Evaluation of suitable landuse for existing condition in South Coastal of Sampang Regency

Yanto Budisusanto¹, Cherie Bhekti Pribadi¹, and Annisa’ Kunny Latifa¹

¹Department of Geomatics Engineering, Institut Teknologi Sepuluh Nopember Kampus ITS, Keputih, Sukolilo, Surabaya, 60111, Indonesia

Abstract. The detailed and systematic guidelines and direction of development and urban planning are regulated in Regional Spatial Plan (RTRW) under the Law Number 24 of 1992 concerning Spatial Planning, defined that a structural form and pattern of spatial use, whether planned or not. Because the influence of population growth is relatively high and the level of urbanization is not controlled, eventually resulting in the conversion of land use to other uses. The identified problems occurred in the South Coast of Sampang Regency, namely the utilization transition that occurred in the mainland area around the coast, that related to economic interests which affected the availability of land. With these conditions, it is necessary to map and analyze the suitability of existing conditions with the plan documents. This study identified the suitability of 9 coastal land cover classes using the interpretation method in Pleiades satellite images, by digitizing on screen. From the analysis conducted, the dominating land cover class is rice field, which are 5147.656 Ha. The total suitability of land cover with RTRW is 77%, with the most suitable class being ponds, which is equal to 96.75%. Meanwhile, the most inappropriate class is farm class with an area of around 5.09%.

1. Introduction

Coastal areas are one of the most productive ecosystems. But behind this potential, development is usually also concentrated in coastal areas, so it often has a negative impact on the potential of these resources. Human activities in utilizing natural resources such as industry, agriculture, fisheries, settlements, mining, navigation, and tourism, often overlap, so that the benefits or value of the ecosystem go down. These activities have an impact on pollution and sedimentation in coastal areas. As an area with high utilization rates, coastal areas face various negative impacts due to human activities and natural disasters. Forms of land use in a region or region related to population growth and activities. Therefore, the increase in population and the intensification of activities in one place is the trigger for the increasing rate of change in land use. Utilization of coastal areas so far has a positive impact in the form of increasing income of coastal communities and foreign exchange. However, in the utilization of these ecosystems activities tend to be carried out uncontrollably, thus giving a negative impact which is the occurrence of damage to coastal and marine ecosystems [1].
Problems identified are land requirements, overlapping of utilization areas, threats of pollution and environmental degradation and utilization zoning. Camplong Subdistrict is one of the areas that experienced these problems, namely land conversion and reclamation. If these conditions do not receive adequate treatment, some infrastructure, such as the (main) highway on the south side, will be damaged. Overlapping or overlapping of utilization areas occurs in land areas around the coast and coast and in its waters. These conditions are related to economic interests so that it affects the availability of land. This causes overlapping utilization in the mainland in the form of conversion of mangrove forests to be used for various purposes, such as settlements and industries [2].

Spatial planning (planning, utilization and control) is needed to create a safe, comfortable, productive, and sustainable space based on the insights of the archipelago and national resilience that are created through harmony between the natural environment and the artificial environment, integration in the use of natural resources and artificial resources by paying attention to human resources, as well as protecting space functions and preventing negative impacts on the environment due to the use of space [3]. According to the Law of the Republic of Indonesia in 1992 concerning Spatial Planning, spatial planning is a form of structure and pattern of spatial use, both planned and not, and spatial planning is the process of spatial planning, spatial use and control of spatial use [4]. As an effort to guide the utilization of the potential of a space or region, spatial planning has been regulated in the Law. In planning in the land area which covers the administrative area in one Regency or City, the RTRW is used. To maximize this activity, it is necessary to know the extent to which the Rules for Spatial Use Patterns can control any land development or utilization in the area concerned.

2. Methodology

2.1. Study Area and Data
Sampang Regency is geographically located between 113° 08’ to 113° 39’ East and 6° 05’ to 7° 13’ Sout. The coastal and marine areas studied were 4 sub-districts located on the southern coast of Sampang Regency, namely Sreseh, Pangarengan, Sampang and Camplong Districts.
Of the 4 coastal districts south of Sampang Regency, there are 16 villages closest to the coast. The closest villages to the southern coastal region are as follows:

a. Sreseh Subdistrict: Noreh, Labuhan, Taman, and Sreseh
b. Pangarengan Subdistrict: Pangarengan, Apaan, and Gulbung
c. Sampang Subdistrict: Aengsareh, Polagen, and Banyuanyar
d. Camplong Subdistrict: Taddan, Banjartalela, Tamba’an, Dharmacamplong, Sejati, and Tanjung

2.2. Data Survey
The data used in this study are:

1. Regional Spatial Planning / RTRW of Sampang Regency in 2012.
2. Administrative boundaries of Sampang Regency.
3. Pleiades Satellite Image corrected in Sampang Regency in 2018.

2.3. Data Processing
The following are the stages in the study:

**Figure 2.** Flowchart Data Processing
First, cut the RTRW according the southern coastal region of Sampang Regency, in 16 coastal villages. Classification of land cover is done by the method of interpretation of Pleiades satellite images, then topology is performed on the results of digitization. After the classification, do the ground truth. The ground truth was conducted to validate coastal’s land cover, using 222 sample points spread across
9 land cover classes. The classification accuracy test was carried out with a confusion matrix using ground truth data, using data samples in each land cover class. The result of the matrix calculation is the value of Overall Accuracy and Kappa Coefficient. The overall accuracy value used is ≥85% [6]. If it is less than this value, the image interpretation is done again. After the overall accuracy done, overlay of Existing Land Cover with RTRW. This process is carried out using the GIS principle, namely the overlay method with the tool in the form of Intersect. On the existing coastal land cover, an overlay was carried out with the RTRW [7]. Suitability analysis was conducted to determine the suitability of land cover on the southern coast of Sampang Regency with an RTRW. Analysis is carried out using attribute table data in the overlay results. After analysis, the presentation of a suitability map with the map layout process is carried out in accordance with the cartographic rules.

3. Result and Discussion

3.1 Results of Land Cover Classification
Classification of land cover is done by the method of interpretation in the image, by digitizing on screen. The image used is high-resolution satellite imagery Pleiades corrected. From the classification results, 9 land cover is found on the southern coast of Sampang Regency. The following table is a broad comparison of the land cover classification of Sampang Regency in 2018:

| No | Class       | Area (Ha)  | Percentage |
|----|-------------|------------|------------|
| 1  | Farm        | 230,854    | 2.09%      |
| 2  | Field       | 312,949    | 2.83%      |
| 3  | Open field  | 22,467     | 0.20%      |
| 4  | Mangrove    | 295,801    | 2.68%      |
| 5  | Settlement  | 1460,989   | 13.22%     |
| 6  | Bush        | 972,062    | 8.80%      |
| 7  | Rice fields | 5147,656   | 46.58%     |
| 8  | River       | 308,387    | 2.79%      |
| 9  | Ponds       | 2300,643   | 20.82%     |
|    | TOTAL       | 11051,806  | 100%       |

From the classification results, it shows that the largest land cover class on the southern coast of Sampang Regency in 2018 is rice fields of 5147,656 hectares, or cover 46.58% of the total land cover. Figure 3 show the percentage of land cover area from the image classification in 2018:
3.2 Results of Taking Land Cover Sample Data in the Field

Retrieval of land cover sample data was carried out to assess the accuracy of the results of land cover classification in the image with data in the field. The sample points are taken from each land cover class. Of the total land cover class, 222 sample points were taken.

From sampling in the field, there are several data samples above taken in accordance with the land cover in the field, as well as some deviations between samples with land cover resulting from classification in the image. These deviations occur in residential classes, rice fields and bushes. In all three classes, land function changes occur when ground truth is performed. In the residential class there are 2 samples which when carried out ground truth are open land classes. While in the rice field class, there are 4 classes identified as Farms, and there is 1 class of shrubs identified as fields.

3.3 Classification Accuracy Test Results

To measure the accuracy of the classification results of each land cover, a thorough classification of the sampling taken was carried out. The method used is the calculation of the error matrix (confusion matrix) with a classification accuracy level of ≥85%.

| Classification/Validation | Farm | Field | Open Field | Mangrove | Settlement | Bush | Rice Field | River | Ponds | Total | Komisi | MA (%) |
|---------------------------|------|-------|------------|----------|------------|------|------------|-------|-------|-------|--------|--------|
| Farm                      | 20   | 0     | 0          | 0        | 0          | 0    | 0          | 0     | 0     | 20    | 0      | 83.33  |
| Field                     | 0    | 2     | 0          | 0        | 0          | 0    | 0          | 0     | 0     | 2     | 0      | 100    |
| Open Field                | 0    | 0     | 0          | 10       | 0          | 0    | 0          | 0     | 0     | 10    | 0      | 100    |
| Mangrove                  | 0    | 0     | 0          | 20       | 0          | 0    | 0          | 0     | 0     | 20    | 0      | 100    |
| Settlement                | 0    | 0     | 2          | 0        | 56         | 0    | 0          | 0     | 0     | 58    | 2      | 96.67  |
| Bush                      | 0    | 1     | 0          | 0        | 0          | 13   | 0          | 0     | 0     | 14    | 1      | 93.33  |
| Rice Field                | 4    | 0     | 0          | 0        | 0          | 42   | 0          | 0     | 0     | 46    | 4      | 92     |
| River                     | 0    | 0     | 0          | 0        | 0          | 22   | 0          | 0     | 0     | 22    | 0      | 100    |
| Ponds                     | 0    | 0     | 0          | 0        | 0          | 0    | 30         | 0     | 0     | 30    | 0      | 100    |
| Total                     | 24   | 3     | 12         | 20       | 56         | 13   | 42         | 22    | 30    | 222   | 215    |        |

With the overall accuracy of 96.85% the classification is considered correct because it meets the standard value of ≥85%. While for the level of closeness, seen from kappa accuracy, which is obtained at 0.963. This number is in the range of 0.81-1.00, so it can be said to be very strong (very good). Each class has a mapping accuracy. Mapping accuracy is needed to determine whether the results of the classification process in the image are in accordance with the actual conditions in the field, from the sample measurements that have been made. The results of the accuracy mapping are in the form of percentages to determine the accuracy of the classification. Based on the results of calculations with confusion matrix, there are 5 classes that have a mapping accuracy level of 100%, namely the class of fields, open land, mangroves, rivers, and ponds.

3.4 Suitability of Land Cover
Suitability analysis of coastal land was carried out by overlaying between existing land cover and RTRW. This process is done using the Intersect tool from ArcMap 10.6.1 software. From the results of the analysis carried out it is known that there are several land coverings that are not in accordance with the RTRW that have been prepared.

Most of the conditions in the southern coast of Sampang Regency are in accordance with the RTRW, where the appropriate amount of land cover is 77%, with the most suitable land cover being ponds. Meanwhile, the total area that is not suitable is 33%, with the most inappropriate utilization being Farms. The comparison of Suitability of Land Cover in Sampang Regency showed in the figure 4.

![Figure 4. Comparison of Suitability of Land Cover.](image)

The description of the suitability of land cover on the southern coast of Sampang Regency can be seen in table 3 below:

| No | Classification | RTRW | Area (Ha) | Suitability per Class | Total of Suitability |
|----|----------------|------|-----------|-----------------------|----------------------|
| 1  | Farm           | Farm | 11.696    | 5.09%                 | 0.11%                |
|    |                | Settlement | 9.243    | 4.02%                 | 0.08%                |
|    |                | Rice fields | 204.582  | 89.04%                | 1.88%                |
|    |                | Mangrove | 0.327    | 0.14%                 | 0.00%                |
|    |                | Bush | 3.907    | 1.70%                 | 0.04%                |
| 2  | Field          | Field | 131.856  | 22.26%                | 1.21%                |
|    |                | Bush | 7.357    | 1.24%                 | 0.07%                |
|    |                | Rice fields | 405.601  | 68.48%                | 3.72%                |
|    |                | Open field | 14.630   | 2.47%                 | 0.13%                |
|    |                | Farm | 4.213    | 0.71%                 | 0.04%                |
|    |                | Settlement | 24.387   | 4.12%                 | 0.22%                |
|    |                | Mangrove | 4.213    | 0.71%                 | 0.04%                |
| 3  | Open Field     | Open field | 14.801   | 65.88%                | 0.14%                |
|    |                | Rice fields | 7.609    | 33.87%                | 0.07%                |
|    |                | Settlement | 0.057    | 0.25%                 | 0.00%                |
| 4  | Mangrove       | Mangrove | 207.546  | 82.78%                | 1.90%                |
| No | Classification | RTRW Area (Ha) | Suitability per Class | Total of Suitability |
|----|----------------|----------------|-----------------------|----------------------|
| 1  | Rice fields    | 2.574          | 1.03%                 | 0.02%                |
| 2  | Ponds          | 38.902         | 15.52%                | 0.36%                |
| 3  | River          | 0.761          | 0.30%                 | 0.01%                |
| 4  | Settlement     | 0.915          | 0.36%                 | 0.01%                |
| 5  | Farm           | 0.007          | 0.00%                 | 0.00%                |
| 6  | Settlement     | 904.382        | 62.72%                | 8.30%                |
| 7  | Rice fields    | 424.942        | 29.47%                | 3.90%                |
| 8  | Ponds          | 18.885         | 1.31%                 | 0.17%                |
| 9  | Farm           | 3.993          | 0.28%                 | 0.04%                |
|    | River          | 78.332         | 5.43%                 | 0.72%                |
|    | Open field     | 7.660          | 0.53%                 | 0.07%                |
|    | Bush           | 3.121          | 0.22%                 | 0.03%                |
|    | Field          | 0.246          | 0.02%                 | 0.00%                |
|    | Farm           | 0.318          | 0.02%                 | 0.00%                |
|    | Rice fields    | 91.655         | 13.50%                | 0.84%                |
| 10 | Mangrove       | 2.258          | 0.33%                 | 0.02%                |
|    | Field          | 0.165          | 0.02%                 | 0.00%                |
|    | Farm           | 92.449         | 13.62%                | 0.85%                |
|    | Settlement     | 80.044         | 11.79%                | 0.73%                |
|    | Open field     | 998            | 0.15%                 | 0.01%                |
|    | F  | 6067           | 1.78%                 | 0.11%                |
|    | Ponds          | 4604.905       | 89.67%                | 42.25%               |
| 11 | Rice fields    | 201.104        | 2.26%                 | 1.07%                |
|    | Ponds          | 116.104        | 0.01%                 | 0.01%                |
|    | River          | 0.549          | 0.14%                 | 0.07%                |
|    | Mangrove       | 7.145          | 1.91%                 | 0.90%                |
|    | Bush           | 97.833         | 3.58%                 | 1.69%                |
|    | Field          | 7.673          | 0.30%                 | 0.14%                |
|    | Farm           | 101.877        | 0.15%                 | 0.07%                |
|    | River          | 201.104        | 1.98%                 | 0.93%                |
| 13 | Settlement     | 3.653          | 1.43%                 | 0.03%                |
| 14 | Bush           | 0.502          | 0.02%                 | 0.00%                |
| 15 | Rice fields    | 1.527          | 0.60%                 | 0.01%                |
| 16 | Ponds          | 47.741         | 18.74%                | 0.44%                |
| 17 | Ponds          | 2219.503       | 96.75%                | 20.36%               |
| 18 | Settlement     | 12.609         | 0.55%                 | 0.12%                |
| 19 | River          | 3.651          | 0.16%                 | 0.03%                |
| 20 | Bush           | 0.392          | 0.02%                 | 0.00%                |
| No | Classification | RTRW | Area (Ha) | Suitability per Class | Total of Suitability |
|----|----------------|------|-----------|----------------------|---------------------|
|    | Rice fields    | 12.070 | 0.53% | 0.11% |
|    | Field          | 0.238 | 0.01% | 0.00% |
|    | Farm           | 0.052 | 0.00% | 0.00% |
|    | Mangrove       | 43.891 | 1.91% | 0.40% |
|    | Open field     | 1.623 | 0.07% | 0.01% |
|    | TOTAL          | 10899.994 | 100% | |

From the conformity analysis that has been done, there is a shift in the function of land in land cover in the South Coast of Sampang district. The distribution of land cover suitability can be seen on the map in figure 5.

According to the suitability of each class, the most suitable class is a farm, with a percentage of 96.75%. While the class with the least suitability is the Farm, with a suitability level of 5.09%. While based on the suitability of the total class and RTRW, the most suitable class is rice field, which is equal to 42.25% and the least suitable class is Farm, which is equal to 0.11%. Rice fields have the greatest degree of conformity compared to other classes, because rice fields have a vast dominance in the cover of the coastal area south of Sampang Regency.

4. Conclusion

1. There are 9 coastal land cover classes, namely Farms, fields, open land, mangroves, settlements,
shrubs, rice fields, river, and ponds, where there are discrepancies in utilization in each class.

2. In the southern coastal area of Sampang Regency, the land cover class that best fits the RTRW is a farm of 96.75%, rice fields by 89.67%, mangroves at 82.785%, rivers at 78.10%, open land at 65.88 %, settlements at 62.72%, fields 22.26%, bushes at 13.50%, then the most inappropriate class is Farm 5.09%. While based on the suitability of the total class and RTRW, the most suitable class is rice field, which is equal to 42.25% and the least suitable class is Farm, which is equal to 0.11%.

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