Identification of Settlement in the Area Site RDE and It’s Surrounding for Social Engineering Evaluation

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Abstract. Land used, especially for the settlement has grown rapidly in the around PUSPIPTEK Area. The rapid movement of population around the PUSPIPTEK area will have the impact of changing the use of productive agricultural land into residential or industrial areas. The development of a fairly fast settlement will also affect the existence of Puspiptek Region which has been established as a High Technology Area, such as social issues. Identification of settlements around Puspiptek area becomes very important in Puspiptek area development plan related to development plan of RDE. This study aims to determine the existing condition and the development of settlement covering a radius of 5 km from the center of the RDE program in the area PUSPIPTEK has increased quite rapidly along with the addition of a fairly dense population. Identification of settlement and developments aimed at supporting social engineering programs in preparation for RDE development.

Keywords: Land Use, settlement, RDE, social

1. Introduction

Settlements are the most important areas in emergency mitigation program [1]. Settlements are part of the environment, where there are urban settlements and rural areas that function as residential or residential areas or places of activities [2]. Increased population and economic level from year to year increase the community's need for housing needs. Utilization of productive lands and empty land is needed developers in developing settlements. This is done because the middle ground of the city is no longer an ideal place from the economic side.

The development of an area especially the urban areas has characteristics with the imbalance of development between regions and unequal centers of services for the community, resulting in problems, such as the tendency of concentration in certain areas, the development of mixed land use, the occurrence of land conversion from open space, conservation area, or green open space into intensive building areas (settlements, industries, offices, infrastructure) [3].

Preparation of the creation of social engineering for development and development program of RDE in Serpong Nuclear Area (KSN) in Puspiptek require support of residential characteristic data of Serpong area. This condition is very important because the identification of the settlement is the part that should be evaluated in the dispersion and population aspects. Evaluation of the dispersion and population aspects is one aspect that should be evaluated in the RDE permit process. As well as for social engineering analysis as a form of community involvement and emergency evaluation of the RDE program [4].
Based on the RTRW of Banten Province in 2010-2030 and RTRW of South Tangerang Municipality in 2011-2031, PUSPIPTEK Area in Setu Sub-district of Tangerang Selatan City has been established as a strategic area of the province from the point of view of the utilization of natural resources and/or high technology [4,5]. Meanwhile, the location of the RDE project is located in the strategic area of the city, namely PUSPIPTEK. PUSPIPTEK is an area that has strategic value utilization of natural resources and/or high technology [4, 5, 6, 7, 8, 9, 10, 11]. The purpose of this research is to collect data base related demography aspect, specially related to data of settlement evaluation which will be done in process.

The RDE development program is the development of nuclear facilities in the Serpong Nuclear Area. This development plan with regulation either from BAPETEN or KLHK so that safety will be obtained.

2. Methodology
The research is done by spatial approach to identify the development of physical space of settlement. While the technique of data collection is done by collecting primary data and secondary data. Implementation of projection with DYNAMICA modeling.

2.1. Research sites
The study site covers a radius of 5 km from the center of the RDE development plan site, which is ± 600 m from Siwabessy RSG in Serpong PUSPIPTEK [4, 10].

2.2. Data Model
Land use projection using DYNAMICA model with map (land use or land cover) as its main input. In addition, this model also uses other maps as variables. These variables can be categorized as dynamic and static variables. To run the simulation, DYNAMICA requires at least two maps: the initial map and the final map. When the model runs, it will generate a transition possible map for each transition indicating the probability that the cell (x, y) will change from type i to j, dynamic variable map and simulation map (one for each iteration).

Figure 1. Study Area Boundary Map
DYNAMICA can handle data in several formats, including raster or imagery maps, tables, matrices and a weighted coefficient of evidence file. For spatial data, DYNAMICA only supports raster data in three formats: ER Mapper, Geotiff and ASCII Arcview format. To run the simulation, DYNAMICA also needs some parameters such as:
- Number of iterations of time
- Transition metrics
- The weighting coefficient of evidence to calculate the possibility of transition for each i-j transition
- Percentage of transitions for each transition function
- Average patch size and patch variance for each type of land use.

3. Result and Discussion

3.1. Settlement Land Use

Previous research that discussed land use in RDE area within 5 km radius, stated that PUSPIPETEK is located in three administrative areas, namely Serpong District (South Tangerang City), Cisauk & Pagedangan Sub-district (Tangerang Regency), and Rumpin & Gunungsindur Sub-District (Bogor Regency). This area has developed very rapidly, especially in the northern part of the research area in the District Serpong [6].

3.2. Development of Land Use Settlement around Puspiptek

RDE development program in Puspiptek area, Puspiptek area in RTRW Banten document and South Tangerang city has been designated as Kawasan Teknologi Tinggi (Figure 2). Serpong Subdistrict that has a direction as a residential area to develop because it is influenced by the existence of Megapolitan Jabodetabek area with the Province of Jakarta as the center of its activities. This is in line with Presidential Regulation No. 54/2008 on Spatial Planning Jabodetabekpunjur Area. Serpong district is developed as a residential area. The existence of an increasingly limited land in Serpong Sub-district caused the expansion of settlement area to Kecamatan Cisauk, whose land availability is still quite wide. In the last 3 years, the development of settlements in this region occurred rapidly so that land use is very dynamic, especially the change of non-built land into wake land [6].

Figure 2. Nuclear Area Puspiptek in Spatial Planning of South Tangerang [5]
In a previous study it has also been mentioned that there has been a rapid increase of land use for residential areas as evidenced by the increasing number of new housing constructed by developers [6].

### 3.3. Projection of Change of Land Use of Settlement

Puspitek area land use projection is done to see the prediction of 5 years land use change in 2015 and 2020 period. This land use change is important to see the trend of change that will happen especially in Puspitek area. Predicted land use change is useful in anticipating the potential and level of disaster risk that can occur from an activity.

This modeling requires two periods of land use maps to see trends in land use change taking place. The land use map used is the 2014 land use year map and the year land use map of 2015.

#### Table 1. Land Usage Change Rate

| From                        | To                        | Rate of Change (%) |
|-----------------------------|---------------------------|--------------------|
| Garden                      | Building                  | 0.014238204        |
| Garden                      | Settlement                | 0.07264602         |
| Garden                      | Grass / Empty Land        | 0.135280261        |
| Garden                      | Shrubs                    | 0.276449803        |
| Garden                      | Tissue / Field            | 0.100360285        |
| Swamp                       | Building                  | 0.003965631        |
| Swamp                       | Garden                    | 0.045604759        |
| Swamp                       | Settlement                | 0.001321877        |
| Swamp                       | Grass / Empty Land        | 0.079973562        |
| Swamp                       | Shrubs                    | 0.269001983        |
| Swamp                       | Tissue / Field            | 0.050892267        |
| Grass / Empty Land          | Building                  | 0.019506856        |
| Grass / Empty Land          | Settlement                | 0.042747698        |
| Grass / Empty Land          | Shrubs                    | 0.129208781        |
| Grass / Empty Land          | Tissue / Field            | 0.031223846        |
| Irrigated Rice Fields       | Building                  | 9.02907E-4         |
| Irrigated Rice Fields       | Garden                    | 0.030337687        |
| Irrigated Rice Fields       | Settlement                | 0.016854271        |
| Irrigated Rice Fields       | Grass / Empty Land        | 0.146993318        |
| Irrigated Rice Fields       | Shrubs                    | 0.165111166        |
| Irrigated Rice Fields       | Tissue / Field            | 0.072593752        |
| Rice Fields Rain            | Garden                    | 0.170542636        |
| Rice Fields Rain            | Grass / Empty Land        | 0.209302326        |
| Shrubs                      | Building                  | 0.004006529        |
| Shrubs                      | Garden                    | 0.551417124        |
| Shrubs                      | Settlement                | 0.023297225        |
| Shrubs                      | Grass / Empty Land        | 0.102834248        |
| Shrubs                      | Tissue / Field            | 0.04644606         |
| Tissue / Field              | Building                  | 0.022017489        |
| Tissue / Field              | Garden                    | 0.107979388        |
| Tissue / Field              | Settlement                | 0.037788882        |
| Tissue / Field              | Grass / Empty Land        | 0.196986259        |
| Tissue / Field              | Shrubs                    | 0.240006246        |
In the model simulation structure, there is a transition rule that affects land use change, besides the transition rule is also a limiting factor that limits a class of land use can not be changed into other land use classes. For example, the class of land use settlements may not turn into irrigated rice fields or settlements changed into water bodies. The land use classes of water bodies and airports in this model have not changed.

The structure of this land use simulation model is made with respect to land use maps in 2014 and 2015. The change trends in both years can provide information on the transition rate of changes in any land use change. The opportunity of a land use class to change is also influenced by the variables in the model. The variable is a driving factor that affects a class of land change turned into another land use class.

Puspitek area mostly located in South Tangerang City has a spatial use direction as urban settlement area which is fast growing area due to Megapolitan Jakarta activity. It is characterized by the number of existing large and medium scale housing that is being developed in the region especially in Serpong and Cisauk Subdistricts. The transition rate of land use change uses fixed parameters every year. This parameter is derived from the rate of change on land use maps 2014 and 2015. Based on table 1 before, it can be seen that the conversion rate of several classes of land use has a big enough chance to change. Some interesting land use changes to change are land use to settlements and buildings. Field observation shows that the conversion of non-constructed land into intensive land is quite intensive. At this time the trend of residential and residential development in the area leads to the southern part of Serpong District and Setu Subdistrict in South Tangerang City and Cisauk Subdistrict, Tangerang Regency, part of which is Puspitek area.

The following Table 2 shows the simulation results of land use change model from 2015 to 2020 using baseline data of 2015. The change uses 2014 and 2015 usage data which obtained the rate of land use change. Some classes of land use have not changed land use until 2020, including airports and water bodies. The transition rule plays the role of land use change in which the two classes have a rate of land use change of 0 (zero) which means unchanged land use.

| Land used            | 2015   | 2016   | 2017   | 2018   | 2019   | 2020   |
|----------------------|--------|--------|--------|--------|--------|--------|
| Airport              | 35.687 | 35.687 | 35.687 | 35.687 | 35.687 | 35.687 |
| Building             | 313.520| 374.270| 435.703| 496.078| 554.667| 610.428|
| Garden               | 1079.132| 1143.585| 1098.947| 1035.081| 966.354| 901.581|
| Settlement           | 2400.347| 2596.586| 2793.897| 2984.585| 3166.546| 3339.021|
| Swamp                | 51.932 | 28.682 | 16.057 | 9.057  | 5.682  | 4.557  |
| Grass / Empty Land   | 1360.404| 1534.792| 1604.649| 1611.786| 1581.226| 1528.438|
| Irrigated Rice Fields| 588.181| 333.651| 189.428| 107.648| 61.175 | 34.808 |
| Rice Fields Rain     | 4.915  | 3.066  | 2.157  | 1.407  | 0.937  | 0.687  |
| Shrubs               | 1128.691| 1042.768| 979.891 | 916.825| 857.526| 801.325|
| Tissue / Field       | 626.789| 496.512| 433.182| 391.443| 359.798| 333.065|
| Water Body           | 252.453| 252.453| 252.453| 252.453| 252.453| 252.453|

Source: Analysis, 2015
Some land use classes tend to decrease until 2020. Agricultural land is a class of land use that is massively diminished in the next 5 (five) years based on the simulation of land use change from 2015 to 2020. Irrigated rice field is reduced from 588,181 Ha in 2015 to 34,808 Ha in 2020. Rainfed rice fields also decreased considerably from 4,915 Ha to 0.687 Ha. While the moor / field decreased almost 50% from 626,789 ha in 2015 to 333,065 Ha in 2020. The change in agricultural land is quite interesting considering the existence of agricultural land in areas that still have rural characteristics in the region Puspitek.

The phenomenon of urban sprawl in big cities in Indonesia including in the outskirts of DKI Jakarta province caused the city of South Tangerang experienced a very rapid development. It is caused by the existence of Megabolitan Jabodetabek which affect the surrounding hinterland area. The location is quite strategic with the support of good accessibility and the competitive lands of the land causing this area to experience the conversion of land use is quite high. Agricultural land in the area is transformed into wake land, it is difficult to avoid because of the dominant market mechanisms in the change of land use.

Other classes of usage that decrease the area within the period 2015 s / d 2020 is the garden, shrubs, and swamp. The gardens are reduced from 1,079,132 hectares in 2015 to 901,581 ha in 2020. The conversion of the garden into a wake-up area is due to the fact that the garden is partly utilized as a mixed garden in the form of yard. While the shrubs experienced a varied land use change. In 2015 shrubs have an area of 1128,691 hectares to 801,325 ha in 2020. The land that was originally a good agricultural land in the form of irrigated rice fields, rainfed rice fields, and dry fields / fields are drying process for the land to be built. In the process is often the land is not built directly built, some of its use into shrubs because the land tends not to be utilized to become land for sleep or unproductive land. But most of the shrubs will be transformed into constructed land for commercial, commercial and service areas as well as other facilities or as a residential area.

Swamps also experienced a dynamic development of land use changes. In 2015 the swamp area of 51.932 Ha to 4.557 Ha in 2020. Swamp is predicted to be reduced due to the presence of swamps that are mostly located around the settlement. In its development, swamps are often carried out so that the available land becomes more available. Swamp turns into grass / vacant land that is ready to build area for the next swamp will turn into a wake area. The reduced swamps of course provide logical consequences for the surrounding environment. Swamps that have ecological functions as water reservoirs lead to the loss of water reservoirs that potentially cause flooding. This should be of concern to local governments for the use of swamplands maintained.

The use of a fairly dynamic land is grass / empty land. In general, grass / vacant land increased from 1,360,404 hectares in 2015 to 1,528,438 hectares by 2020. But the extent of grass / vacant land decreases from 2019 to 1,581,226 Ha and decreases again in 2020 to 1,528, 438 Ha.

Transition rule affects land use change, there is no change of land use mechanism and necessarily change in one particular class. Agricultural land does not necessarily turn into a wake-up land. There is a gradual change mechanism. Farmland will turn into grass / vacant land then turned into a settlement. Swamps turning into grass / vacant land can also turn into underbrush if the implementation process of development is delayed.

In the model process iteration occurs to obtain a land use class corresponding to the driving factor and transition rule. That is what happens in land use change. In the change before becoming a residential area, there is a transition from agriculture to empty land is quite large considering the need for further processing such as leveling the land, build a road that the process takes quite long before the settlement so that the opportunity to change into grass / empty land is large enough [13,14,15].
Figure 3 above shows a simulation chart of land change models from 2015 to 2020. The settlements have the most dominant area and increase annually. Grass / vacant land has the next extent and tend to fluctuate each year where the year 2015 s / d 2018 experienced an increase in area but began to decrease from the year 2019 s / d 2020.

In that period the grass / vacant lands changed into a large settlement because some of the land use is a ready-to-build area. The rate of increase in settlements is greater than the rate of increase of grass / vacant so the grass / vacant land area is reduced. While the agricultural land in the form of irrigated rice fields, rain-fed rice fields and fields tend to decrease each year. The land use simulation map from 2015 to 2020 can be seen on the map below.

Figure 4. Land Use Simulation Year 2015
Figure 5. Land Use Simulation Year 2016

Figure 6. Land Use Simulation Year 2017
Figure 7. Land Use Simulation Year 2018

Figure 8. Land Use Simulation Year 2019
Figure 9. Land Use Simulation Year 2020

Land use simulation map 2015 s/d 2020 can be seen in the picture 4 s/d 9 above. The simulation is done by looking at the rate of land use change, driving factors affecting land use change and transition rule. The land use prediction simulation illustrates that rapid settlement land use occurs in the northern part of Puspitek. Most of the existing land use in the northern part of Puspitek is a settlement and trade and services. In Predicted land change shows the settlements in that part will continue to grow. Serpong sub-district will be more densely built land. The denser and saturated land causes the nearby area to be affected by the development of residential areas.

In general, the simulation results show that settlements will tend to lead to Setu and Cisauk sub-districts. Serpong sub-district is already densely settled so that the development of settlements will increase but not semasi in those two subdistricts. The results of observations in the field did indicate the direction of the development of settlements to the two sub-districts. While settlements in the southern part of the Puspitek region developed relatively slowly. The development will run naturally but its development is not as fast as in the northern part of Puspitek area [4,5].

The results of the identification of settlements in Puspitek and surrounding areas are expected to find a formulation of perceptions and community responses to the planning of RDE development and anticipate the possibility of local community resistance to the RDE program. Conceptually, this strategy is basically more directed towards community involvement in the RDE development program [13].

4. Conclusion
Based on the research results have obtained data base settlement and dynamics in Serpong Nuclear Area, Puspiptek and surrounding areas within a radius of 5 km. This data is important for the input of stakeholders in the city of South Tangerang. Distribution of settlements that lead to Serpong Nuclear Area should be anticipated to keep the density of the population around the area has a category of settlements that are not solid. Because it is not in accordance with the provisions in the RTRW, Serpong Nuclear Area should be conditioned according to allotment, especially in a radius of 1 km.

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