

THESIS

**ESTIMATION OF GREEN LAND TO URBAN
CHANGE BASED ON CELLULAR AUTOMATA (CA)
METHOD IN SINGARAJA CITY AND ITS
SURROUNDING AREAS**



I NYOMAN ARTO SUPRAPTO

**POSTGRADUATE PROGRAM
UDAYANA UNIVERSITY
DENPASAR
2016**

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Thesis to Get Master Degree
At Graduate Study of Environment Science
Postgraduate Program Udayana University

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Hereby declare that the scientific work is plagiarism free. If in the future prove to have plagiarism in scientific work and then I am willing to accept sanction in accordance with the regulation of Minister of Republic Indonesia number 17 in 2010 and regulation applicable in the Republic of Indonesia.

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Hopely this research can be useful for the community and if there is less criticism and suggestions are welcome for future refinement of this research.

Denpasar, January 2016

Author

ABSTRAK

Estimasi Perubahan Lahan Hijau menjadi Lahan Terbangun dengan Menggunakan Metode Cellular Automata (CA) di Kota Singaraja dan Sekitarnya.

Kota Singaraja adalah kota terbesar kedua di Bali yang memiliki pertumbuhan cukup pesat. Pertumbuhan dan perkembangan wilayah di kawasan perkotaan Singaraja berdampak positif terhadap perekonomian masyarakat namun juga berdampak negatif terhadap lingkungan. Alih fungsi lahan menjadi salah satu isu negatif dari perkembangan wilayah perkotaan Singaraja. Penelitian ini bermaksud untuk menghitung besarnya alih fungsi lahan yang terjadi dari lahan hijau menjadi lahan terbangun dalam kurun waktu 14 tahun (2001 – 2015) dan prediksi penggunaan lahan tahun 2020 dan 2025 di Kawasan Perkotaan Singaraja dan sekitarnya.

Citra Landsat 7 dan Landsat 8 digunakan dalam penelitian ini untuk mengetahui peta penggunaan lahan. Peta penggunaan lahan diperoleh melalui proses klasifikasi citra dengan menggunakan metode supervised kemudian diverifikasi menggunakan data lapangan. Peta penggunaan lahan tahun 2015 dan 2001 digunakan untuk menghitung besarnya perubahan kawasan terbangun selama kurun waktu 14 tahun yaitu sebesar 11,37% (3.153,74 ha) sedangkan lahan hijau mengalami penurunan sebesar 11,17% (3.097,68 ha). Prediksi penggunaan lahan dilakukan dengan menggunakan metode Markov. Hasil prediksi menunjukkan besarnya lahan terbangun pada tahun 2020 adalah 27,40% (7.598,45 ha) dan pada tahun 2025 adalah 35,97% (9.974,55 ha). Hasil prediksi ini diperoleh dengan tingkat akurasi sebesar 0,91.

Kata Kunci : Perubahan Lahan, Lahan Hijau, Lahan Terbangun, dan Cellular Automata (CA),

ABSTRACT

Estimation of Green Land to Urban Change Based on Cellular Automata (CA)
Method in Singaraja City and Its Surrounding Areas

Singaraja city is the second largest city in Bali which have a fairly rapid growth. Growth and development of the region in urban areas of Singaraja give the positive impact on the economy of the community but also give the negative impact on the environment. Land use change and land conversion into one of the negative issues of the development of urban areas in Singaraja. This study intends to calculate the amount of land conversion occur on the green land into urban areas within 14 years (2001-2015) and predict land use change in 2020 and 2025 in Singaraja City and Its Surrounding Areas.

Landsat 7 and Landsat 8 imageries were used to determine the land use map. Land use map obtained through the process of image classification using supervised method then verified using data field. Land use maps in 2015 and 2001 used to obtain the amount of change of urban areas and green land during the period of 14 years. This results show increasing amount of urban areas as 11,37% (3.153,74 ha) whereas green land decreased by 11,17% (3.097,68 ha). Land use change was predicted by Markov method. The projection results show the amount of urban areas in 2020 was 27,40% (7.598,45 ha) and 35,97% (9.974,55 ha) in 2025. The results obtained with this prediction accuracy rate of 0.91.

Keyword: Land Change, Green Land, Urban Land, and Cellualr Automata (CA)

SUMMARY

Nyoman Arto Suprpto. Estimation of Green Land to Urban Change Based on Cellular Automata (Ca) Method in Singaraja City and Its Surrounding Areas.

Singaraja city is the second largest city in Bali which have a fairly rapid growth. Growth and development of the region in urban areas of Singaraja give the positive impact on the economy of the community but also give the negative impact on the environment. Land use change and land conversion into one of the negative issues of the development of urban areas in Singaraja.

The porpuse of this reaearch are 1). To know change of green land into urban land in Singaraja City and its surrounding areas occurred during the periode of 2001 – 2015, 2). To know the projection of land use change of green land into urban land in Singaraja City and its surrounding areas in 2020 and 2025, 3). To know the accuracy of Landsat image classification and land use projection. This study intends to calculate the amount of land conversion occur on the green land into urban areas within 14 years (2001-2015) and predict urban change in 2020 and 2025 in Singaraja City and Its Sorrounding Areas.

This research was conducted in two phases, namely the interpretation of satellite imageries and urban change projections. Image interpretation conducted to obtain the land use map. Urban change projection conducted to know how the use of urban land in 2020 and 2025. Land use map in the period of 2001-2015 used Landsat ETM+ imageries in 2001 and 2015. Land use map was classified into three classes namely urban area, green land, and water. The resolution of the Satellite image used is 30 m x 30 m.

This study showed, within 14 years from 2001 to 2015, the total increase in value of urban areas reached 11,37 % (3.153,74 ha). At the same time, green land decrease about 11,17 % (3.097,68 ha). Water decreased by 0,20 % (56,06 ha). Overall it can be concluded that within 14 years there was increase of urban areas of 11,37 % coupled with the reduction of green land by 11,17 %. There was a

difference in value between the green land and urban areas by 0,20 %. The difference was caused by the the change of green land into water body.

Transition matrix and transition map were used to estimate the prediction map in 2020 and 2025. The result of the prediction show the land use change occur from green land into urban areas mostly occur in the city center of Singaraja, center of settlement, and the develop following the main road. The amount of urban areas in 2020 was 27,40 % (7.598.45ha) and 35,97% (9.974.55 ha) in 2025.

The accuracy of this study is very good. Land use classification obtained with accuracy of 0.84 which shows the land use classification results is good enough for further analysis. Land use projections even showed a very good level of accuracy that is equal to 0.91 which mean the projected results is very good.

The result of this study is quite good. Meanwhile there are some suggestion need to take to get the better result. 1). Its need good quality of Landsat images need to be used to get the best result of land use map. Otherwise it need the other process to improve the quality of satellite images. 2). Its need more precision satellite image to get the better result of land use map. 3). Land use predction should be combine with driving and inhabiting factor of land use.

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LIST OF ABBREVIATION

BIG	: Badan Informasi Geospasial (Spatial Information Agency)
CA	: Cellular Automata
CLUE	: Conversion of Land Use and its Effects
DN	: Digital Number
ETM	: Enhanced Thematic Mapper
GIS	: Geographic Information System
HDI	: Human Development Index
MLR	: Multinomial Logistic Regression
OLI	: Onboard Operational Land Imager
PKN	: Pusat Kegiatan Nasional (Center of Nasional Activity)
PKW	: Pusat Kegiatan Wilayah (Center of Regional Activity)
RGB	: Red Green Blue
ToA	: Top of Atmosphere
USGS	: United States Geological Survey