Development of Disaster Mitigation Model in Ecotourism Area of North Bandung

Wanjat Kastolani
Department of Geography Education, Faculty of Social Sciences Education, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229, Bandung, Indonesia
wanjat_pci@yahoo.co.id

Keywords: Ecotourism, Disaster Mitigation.

Abstract: The area of North Bandung is a tourism area that continues to grow. There are various natural tourist destinations around Mount of Tangkuban Parahu. However, this region has a potential disaster such as volcanic eruptions, earthquakes and ground movements. As an effort to anticipate losses from the disaster, mitigation efforts are needed in the North Bandung tourism area. Disaster mitigation in the tourism area is very important to be done because tourist is usually the center of economic growth and of course the population, so it is important to develop a special mitigation model for tourist areas. This research intends to develop disaster mitigation model in North Bandung area. The research method used is descriptive research method, that is to explore and describe all phenomena or conditions systematically related to the potential of disaster and mitigation efforts that have been done both by the manager of the tourist area andthe local community. The output of this research is to get the model of disaster mitigation in nature tourist area of North Bandung.

1 INTRODUCTION

Indonesia is one of the countries prone to the disaster as said by Zein (2010) the high level of disaster occurrence in Indonesia one of them is North Bandung area (KBU) an area located in four administrative areas of Bandung, Bandung City, Bandung Regency, West Bandung Regency and Cimahi City. The area of North Bandung was originally an area developed for protected or conservation areas. It is based on the Governor's Decree No.181 (1982) on Land Allocation in Core Area of North Bandung Raya. Due to the rapid development in this area, it is needed more spatial arrangement with the birth of West Java Provincial Regulation no. 1 (2008) About the Control of Space Utilization Area of North Bandung.

Based on these rules, the development of tourism in that region get a strong legal basis. The utilization pattern of North Bandung area is as a protected area and cultivation area. One form of utilization of the cultivation area is a tourist area with the provision does not interfere the hydroorologis function of North Bandung area.

Being on the fracture of the valley and between the mountains of Burangrang and Tangkuban Parahu make make the western bandung district has a morphology of hills that make it develop ecotuorism but also make it vulnerable to natural disasters, especially mountain eruption and landslides. Quarantelli (1998) in Lestari (2006) describes disaster as an actual occurrence, more than one potential or more threat is termed as more than an actual threat or termed as the realization of danger

In the next development, the area of North Bandung (KBU) developed into a tourist destination that is visited by tourist or traveller both from local and foreign. It issues to this area has a beautiful scenery because it is in the highlands with rows of mountains, cool temperatures and diverse tourist attractions are offered when visiting this region. So many visited by tourists and should come to have knowledge about disaster mitigation in the area that he visited. Annisa (2011) explains that disaster is anything that happens both due to nature and human impact itself that has the potential to interfere with life, harm human beings, cause natural damage either caused by natural, non-natural or human factors

The development of North Bandung Area (KBU) to be a tourist destination will certainly increase the economic growth of the people in the area,

Kastolani, W.
Development of Disaster Mitigation Model in Ecotourism Area of North Bandung.
In *Proceedings of the 2nd International Conference on Sociology Education (ICSE 2017) - Volume 2*, pages 439-445
ISBN: 978-989-758-316-2

investment in services sector such as hotels, restaurants, cafes, thematic nature attraction continues to increase. This condition besides gives benefit economically, but there is also potential for disaster in the region.

The disaster vulnerability in North Bandung area (KBU) is caused by the geographical condition of the area which is located in the active volcano area of Tangkuban Parahu, an active fault area of Lembang fault, and slope conditions of its slope ranging from 20 -> 40% that potential to occurrence of land movement. Based on the slope condition above, it needs a disaster mitigation development model for the tourism area in North Bandung is needed. The development of this disaster mitigation model is intended to keep environmental conditions from the damage that directly affects to humans to participate in preventing environmental damage, as occurs in some developing countries (Akinbile and Yusof, 2011).

2 METHODS

Silverman (2005) stated "methodology as a general approach to studying research topics" and Kothari (2004) stated "research methods may be understood as all those methods/techniques that are used for conduction of research".

Research method is a scientific way to get data and usefulness or a certain purpose. This research uses descriptive research method and uses qualitative approach based with research development (R & D).

Descriptive research method is one of the research methods for analysis data that are widely used in research that aims to explain an event. As stated by descriptive research is a study that aims to provide or describe a state or phenomenon that occurs today by using scientific procedures to answer the problem in actual. Data colletion by observation, interview, study literature and study documentation.

Descriptive research method is a method that tries to describe, interpret something, such as existing condition or relationship, developed opinion, ongoing process, effect or on current tendency. Based on these two meanings, the descriptive research method is a method used to describe, interpret something phenomenon, such as existing conditions or relationships, developed opinions, by using scientific procedures to solve actual problems, in this case is disaster mitigation in the tourism area of North Bandung.

This research was conducted in Lembang District, West Bandung Regency. Researchers take research at these locations because this location is a tourism area that is highly developed and potentially affected from the eruption of volcanoes, earthquakes and ground movements in West Bandung regency. Samples were taken from several villages: such as Lembang, Jayagiri, Cikole and Suntenjaya villages.

3 RESULTS

3.1 Potential Disaster in North Bandung Tourism Area

The potential of disaster can be caused by two factors, namely by natural events and man-made disaster. Based on Law of the Republic of Indonesia Number 24 (2007) there are three factors that cause the occurrence of disaster that is natural factor, non-natural and also human factor (social disaster). The potential of natural disasters in the North Bandung Tourism Area, based on geographical conditions is in the active volcano of Tangkuban Parahu area, the existence of an active fracture that is Lembang fault and its slope between 50-150, except for a steep enough valley between 150- 600.

These conditions cause the potency of diverse disaster, such as the disaster of Tangkuban Perahu Volcano eruption, the land movement disaster and / or landslide disasters, and earthquakes that can be resulted from volcanic eruptions and arising from active plate shifts in the cesarean area (tectonic earthquake). The potential for disaster has a wide range of disaster vulnerabilities, ranging from low, medium, high, to very high, depending on the conditions of each region. Based on the geographical condition of its region, the area that has high to very high level of vulnerability lies in the area of Bandung Regency and West Bandung regency. This is influenced by the factor or condition of the area itself that is around or close to Mount of Tangkuban Parahu and located in the Lembang fault region. Based on that condition, the tourism area in North Bandung is located in disaster prone areas.

According to the Law of the Republic of Indonesia Number 24 (2007) about Disaster Management, it is a condition or geological, biological, cultural, political, economic, and technological, geological, geological, hydrological, climatological, geographical, social, cultural, political, economic and technological characteristics of an area for a certain period of time. Reducing the ability to prevent, reduce, achieve readiness, and

reduce the ability to respond to the adverse effects of certain hazards.

3.1.1 The Danger of Mount of Tangkuban Parahu

The eruption of Tangkuban Perahu volcanic is characterized by small explosive eruptions and occasionally interspersed with phreatic eruptions by eruption spans ranging from 2-50 years. Based on observations since the 19th century, this volcano has never shown a major magmatic eruption, except the eruption of ash without being followed by lava eruptions, hot clouds or incandescent rocks. Generally, the danger of volcano eruption can be categorized as primary and secondary hazards.

Primary hazards are a danger as a direct result of volcanic eruptions, such as: phreatic material, stone burst (incandescent), ash rain, mud rain, poisonous gas, hot clouds, and lava flows. The geological and historical data of the eruption showed that the recorded eruptions of Tangkuban Parahu volcano in history are small explosive eruptions, in the form of phreatic eruptions, poisonous gases and mud bursts, whereas hot clouds and lava flows have never occurred. The distribution of phreatic deposits and stones (glow) from previous eruptions is generally exposed at a distance of 500-1000 meters from the eruption center, while the ash rain due to it is smoother caused its spread wider.

Secondary danger is a danger of direct trial of volcano eruption. This secondary effect is lava. Lahar generally occurs when the loose material is a cloud of hot and ash deposits that accumulate in the peaks and valleys in the upstream region of the river come from a peak that is embraced by rainwater, melting snow or ice or a crater lake containing water. From the research that has been done, as in Merapi Mount (Central Java), lava formed when rainfall reaches 40 mm in 2 hours, and the potential zone for the occurrence of lava is between the altitude of 600 m - 450 m (Lavigne et al, 2000).

The dangers of eruption of Tangkuban Parahu Volcano include small explosive type of intensity and occasionally interspersed by phreatic eruptions with eruptive time spans ranging from 2-50 years. Based on observations since the 19th century, this volcano never showed a major magmatic eruption, except the eruption of ash without being followed by lava eruptions, hot clouds or incandescent rocks. Phreatic eruption dominates the incidence of Tangkuban Parahu Mount eruption and followed by increased solfatara and fumarola temperatures in several active craters, ie Kawah Ratu, Kawah Baru and Kawah Domas. The volcanic material that was thrown in the form of ash which limited to around the peak of several kilometers. Mud bursts just happen around the crater. In the event of increased volcanic activity, it usually appears fumarole or solfatara white smoke that is sometimes followed by the emergence of toxic gases CO and CO2.

Furthermore, the Directorate of Volcanology and Geological Mitigation (DVMBG) then divide the three levels of Disaster Prone Areas from low to high, namely: Disaster Prone Area I, Disaster Prone Area II, Disaster Prone Area III. The description of the three levels are as follows.

Disaster Prone Area I is a potentially lava-stricken area. During the eruption, this area has the potential of falling material such are ash rain and possibly throwing stones (incandescent). Prone areas of ash rain without regard to the direction of the wind and the possibility of exposure to stones (incandescent). The limit of radiation distribution of ash rain and stone lontara for KRB I is not determined because it can be further. So the residential area located on a larger radius of 5 km from the eruption center is a disaster prone area I (KRB I) that potentially hit by ash rain.

Regions is divided based on the potential of its material (1) KRB II that is potentially experienced hot clouds. Mount of Tangkuban Parahu according to the records never issued a hot cloud, but if there is a hot cloud spread is estimated only limited in the crater area and follow the valley Cikoneng on the slopes of the northeast at a distance of ± 5.5 km from the eruption center (Kawah Ratu), Cipangasahan Valley through Dawuan to the east G. Palasari area at a distance of 5.5 km from the eruption center and eastward through the Rhino Crater; (2) KRB II which is potentially lava affected. Lava flows are controlled by the morphology it passes and usually through areas such as river valleys in the peak areas. Based on the morphology of the peak areas, if there is an eruption that produces lava, the distribution of lava flow is expected to occupy only the area of Kawah Ratu or Upas Crater unless there is eruption from the side then the spread through the lower valley around the eastern slope. Based on the position of the current crater (Domas), the area that has the potential of lava flows is the northeast slope. Lava is a potential that can be avoided because the flow of movement is relatively slow ± 5-10km / hour so there is plenty of time to stay away from the flow; (3) KRB II which is potentially affected by lava. The lava-stricken areas are following the hot clouds on the northern slopes of the river, north-eastern and the eastern

slopes, while the southeastern, southern, southwest and western slopes are less likely because the lava-forming material is derived only from pyroclastic falling deposits; (4) KRB II which has the potential of drowning heavy ash and pebbles. Heavy ash rain is a material of eruption-sized lapili to ash both magmatic and semi magmatic / phreatic eruption results, while the stone throw (incandescent) in the form of volcanic bombs and old rock fragments that were carried away during the eruption. The droplets of heavy ash rains and the thickest stones (incandescent) in the peaks and surrounding areas, the relatively smaller fragments reach a radius farther away from the eruption center. From geological data, it is known that heavy ash and stone incidence reaches 5 km radius from eruption center and in this radius is Cikole area (southeast slope), then Sukatinggi area (south slope). Most of the land uses in this area are forests and plantations and agricultural land of the population.

The disaster prone area III is an area close to the source of eruption that is often hit by poison gas, throwing (glow) phreatic eruption and possible hot clouds. Due to high levels of vulnerability, this area is not allowed for residential and commercial purposes. The implementation of KRB III is solely to anticipate possible dangers, because the crater area is a tourism area visited by many tourists. The limit of material throwing and ash rain on phreatic eruption is within a radius of 0.5 to 1 km from the eruption center.

3.1.2 Potential of Tectonic Earthquake of Lembang Fault

Lembang fault extends more than 22 km and includes the type of normal faults. The north moves is relatively down, while the southern part is raised. The city of Lembang to Cisarua in the west and Maribaya to Cibodas / Batuloceng in the east is part of that decline. As a result of this tectonic process sprawled an escarpment (the straight slope) which is a slope field of Lembang Fault that can be clearly seen from Lembang to the east. Based on a study from the Bandung Basin Research Group (2004) Lembang fault is an active fault that can produce shallow earthquakes with a strength of 6.7 - 6.9 on the Richter Scale, or more.

According to Dam (1994) cited by Yulianto (2009) the morphology along the fault line shows distinctly different characteristics. The east side of the fault that cuts the lava forms a very high escarpment. Elevation of this escarpment decreases to the western side so as to show morphology resembles a hinge. This condition indicates that the eastern and western side of the fracture may be move by a different mechanism that is on the east side have a vertical motion component (dip-slip) more dominant than the strike slip component while the opposite occurs on the west side of the fault. These mechanism differences may indicate segmentation along the fault. The only report that shows the existence of segmentation on Lembang Fault is given by Dam (1994) in Yulianto (2009). If the Lembang Fault consists of only one segment that moves together then the raised earthquake can reach 7 Richter scale and if more than one segment and move together, then the earthquake potential will be more than 7 on the Richter scale.

3.1.3 Potential of Land Movement

West Java Province is most vulnerable to earth movement / landslide disaster compared to other provinces in Indonesia. It is not separated because of geological conditions, rainfall, population activity, slope and other factors. Principally, ground motion or the term landslide generally occurs when the driving force on the slope is greater than the retaining force. The retaining force is affected by rock strength, and soil density. While the driving force is influenced by the magnitude of the angle of the slope, water, and the load and the gravity of the soil. Meanwhile the factors that trigger the movement of the soil are rainfall, vibration and human activity. Human activities in this case relate to land use, such as forest clearance arbitrarily, planting too heavy tree species with too dense spacing, mining, cutting / slope for roads or settlements that do not meet technical standards.

The mechanism of ground movement is usually triggered by high and long rainfall so that the water content in the soil increases (saturated water), soil weight increases, the bond between the grains decreases, and the soil carrying capacity decreases, plus the runoff from the slopes Relatively steep and unstable so that it moves to find a new balance and there is movement of the land. Based on the physical condition of the northern area of Bandung is a mountain with a slope of the slope between 50-150, except for steep enough valley cliffs between 150-600, coupled with unstable soil conditions and high rainfall makes the natural tourism area of North Bandung is very vulnerable to the soil movement.

The condition of ecotourismarea of North Bandung with the vulnerability of disaster from

Tangkuban Parahu Mount, Lembang Fault and ground movement of course require an effort to reduce disaster risk (mitigation).

4 DISCUSSION

The existence of natural tourism area in North Bandung surely have big risk if disaster happened. Disaster risk is the potential loss caused by a disaster in an area and a certain period of time that can be death, injury, illness, life threatened, loss of security, displacement, damage or loss of property, and disruption of community activities. To reduce the risk of such a large disaster is required mitigation. According to Law of the Republic of Indonesia Number 24 (2007) on Disaster Management, that mitigation means a series of efforts to reduce disaster risks, both through physical development and awareness and enhancement of the ability to deal with disaster threats.

Mitigation efforts can be carried out in the form of structural mitigation by strengthening buildings and infrastructure, such as building codes, engineering designs, and construction to hold and strengthen structures or construct landslide retaining structures, retaining walls, and so on. In addition mitigation efforts can also be done in a non-structural form, such as avoiding disaster areas by way of building away from disaster areas that can be known through spatial and regional planning and by empowering the community and local government

Institutional strengthening, whether government, community, or private is a key factor in disaster mitigation efforts. Institutional strengthening in the form of preparedness, early warning systems, emergency response, barrack management and disaster evacuation aims at creating a powerful community so as to minimize the impact of disasters.

The role of society or community in mitigation efforts has a positive value in efforts to improve disaster management capacity, so it is able to reduce disaster risk in North Bandung area where they live. Experience in the implementation of disaster management oriented towards community empowerment and independence will refer to: (1) undertake disaster risk reduction efforts with communities in disaster prone areas, so that the community will be able to manage disaster risk independently, (2) avoid new vulnerability & dependency (3) disaster risk management is an integral part of the process of development and management of natural resources for the sustainability of community life in disaster prone areas, (4) multisectoral, multi-disciplinary and multicultural approaches.

Based on the importance of society or community participation in disaster mitigation, it is necessary to develop disaster mitigation model for ecotourismarea in North Bandung based on community. Models are simplifications of the real world. The model can also be applied in various forms of problems including community-based disaster mitigation. Through the preparation of community-based mitigation model, the resulting model can be applied to various regions in Indonesia. The modeling can be done by developing a conceptual model of community-based disaster mitigation. To test the model, selected tourism area in North Bandung.

The development of a community-based mitigation model will be able to explore the potential of local wisdom. Understanding the potential of local wisdom within a particular community will be widely explored through a participatory approach. People with "skills" (local knowledge, local technology, local institutions) they possess will easily understand, and accept their planning and designing steps if the "language" they are using can be understood. Local people generally have local knowledge and ecological wisdom in predicting and mitigating natural disasters in their areas. Such local knowledge is usually derived from the rich empirical experience of interacting with the ecosystem. For example, local people living on the slopes of Mount Merapi have the ability to predict the likelihood of eruptions. Another example is the local wisdom of the P.Simelue community in reading the natural phenomena of the coast has saved thousands of people from the Tsunami disaster on 26 December 2004. Early warning through warnings of "shouts" of semong, (sea water receding and having to flee), obtained from generation to generation, Learned from disasters some decades ago. In the vicinity of EcotourismArea of North Bandung in Suntenjaya Village Lembang District, West Bandung Regency there is also local wisdom namely Batuloceng site that is in the form of a stone which looks like human body is meditated (semadi). This stone according to the local community was able to make a sound and shine as a sign of an earthquake. The sacred stone is an inscription of the relics of the Pajajaran Kingdom found around the 16th Century. The site is a bell-shaped stone with a diameter of 30 cm and a height of 50 cm.

The development of disaster mitigation model with community participation (mitigation based

community) in North Bandung ecotourismarea has strategic value to place community participation as main stakeholder in effort to reduce disaster risk in the area. Because who can understand the opportunities and obstacles at the local level only the community or the local community itself, where they live their life. Because local communities should be involved in the identification and problem solving related to vulnerability to disasters and information must be obtained in ways and languages that can be understood by the community.

The development of community-based mitigation model must be done systematically by government institutions / institutions by providing legal protection and community empowerment efforts. In the business of community development, it can also invite tourism entrepreneurs to allocate their Corporate Social Responsibility (CSR) for the empowerment of surrounding communities in increasing knowledge and ability of disaster mitigation.

The biggest obstacle and challenge of applying community participation is how to ensure that participative management is not distorted and manipulated by certain groups, such as village elites and so on. Therefore, the development of public policy formulation systems / mechanisms, including conflict resolution, as well as capacity building for communities and social capital are urgently required. Indeed, the development of participatory management is not easy. Tourists Managers have usually outgrown the material for the licensing process from the local community, so that if any programs related to the community usually become resistant, they already feel they are paying. Another issue related to the development of a community-based disaster mitigation model is the obstacles to community participation.

According to Hetifah (2000) in Wikantiyoso (2010) suggested three main obstacles to good participation: First, structural obstacles that make the climate or environment less conducive to participation. Among these are the lack of awareness of the various parties to the importance of participation as well as the policies and rules that are less supportive for participation to work; Second, the internal constraints of the community themselves, among them lack of initiative, unorganized and lack the capacity to engage productively in the decision-making process. This occurs, among others, due to lack of information; Third, it is an obstacle due to the lack of mastery of participatory methods and techniques

In the implementation of disaster mitigation model in the tourism area in North Bandung based on Society or community there are findings that the values of local wisdom also began to fade along with the growth of tourism business. Because the tourism sector is more economically profitable, so the environment is getting depressed. With the development of this mitigation model, people are encouraged to re-explore the local wisdom of their ancestral heritage so that there is expected synergy between the development of tourist areas with a sustainable environment.

5 CONCLUSIONS

Disaster mitigation is a series of efforts to reduce disaster risks through physical development and awareness raising and capacity building for disaster threats. Mitigation efforts can be done in the form of structural and non structural mitigation. One form of non-structural mitigation is to empower communities and local governments. FAO (1993) argued that "the land is a segment of the earth's surface and the attributes of the biosphere which are reasonably stable or cyclically foreseeable" whose existence must necessarily be maintained primarily by humans as a creature that utilizes land on the surface of the earth.

In the implementation of disaster management carried out one of them is involving community participation. The participation of local communities in disaster mitigation is very strategic to implement because they are the ones who have knowledge and depend on their life in the region. Local people generally have local knowledge and ecological wisdom in predicting and mitigating natural disasters in their areas.

The development of disaster mitigation model in North Bandung EcotourismArea is an effort to collect all local potentials (local wisdom and local knowledge) of local technology, local culture and local traditions that have been "tested" able to contribute in disaster mitigation so as to be structured systemically and Become a reference for community empowerment elsewhere to use it in an effort to reduce disaster risks

One example of the local wisdom of Sunda, namely in Gawir in Awian, is contained in the meaning of bamboo plant as one of the conservation of research results showed Uchimura (1997) and Widjaya (2004) in Yani (2012) revealing the fact that the population of The world of bamboo consists of 75 genera and 1250 - 1350 species and in

Indonesia there are 157 where this amount 10% of world bamboo species. 50% of Indonesia's bamboo is endemic and 50% has been utilized by the community. Such diversity is certainly an excellent potential if developed.

Other studies have shown that bamboo theoretically has mechanical properties that distinguish them from other plants, such mechanical properties are as follows (Modification and development of Frick (1997) and Suseno (1999) bamboo has moisture on the stem so good for conservation. Sentences of local wisdom are profound in particular for the conservation and mitigation of disasters.

In addition the community can also be given additional knowledge related to the plant that is characterized by Ocshe et al. (1961) described that the suitable vegetation to be a crop of erosion impact reduction is (1) easily reproduced (2) does not require fertile soil (3)) Has a root system that can bind the soil structure (4) grows rapidly by producing leaf or midrib (5) resistant to pests, diseases and drought (6) easily eradicated if the land is to be used (7) has no such discomforting properties and the twisted tendrils (8) have a benefit value.

REFERENCES

Akinbile, C., Yusoff, M., 2011. Environmental Impact of Leachate Pollution on Groundwater Supplies in Akure, Nigeria. *International Journal of Environmental Science and Development.* Vol. 2 (1) Pp, 81-86.

Annisa, 2011. *Zonasi risiko bencana banjir akibat sea level rise,* Surabaya Technological Institute. Surabaya.

Bandung Basin Research Group, 2004 *Sebuah Kajian Awal Patahan Lembang Dari Fakta Sampai Potensi Bencana Slide Ekskursi Patahan Lembang,* Mei 2004, Tidak Diterbitkan.

FAO, 1993. FESLM: *an international framework for evaluating sustainable land management,* Smyth, A. J., Dumanski, J. J., World Soil Resources Report 73, FAO, Rome. 74 p. INTOSAI, WGEA. Giangxi.

Frick, H., 1997. *Structural Patterns and Building Techniques in Indonesia,* Kanisius. Yogyakarta.

Governor's Decree No. 181, 1982. *About Land Allocation in Core Area of Bandung Raya North,*

Kothari, C., 2004. *Research Methodology (Methods and Techniwue),* New Age International Publisher. New Delhi, 2nd edition.

Lavigne, F., Thouret, J. C., Voight, B., Suwa, H., Sumaryono, A., 2000. Lahars at Merapi volcano, Central Java: an overview. *Journal of Volcanology and Geothermal Research*. 100(1), 423-456.

Law of the Republic of Indonesia Number 24, 2007. *on Disaster Management.*

Lestari, F. F., 2009. *Application of Geographic Information System in Mapping Landslide Prone Areas in Bogor Regency,* Institut Pertanian Bogor. Bogor.

Lexy, J., Moleong, 2001. *Qualitative Research Methodology,* PT Remaja Rosdakarya. Bandung.

Ocshe, J. J., Soul, M. J., Dykeman, C., Wehlburg, C., 1961. *Tropical and Subtropical Agriculture,* Vol 2. McMillan.

Silverman, D., 2005. *Doing Qualitative Research,* SAGE Publition Inc. London, 2nd edition.

Suseno, W., 1999. *Bamboo Manual Technology for Building Construction. Journal of the Series of Scientific Review.* Vol. l9. No. 1. pp, 145.

West Java Provincial Regulation no. 1, 2008. *About the Control of Space Utilization Area of North Bandung.*

Wikantiyoso, R., 2010. Disaster Mitigation in Urban; Adaptation or Anticipation Town Planning and Design? Potential of Local Wisdom in Urban Planning and Design for Disaster Mitigation Measures. *Local Wisdom.* Vol 2 (1). Pp. 18-29.

Yani, P. A., 2012. Bamboo Diversity and Population in Talang Pauh Village, Central Bengkulu. *Journal of Ecsakta.* Vol. 10 (1) June 2012. Pp. 61-70.

Yulianto, E., 2009. *Paleoseismology Lembang Fault In Record Sagpond,* (online) available at: http://www.vsi.esdm.go.id.

Zein, M., 2010. *Community Based Approach to Flood Hazard and Vulnerability Assessment in Flood Prone Area: A Case Study in Kelurahan Sewu, Surakarta City, Indonesia,* ITC. The Netherland, Thesis.