Assuming that the areas of DKI Jakarta are allocated for cultivated and settlement areas, the protected areas in Java (1,089,978 ha) only accomplish the minimum standard as stated in RTRW Chapter 54.

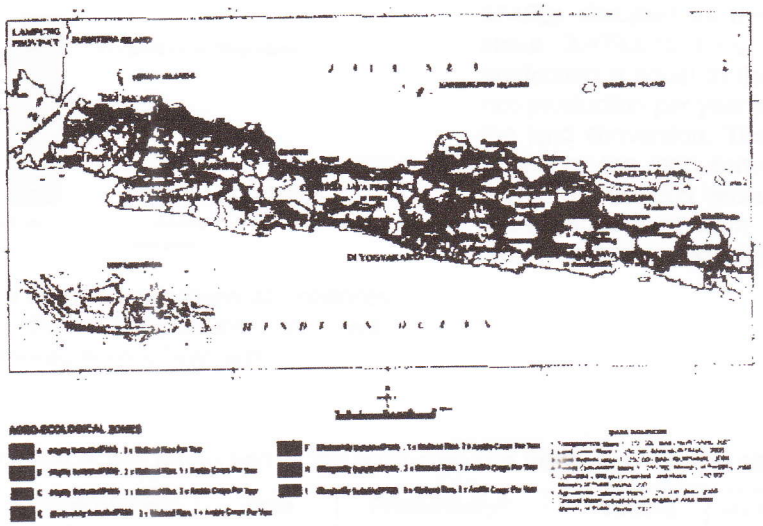

Figure 1. Map of Rice field agro-ecological zone of Java (Nurwadjed *et al.*, 2009)

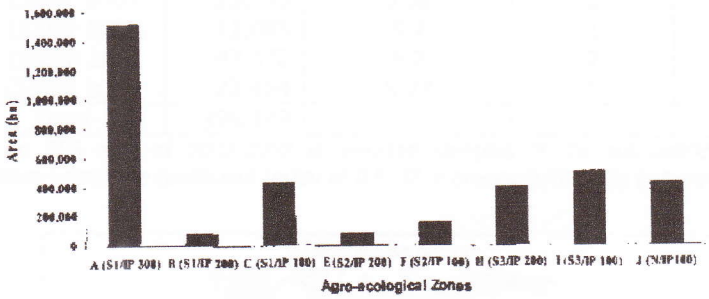

Figure 2. Rice field agro-ecological zone distribution (Nurwadjed, et al. 2009)

Threat of RSUP to Sustainable Rice Fields

The rice field agro-ecological zones presented in this study are the physical aspect of spatial use management. According to Rustiadi *et al.* (2008), the physical aspect of the spatial use management has important functions in relation to the 3 things, namely 1) the efficiency and productivity, 2) the goal of the proportional and balance distribution of resource, and 3) the prevention of sustainability. Therefore, the results of the rice field agro-ecological zones in this study are useful for the benchmark of the sustainable agricultural management system. The important role of the rice field agro-ecological zones, however, is facing the threat of the land conversion into settlement areas as indicated in provincial RTRW map.

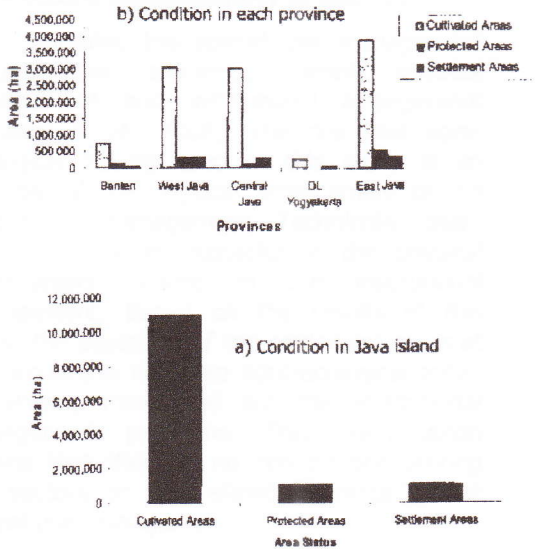

Figure 3. The spatial use pattern at provinces of the rice producer in Java, compiled from RTRW (a,b)

The study also shows that at the provincial RTRW map, the 398,349 ha (12,7 %) of the 7 RFAEZs which distribute at the productive lands are allocated at the settlement areas. This finding strengthens the statement of Isa (2006), who states that there is an indication of a systematic way to convert irrigated rice fields into settlement areas through the mechanism of RTRW. As shown in Table 2, the potential rice production of the 7 RFAEZs allocated as the settlement areas is about 3,479,675 tons per year. This rice production is equal to the potential loss of the rice production per year that will be induced by the land conversion. The potential loss which is due to the land conversion will be higher than the prediction because the rice fields are multi-functions in term of soil conservation, social, economy, and cultures.

Table 2. Prediction of rice production at the productive rice fields alloca as the settlement areas

No.	Agro-ecological Zones	Area (ha)	Productivity* (ton/ha)	Cropping Intensity	Rice Production** (ton/year)
1.	A (S1/IP 300)	250,041	6.2	3	2,790,454
2.	B (S1/IP 200)	2,322	6.12	2	17,054
3.	C (S1/IP 100)	50,680	5.75	1	174,844
4.	E (S2/IP 200)	13,295	5.58	2	89,026
5.	F (S2/IP 100)	11,085	5.7	1	37,910
6.	H (S3/IP 200)	47,472	5.2	2	296,224
7.	I (S3/IP 100)	23,454	5.27	1	74,162
	Total	398,349	-	-	3,479,675

Notes: * Based on BPS data of 2003-2008 at selected samples of the sub-district areas and field survey calculation using the coefficient factor of 0.6, IP = cropping intensity (x harvesting/ year)

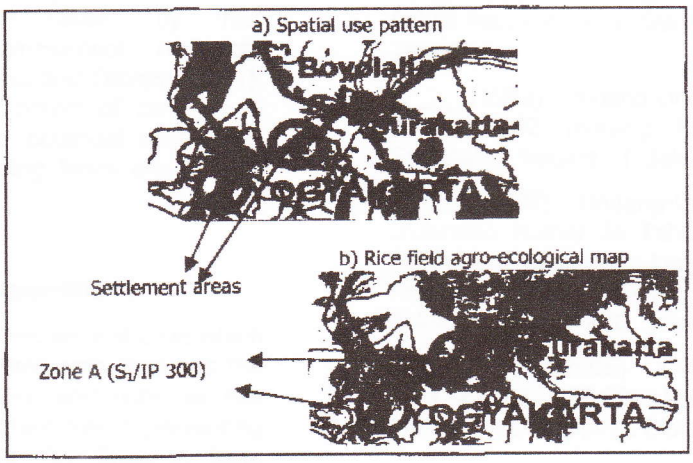

Figure 4. An example of the rice field agro-ecological zones converted into settlement areas

The Challenges of the Rice Field Agriculture Sustainability in the Future

Basically, the spatial use management includes two elements, namely physical arrangement and institutional arrangement (Rustiadi et al., 2008). The rice field agro-ecological zoning used in this study is an example of the physical arrangement of the spatial use management. Technically, there are no significant obstacles in the physical arrangement, unlike in the institutional arrangement. Based on the results of this study, the allocation of the settlement areas at the productive rice field agro-ecological zones as already mentioned are the institutional arrangement problems. This phenomenon implies that there is no coordination among the sectors or the related agencies in the spatial use management.

The problem of the spatial use management of the rice fields which is due to the coordination among sectors is caused by the failure of managing the relation among stakeholders and the allocation of the land resource. In this case, the government fails to arrange the value system how the stakeholders allocate the land resource as stated in RTRWN. This institutional arrangement problem is a main challenge of the rice field sustainability in Java in the future. It is predicted that the failure of managing this challenge will cause the degradation of the land resource and environment. Torras and Boyce (1998) and Katharine (2007) *in* Rustiadi et al. (2008) stated that the degradation of land resource and environment is the institutional arrangement problem, rather than the physical and economic problems. The impacts of the environment and land degradation on land resources are mainly caused by their characteristics as commo-pool resources (CPRs). According to Hess and Ostrom (2001), CPRs are subject to problem pf congestion, overuse, pollution, and potential destruction unless harvesting or using limits are devised and enforced.

Conclusions and Suggestions

The rice field agro-ecological zone which is defined as the rice field area that has the similarity to land qualities and potential rice production has an important role in preventing the sustainability of the rice fields in Java. Because of its capability in classifying the land qualities and potential rice production, the rice field agro-ecological zones map is proposed as the inputs in establishing the rice field standard.

The sustainability of the rice fields in Java still faces the problem of the institutional arrangement. The government policies in preventing the rice field sustainability is not yet consistent with the regulations as stated in RTRWN. In establishing the settlement areas of the spatial use management, the related agencies from non-agricultural sectors have not considered the strategic values of the productive rice fields as presented in the rice field agro-ecological zones in this study. To protect the productive rice fields which are allocated as the settlement areas, the existing provincial RTRW should be revised. Because of their multifunction characteristics, it is predicted that the failure of the effort in protecting these productive agro-ecological zones could cause the negative multidimensional impacts.

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