

## **Analysis of Conformity of Forest Area Function, Agricultural Land, and Settlement with RTRW of District Bondowoso (Spatial Planning, Licensing, Development and Geospatial Information Management)**

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**Abstract.** Area planning is important for government and society. The layout and special attention to the directive of the land use function based on the assessment of its character is important to note. The function of knowing the direction of the utilization of the appropriate land use is to avoid the misuse of land use that has the potential to damage the environment. The purpose of this paper is to know the suitability of forest area function, agricultural land, and settlement with RTRW of District Bondowoso. The method used is institutional survey. The unit of analysis covers all Sub-districts in District of Bondowoso. Data in the form of administrative maps, rainfall, soil type, and slopes are taken from BAPPEKAB Bondowoso in 2006. Data on agricultural land use and settlement are taken from satellite imagery through SAS Planet assistance. Data analysis using spatial analysis overlay with the help of Arc GIS 10.1 and Microsoft Excel 2010. The results of this study are as follows. *First*, the effective area of protected forest 525.21 km<sup>2</sup> above RTRW 306.75 km<sup>2</sup>, and production forest 268.33 km<sup>2</sup> under RTRW 291.95 Km<sup>2</sup>. *Second*, the area of agricultural land is 728.16 km<sup>2</sup> above RTRW 472.93 Km<sup>2</sup>. *Third*, the area of settlement is 42.20 km<sup>2</sup> under RTRW 64.78 Km<sup>2</sup>. Based on these results there are two things that need to be observed. (1) The number of production forest areas decreased by 23.62 Km<sup>2</sup>, and (2) Agricultural land increased to exceed RTRW area of 255.23 Km<sup>2</sup>.

**Keywords:** Functions of Forest Areas, Agricultural Land, RTRW

### **INTRODUCTION**

Area planning is important for the community. According Suharsono (1985), regional development planning is an effort to exploit the potential of land resources with a maximum that aims to improve the welfare of the community and local revenues without leaving conservation efforts. Based on this opinion, the form of land use efforts in regional development should be done to achieve the optimization of the land resources of the area. It aims to achieve a better order than before without neglecting the environment.

The process of realizing the objectives of regional planning better, must memhaikan physical aspects as the basis of planning to be prepared. In addition to physical aspects, non-physical aspects are also an important factor. According to Suharsono (1985), in the preparation of regional planning, physical aspects become one of the determinants of planned activities, in addition to consideration of non-physical aspects, such as: social, economic, and law. According to Sandhy (1973), the physical condition of the land becomes the determinant of whether the land is determined to be a protected, buffered, or awakened land. According to the Letter of Appeal of the Minister of Agriculture No. 837/KPTS/UM/II/1980 and No. 683/kpts/um/ VIII/1981, the direction of the land use function is the basis for determining the appropriate activities and is permitted to be applied on a land by considering the physical, then divided into: protected areas, buffer zones, and cultivation areas.

The layout as well as the focus on the function of land use functions according to their characteristic assessment as the basis of land use arrangements and arrangements is important to

note. This is because the basis in determining the direction of land use functions can maintain the quality of the environment, maximize the potential, and utilization of space, and maintain its sustainability. According to Law No. 26 of 2007, that spatial is defined as the process of spatial planning, space utilization, and control of space utilization.

Based on the benefits of land use function directives, it is important to know that the appropriate land use function directives to avoid misuse of land use that may interfere with environmental sustainability. The reality in the field of many discrepancies occurred in regional development. There is a practice of spatial use activities violating the provisions, such as using a protected area into a wake area. This can harm society and the environment. *World Bank* research results reporting events of 1994, that excessive housing development causes forest destruction. For example, in Uganda in 1992, the excessive use of land for settlements, led to 30,000 hectares of forest destruction. The consequences that arise from the above problems are floods, droughts, smog, and landslides.

The problem of land overhead also occurs in Indonesia which can cause disaster. According to data from the Ministry of Forestry in 2006, that land damage including forests reached 59.2 million hectares, with a deforestation rate of 1.19 million hectares annually. According to the Ministry of Environment, based on the interpretation of Landsat 7 EM image in 2005, the extent of land destruction reached 70.8 million hectares. The destruction of the land is not only used for sufficient economic and forest resources, but also for other land use activities. According to Lestari (2008), due to the development of Puncak area that should function as a buffer zone, many areas experience various natural disasters, such as floods and landslides.

The above description shows that land use that overrides the environment can cause negative things for humans in the form of disaster. This suggests that land use planning and activities should take into account the direction of land use functions, which is a reflection of space capacity as a planning container that is run.

District of Bondowoso with an area of 158.071 hectares (the result of map digitization from BAPPEKAB) is one of the areas that have an important influence in maintaining the environment in the area around the mountain of Ijen. This is because District of Bondowoso physically has steep slopes with bumpy morphology, hills to the mountains. Environmental changes in the upper regions will affect the areas under it. This resulted in the District of Bondowoso having an environment susceptible to activities that could affect the quality of land. Based on the importance of the District of Bondowoso in the effort to conserve the surrounding environment and the natural conditions that are very vulnerable to environmental changes, it is important to do land use activities in accordance with the physical and environmental capabilities. The way that can be pursued by planning a match with the direction of land use function.

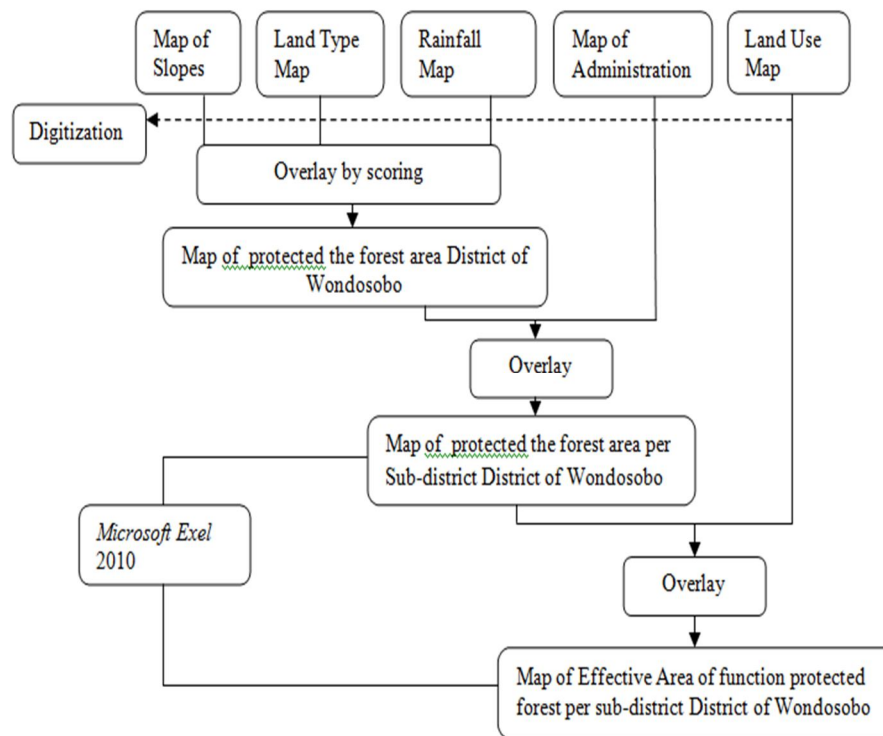
Development of the area as discussed before should pay attention to the physical condition. The direction of land use function that takes into account the physical condition can be used as a basis to know the area with the direction of the function of utilization of protected forest and production forest. Developments outside the function of the area should be limited, ie preventing other designations on areas that have been designated as protected forests, reducing the increase in human activities, and increasing the need for built space.

Geographic Information System with *ARC GIS* 10.1 program is able to conduct overlay analysis with scoring that produces the area of protected forest, especially in Bondowoso regency. The area is reduced by land use (settlements and rice fields) in order to know the effective area of protected forest, production forest, and limited production forest. Therefore, the purpose of this paper is to know the suitability of the function of forest area, agricultural land, and settlement with RTRW in District of Bondowoso.

## METHOD

This research method is institutional survey. The unit of analysis in this survey covers all Sub-districts in District of Bondowoso consisting of 22 Sub-districts. Data on administrative maps, rainfall, soil types, and slopes were taken from BAPPEKAB Bondowoso in 2006. Data on agricultural land use and settlement were taken from satellite imagery in 2016 through the assistance of *SAS Planet*.

This data is analyzed using descriptive with overlay scoring spatial analysis through the help of *Arc GIS 10.1* and *Microsoft Excel 2010*. Data about slope map, soil type, and rainfall are then given score to determine forest area according to Decree of Minister of Agriculture Number 2837/Kpts/Um/11/1980. According to Budianto (2010), overlay and map scoring are used simultaneously when a conclusion process is needed, whereby the various spatial phenomena embodied into thematic maps can influence each other. Flowchart of this research method can be seen in Figure 1 below.



**Figure 1:** Flowchart of research method

## RESULTS

After baseline map with each score overlaid then resulted in the area of protected forest of District Bondowoso with protected forest covering 575 km<sup>2</sup> or occupying the second position after limited production forest. This is in accordance with the slope conditions, rainfall, and soil types that support the area are classified as forest areas. Area of Forest Area Forestry of District Bondowoso can be seen in Table 1 below.

**Table 1:** Area of Forest Area Forestry of District Bondowoso

Classification of the area	Area (km <sup>2</sup> )
Protected forest	575.16
Production forest	293.01
Limited production forest	720.90

Based on Table 1, it is seen that the area of protected forest protection in Bondowoso Regency is 575.16 Km<sup>2</sup>. From 21 sub-districts in District of Bondowoso, there are 4 sub-districts that have the largest protected forest area sub-districts: Botolinggo covering 111.83 Km<sup>2</sup>, Sempo covering 89.84 Km<sup>2</sup>, Sumber Wringin covering 80.57 Km<sup>2</sup>, and Cerme covering 60.69 Km<sup>2</sup>. In detail the extent of forest area per Sub-district in district of Bondowoso can be seen in Table 2 below.

**Table 2.** Agihan (distribution) Forest Area Each Sub-district in District of Bondowoso

Sub-district	Area of Agihan (distribution) Forest Area (Km <sup>2</sup> )		
	Protected forest	Production forest	Limited production forest
Binakal	18.17	10.32	9.12
Bondowoso	0.00	8.73	14.49
Botolinggo	111.83	15.03	9.99
Cermee	60.69	37.72	32.50
Curah Dami	17.79	22.57	9.92
Grujugan	40.25	7.04	25.58
Jambosari	0.00	0.00	27.83
Klabang	26.77	19.29	17.90
Maesan	20.77	0.03	34.11
Pakem	45.97	1.93	10.59
Prajejan	9.85	39.73	9.29
Pujer	0.00	0.00	37.19
Sempo	89.84	19.34	126.00
Sumber Wringin	80.57	0.00	61.75
Tagal Ampel	0.00	22.59	7.92
Taman Krocok	0.31	34.43	25.99
Tamaran	0.00	0.00	29.54
Tapen	2.67	2.16	80.31
Tenggarang	0.00	0.00	24.78
Tlogosari	48.56	0.00	64.15
Wonosari	0.00	0.00	40.43
Wringin	1.12	52.10	21.52
<b>Total</b>	<b>575.16</b>	<b>293.01</b>	<b>720.90</b>

Based on the extent of forest area in Table 2, not all areas that are in accordance with the classification of overlay techniques with the scores of the criteria of Minister of Agriculture Decree

No.837/KPTS.UM/1980 above are compatible with the reality in the field. It means to know the use of community land of District Bondowoso especially settlement and rice field. Based on the digitasi obtained results that the settlement area of 42.20 km<sup>2</sup> and rice fields of 42.20 km<sup>2</sup>. The largest rice field in Sub-district Tapen is 79.16 Km<sup>2</sup>, while the widest settlement in District of Bondowoso is 8.15 Km<sup>2</sup>. Land use in District of Bondowoso can be seen in Table 3 below.

**Table 3.** Land Usage in District of Bondowoso

Sub-district	Area (Km <sup>2</sup> )	
	Rice fields	Settlement
Binakal	20.06	1.41
Bondowoso	15.07	8.15
Botolinggo	20.96	0.61
Cermee	54.73	4.05
Curah Dami	32.40	3.89
Grujugan	30.25	1.96
Jambosari	26.43	1.40
Klabang	43.40	0.00
Maesan	24.84	0.00
Pakem	23.95	0.29
Prajejan	27.83	1.99
Pujer	34.90	2.29
Sumber Wringin	33.81	1.88
Tagal Ampel	27.26	2.36
Taman Krocok	43.93	1.02
Tamaran	29.54	0.00
Tapen	79.16	0.91
Tenggarang	21.43	3.35
Tlogosari	48.60	0.59
Wonosari	36.59	3.84
Wringin	53.02	2.21
<b>Total</b>	<b>728.16</b>	<b>42.20</b>

Based on the presence of settlements and rice fields in table 3, it can be known the effective area of forest in District of Bondowoso. Certainly experiencing widespread depreciation of past forest landings per sub-district, due to the reduced use of land (settlements and rice fields). From the results of digitization of protected forest in sub-districts of Botolinggo, Sempo, Sumber Wringin and Cerme which previously were 111.83 Km<sup>2</sup>, 89.84 Km<sup>2</sup>, 80.57 Km<sup>2</sup> and 60.69 Km<sup>2</sup>. Now it has depreciated to respectively of 109.26 Km<sup>2</sup>, 82.17 Km<sup>2</sup>, 80.02 Km<sup>2</sup>, and 60.13 Km<sup>2</sup>. Similarly, other sub-districts where there is a classification of protected forests are subject to widespread depreciation. In detail the effective area of forest monitoring per sub-district in District of Bondowoso can be seen in Table 4 below.

**Table 4:** Effective Area of Forest Area per Sub-district in District of Bondowoso

Sub-district	Effective Area of Forest Area (Km <sup>2</sup> )		
	Protected forest	Production forest	Limited production forest
Binakal	15.66	0.00	0.48
Bondowoso	0.00	0.00	0.00
Botolinggo	109.26	0.04	5.97
Cermee	60.13	0.00	12.00
Curah Dami	12.81	0.00	1.18
Grujugan	36.78	0.42	3.47
Jambosari	0.00	0.00	0.00
Klabang	13.08	2.79	4.67
Maesan	19.86	0.03	10.18
Pakem	34.18	0.00	0.05
Prajekan	9.12	15.87	4.05
Pujer	0.00	0.00	0.00
Sumber Wringin	82.17	19.34	125.90
Tagal Ampel	80.02	0.00	26.60
Taman Krocok	0.00	0.00	0.00
Tamaran	0.31	2.28	13.20
Tapen	0.00	0.00	0.00
Tenggarang	2.60	0.35	2.12
Tlogosari	0.00	0.00	0.00
Wonosari	48.28	0.00	15.24
Wringin	0.00	0.00	0.00
Binakal	0.95	0.00	2.00
<b>Total</b>	<b>525.21</b>	<b>41.12</b>	<b>227.11</b>

## DISCUSSION

After known the function of forest area in Bondowoso District, then further evaluation of compatibility between actual land uses with land area function. This evaluation is intended to find out actual land use in Bondowoso District that is not in accordance with the main function of the region. Furthermore, the direction of land use function can be determined. Based on the assessment matrix, it is known that the land unit whose actual land use is not in accordance with the main function of its area is as follows.

*First:* The function of protected areas. The permitted use of land in this area should be zero tillage and forbidden to cut forest vegetation. But in reality in the field, there are still activities of the population such as rice fields and settlements that began to erode the existence of Hutton protected area. Actual land use in the local protected area in Districts of Bondowoso does not reflect land use that is suitable for land area function. One example is the use of paddy fields or other seasonal crops cultivated on land with high slopes, whereas it should be used as forest areas. Protected forest areas in Districts of Bondowoso are located on the eastern slopes covering the Sub-districts of Cerme, Sempo, Botolinggo, Sumber Wringin and Tlogosati. Protected areas on the

northern slopes include sub-district of Klabang; and protected areas on the western slopes include sub-districts of Pakem, Binakal, Curah Dami, Grujugan, and Maesan. These three areas should be used as protected forest areas because of the steep topography and the hills. When used as a resident's activity will endanger the population itself, especially against landslide disaster. According to Kubelaborbir and Yarangga (2010), the condition of the land with slopes is very steep and high rainfall is very vulnerable to erosion that impacts on the land quality decrease and environmental damage. Regions have an average score greater than 175 is a protected forest area that can function to maintain the balance of the environment. For example, avoiding greater erosion, and maintaining water availability as a catchment area. Therefore, this area must be protected and preserved. Everyone is prohibited from logging and disturbing and changing its function to a specified radius or distance. Land management must be in accordance with the ability of the land so as not to reduce the productivity of the land. Land capability is the nature of the ability of the land to provide results for certain uses optimally and sustainably.

*Second:* Limited Production Forest Area. Limited production forests are in areas with steep slopes but are close to the activities of the population (both in the form of settlements or rice fields) such as in Sub-district of Tlogosari, Sumber Wringin, Botolinggo, Cerme, Tapen, Krocok Park, Prajekan, Wringin, Binakal, Curah Dani, , and Grujugan. Particularly in Sub- districts of Sumber Wringin, Botolinggo, Prajekan, Cerme, and Grujugan, the limited production forest location is very close to the settlements; even the settlements are within limited production forest areas. One of the reasons for using hilly terrain for settlements is the attraction of the scenery, the cool air temperature, and is suitable for agriculture (especially vegetables). However, few residents live and move in the sub-district.

*Third:* Production forest area. Production forest areas are areas closer to population activity than limited production forest areas such as Sub-district of Tapen, Botolinggo, Prajekan, Krocok, Grujugan and Sempo. Production forest area is only small because people prefer agricultural activity. And the majority of land use in the form of rice fields. This resulted in the number of production forest areas (combined between production forests and limited production) decreased by 23.62 Km<sup>2</sup>. Decrease can be prevented by patrol or supervision of limited forest area.

*Fourth:* Function area of agricultural land and settlement. Land use in this area is in accordance with its function as a residential area with slope requirements of less than 8%. Residential area in Bondowoso District there is no deviation of actual land use to land area function. The area of land used for the settlement is 42.20 Km<sup>2</sup>. The majority of settlement areas based on overlay results are found in Bondowoso Subdistrict. That's because the region when viewed with the image of the downloaded SAS Planet is a flat area so safe for the activities of the population. In addition Bondowoso sub-district area of overlay result is a production forest area and limited production forest, but the area is used as a residential area because it is the capital of Bondowoso regency, thus becoming the center of population activity in the district. When viewed from the slope of the slope, Bondowoso District including flat that is between (3-15) % and rainfall 1501-2000 mm /year.

Another area in the middle of Bondowoso Regency all its territory consists of rice fields and settlements such as sub-districts of Tenggarang, Wonosari, Jambosari, Tamaran, Tegal Ampel, Tapen, Wringin, and Pujer. This is because the soil type is fertile, rainfall is sufficient for agriculture, and the most important is the low slopes/slopes. Special Sub-district Wringin and Tapen forest area, but only a little on the slope. The existence of this agricultural land becomes important because it has increased beyond RTRW area of 255.23 Km<sup>2</sup>. The government needs to limit and implement article 88 of the RTRW. In the elucidation of the article, the government is entitled to

conduct an investigation of violations of the law and may include in a crime if necessary. Socialization approach is also an alternative solution, besides criminal.

## CONCLUSION

*First*, the effective area of protected forest 525.21 Km<sup>2</sup> above RTRW 306.75 Km<sup>2</sup>, production forest 268.33 Km<sup>2</sup> under RTRW 291.95 Km<sup>2</sup>. *Second*, the area of agricultural land is 728.16 Km<sup>2</sup> above RTRW 472.93 Km<sup>2</sup>. *Third*, the area of settlement is 42.20 Km<sup>2</sup> under RTRW 64,78 Km<sup>2</sup>. Based on these results there are two things that need to be observed. (1) the number of production forest areas decreased by 23.62 Km<sup>2</sup>. Secondly, agricultural land has increased beyond RTRW area of 255.23 Km<sup>2</sup>.

## SUGGESTION

Suggestions that can be submitted related to this paper for the community, especially farmers are expected to manage the land wisely and still pay attention to the rules of conservation.

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