

Influencing Factors Determination Land Use Change Trend in the Pheryurban Area of Malang City Based On V-Cramer

Annisa Hamidah Imadudinna ^{a,1}, Widiyanto Hari Subagyo Widodo ^{a,2}, Ibnu Sasongko ^{a,3}

^aInstitut Teknologi Nasional Malang

nisa_pwk@yahoo.com*; harry_4444@rocketmail.com ; koko_is@yahoo.com

Informasi Artikel	ABSTRACT
<i>Sejarah artikel</i> Diterima : 22-09-2022 Revisi : 22-12-2022 Dipublikasikan : 03-03-2023	<i>The limited land needed to fulfill the development space of a city if it has reached the saturation point has implications for the urban sprawl phenomenon that leads to the pheryurban area. Malang City is the center of the Malang Raya agglomeration area which is one of the prospective metropolitan areas in East Java. The development of the pheryurban area in Malang City is also influenced by growth centers both functionally and geographically. If viewed from the service center, development will be more directed to areas that are included or reached on the scale of service facilities so that the closer to the center of the facility, the higher the potential for the area to develop. Because of the urgency above, it is very important to do research related to factors that affect land use changes based on v-cramers in the pheryurban area, especially to serve as a basis or justification for future planning so as to be able to get an overview of driving and constraint factors. Knowing these factors is expected to reduce the gap between the existing and the plan so that the planning process in the future will be more optimal.</i>
Keywords: <i>Land Use Change</i> <i>V-Creamer</i> <i>Malang</i>	ABSTRAK Keterbatasan lahan yang dibutuhkan dalam pemenuhan ruang pembangunan dari suatu kota jika sudah mencapai titik jenuh berimplikasi pada fenomena urban sprawl yang mengarah ke kawasan pheryurban. Kota Malang merupakan pusat dari kawasan aglomerasi Malang Raya yang merupakan salah satu calon kawasan metropolitan di Provinsi Jawa Timur. Perkembangan kawasan pheryurban di Kota Malang juga dipengaruhi oleh pusat pertumbuhan baik secara fungsional (industri) maupun geografis (pemusatan fasilitas). Jika dilihat dari pemusatan pelayanan, pembangunan akan lebih mengarah pada wilayah yang masuk atau terjangkau pada skala pelayanan fasilitas sehingga semakin dekat dengan pusat fasilitas maka semakin tinggi potensi wilayah tersebut akan berkembang. urgensi diatas maka penelitian terkait factor yang mempengaruhi perubahan penggunaan lahan berbasis v-cramers di kawasan pheryurban sangat penting untuk dilakukan terutama untuk menjadi dasar atau justifikasi dalam perencanaan ke depan sehingga mampu mendapatkan gambaran driving dan constraint factor. Dengan mengetahui factor tersebut diharapkan akan memperkecil gap antara eksisting dan rencana sehingga proses perencanaan ke depan akan lebih optimal.

INTRODUCTION

The rapid urban development of the pheryurban area and the increasing rate of population growth are directly a response to the need for land. The limited land required to fulfill the development space of a city if it has reached the saturation point has implications for the urban

sprawl phenomenon that leads to the pheryurban area. The centrifugal force resulting from the limited land in the core urban area has resulted in an increase in the complexity of the activities of the pheryurban area. The response of the pheryurban area to this centrifugal force varies depending on the driving force that forms the

force and the dominance of activity functions in the bordering area.

Land use change is a change in the use or activity of a land that is different from previous activities.¹ Land use change can be interpreted as a process of changing the previous land use to another land use which can be permanent or temporary and is a logical consequence of growth and transformation of structural changes social, economic, physical aspects of a developing region. Change in land use is not merely a physical phenomenon of decreasing land area, but is a dynamic phenomenon that involves aspects of human life, because it is directly related to changes in the economic, social, cultural and political orientation of the community.

Malang City is the center of the Malang Raya agglomeration area which is one of the prospective metropolitan areas in East Java Province and is part of the Gerbangkertosusila Megapolitan area. The positive externality of the formation of this agglomeration area is the formation of the conurbation phenomenon from the downtown area and the pheryurban area which results in an increase in the area and order of an urban area. The increase in order and complexity is a positive thing that creates benefits in the development process because it is positively correlated with increasing the economy of an urban area.

Each pheryurban area has a different response to each centrifugal force that drives urban sprawl. Each factor, both constraint and driving, will form its own pheryurban character because in the border area in this pheryurban there is assimilation of urban and rural activities. The urban phery area in Malang City has various characters and responses to this centrifugal force, some of which lead to industrial activities, housing activities, and some that lead to trade and service activities. The morphological patterns formed are also varied, either leading to ribbon development (linear), leap frog or already forming conurbation areas. Identifying the factors that influence the formation of this pheryurban area has a high urgency because it will be a justification or basis for spatial planning to be carried out so that it will

be easier to direct trends or trends to targets to be achieved in the plan or maximize trends and trends if the direction of the plan is more to accommodation of a positive trend. The dominant factor influencing the formation of the pheryurban area and its morphology is the transportation system.

Transportation routes and node points in a transportation system have a significant role in the development of city morphology.³ This was added by Berry (1964) who stated that the transportation network in the form of a ring road has a major role in the development of the city, especially at the intersection of the ring road and the ring road. other roads that cause the phenomenon of "mini peaks" or the peak of land values that have the potential to become built-up areas, Based on this, the development of this infrastructure significantly affects land use conditions and has implications for the formation of the character of the pheryurban area. In addition, urban development in the pheryurban area is also influenced by growth centers in the form of the CBD. CBD as a growth center has a locational advantage effect for areas that have a high level of accessibility to CBD.

If it is correlated with the tendency of high land values in areas that have high accessibility to facilities, urban development has a positive type of correlation with this factor. The closer to the facility, the higher the probability of an area developing into a pheryurban area with high activity complexity.

The pheryurban phenomenon in Malang City is also strongly influenced by the dominance of the function of the adjacent core urban area, for example the area is an industrial area. The development of the pheryurban area in Malang City is also influenced by growth centers both functionally (industry) and geographically (concentration of facilities). The growth center in the form of an industrial area significantly affects the development of the city. This is based on the fulfillment of the need for industrial activities in the form of settlements for industrial workers so that the closer the area to the industrial center, the

higher the potential for the area to develop. If viewed from the service center, development will be more directed towards areas that are included or affordable on the scale of service facilities so that the closer to the center of the facility, the higher the potential for the area to develop.

Based on the urgency above, research related to changes in land use in the pheryurban area is very important, especially as a basis or justification for future planning so as to be able to get an overview of the direction of development and trends in changes in the research area. By knowing the trend of change, it is hoped that it will reduce the gap between the existing and the plan so that the planning process in the future will be more optimal and measurable, especially in the realization of the plan.

METHOD

Research Approach

The approach used in this study is a rationalism approach that is based on empirical and ethical theory and truth (Muhadjir, 1990). First of all, in the preparation of the research, the conceptualization of the theory related to the concept of characteristics and their indicators is formulated, as well as the theory of the concept of tidal inundation.

Then, the object of research is still seen in its context which is included in the construction of the theory, because basically the topics related to modeling cannot stand alone because of the relationship between the factors in it then the last stage is the stage of generalizing the results, namely drawing a conclusion based on the results of the analysis. and supported by the theoretical basis used with empirical facts that emerged from the results of the analysis.

Research related to the pattern of economic disparity in this region is located in Malang Raya which consists of 3 regions, namely Malang City, Malang Regency and Batu City. The general description related to each region.

The type of research conducted is a type of combination research or a combination of

qualitative and quantitative research. Where there are several explanations that can be described in sentences but there are also problems that must be explained mathematically.

The type of research that will be conducted is descriptive with a case study research model. The purpose of descriptive research is to make a systematic, factual and accurate description of the facts and characteristics of the object of research which in this case is land use change. In addition, there are also those who state that descriptive research aims to describe the nature of a situation that is currently ongoing at the time the research is conducted and examines the correlation between factors of a particular symptom (Travers, 1978).

Method of collecting data

In this activity are observations and interviews where the Land Use of the Malang City pheryurban area in 2015 and the Malang City pheryurban area of land use in 2022. The interview technique is a data collection technique in order to assist and complete data collection that cannot be expressed by field observations. By using this technique, the data in the form of opinions or how the attitude of the population towards the symptoms or problems studied can be carried out. Interviews were more focused on extracting data related to land use changes.

ANALYSIS METHOD

Identifying Land Use Change

At the identification stage of land use change, a visual interpretation of the Quickbird 1:5,000 image from Google Earth in 2015, 2020 and 2022 is carried out. The following is a flowchart of the image that presents a schematic of the remote sensing image interpretation process.

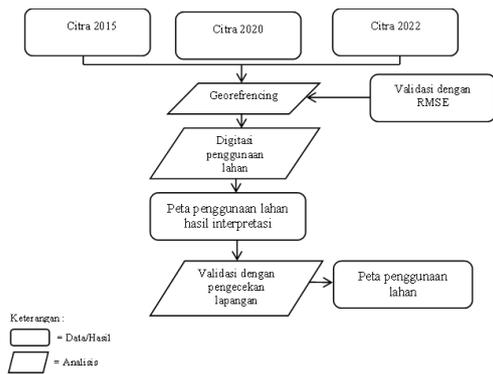


Figure 1 Schematic of Remote Sensing Image Interpretation Process.

In this study, the land use classification used is the classification issued by the National Standardization Agency, namely SNI number 7645:2010 and adapted to land use as stipulated in the Regulation of the Minister of Public Works Number 20 of 2011 concerning Guidelines for Detailed City Spatial Planning. The use of land use classification from BSN and Public Works Number 20 of 2011 concerning Guidelines for Detailed City Spatial Planning is based on the fact that this classification standard is used in classifying spatial pattern plans at the sub-district level. Furthermore, the map from the visual interpretation was tested for its level of validation by conducting a primary survey in the field.

Based on a valid land use map, an analysis of the trend of land use changes is carried out. The results of this analysis are used for the analysis phase of land use prediction, namely as map data of probability of land use change and data on the extent of land use change per land use class. The following is a scheme that presents an analysis of trends in land use change.

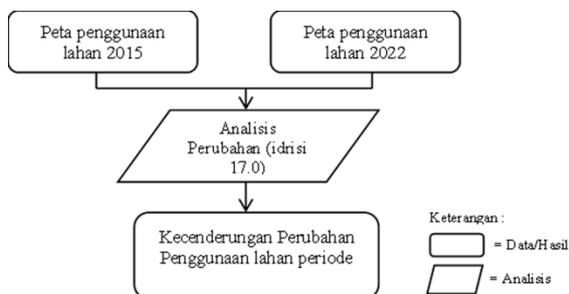


Figure 2 Land Use Change Analysis Flow

Factor Analysis With V-Cramer

Factor analysis is used to obtain factors that influence or cause changes in land use. The variables that have been determined based on the synthesis of the literature review will be compared with the factual conditions in the research area, so that the factors that influence changes in land use in the research area will be obtained. Factor analysis used in terms of the value of v-cramer's, v-cramers is used to measure the strength of the association between variables. In this study, V Cramer was used at the factor analysis stage to determine whether land use variables had a relationship to land use changes in the research area. the lower limit value used as a reference that the land use factor has a relationship or correlation with land use change is 0.20. The factor that has a v-cramer's ≥ 0.20 is used as a factor of land use change.

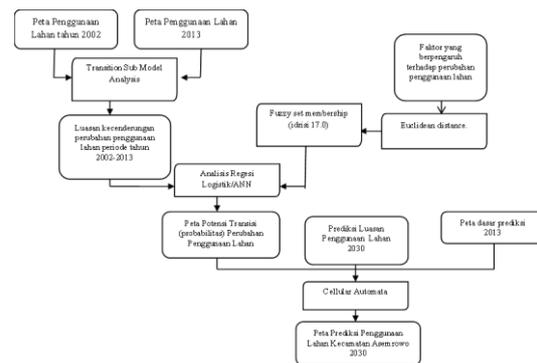


Figure 3 Factor Analysis With V-Cramer

Analysis Method Geographic Information System (GIS)

According to (Aronoff, 1989) in (NTB, 2013) Geographic Information System (GIS) or the so-called Geographic Information System (GIS) is a computer-based information system that is used to process geographic data or information. Geographic information systems became known in the early 1980s. The development of GIS coincides with the development of computer equipment, both software (software) or hardware (hardware). In 1990 the development of GIS began to grow very rapidly and is currently growing.

In general, a geographic information system is a component consisting of hardware, software,

human resources, and data that collaborate effectively to enter, manage, integrate, enter, improve, store, display, analyze, update, and manipulate data in geographic information.

RESULTS AND DISCUSSION

Urban Fairy Area Malang City

Based on population data from Badan Pusat Statistik (BPS) Indonesia in 1970 had a population of about 119 million people and in 2010 it increased to 237 million people, meaning that it has increased. This of course also has an effect on increasing the need for higher space and of course the conversion of agricultural land to construction land, especially in urban areas, is increasing. so that means there will be a physical, social, economic and cultural transformation in the region. Changing the area can be understood as changes that occur in an area in the process within a certain period of time in various aspects at certain regional boundaries.

The most visible transformations in an area are physical or spatial transformations. A suburban area is an area which is also known as an "urban fringe" area or an "urban fairy" area (Yunus, 2008). The development of peri-urban areas in Indonesia has spread to almost all cities, which are generally big cities, one of which is Malang City.

Malang is the second most populous city in East Java and is a student city with several universities that attract residents to settle here. The situation in the city center seems to be starting to feel uncomfortable because of high activities such as pollution and also the density of buildings that occur in the city center, this phenomenon causes a shift in development to suburban areas directly adjacent to Malang City and causes regional variations.

Malang is the second largest city in East Java after Surabaya. Based on the Malang City Regional Regulation concerning Rencana Tata Ruang Wilayah (RTRW) Malang City From 2010 to 2030, Malang City will be coordinated as a city with tourism, industry, and education. As a city of education, the city of Malang attracts thousands of students from all over Indonesia and even from foreign countries to come to Malang City, even after completing their education, not a few stay in

Malang City. The Department of Population and Civil Registration (Dispendukcapil) noted that in 2015 the population in Malang City reached 881,794 people, while in 2016 there was an increase in population by 1.58% every year to 887,443 people.

Malang Regency is located in an area around Malang City which causes Malang Regency to be one of the areas affected by the physical development of Malang City. This is quite clearly illustrated from the Existing Conditions of the Districts in Malang Regency which are directly adjacent to Malang City, namely Dau District, Karangploso District, Tumpang District, Pakis District, Tajinan District, Pakisaji District, and Wagir District. Land changes that occur due to the impact of Malang City are not evenly distributed throughout the sub-districts. In these sub-districts there are still villages that are still dominated by agricultural land use.

Changes in land use that are not evenly distributed in peri-urban areas cause differences in the characteristics of each region. For this reason, the locations chosen as research are 8 sub-districts that are directly adjacent to Malang Regency, namely Dau District, Singosari District, Karangploso District, Pakis District, Tumpang District, Tajinan District, Pakisaji District and Wagir District.

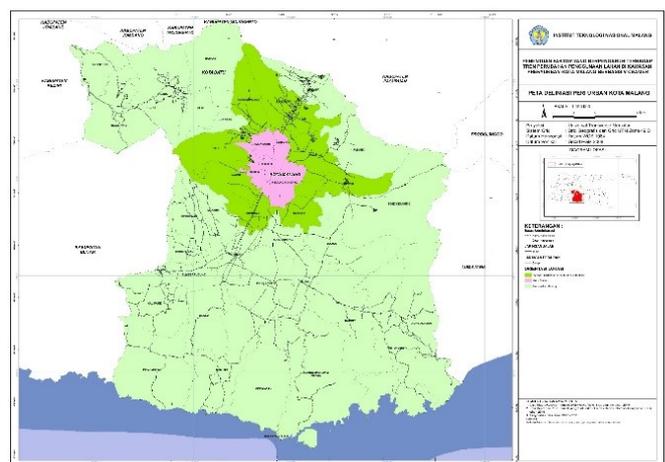


Figure 4. Malang City Fairy Delineation

Land Use 2015

Existing land use in the peri-urban area of Malang City in 2015 which is located in 8 Districts of Malang Regency is divided into several

Table 3 Land Use in Urban Fairy Area Malang City In 2022

Land Use	Area (m ²)	Area (Ha)	Presentation
Forest	86.104.452,15	8.610,45	16,35%
Swamp and lake	373.102,19	37,31	0,07%
Plantation	10.995.114,80	1.099,51	2,09%
Settlement	70.485.381,29	7.048,54	13,38%
Farming	155.639.718,76	15.563,97	29,55%
Shrubs	1.758.743,11	175,87	0,33%
River	0,072	0,000007	0,00%
wasteland	1.159.583,76	115,96	0,22%
Field	200.150.871,18	20.015,09	38,00%
Total	526.666.967,31	52.666,70	100%

Based on the table above, it is known that in 2022 the land use in the peri-urban area of Malang City is the widest field/field with an area of 200,150,871.18 Ha or dominates 38.00% of the area of the Peri-Urban Area of Malang City. As for the smallest land use is the river of 0.072 m2. For Residential Land Use and Activities or Built-up Areas in 2022, it covers an area of 7,048.54 Ha or 13.38% of the area of the Peri-Urban Area of Malang City.

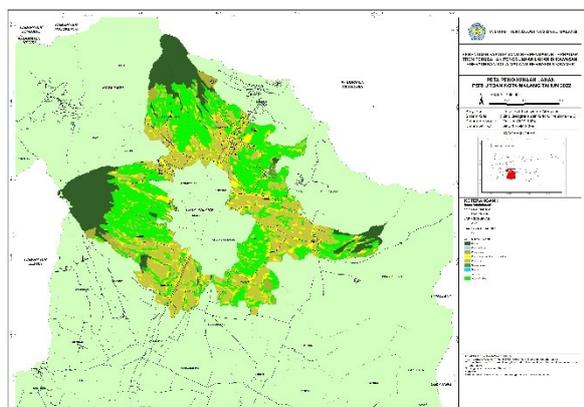


Image 6 Land Use In 2022

Land Use Change

Identification of land use changes in the Urban Peri Area of Malang City from 2015 to 2022 was carried out as an 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 aims to identify changes in land use that can be used as input for the next step.

The map base used in the analysis of land use change is the Land Use Map sourced from the Existing Map of Malang Regency in 2015 and Peta Rupa Bumi Indonesia (RBI) in 2022. These two maps will be the initial basis for knowing changes in land use in the Peri Urban Area of Malang City. The following will describe the distribution of each land use in the Peri-Urban Area of Malang City and its changes.

Based on the results of spatial analysis by means of change analysis of land use in the Peri-Urban Area of Malang City from 2015 to 2022, it was found that the land for settlements and places of activity or the Built-up Area in the Peri-Urban Area of Malang City experienced a considerable change, amounting to 3,728 Ha. For more details on the changes can be seen in the following table:

Table 3 Transition to Land Change in the Urban Peri Area of Malang City

District	Change	Unchanged
Dau	1.106,29	7.072,67
Karangploso	708,15	5.447,83
Pakis	536,96	5.728,77
Pakisaji	1.431,38	2.791,69
Singosari	1.476,20	9.839,17
Tajinan	478,95	3.670,06
Tumpang	1.647,07	4.697,30
Wagir	996,12	5.038,08

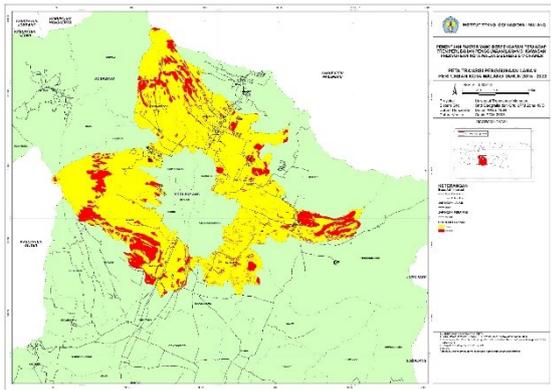


Image 7 Land Use Transition in Malang City Fairy Urban Area

Factors Affecting Land Use Change

Determination of factors that influence land use change in the pheryurban area of Malang City is the most important aspect. This is because the more specific the driving or influencing factors and according to the characteristics of the planning location, the more accurate it is when we want to predict the land development of a location. In this case, there are several factors that

influence land use changes in the pheryurban area of Malang City, including:

- a. Proximity to Facilities (Health, Government, and Education Facilities)
- b. Distance to Existing Land Use (Forest, Settlement, Agriculture, Plantation, Shrub)
- c. Distance to Road Network (Collector Road, Local Road, Footpath)

V-Cramer Value Factors Affecting Land Use Change

The analysis of the driving factors of land change used in terms of the v-cramer's value, v-cramers was used to measure the strength of the association between variables. (Widiyanto, 2014) In this study, V Cramer was used at the factor analysis stage to determine which land use variables had a relationship to land use changes in the pheryurban area of Malang City.

Based on the test variable using v-cramer which is focused on residential land use with the following results:

Table 4. V-Cramer Results Land Use Change Factor

No	Description	V-Cramer	Information
1	Medical facility	0,2809	Low Correlated
2	Government Facilities	0,3038	Low Correlated
3	Educational Facilities	0,2979	Low Correlated
4	Forest	0,3139	Low Correlated
5	Settlement	0,2721	Low Correlated
6	Farming	0,2846	Low Correlated
7	Plantation	0,2408	Low Correlated
8	Shrubs	0,1846	Uncorrelated
9	Collector Road	0,2692	Low Correlated
10	Local Road	0,2688	Low Correlated
11	Footpath	0,2244	Low Correlated

Based on the table above, 11 of the variables that have the highest v-cramer value are proximity to forest land use, which is 0.3139. Then in the table above, there is one uncorrelated variable, namely proximity to bushland use.

Conclusion

Malang City is the center of the Malang Raya agglomeration area which is one of the prospective metropolitan areas in East Java Province and is part of the Gerbangkertosusila Megapolitan area. The positive externality of the

formation of this agglomeration area is the formation of the conurbation phenomenon from the downtown area and the pheryurban area which results in an increase in the area and order of an urban area. The pheryurban phenomenon in Malang City is also strongly influenced by the dominance of the function of the adjacent core urban area, for example the area is an industrial area. The development of the pheryurban area in Malang City is also influenced by growth centers both functionally (industry) and geographically (concentration of facilities).

Based on the results of research analysis, it can be seen that in 2015 the most extensive land use in the peri-urban area of Malang City, namely dry fields/fields of 41.56% of the area of the urban peri-urban area of Malang City and underwent a change in 2022 where the area of the moor became 38,00% of the area of the Peri Urban Area of Malang City. Other land uses that are experiencing rapid changes are plantations where many plantation areas are used as residential areas and built-up areas or places of activity.

Based on the results of the calculation of the value of the v-creamer variable that affects changes in land use in the peri-urban area of Malang City, the highest v-creamer value is proximity to forest land use, which is 0.3139. Then in the table above, there is one uncorrelated variable, namely proximity to bushland use. The v-creamer value for the proximity of Settlement and Activity Places is 0.2721, which means that the closer it is to residential land and activities, the greater the potential for land use changes.

Acknowledgments

Acknowledgments are expressed to various parties who have assisted in the research/compilation of the article.

Reference

- Othman, A., & Gloaguen, R. (2013). River Courses Affected by Landslides and Implications for Hazard Assessment: A High Resolution Remote Sensing Case Study in NE Iraq–W Iran. *Remote Sensing*, 5(3), 1024–1044.
- Danoedoro, P. (2009). *Land-use Information from the Satellite Imagery: Versatility and Contents for Local Physical Planning*. Lambert Academic Publishing AG & Co. KG.
- Aziz, N. (2006). *Analisis Ekonomi Alternatif Pengelolaan Ekosistem Mangrove di Kecamatan Barru, Kabupaten Barru*. Tesis Sekolah Pascasarjana Institut Pertanian Bogor. Bogor. 105 hlm.

Arvian. (2021). *Kajian Delta (Δ) Risiko Kawasan Rawan Bencana Tsunami Di Kabupaten Banyuwangi Berdasarkan Perspektif Multitemporal Tahun 2019-2039 (Using Cellular Automata)*. Skripsi Institut Teknologi Nasional Malang.

Widiyanto, H. S. (2014). *Pemodelan Spasial Perubahan Penggunaan Lahan Akibat Genang Pasang Air Laut Di Kecamatan Asemrowo, Kota Surabaya*. Tesis Program Studi Ilmu Lingkungan Minat Studi Geo-Informasi Untuk Manajemen Bencana, 70

RI (Republik Indonesia). (2012). *Undang-Undang No. 18 Tahun 2012 tentang Pangan*. Lembaran Negara RI Tahun 2012, No. 227. Sekretariat Negara. Jakarta.

Setiawan I. B. (1999). *Studies on environmental change and sustainable development of Cidanau Watershed*. Proceeding of International Workshop on Sustainable Resources Management of Cidanau Watershed. Vol.1. RUBRD-UT/IPB. Bogor.