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Land Use Conflict with a Particular Reference to Spatial Planning Implementation in South Sulawesi

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Abstract. Land use changes and conflicts have recently become a major issue in newly developed regions of Indonesia, since the implementation of regional autonomy policies, which put emphasis on decentralization of land use governance. In South Sulawesi, there are two main issues related to land use conflict. First is the invasion on protected forest land in rural areas, and second is the growing spread of *urban development* into rural areas which has created many types of *conflicts* over *land use*. The primary aim of this paper is to assess land use conflict within these two contexts in terms of unsuitable spatial location of existing land use with land use functions in the spatial regulation at two different scales: provincial and regency. At a provincial level, a careful detection was done at some selected area in South Sulawesi, while at regency level, some forms of conflict were assessed in the southern parts of South Sulawesi. The study employed integrated techniques of spatial data analyses and interviews, and the data were analyzed in geographic information systems (GIS). This study indicates that, at a provincial level significant areas of dry land agriculture, estate plantation, mining, and residential were found in the land designated as protected forest, and within GIS data base it can be identified a total areas of 2,075 ha, 677 ha, 1,415 ha, and 193 ha, respectively. At a regency level, conflicts occurred between existing land use and land functions in local spatial planning regulation, particularly at agriculture and urban-suburban areas. Results of interviews and questionnaires by purposive sampling with the community indicate several factors causing land use change include: a) low incomes of local community, b) increasing of price of basic needs, c) attempts to gain more revenue from land use, c) land use existed before spatial regulation being implemented, and d) ecological condition that forces farmers to practice shifting cultivation. The results of this study will give insights into how to design future land use policies both at provincial and regency levels in this region.

Keyword: *agriculture land, land use conflict, GIS, spatial planning, and South Sulawesi.*



1. Introduction

Since implementation of regional autonomy that concerned about land use management, land use changes and conflicts become urge on developing areas. Increasing population and high level economy, is proportional with land necessary, and will be affect to land use change and conflicts. In South Sulawesi, there are two issues correlate with land use conflicts. The first was invasion on protected forests at rural areas, and the other one is spreading of urban development towards rural areas which has created various conflicts of land use [1]. Traditionally, land use choice depends very much on the criteria used, but in essence it should embrace three different and sometimes conflicting aspects: productivity, workability and the environment [2].

The primary aim of this paper was to assess land use conflict within these two contexts in terms of unsuitable spatial location of existing land use with land use functions in the spatial regulation at two different scales: provincial and regency. At a provincial level, a careful detection was done at some selected area in South Sulawesi, while at regency level, some forms of conflict were assessed in the southern parts of South Sulawesi.

2. Methodology

Study Area

The study area was in district of Jeneponto (Figure 1). South Sulawesi province was located on latitude $1^{\circ}53'34.0''$ and $7^{\circ}30'18.4''$ S and longitude $119^{\circ}15'0.0''$ until $121^{\circ}50'21.3''$ W, instead Jeneponto was located on latitude $5^{\circ}42'9.8''$ and $5^{\circ}23'8.9''$ S, and longitude $119^{\circ}29'12.1''$ until $119^{\circ}56'21.4''$ W.

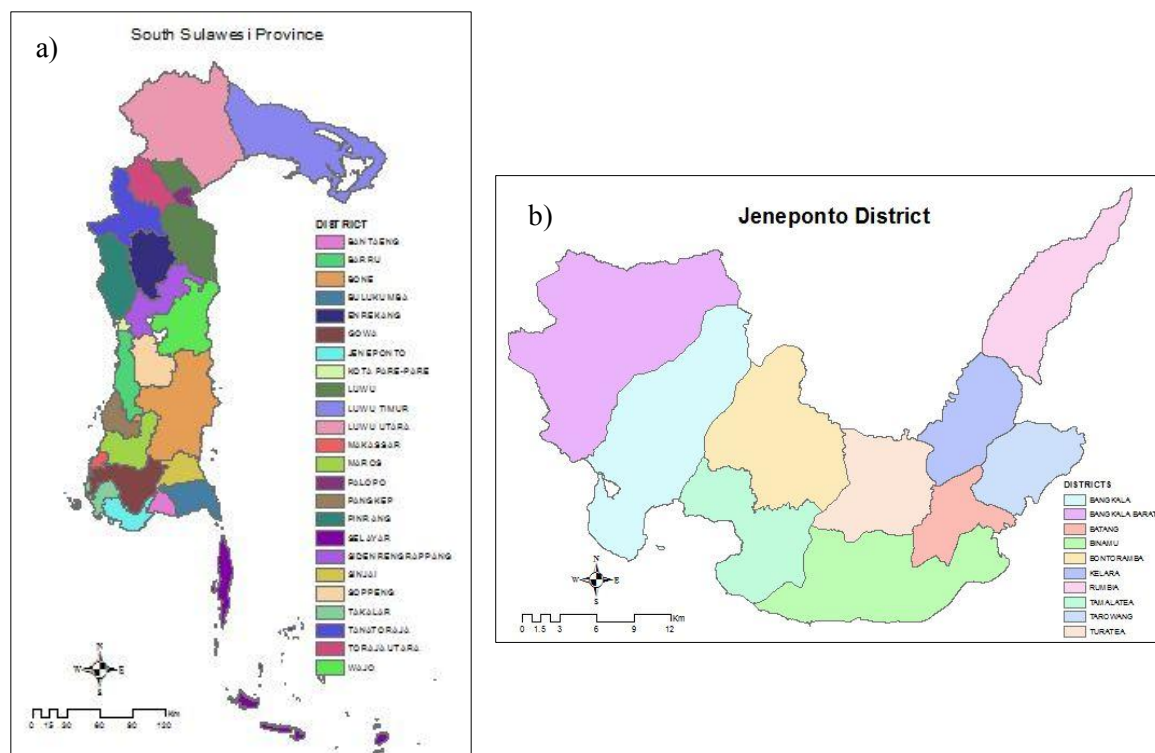


Figure 1. Administrative maps of South Sulawesi (a) and Jeneponto District (b)

South Sulawesi was covering an area of 4,453,049 ha, inclusive 24 districts/city in there, which is the largest city as capital city is Makassar city. According to statistics, population of South Sulawesi was about 8.7 million [3]. Area of Jeneponto was about 80,069 ha, there were 10 sub-districts consists of Bangkala, West Bangkala, Batang, Binamu, Bontoramba, Kelara, Rumbia, Tamalatea, Tarowang, and Turatea. As statistically, population of Jeneponto was proximately 359,787.

Database

This study used basic-spatial data resource, consists of: (i) Indonesia topographic digital map; (ii) Map of forest estate status; (iii) land use map; (iv) climate map; (v) administrative map; (vi) map of land use planning of South Sulawesi and Jeneponto district, and (vii) satellite imagery data (Landsat 8) that has been acquired on 2017. Indonesia topographic digital map of area study was on scale 1: 25.000 from Geospatial Information Agency on 2015, it was used as maps references. Indonesia topographic digital map was in vector so it is easier to build vector basic data based on GIS standard. All data layers were saved using UTM (Universal Transverse Mercator) coordinate system. Another used data is interview results of informants.

Analysis method

The study employed integrated techniques of spatial data analyses and interviews, and the data were analyzed in Geographic Information Systems (GIS). Procedure of analysis that was used shown as following:

1. Land use analyze

Digital image processing for land suitability analysis was done by extracted the satellite recording of Landsat 8 in 2017 in order to make a land use map. Image extraction is done by using multispectral classification. Multispectral classification is process of digital image processing which is generate thematic map (generally, it is land use map), moreover it usually be an input on spatial model on Geographic Information System (GIS). The first assumption on multispectral classification was the objects could be recognized from one another based on its spectral value. In fact, showing that every objects is given specific pattern of spectral respond. The accuracy of multispectral classification is increase as narrow and as much the channels. As principal, how the multispectral classification algorithm work was marked every kind of objects and it will be seen the differences between one and another, based on features of spectral value and the channels outright. In the other words, multispectral classification algorithm simply has procedure as following:

- a. Determine the representative spectral value for every object by sampling method. Average value each sample will be grip for object identification.
 - b. Place the representative value of sample on multidimensional diagram.
 - c. Determine tolerance limit as spectral distance from representative value. It means counted pixels vector on outside of this distance will be classed not as object.
 - d. Decision making is be like counting a whole of pixels and inserted it into available classes, as long as they are shorter or same with each object's tolerance distance, and group it was non classified since they are not able to classify in any class.
2. Spatial analysis in GIS using software Arc-GIS was an analysis which is done based on space considerations, include the point acquisition/locational accuracy of object or phenomenon with specific study scale. There is the first step should do before the analysis, is equate delineation area for all used parameters. Especially for land use in raster format should be converted become vector, due to the analysis is in vector. After that is coding process for describe every polygon on map layers, and save it in the attribute table. Next step, overlay all the parameter maps to gain land mapping unit, the used method is Union method. The results of land mapping unit have more polygon based on overlaying all parameters. Every polygon was measured its large using PIVOT. The result of PIVOT give illustration of land use conflict, both based on forest estate status or land use planning.
3. Interviews and questioner using purposive sampling
4. Ground truth, to see output of land suitability analysis with ground condition.

All the analyses was carried out all over South Sulawesi Province and continued in Jeneponto as a detailed archetype.

3. Results and discussion

Land use conflicts in provincial level

Land use is dynamic parameter of environment [4, 5]. Land use conflicts are indeed a widespread phenomenon, and can occur at any time or place between different stakeholders, mainly for different land expectations [6; 7; 8]. The changes quickly happen on developing area. Distribution of land use in South Sulawesi is showed at Figure 2. Dominated land use was agriculture namely dry land-shrubs as much as 1,565,894 ha, and followed by secondary dry land forest (765,380 ha), paddy field (605,871 ha), primary dry land forest (587,853 ha) and shrubs (507,798 ha). Overall protected areas in South Sulawesi have been reached 2.083.950 ha or equal with 44.96% of total large of land (Table 1). This value was good based on DAS/DPS and districts/city, it is various (Figure 2b).

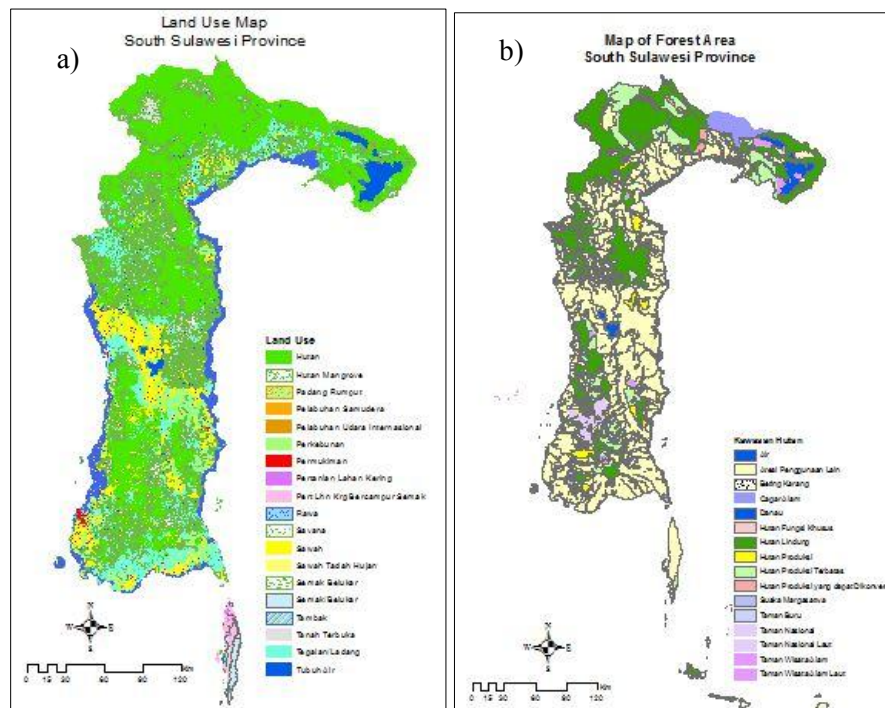


Figure 2. Land Use Map (a) and Forest Estate Status (b) South Sulawesi

Table 1. Wide Area of Protected Areas and Cultivation Area in South Sulawesi

No.	Areal Function	Hectares	Percentage
1.	Cultivation (Other land use areal)	1.909.226	41,19%
2.	Production forest	641.846	13,85%
3.	Protected areal	2.083.950	44,96%
	Total	4.635.022	100,00%

According to spatial analysis (Table 2), there was land use conflict on protected areas. At protected areas, there were some nonprotected areas, such as dry land agriculture as much as 2.075 ha, farm 677 ha. Inside limited-production forest, there were dry land agriculture 1.049 ha, pond 4.500 ha, and open spaces 1.631 ha.

Table 2. Protected areal pattern and large of land use

Spatial patterns	Dry land agriculture	Pond	Open spaces	Plantation	Settlement	Mining
Nature preserve			43.42	10.67	9.49	
Protected forest	2,075.27	17,626.05	2,378.24	677.13	193.98	1,415.10
HP	572.20		173.39	230.57	53.45	
HPK		1,374.48	2.55	98.48	10.54	
HPT	1,049.90	4,500.74	1,631.35	7.43	64.11	
Civil forest	678.51	222.02	15.50	84.27	7.87	
Mangrove	98.25	5,085.70				
National park	194.91		159.18			
Marine national park			10.46			
Nature park	5.62		79.52	52.08		

This study indicates that, at a provincial level significant areas of dry land agriculture, estate plantation, mining, and residential were found in the land designated as protected forest, and within GIS data base it can be identified a total area of 2,075 ha, 677 ha, 1,415 ha, and 193 ha, respectively. At a regency level, conflicts occurred between existing land use and land functions in local spatial planning regulation, particularly at agriculture and urban-suburban areas. Results of interviews and questionnaires by purposive sampling with the community indicate several factors causing land use change include: a) low incomes of local community, b) increasing of price of basic needs, c) attempts to gain more revenue from land use, c) land use existed before spatial regulation being implemented, and d) ecological condition that forces farmers to practice shifting cultivation.

Land Use Conflict on District Level

Land use distributon in Jeneponto was shown on Figure 3a and Table 3. Type of land use was dominated was non irrigated dry land as much as 36,581 ha, and followed by paddy fields (24,556 ha), shrubs (5,932 ha), and forest (5,658.09 ha). Moreover, forest estate status was shown on Figure 4b.

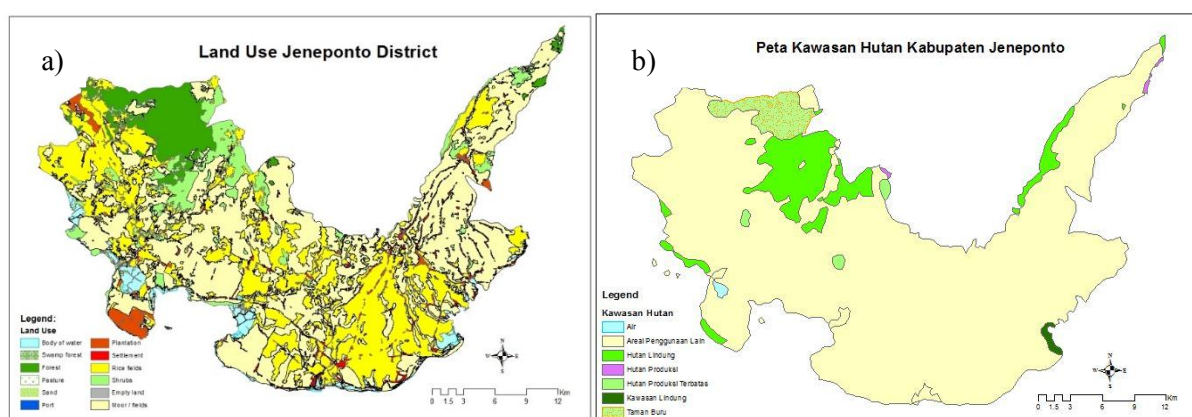
**Figure 3.** Land use Map (a) and Forest Estate Status (b) Jeneponto District

Table 3. The large area of land use in Jeneponto

Land Use	Hectares
Swamp forest	38.73
Forest	5,658.09
Savana	1.69
Dune	44.81
Ocean harbor	0.03
Plantation/farm	1,396.72
Settlements	2,602.43
Irrigated-field	24,556.40
Paddy field	343.15
Shrubs	5,932.97
Vacant land	37.40
Dry land agriculture	36,581.40
Water resources	2,381.07

On district level, there was conflict between existing land use and land function on land use planning, especially on agriculture sector and suburb area (Table 4).

Table 4. Protected area pattern and wide area (ha) of land use

Land Use	Spatial Pattern		
	Cultivation areas	Protected areas	Water Resources
Swamp forest	38.73		
Forest	2,210.53	3,447.56	
Savana	1.69		
Dune	40.68	2.68	1.45
Ocean harbor	0.03		
Plantation/farm	1,222.63	174.03	0.06
Settlements	2,552.62	49.80	0.00
Irrigated-field	24,010.73	542.89	2.79
Paddy field	220.20	121.70	1.25
Shrubs	3,605.68	2,297.12	30.06
Vacant land	37.40		
Dry land agriculture	34,426.14	2,150.47	4.76
Water resources	1,968.69	210.58	9.61

Reasons of Land Use Conflicts

According to Baja et al research [1], an adequate wide land use changing in South Sulawesi happened for 2 decades ago was shrubs and farm become paddy fields, and only a few from settlements become industries. However, the changing of farm, shrub, and paddy field were lately happen, and usually become urban areas, specially settlements and industries. According to this study, the dynamics was really affected by some driving factors, consists of (i) actors, (ii) physics, (iii) economic, (iv) social-culture, and (v) institutional and policy.

Actors was dominant factor on spatial dynamics of land use changing, they are civil, investor, and government. Physics factor as main infrastructure development that change landscape and land use, also the catastrophe. Economic as infrastructure development (road, industry, beach reclamation, paddy field build (by government), plantation development on large scale (like cocoa and oil palm) especially by investors, and opening of mining concession (specifically in East Luwu done by investors). Other factor was social-culture, depending on society habitual, such as villagers, land use on the past was still hold on local wisdom and then it is enriched by science; for forest community, the ignorance about forest ecology aspect cause land using in forest area, even though the scale is not significant in this study; for middle class, most of them leave in urban area, they are change by their attitudes and mindsets significantly. Ecology was main component of indigenous culture and it was also shifted. Natural resources exploitation was become infinite without noticed about environment capability. Figure 4 shown the changing of land use structure in South Sulawesi by Baja [1].

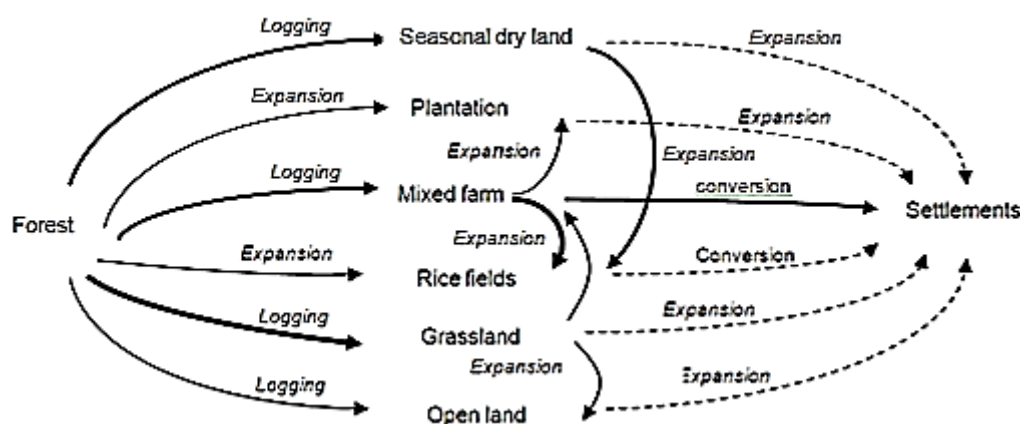


Figure 4. Structure of land use changing in South Sulawesi

Land use problems are mostly created by influential landlords or politicians, because the owners of the land are illiterate to understand their rights, and at times, even they do not know about the economic value of their land. Thus, the process and structure in which use and control of the land is managed forcibly, and decisions are implemented without democratic process, can be termed as land governance failure [9, 10]

This study indicates that, at a provincial level significant areas of dry land agriculture, estate plantation, mining, and residential were found in the land designated as protected forest, and within GIS data base it can be identified a total areas of 2,075 ha, 677 ha, 1,415 ha, and 193 ha, respectively. At a regency level, conflicts occurred between existing land use and land functions in local spatial planning regulation, particularly at agriculture and urban-suburban areas.

Results of interviews and questionnaires by purposive sampling with the community indicate several factors causing land use change include: a) low incomes of local community, b) increasing of price of basic needs, c) attempts to gain more revenue from land use, c) land use existed before spatial regulation being implemented, and d) ecological condition that forces farmers to practice shifting cultivation. The results of this study will give insights into how to design future land use policies both at provincial and regency levels in this region.

4. Conclusion

Conclusion that could be knew from this paper are:

1. This study indicates that, at a provincial level significant areas of dry land agriculture, estate plantation, mining, and residential were found in the land designated as protected forest, and within GIS data base it can be identified a total areas of 2,075 ha, 677 ha, 1,415 ha, and 193 ha, respectively.

2. At a regency level, conflicts occurred between existing land use and land functions in local spatial planning regulation, particularly at agriculture and urban-suburban areas which was driven by a) low incomes of local community, b) increasing of price of basic needs, c) attempts to gain more revenue from land use, c) land use existed before spatial regulation being implemented, and d) ecological condition that forces farmers to practice shifting cultivation.

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