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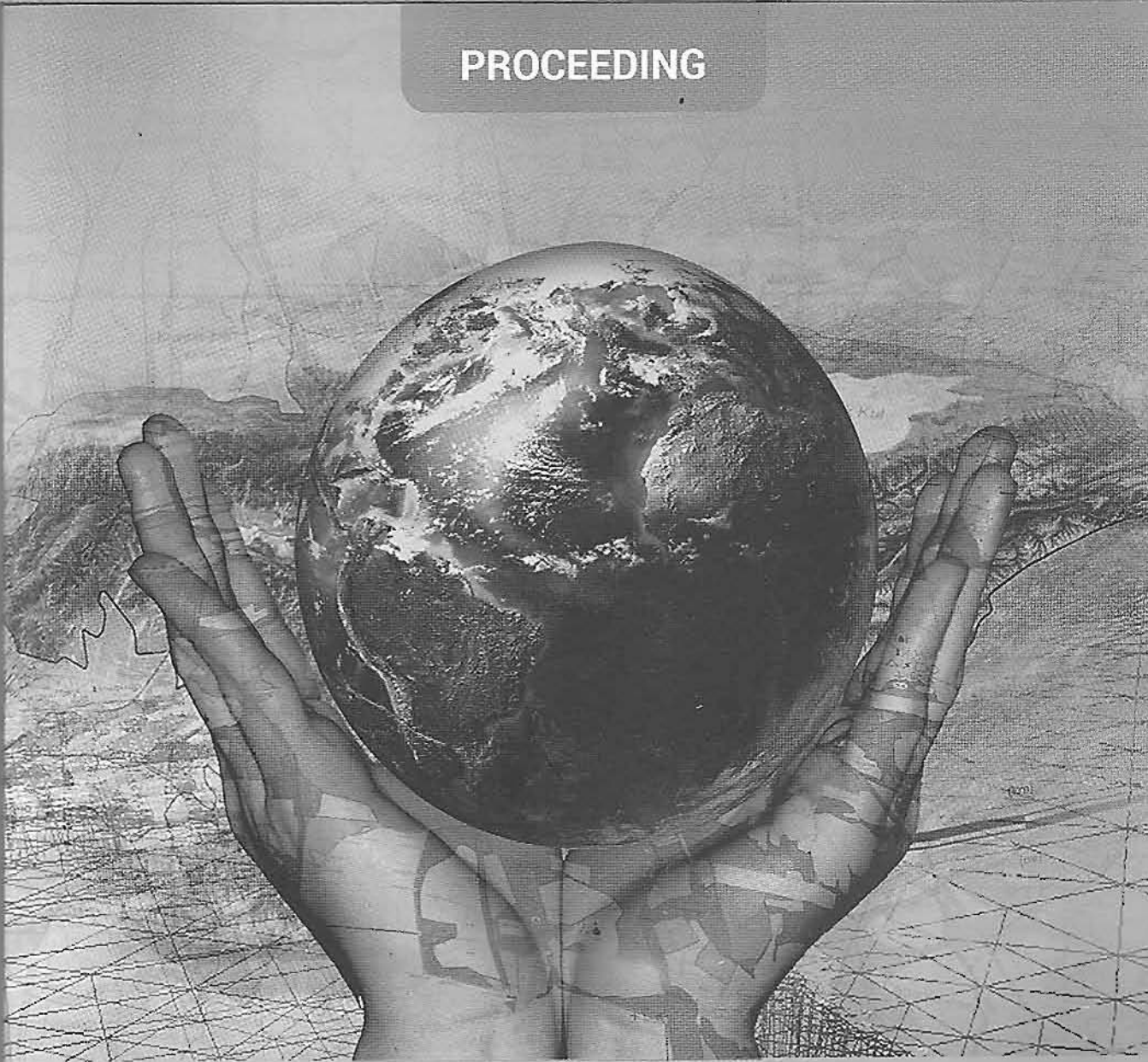

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Sustainable Rice Field to Assure Food Security in Garut Regency, West Java

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ABSTRACT

Government of Garut Regency has been preparing to allocate some spaces for food security integrated within spatial planning as it is a mandate of the National Law No 41, 2009. There are several criteria to delineate food-production areas, including biophysical, socio and economic factors. However, detailed variables and criteria need further exploration and exercises. This research aims to find out appropriate factors and criteria to match local requirements, hence contributing to food security on either local or larger community areas. To achieve the goals, this research employed high resolution imageries such as ALOS AVNIR-2 and Quickbird imageries, coupled with infrastructure, land system, administrative maps, and socio-economic datasets. Field data were obtained through several site surveys which were utilized to validate image interpretation and observe detailed socio-economic aspects of farmers. Several methods were implemented such as remotely sensed baseline rice mapping, spatial analysis using GIS tools and statistical analysis. The result showed that appropriate variables used to assess sustainable local food-production areas were different in some districts (*kecamatan*). Not all generic variables such as land suitability could be implemented to identify paddy-production on all districts. Different variables were more influential than physical aspects. These included capacity of food supply for local demand and establishment of environmental friendly land management. In terms of food security status, the research indicated that majority of districts secured their local food requirements and few of them had excess rice production. At Garut Regency level, the aggregated data showed that Garut had some surplus in paddy production. This information combined with demographic, paddy production and other data implied that several zones of rice fields required some protections either in cultivated or in protected area in the spatial planning. In addition, environmental virtue has to be included within agricultural zoning for better land protection in food security campaign.

Keyword: Local food security, spatial analysis, unique land management, paddy balance, land zonation,

Introduction

The Government of Garut Regency prepares to allocate land for food security in current revision of spatial plan as it is a mandatory to obey the National Law No 41/ 2009. To support this task, it is necessary to mark out areas to ensure sustainable food development. There are some constraints to delineate rice field in Garut, including limited physically-suitable and legally-acceptable areas for paddy cultivation and disaster prone due to volcanic eruption, tsunami, landslide, and sloping land. The actual paddy fields inventory has not been systematically developed yet. Therefore, baseline map of paddy production area was known inaccurately. There are several criteria to define the sustainable rice field area, including biophysical, socio and economic factors. Some researches considered all of these conceptual criteria to demarcate sustainable food production area, for instance Christina (2011) who delineated food region in West Java and Bachry (2011) who marked out land for sagoo in Papua. These explorations have utilized remote sensing and GIS and have contributed significantly supporting spatial plan (Barus, 2011; Barus *et al.*, 2011). Since the law has quite pristine and has limited directives, apparently its implementation is uncertain. Methods and executions should be explored to direct and put the regulation into operation properly. Detail factors and criteria are supposed to be explored.

Many scholars such as Brown et al. (2009), Gamage et al. (2009), and Boken et al. (2009) reported various methods to map irrigated land where it was usually cultivated by paddy. Indeed, time series aspect was seemed to be the focus of those researches, since it was carried out on a global map project. Therefore, most of them employed coarse to medium spatial resolution of imageries for the purpose. Since Indonesian farmer is in average occupied small scale of land, high spatial resolution of image should be employed.

The general purpose of this research is to find out several appropriate factors and criteria to match local requirements, hence contributing to secure food sufficiency for local and larger communities. The specific purposes were (1) to develop actual paddy field map and its characteristics, (2) to analyze food security status of district, (3) to delineate sustainable paddy-production area regarding Act No 41, 2009, and (4) to develop contribution of paddy field on regional spatial plan (RTRW).

Method

There were two types of data employed in this research, i.e. primary and secondary data. Some primary data comprised of paddy field map (2011), paddy production and socio-economic aspect of farming system, while the secondary data consisted of ALOS image (2009), Quickbird (2010), infrastructure/irrigation map, land system (1990, scale 1:250,000), draft of Spatial Plan of Garut Regency 2011-2025, administrative maps, and some socio-economic aspects of farmers (2010). The research was conducted on May – July 2011, in Studio of Regional Information of Crespent, IPB and field observation on June, 2011.

There are three methods implemented, including image interpretation to generate paddy field map through visual interpretation of high resolution imageries and the ground check; GIS analysis of several thematic maps such as land system, paddy field map, irrigation map, spatial planning map, and others; and statistical analysis. The image interpretation was performed by using visual keys of interpretation such as tone or color, texture, structure, association, shape, etc (Jensen, 2000). Quickbird imagery was utilized as primary source on image interpretation to delineate paddy field, while ALOS data was used to complete and fill up some areas with severe cloud covered. The result of interpretation was used as paddy field baseline (*sawah baku*). Geographical analysis was carried out to develop land capability map which was used as basic consideration to evaluate physical aspects of paddy field. It was then super imposed with thematic maps of irrigation, road and regional spatial plan (RTRW). The stage was important to match recent paddy field distribution and future allocation of paddy-production area on RTRW. Moreover, database resulted from the previous stage was then employed to calculate land required to fulfill food demand. The food demand was estimated for 25 years in the future from average of 10 years population growth (1971-2009) and paddy consumption according to minimum and maximum of national and also local standard. Some current (2008) paddy productivity of each sub-districts and cropping intensity (*indeks pertanaman*) were considered to calculate paddy balancing system.

Result And Disscussion

Actual paddy field and characteristics

Garut is one of potential regencies on West Java for food production. It is because of its physical characteristics coupling with strategic position due to proximity to Bandung, the capital of West Java. Result of image delineation was total acreages which then called as "sawah baku" or standard area of food production. There were approximately 45 521 Hectares could be designated as the food production areas. The inventory was based on all scattered polygons identified and verified using ground data (approximately 400 GCPs) distributed in all *kecamatans* of Garut, in-depth interviews with farmers, and supporting data such as food area dynamics, and seasonal cultivation. The distribution of standard area for food production in all *kecamatans* is presented in Table 1.

Table 9. Distribution of paddy field in all kecamatans of Garut Regency

No	Kecamatan	Acreages (Ha)	Percentage (%)	No	Kecamatan	Acreages (Ha)	Percentage (%)
1	Banjarwangi	1,725.22	3.79	22	Kersamanah	586.59	1.29
2	Banyuresmi	1,201.34	2.64	23	Leles	1,069.17	2.35
3	Bayongbong	1,407.48	3.09	24	Leuwigoong	924.53	2.03
4	Bl. Limbangan	1,610.26	3.54	25	Malangbong	1,811.85	3.98
5	Bungbulang	2,868.71	6.30	26	Mekarmukti	961.21	2.11
6	Caringin	1,223.22	2.69	27	Pakenjeng	2,344.05	5.15
7	Cibalong	894.31	1.96	28	Pameung-peuk	1,010.58	2.22
8	Cibatu	1,114.64	2.45	29	Pamulihan	246.54	0.54
9	Cibiuk	509.26	1.12	30	Pangatikan	501.23	1.10
10	Cigedug	169.52	0.37	31	Pasirwangi	679.10	1.49
11	Cihurip	611.86	1.34	32	Peundeuy	743.18	1.63
12	Cikajang	156.20	0.34	33	Samarang	1,045.62	2.30
13	Cikelet	1,629.64	3.58	34	Selaawi	912.01	2.00
14	Cilawu	1,180.40	2.59	35	Singajaya	1,338.15	2.94
15	Cisewu	2,102.10	4.62	36	Sucinaraja	310.40	0.68
16	Cisompet	1,643.13	3.61	37	Sukaresmi	740.68	1.63
17	Cisurupan	867.68	1.91	38	Sukawening	1,030.78	2.26
18	Garut Kota	894.83	1.97	39	Talegong	1,901.68	4.18
19	Kadungora	1,292.02	2.84	40	Tarogong Kaler	1,168.23	2.57
20	Karangpawitan	1,485.36	3.26	41	Tarogong Kidul	844.49	1.86
21	Karangtengah	308.09	0.68	42	Wanaraja	455.24	1.00
				TOTAL (Ha)		45,520.60	100.00

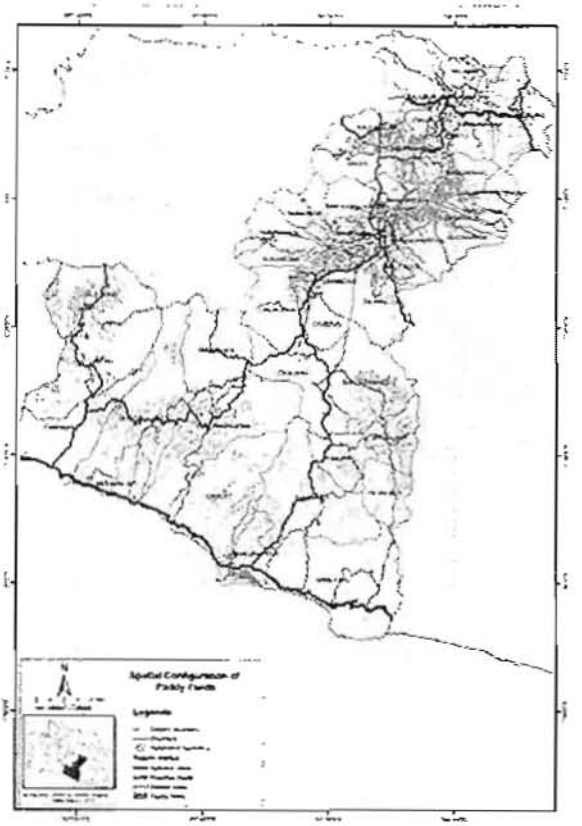

Figure 1. Spatial Distribution of paddy field in Garut Regency (green spot)

From the image processing and GIS procedure, spatial distribution of paddy field in Garut could be delineated as presented in Figure 1. Apparently it is distributed from North to South of Garut.

The figure shows that most of paddy field located in the North part of Garut. The density is quiet intense in the North than in the South. Apparently, parcel of the paddy field was quite different between South and Nort region of Garut. In the North and Center of Garut parcel size is quite bigger than in the North part. Spatial distribution of river is also denser in the North and the South. Paddy is highly consuming water during its growth. Water availability is crucial and demanded to support the paddy-growth therefore close area to river will always be preferred. Besides, considering the physical characteristics of soils and its topographic, the North area is quiet flatter than South and considered more suitable to support paddy growth the the South areas. It was then assessed the

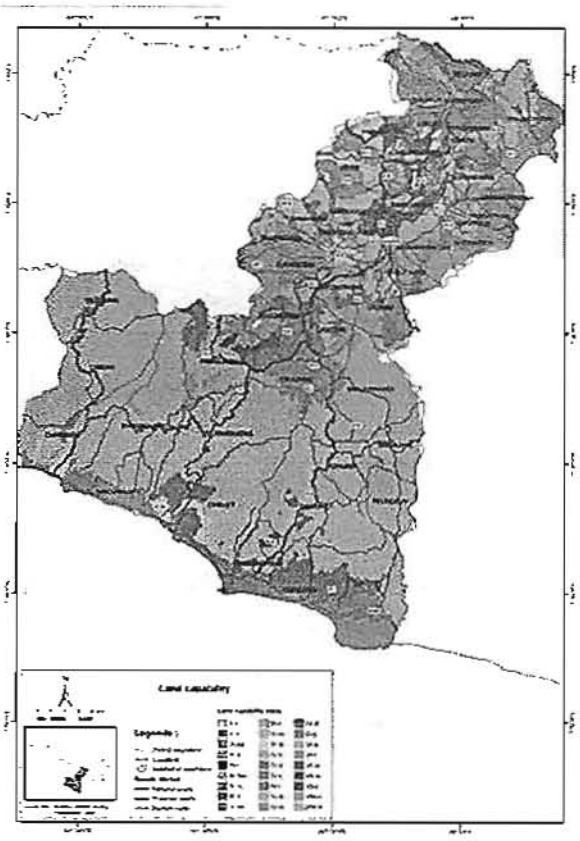

Figure 2. Spatial distribution of land capability in Garut Regency

physical characteristics of those paddy area to guide food production area designation. Some variables including slope, land system and climate characteristics were considered to direct the delineation. Map of land capability was generated from those variables and the spatial distribution is presented in Figure 2.

Figure 3.

Food security of Garut District

Food security is an important issue since it is related to human basic need. Discussing food security of Indonesian context means dealing with paddy. Garut has been stated as one of West Java's paddy-production area. To guarantee whether it can be fulfilled self-sufficiently, baseline paddy field and current land use must be delineated precisely. The previous part has discussed empirical paddy field of Garut Regency and some characteristics including cropping intensity and yield of each sub district. From the delineated areas, :

was estimated paddy produced at each sub district in the next 25 years. The result was then matched with the rice demand calculated from number of population and standard consumption. It is presented in Table 1.

Table 10. Estimated population, rice demand and balancing status on the next 25 years

Sub districts	Estimated Population	Rice demand			Estimated balancing rice (ton)		
		using Indonesian standard (max)	using Indonesian standard (min)	using Garut standard	using Indonesian standard (max)	using Indonesian standard (min)	using Garut standard
Banjarwangi	101107	13447	14054	10717	-108	-714	2622
Banyuresmi	130227	18118	18936	14440	-3697	-4514	-18
Bayongbong	159000	21147	22101	16854	-9461	-10415	-5168
Bl Limbangan	123623	16442	17184	13104	2289	1547	5627
Bungbulang	97903	13021	13608	10378	8872	8285	11515
Caringin	41269	5489	5736	4374	3532	3284	4646
Cibalong	65552	8718	9112	6949	-2105	-2499	-336
Cibatu	113499	15095	15776	12031	-2174	-2855	891
Cibiuk	44753	5952	6221	4744	-55	-324	1153
Cigedug	53204	7076	7395	5640	-5733	-6052	-4297
Cihurip	25854	3439	3594	2740	3560	3405	4258
Cikajang	129428	17214	17993	13719	-16033	-16810	-12539
Cikelet	59898	7966	8326	6349	10069	9710	11687
Cilawu	158919	21136	22090	16845	-16652	-17606	-12361
Cisewu	50760	6751	7056	5381	8790	8486	10161
Cisompet	72561	9651	10086	7691	2627	2192	4587
Ciserupan	166476	22141	23140	17646	-15477	-16476	-10982
Garut Kota	158131	21031	21980	16762	-10594	11543	-6325
Kadungora	137433	18279	19103	14568	-2211	-3036	1499
Karangpawitan	200697	26693	27897	21274	-14255	-15460	-8837
Karangtengah	24928	3315	3465	2642		360 210	1033
Kersamanah	52083	6927	7240	5521	-101	-413	1306
Leles	116031	15432	16128	12299	-2448	-3144	685
Leuwigoong	64928	8635	9025	6882	2341	1952	4095
Malangbong	194755	25902	27071	20644	-4585	-5753	674
Mekarmukti	22449	2986	3120	2380	7741	7606	8347
Pakenjeng	95185	12660	13231	10090	4744	4173	7314
Pameungpeuk	56764	7550	7890	6017	3350	3009	4882
Pamulihan	24390	3244	3390	2585	-1421	-1568	-763
Pangatikan	55885	7433	7768	5924	-1598	-1933	-89
Pasirwangi	88469	11766	12297	9378	6500	-7031	-4111
Peundeuy	36658	4875	5095	3886	727	507	1717
Samarang	125940	16750	17506	13350	-4499	-5254	-1098
Sefaawi	63464	8441	8822	6727	-1400	-1781	313
Singajaya	70578	9387	9810	7481	5891	5468	7797

Sub districts	Estimated Population	Rice demand			Estimated balancing rice (ton)		
		using Indonesian standard (max)	using Indonesian standard (min)	using Garut standard	using Indonesian standard (max)	using Indonesian standard (min)	using Garut standard
Sucinaraja	39673	5277	5515	4205	-2842	-3080	-1771
Sukaresmi	50748	6750	7054	5379	-1021	-1325	349
Sukawening	80761	10741	11226	8561	1474	989	3654
Talegong	45018	5987	6258	4772	15124	14853	16339
Tarogong Kaler	156523	20818	21757	16591	-7279	-8218	-3053
Tarogong Kidul	141825	18863	19714	15033	-9160	-10011	-5331
Wanaraja	65377	8695	9087	6930	-5126	-5518	-3360
Jumlah	3472226	461806	482639	368056	-22821	-43654	70929

In general, using the Indonesian rice-consumption standard both maximum and minimum, local production was less than total demand. Since the Garut standard not as much of those, it apparently will be fulfilled self sufficiently. Indeed, if we examines in detail at each sub district, it seems that some of sub districts will discontent its local demand.

Area for paddy sustainable development

Paddy sustainable development was determined considering its physical characteristics, current (existing) condition of paddy area and production and local self-sufficiency. The result showed that appropriate variables used to delineate sustainable land for agricultural food was different among sub-districts. There was no generic variable to mark out paddy field in all sub-districts, whereas different variables were more important in such sub-districts but apparently not in the others. Capacity to supply food for local demand and establishing friendly environmental land management came out to be considered in some cases. Table 2 shows 3 type of priority area to ensure sustainable land for foods in Garut Regency.

Priority of agricultural land to support food security in Garut Regency, its acreages, cropping intensity and production for every sub districts

No	Kecamatan	Paddy Acreages (Ha)	Cropping intensity	Paddy production (Ha)	Priority for agr. land
1	Banjarwangi	1,725.22	IP2	27,831.60	1
2	Banyuresmi	1,201.34	IP3	24,566.20	1
3	Bayongbong	1,407.48	IP2	31,679.00	1
4	Bl. Limbangan	1,610.26	IP3	25,613.60	1
5	Bungbulang	2,868.71	IP2	42,878.80	2
6	Caringin	1,223.22	IP2	8,960.80	3
7	Cibalong	894.31	IP2	12,720.00	3

No	Kecamatan	Paddy Acreages (Ha)	Cropping intensity	Paddy production (Ha)	Priority for agr. land
8	Cibatu	1,114.64	IP3	15,689.60	1
9	Cibiuk	509.26	IP3	10,234.00	1
10	Cigedug	169.52	IP2	3,692.80	2
11	Cihurip	611.86	IP3	6,701.00	2
12	Cikajang	156.20	IP2	2,817.80	2
13	Cikelet	1,629.64	IP3	12,690.80	3
14	Cilawu	1,180.40	IP1	19,675.20	2
15	Cisewu	2,102.10	IP2	19,130.80	3
16	Cisompet	1,643.13	IP2	18,521.20	3
17	Cisurupan	867.68	IP2	18,296.60	1
18	Garut Kota	894.83	IP3	20,176.80	3
19	Kadungora	1,292.02	IP3	27,654.00	1
20	Karangpawitan	1,485.36	IP2	27,019.20	1
21	Karangtengah	308.09	IP3	13,682.00	2
22	Kersamanah	586.59	IP3	8,200.00	2
23	Leles	1,069.17	IP3	20,354.80	1
24	Leuwigoong	924.53	IP3	20,220.40	2
25	Malangbong	1,811.85	IP3	32,092.80	1
26	Mekarmukti	961.21	IP3	10,699.40	2
27	Pakenjeng	2,344.05	IP2	25,653.20	2
28	Pameungpeuk	1,010.58	IP3	14,278.60	1
29	Pamulihan	246.54	IP2	6,442.60	2
30	Pangatikan	501.23	IP3	7,842.60	2
31	Pasirwangi	679.10	IP2	11,498.80	1
32	Peundeuy	743.18	IP2	13,115.40	2
33	Samarang	1,045.62	IP3	23,878.60	1
34	Selaawi	912.01	IP2	13,129.60	2
35	Singajaya	1,338.15	IP3	13,993.60	2
36	Sucinaraja	310.40	IP2	6,014.20	3
37	Sukaresmi	740.68	IP2	11,794.60	1
38	Sukawening	1,030.78	IP3	21,854.80	2
39	Talegong	1,901.68	IP3	15,959.20	3
40	Tarogong Kaler	1,168.23	IP3	15,523.20	1
41	Tarogong Kidul	844.49	IP3	16,862.00	1
42	Wanaraja	455.24	IP2	6,951.00	3
		45,520.60	IP3	706,591.20	

Spatial distribution of the prioritize areas presents in Figure 2. Three types of sustainable land for agriculture in Garut Regency have these following characteristics:

1. Type-1 : actually paddy field, irrigated, 3 x cropping intensity (IP-3) and slope <8 %

Remark : The best and priority of the main area for paddy fields

2. Type-2 : actually paddy field, non irrigated, 1 x cropping intensity or 2 x cropping intensity, slope 8 – 15 %

Remark : area of second priority and cropping intensity still should be improved with technology

3. Type-3 : actually paddy field, non irrigated, all cropping intensity, slope >=15 %

Remark : area of third priority which is potentially landslide area, local self-sufficiency issues and surplus of rice balancing status.

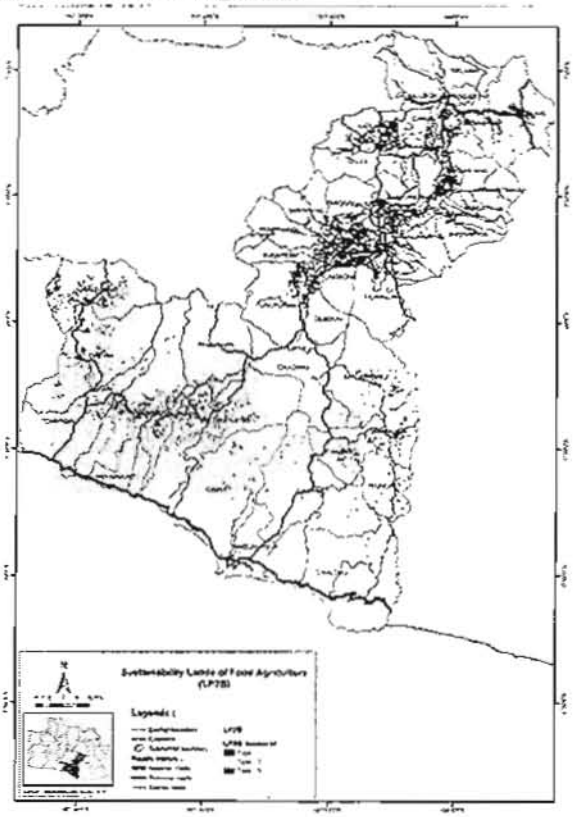

Figure 3. Spatial distribution of sustainable land for food and agriculture in Garut Regency

Land for sustainable food production in relation to spatial planning

Currently revised Garut District spatial plan consist of two different classes, i.e. cultivated and protected areas. The protected area covers almost 70 percent of Garut areas. It was comprised of forest protection area in vulnerable land, volcanic hazard area, tsunami hazard area, and landslide area. The cultivated region was composed of only 30 percent (about 50,000 ha). Empirically, human activities including paddy production and agro-forestry activities has established at the protected area. According to the National Law No 41, 2009, protection area should be excluded from human intensive utilization particularly settlement; but it allows limited agricultural activities.

Paddy field is considered as intensive agriculture, and it covers approximately 45,000 ha in Garut regency and some of it distributed in the protection area. Only small percentage of paddy field, about 10,000 ha, is located in the cultivated region. To protect area and fulfill demand of rice then the paddy field is supposed to be defined as sustainable food and agricultural land. The definition means protecting the lands legally from encroachment (conversion to other uses).

Sustainable agricultural land located in preserved areas has not been recognized in the National Law No 41, 2009. Nonetheless, numbers of people relied on the cultivation system were numerous. Government should take into account the fact and consider local community self-sufficiency since most of the locations were barely accessible. The importance of empirical phenomenon is (1) most of paddy fields along with settlement have been established in the region before the new regulation released. (2) From environmental perspective, these paddy fields has adapted to local condition and harmless locally and globally, and (3) the existence of paddy production area in some places is a must to ensure local self-sufficiency.

Database of paddy field acreage combine with demographic, paddy production and other physical data eventually produced several zoning of paddy lands that should be protected either laying in cultivated or in protected areas in the regional spatial plan (Figure 4).

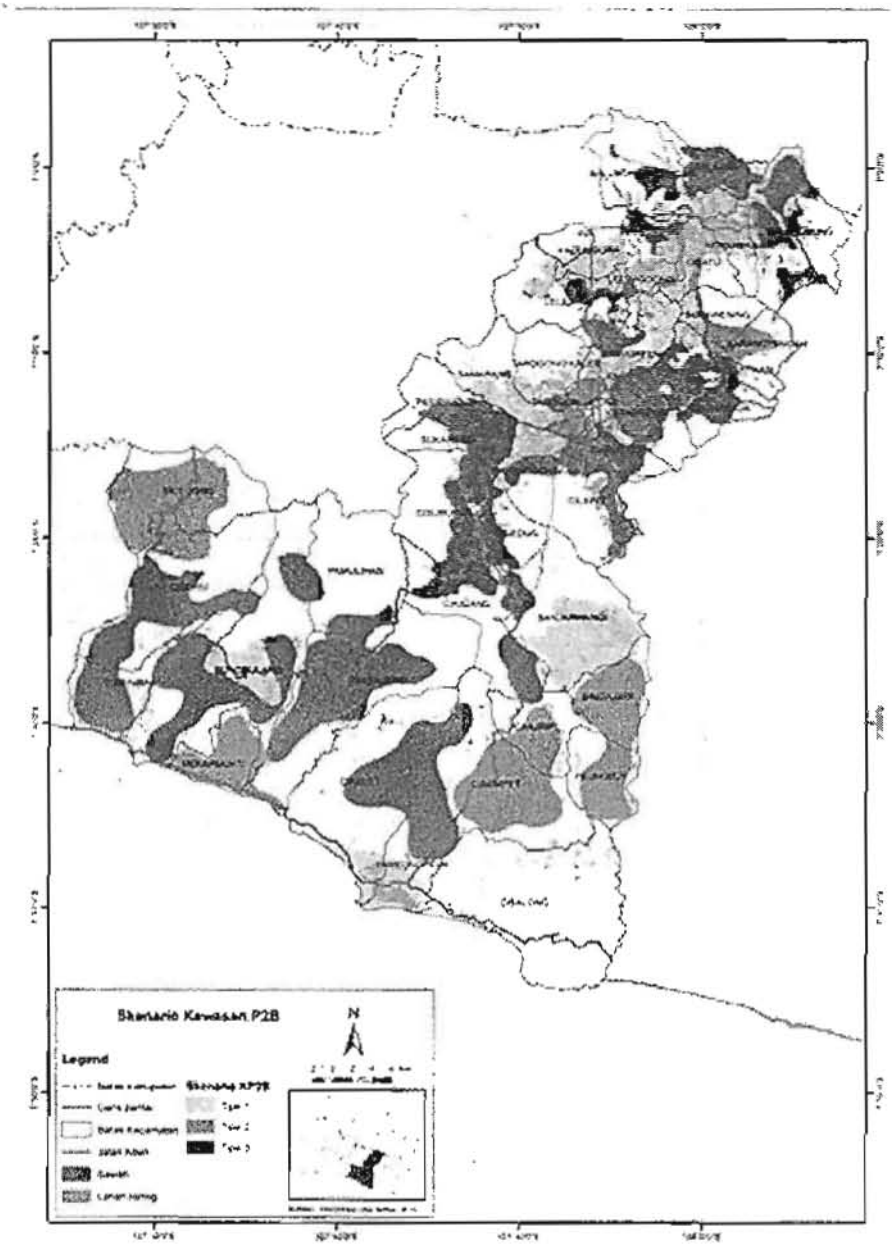

Figure 4. The scenario of sustainable land for food and agriculture to be included in spatial plan

Conclusion

Several important point from this research are as follows :

1. Total actual paddy field area in Garut District is 45 521 ha, with 3 different types, vi.z. (a) *type 1*: paddy field with technical irrigation system, 3 times of harvesting, and suitable for paddy with size of 19 583 ha; (b) *type 2*: paddy field non-irrigated, 1-2 x harvesting time, and moderately suitable for paddy with size of 14 883 ha; and (c) type 3: paddy field non-irrigated, any harvesting time, and not suitable for paddy with size of 10 599 ha.
2. The status of food balance system of Garut is currently surplus (190 000 ton), and apparently will be less than demand for the next 25 years. However, in more detail information, it reveals that 31 sub-districts will be surplus and 11 sub-districts will be deficit. The land demand to guarantee food security following local characteristics will be 38 166 ha.
3. Using criteria of land for sustainable paddy / food production as indicated in the National Law No 41, 2009, there are many potential paddy area can be developed for sustainable food production, but it has been modified physically. Apparently, some areas have to be protected although it has 'less environmental suitable'.
4. Following the draft of Spatial Plan developed by Garut-Regency Government, there are only 9 food security region proposed in spatial plan which is located at the Cultivated Region. It represents small number of paddy field area (approximately 10,000 Ha), and the rest areas proposed as land for food security or reserve land for food security area are located at the Preserved Areas. This empirical phenomenon has not been recognized and administrated in the current regulation.

REFERENCES

Barus, B., K. Gandasasmita, 8. H. Trisasongko, D. Shiddiq, L.S. Iman dan R. Kusumo, 2011. Pemanfaatan Ruang Daerah Gambut untuk Perkebunan Kelapa Sawit di Provinsi Riau dan Kalimantan Tengah. Prosiding Seminar PIT tahun Mapin XVIII, 2011, Universitas Diponegoro, Semarang 8-9 Juni 2011

Barus, 8. 2011. Penentuan Daya Dukung berdasarkan Kemampuan Lahan: *Pengalaman kajian untuk pemanfaatan ruang di Aceh, Kabupaten Gorut dan Kota Banjarmasin.* Pertemuan awal Kajian Daya Dukung Lingkungan Hidup Pulau Sumatra diselnggarakan oleh KLH-PPE Sumatra, Hotel Aryaduta, Pekanbaru, Riau, 15 Agustus 2011

Bachri, S. 2011. Identifikasi lahan sagu dan potensi pemanfaatannya secara berkelanjutan di kabupaten Jayapura. Tesis S2 PS PWL, IPB (tidak dipublikasikan)

Brown JF, Maxwell S, Pervez S. 2009. Mapping irrigated lands across the United States Using MODIS Satellite Imagery. *In* Thenkabail PS, Lyon JG, Turral H, Biradar CM. Remote Sensing of Global Croplands for Food Security. CRC Press. Boca Raton, Florida. Pp. 177-198.

Boken VK, Hoogenboom G, Easson GL. 2009. Applying Pattern Recognition to Satellite Data for Detecting Irrigated Lands: A Case Study for Georgia, United States. *In* Thenkabail PS, Lyon JG, Turral H, Biradar CM. Remote Sensing of Global Croplands for Food Security. CRC Press. Boca Raton, Florida. Pp. 409-420.

Christina, D.R. 2011. Identifikasi lahan potensial untuk mendukung usulan perencanaan lahan pertanian pangan berkelanjutan. Studi kasus di Provinsi Jawa Barat. Tesis S2 PS PWL, IPB (tidak dipublikasikan)

Chang, Kang-tsung, 2002. Introduction to Geographic Information System. McGraw Hill. 349p.

Gamage MSDN, Ahmad MD, Turral H. 2009. Mapping Irrigated Crops from Landsat ETM+ Imagery for Heterogeneous Cropping System in Pakistan. *In* Thenkabail PS, Lyon JG, Turral H, Biradar CM. Remote Sensing of Global Croplands for Food Security. CRC Press. Boca Raton, Florida. Pp. 421-440.

Jensen JR. 2000. Remote sensing of the environment, An Earth Resource Perspective. Prentice-Hall, Inc. Upper Saddle, New Jersey.

Longley, P.A., M.F. Goodchild, D.J. Maguire and D.W. Rhind. 2005. Geographical Information Systems and Science. 2nd edition. John Wiley and Sons. 518p.

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Geospatial and Human-Dimensions on Natural Resource Management

Hosted by P4W/CRESTPENT, Bogor Agricultural University in collaboration with LAPAN, BAKOSURTANAL, MAPIN, STPN, JKPP and supported by Faculty of Human Ecology-IPB, Forum Tata Ruang, Common Indonesia Forum, HDP Indonesia, and SLUAS JSPS Project, the 2011 International Seminar on Geomatics & SAR (GeoSARNas) and Human Dimensions on Sustainable Natural Resource Management was successfully held at IPB International Convention Center, Bogor on September 12-13, 2011. The seminar is designed to (i) understand human and environment systems; (ii) integrate science perspectives to reflect the recognition of the fundamental nature of how human activities on land affecting feedbacks to the earth system and the response of the human-environment system; (iii) facilitate Indonesian and international research communities and practitioners works on land and natural resource issues communicating their recent findings; (iv) link research findings and practical lessons learnt to policy and implementations.

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