Land Use Predictions to the Response of Kediri Airport, Kediri Regency

Annisaa Hammidah Imadudinna[1*], Widiyanto Hari Subagyo Widodo [1], Agustina Nurul Hidayati[1]

[1]Program Studi Perencanaan Wilayah dan Kota. Institut Teknologi Nasional, Malang, Indonesia
nisa_pwk@yahoo.com*; harry_4444@rocketmail.com ; anhidayati21@gmail.com

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A B S T R A K

Kabupaten Kabupaten Kediri adalah kabupaten dengan perkembangan cukup dengan adanya PSN pembangunan Bandara Kediri. Bandara Kediri akhirnya ditetapkan sebagai PSN. Bandara senilai Rp 10 triliun ini masuk PSN sesuai Peraturan Presiden Nomor 56 Tahun 2018. Setelah Bandara Kediri, Segera Bangun Tol Kertosono-Tulungagung Pembebasan Lahan Ruas Kediri Selesai 2021. Dengan adanya proyek strategis nasional tersebut maka perkembangan investasi di Kabupaten Kediri pasti akan mengalami peningkatan. Berdasarkan hal tersebut diatas maka sangat dibutuhkan prediksi penggunaan lahan ke depan untuk dapat mengetahui respon penggunaan lahan terhadap project bandara dan tol yang terintegrasi tersebut. Metode yang digunakan dalam penelitian ini adalah penginderaan jarak jauh, Analisis SIG, Analisis *Celluler Automata* dan Analisis Deskriptif. Dengan mengetahui respon ruang maka akan menjadi masukan yang sangat berarti bagi perencana terutama dalam merumuskan rencana guna memaksimalkan multiplier effect yang ditimbulkan bandara serta tol terhadap ruang di sekitarnya.

Keywords:
Land Use Change
Airport
Kediri Regency

A B S T R A C T

Kediri Regency is a district with sufficient development with the existence of PSN for the construction of Kediri Airport. Kediri Airport was finally designated as PSN. This Rp 10 trillion airport is included in PSN in accordance with Presidential Regulation Number 56 of 2018. After Kediri Airport, Immediately Build the Kertosono-Tulungagung Toll Road. Land Acquisition for the Kediri Section is Completed in 2021. With this national strategic project, investment development in Kediri Regency will definitely increase. Based on the above, it is very necessary to predict future land use to be able to know the response of land use to the integrated airport and toll road project. The methods used in this research are remote sensing, GIS analysis, cellular automata analysis and descriptive analysis. Knowing the spatial response will be a very meaningful input for planners, especially in formulating plans to maximize the multiplier effect caused by the airport and toll roads on the surrounding space.

Introduction

Land is the mainland part of the earth's surface as a physical environment that includes land and all factors that influence its use, such as climate, relief, geological and hydrological aspects that are formed naturally or as a result of human influence. Infrastructure development is one aspect of driving economic growth that requires land for every utilization (Hartato, 2012). Yunus (2008) said that any form of land use change in a particular area will have the potential to affect adjacent land use fields, this phenomenon is referred to as the transboundary effect. (transboundary effect phenomena). Explained by Bourne in Prawiro (2014) that There are four main processes that cause changes in land use, namely the expansion of city boundaries, rejuvenation of the city center, expansion of infrastructure

networks, especially transportation networks, as well as the growth and loss of concentration of certain activities. Based on this, it can be indicated that there is a relationship between the development of land use due to the development of infrastructure networks around the area. The availability of land for development is an absolute requirement to realize the role of sustainable development of a city, especially in its role in realizing the ideal land use arrangement. On the other hand, philosophically, land has a central role and function for the Indonesian people who are agrarian because they have economic, socio-cultural and religious values.

One of the efforts to do modeling is to formulate scenarios. Walker in Rizka (2012) said that scenario is an analytical tool used to describe as well as involve uncertainty factors. Each scenario is a description of one possible state of the future system. Scenarios doesn't predict what will happen in the future, they just describe things that might happen in the future. In addition, the scenario also does not describe a complete description of the state of the system in the future, the scenario only includes factors that may have a major influence on the variables (outcomes) being studied.

Kediri Regency is a district with sufficient development with the existence of PSN for the construction of Kediri Airport. Finally, Kediri Airport designated as PSN. Airport worth 10 trillion rupiah get in PSN in accordance with the Presidential Regulation Number 56 of 2018. After Kediri Airport, the Kertosono-Tulungagung Toll Road will soon build with land acquisition in the Kediri section that estimated will completed in 2021. With the existence of this national strategic project, the development of investment in Kediri Regency will definitely increase. Based on the above, it is very necessary to predict future land use to find out the response of land use on integrated airport and toll road projects. Knowing the spatial response will be a very meaningful input for planners, especially in formulating plans to maximize the multiplier effect caused by airport and toll roads to the surrounding space.

The existence of the determination Kediri Airport as PSN will certainly change the direction of development on the surrounding area, no exception. With the construction of an airport in Kediri Regency, it will certainly affect all activities in Kediri Regency.

Thus, this study is to determine the response of land use to the integrated airport and toll road project. Knowing the spatial response will be a very meaningful input for planners, especially in formulating plans to maximize the multiplier effect caused by the airport and toll roads on the surrounding space. The results of this study are expected to be a very meaningful input for planners, especially in formulating plans to maximize the multiplier effect caused by the airport and toll roads on the surrounding space.

Method

In this study, the data collection method consisted of 2 primary data (observations and interviews) and secondary data (institutional survey and literature survey). This research uses descriptive analysis method, AHP dan Geographic Information System Analysis Method). Analitycal Hierarchy Process (AHP) Have ability to solve multi-objective and multi-criteria problems based on the comparison of preferences of each element in the hierarchy.

This cellular automata analysis will also be supported by several logistic regression analyzes, neural networks and simweights to increase validation in the process of determining the transition model in the analysis of determining future susceptibility conditions. The advantage of this research is in making future predictions with spatial analysis, both projection of flood conditions and future vulnerability conditions projections to formulate risk deltas, namely the overlay results of current risks and future risks that are projected spatially.

Results and Discussion

Existing land use in Kediri Regency in 2018 is divided into several classifications which are dominated by rice fields land use and built area land use, namely residential with a percentage of more than 20%. More clearly, can be seen in the following table and map image.

Table 1. Land Use of Kediri Regency in 2018

Landuse	Area (Ha)	Percentage (%)
Protected forest	8.104,93	5,32%
Production forest	13.826,60	9,08%
Nature Reserve Area, Nature Conservation	475,37	0,31%
Garden	1.997,04	1,31%
Field	128,94	0,08%
Inland waters	421,38	0,28%
Plantation	6.955,05	4,57%
Residential	28.957,31	19,01%
Rice fields	57.963,17	38,05%
Seasonal dry land farming	32.094,75	21,07%
River	1.322,84	0,87%
Open ground	83,94	0,06%
Total	**152.331**	**100%**

Source: Kediri Regency in 2019

Based on table above, the largest land use classification is rice fields with an area of 57,963.17 Ha or 38.05% of the total area of Kediri Regency. Meanwhile, the built-up area especially the residential area, has a total area of 28,957.31 hectares or 21.07% from total area of Kediri Regency.

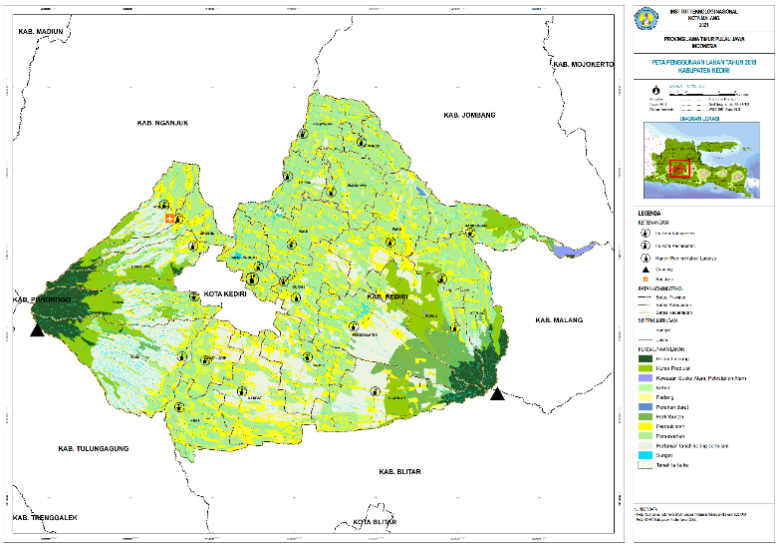


Image 1. Land Use Map of Kediri Regency in 2018

Existing land use in Kediri Regency based on the Spatial Plan (RTRW) of Kediri Regency 2020 is divided into several classifications dominated by land use, fields, and land use. Built-up area, namely residential with a percentage of more than 20%. For more details, can be seen in the following table and map image.

Table 2. Kediri Regency Land Use in 2020

Landuse	Area (Ha)	Presentage (%)
Protected forest	8.233	5,40%
Production forest	13.799	9,06%
Nature Reserve Area, Nature Conservation	473	0,31%
Garden	10.777	7,08%
Field	121	0,08%
Inland waters	13	0,01%
Plantation	8.883	5,83%
Residential	32.605	21,40%
Rice fields	57.873	37,99%
Seasonal dry land farming	18.140	11,91%
River	1.323	0,87%
Open ground	90	0,06%
Total	**152.331**	**100%**

Source: Kediri Regency in 2020

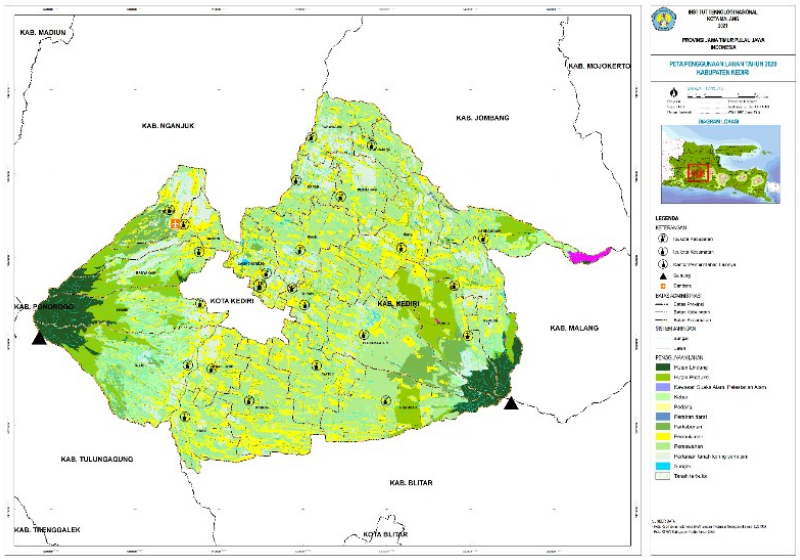


Image 2. Kediri Regency Land Use Map 2020

Identification of land use change in Kediri Regency from 2020 to 2025 was carried out as an initial analysis to determine the change value of each land use and aims to determine the pattern of land use change. In addition, this analysis also has the aim of identifying changes in land use that can be used as input for the next step. The base map used in the analysis of land use change is the Land Use Map sourced from the Existing Spatial Plan (RTRW) of Kediri Regency 2020 and the Rupa Bumi Indonesia Map (RBI) in 2018. These two maps will be the starting base to find out where the land development trend is leading. The following result will describe the distribution of each land use in Kediri Regency.

Based on the results of spatial analysis by means of a change analysis land use in Kediri Regency from 2018 to 2020, it was found that residential land in Kediri Regency experienced large change, amounting to 3,728 Ha. For more details, the changes can be seen in the following table:

Tabel 3. Land Use Change Trends in Kediri Regency

Information	Losses	Gains
Protected forest	-428	556
Production forest	-1375	1328
Nature Reserve Area, Nature Conservation	-6	4
Garden	-1245	10020
Field	-129	121
Inland waters	-410	13
Plantation	-4106	6029
Residential	0	3728
Rice fields	-21675	21568
Seasonal dry land farming	-29150	15152
River	0	0
Open ground	-84	90

Source: Analysis Results in 2021

From the picture above, it can be seen that the one experienced the greatest reduction was seasonal dry land agriculture, with a total loss of 29,150 hectares. Meanwhile, the least changes occurred in the river land use classification that has no change. To see the distribution of locations that have changed land use from 2018 to 2020, see on the below map.

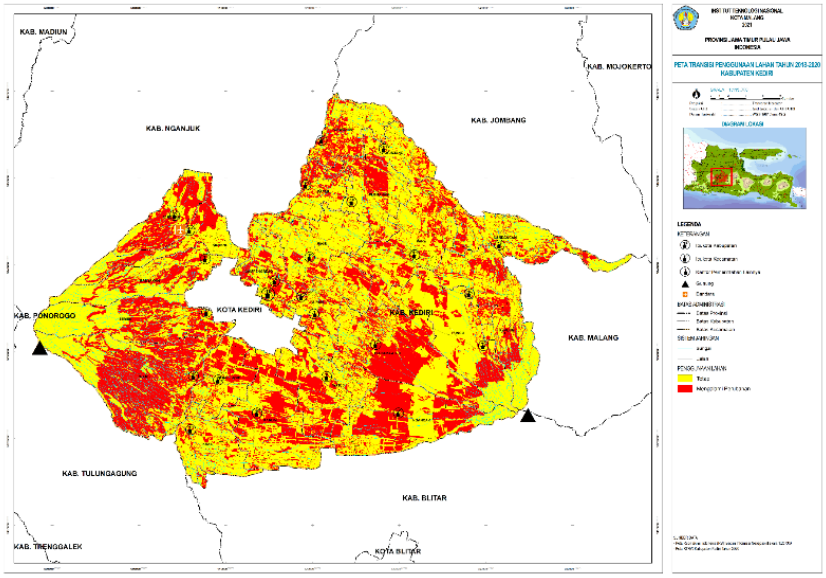
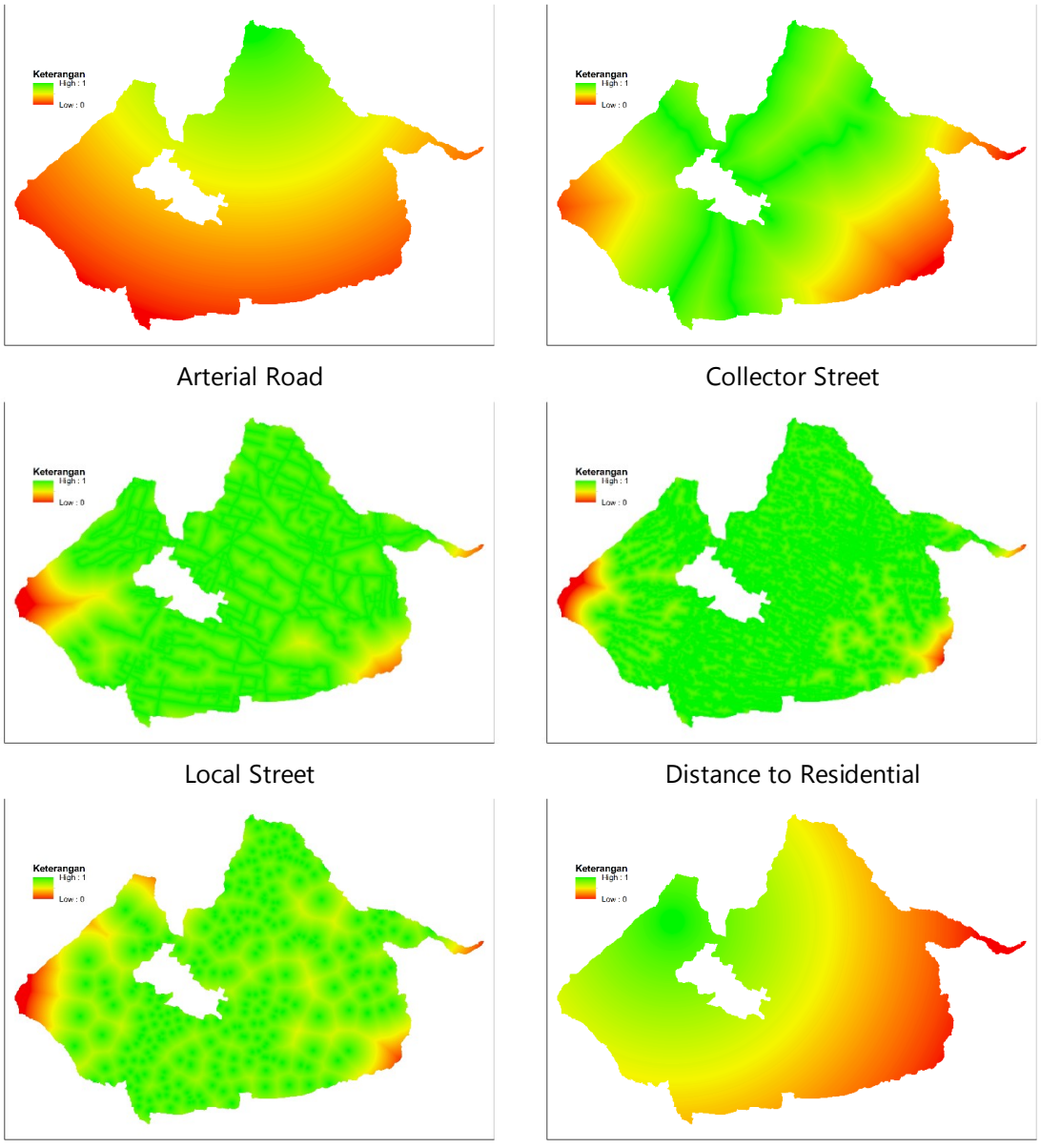


Image 3. Land Use Change Transition 2018-2020

Identification of land use change in Kediri Regency from 2020 to 2025 carried out as a preliminary analysis to determine the change value of each land use and determine the pattern of land use change. In addition, this analysis also to identify changes in land use that can be used as input for the next step. The base map used in the analysis of land use change is the Land Use Map sourced from the Existing Spatial Plan (RTRW) of Kediri Regency 2020 and the Rupa Bumi Indonesia Map (RBI) in 2018 These two maps will be the starting base to find out where the land development trend is leading. The following result will describe the distribution of each land use in Kediri Regency.

For this research, the author uses 6 driving factors, because to find out trends in land development standards. The authors Researchers calculate the distance of each variable using a GIS analysis tool with *Tools Euclidean Distance*, then standardized using a GIS analysis tool with *Tools Raster Calculator* and the last is processed again using analytical tools GIS *Tools Fuzzy Membership* which to reverse the value of the distance. Here is an image of the result map *Euclidean distance* and *fuzzy membership.* The influencing factors can be seen in image 5.41 to image 5.52 Below:



Arterial Road | Collector Street

Local Street | Distance to Residential

Distance to Facility Center | Distance to Airport

Image 4. Distance from Supporting Factors of Land Use Change

The smaller the value or 0, the farther away from the driving factor for land use change and marked by a color that getting blue to white, The more brown it is or the value is 1, it means closer to the facility, the more potential for change.

The analysis of the driving factors of land use change used in terms of the v-cramer's value, *v- cramers* used to measure the strength of the association between variables. (Widiyanto, 2014). In this research, *V cramer* used at the factor analysis stage to determine

the land use variable which has a relationship to land use change in Kediri Regency.

In this analysis, the result of factors from Vcramer's analysis are directly used as basic data in formulation of the probability map of land use change in Kediri Regency. The probability analysis of land use change can be categorized as valid (value ≥ 80%) but has a lower level of validity when compared to the probability map of land use change resulting from logistic regression analysis. (Widiyanto, 2014).

In this analysis, test variables and accuracy values that have potential to affect land use change due to airport construction in Kediri Regency which made potential transition land use change in Kediri Regency. On this below can be seen some results potential transition land use change for built-up areas, especially residential in Kediri Regency.

The discussion of land use predictions on the response to the existence of the Kediri Regency airport, residential land use is the land use that has the fastest increasing graph. To see the changes every 5 years can be seen in this following table.

Table 6. All Land Use of Kediri Regency

No	Landuse	Year 2020	Year 2025	Year 2030	Year 2035	Year 2040
1	Protected forest	8.233	7.609,69	7.147,30	7.129,27	6.603,33
2	Production forest	13.799	16.946,92	19.061,42	20.464,57	21.135,32
3	Nature Reserve Area, Nature Conservation	473	481,79	488,38	492,94	497,48
4	Garden	10.777	11.310,40	10.056,79	8.720,88	7.921,10
5	Field	121	178,65	170,38	164,92	158,47
6	Inland waters	13	31,56	29,35	25,90	25,14
7	Plantation	8.883	8.077,74	7.230,68	6.526,93	5.799,72
8	Residential	32.605	42.789,08	51.391,79	57.993,08	65.596,24
9	Rice fields	57.873	47.075,41	41.047,53	36.652,25	32.068,99
10	Seasonal dry land farming	18.140	16.219,86	14.106,72	12.568,40	10.942,88
11	River	1.323	1.510,54	1.510,54	1.510,54	1.510,54
12	Open ground	90	99,35	90,13	81,34	71,78
Total				**152.331**		

Source: Analysis Results in 2021

From the table above, residential land use and rice field land use have experienced the biggest changes due to response from existence of the airport in Kediri Regency.

Conclusion

Based on the results of the analysis that has been done on the discussion of land use predictions to the response from existence of Kediri airport, it can be concluded from this research:

1. After analyzed the trend of land use change, it can be known the locations that must be noticed about development of residential land use. As can be seen from some of the results above, the trend of land use will develop is at:
   a. Badas District
   b. Kandangan District
   c. Kunjang District
   d. Plemanan District
   e. Papar District

f. Purwoasri District
g. Mojo District
h. Semen District
i. Grogol District
j. Tarokan District
k. Punju District
l. Ngancar District
m. Plosoklaten District

2. The variables that affect to development of residential land in Kediri Regency, are:
   - close to amenities
   - close to existing residential
   - close to District Street
   - close to Provincial road
   - close to National Road
   - location of Airport Construction
3. The predictions of land use change that experienced the biggest increase is residential land use, with the existing area in 2020 is 57,873 Ha or 21,40% becomes 65.596,24 Ha or 43,06% in predictions for 2040.
4. The predictions of land use change that experienced the biggest reduction is rice field land use, with existing area in 2020 is 32.605 Ha or 37,99% becomes 32.068,99 Ha or 21,05% in predictions for 2040.

Trend of the development Kediri Regency Regional Development, the majority spread to all sub-districts in Kediri Regency.

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Reference

David, W. H. & Lemeshow, S., 2000. Applied Logistic Regression. Second Edition ed. New York: A Wiley-Interscience Publication.

Dewa, P. A. S., Ambarawati & I Made, N. T., 2012. Faktor-Faktor yang Mempengaruhi Alih Fungsi Lahan Studi Kasus di Subak Daksina, Desa Tibubeneng, Kecamatan Kuta Utara, Kabupaten Badung. E-Journal Agribisnis dan Agrowisata Volume 1 Nomor 1, pp. 61-68.

Djunire, S. (2009). Kajian Bahaya Dan Risiko Tsunami Berbasis Geomorfologi Untuk Menunjang Rencana Tata Ruang Kota Manokwari Provinsi Papua Barat. Ipb (Institut Pertanian Bogor), 1-103.

Dosen Pendidikan. (2020, 03 27). Mitigasi. Retrieved From Dosenpendidikan.Com: Https://Www.Dosenpendidikan.Co.Id/Mitigasi-Adalah/ Fahmi, M. N., Wikantika, K., & Budiharto, A. (2017). Pembuatan Peta Zonasi Risiko Tsunami Menggunakan Sistem Informasi Geografis Di Wilayah Pesisir Pangandaran. Itb Indonesian Journal Of Geospatial Volume 06 Nomor 2, 15-38.

ESRI, 2016. ArcMap Fuzzy Membership. [Online] Available at: https://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/fuzzy-membership.htm [Accessed Rabu 7 2021].

Fitriana, A. L., Subiyanto, S., & Firdaus, H. S. (2017). Model Cellular Automata Markov Untuk Prediksi Perkembangan Fisik Wilayah Permukiman Kota Surakarta Menggunakan Sistem Informasi Geografis. Jurnal Geodesi Undip Volume 6 Nomor 4 (Issn : 2337-845x), 246-253. Geograph88. (2014, 12 13). Data Raster Dan Data Vektor. Retrieved From Geograph88:

Irjan, Rudyanto, A., & Rusli. (2010). Pemodelan Tsunami Sebagai Bahan Mitigasi Bencana Studi Kasus Sumenep Dan Kepulauannya. Jurnal Neutrino Jurnal Neutrinool.2 No.2, 164. 360 Irwansyah, E. (2013). Sistem Informasi Geografis: Prinsep Dasar Dan Pengembangan Aplikasi. Yogyakarta: Digibooks.

Jokowinarno, D. (2011). Mitigasi Bencana Tsunami Di Wilayah Pesisir Lampung. Jurnal Rekayasa Vol. 15 No. 1, April 2011, 13-20.

Kompas.com, 2020. Teori Kutub Pertumbuhan dan Wilayah Pembangunan di Indonesia.

Latief, H. (2012). Kajian Risiko Tsunami Di Provinsi Sumatera Barat Dan Upaya Mitigasinya. Proceedings Pit Hagi 2012 37th Hagi Annual Convention & Exibition (Pp. 1-5). Palembang: Researchgate.

Putra, A. N. (2009). Tingkat Risiko Bencana Tsunami Dan Variasi Spasialnya (Studi Kasus Kota Padang, Sumatera Barat). Tesis Universitas Indonesia, 1-167.

Putra, M. R., & Rudiarto, I. (2016). Simulasi Perubahan Penggunaan Lahan Dengan Konsep Celluler Automata Di Kota Mataram. Jurnal Pengembangan Kota Volume 6 Nomor 2, 174-185.

Rachmawati, T. A., Rahmawati, D., & Susilo, D. A. (2018). Pengurangan Risiko Bencana Berbasis Tata Ruang. In T. A. Rachmawati, D. Rahmawati, & D. A. Susilo, Pengurangan Risiko Bencana Berbasis Tata Ruang (P. 8). Malang: Ub Press.Sendhy, R. W., Sendi, N. & Umi, R., 2014. Perbandingan Euclidean Distance Dengan Canberra Distance Pada Face Recognition. Techno.Com Volume 13 Nomor 1, Pp. 31-37.

Wijaya, M. S. & Umam, N., 2015. Pemodelan Spasial Perkembangan Fisik Perkotaan Yogyakarta Menggunakan Model Cellular Automata Dan Regresi Logistik Biner. Majalah Ilmiah Globë Volume 17 No. 2 Desember 2015: 165-172, P. 166.