

## Vulnerability and Adaptability of Traditional Community in Facing of Disaster (Case Study: Naga Village in Tasikmalaya District)

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### ABSTRACT

Tasikmalaya is a district with the highest vulnerability index in Indonesia. Naga Village is one of the traditional villages in Tasikmalaya District. Until now, the communities of Naga village have been able to adapt to the hazard that threat them. It is thought to be related to the traditional wisdom that belongs to the community in adapting to the natural conditions of the disaster prone. The aims of the study are identified the level of physical and environmental vulnerability of disaster in Naga Village and; identified the adaptability of Naga Village community in disaster risk reduction. Analysis used descriptive qualitative method, with the triangulasi approach to documents, interviews and field observations. Based on the analysis, the level of physical vulnerability of Naga village is relatively high. While adaptability of communities of Naga village in disaster risk reduction is indicated in environmental management, building and infrastructure. Conclusion, communities of Naga village have adaptability to the environmental and physical vulnerabilities through the traditional wisdom.

**Keyword:** *Traditional wisdom, vulnerability, adaptability*

### INTRODUCTION

Disaster can be interpreted as anything that cause distress, loss, or suffering. Indonesia is a disaster-prone areas, according to report of UNESCAP 1980-2009, Indonesia ranks 4<sup>th</sup> in terms of the number of disaster <sup>[1]</sup>. National Disaster Management Agency (BNPB) data showed increasing number of catastrophic events during the period 1815 – 2014. Conditions of tropical climate with high rainfall, and hilly topography keep very large hydro-meteorological disasters. This is exacerbated by the increasing number and activity of the population as well as environmental damage. During the 2014 hydro meteorological disasters reached 99 percent of the total disaster that occurred in Indonesia<sup>[2]</sup>.

Disaster is the result of a hazard's impact on community, while hazard is anything that has a potential to harm people. Disaster risk is the relationship between the components of hazard, vulnerability and ability or capacity in managing the threat.  $Disaster\ risk = f(Hazard \times Vulnerability / Capacity)^{[3]}$ . Thus, if the level of hazard and vulnerability at the high value, then disaster risk will be high too. But if capacity of adaptation is also high, then disaster risk can be reduced. Hazard is very difficult to predict, therefore two factors that can be expected of predicting the risk of disaster are the level of vulnerability and the capacity of adaptation of community.

Vulnerability is the characteristics and circumstances of a community, system, or asset that makes it susceptible to the damaging effects of a hazard<sup>[3]</sup>. Various studies on disasters show that physical and environmental factors greatly affect the disaster risk. Some physical and environmental factors, which influence the risk of disaster are the distance from the fault <sup>[4]</sup>; population density levels, the site, design and material of buildings and houses <sup>[5]</sup>; building structure and building type<sup>[6]</sup>. Based on these, the vulnerability to be analyzed in this study is the level of physical and environmental vulnerability.

Capacity of adaptation is the ability to adjust to the physical characteristics of the environment; social and economic in order to disaster risk reduction. Disaster events have given the empirical experience of the Indonesian community in facing and reducing the risk of disaster. Based on the study of traditional community in some areas in Indonesia, such as Baduy in Banten<sup>[7]</sup>; Simeulue, Nias and Siberut<sup>[8]</sup>; have



been known that the traditional knowledge of the community are form of adaptation capabilities in order to disasters risk reduction. Based on this, the adaptability to be analyzed is related to the traditional wisdom of community

Tasikmalaya is a district in West Java province, which are disaster-prone areas. Based on the disaster index data in 2011, Tasikmalaya District is ranked 2<sup>nd</sup> of 494 districts in Indonesia with high vulnerability level as disaster prone areas<sup>[9]</sup>. Salawu is one of the subdistricts in Tasikmalaya district which is an area of potential landslides and earthquakes<sup>[10]</sup>. Naga Village is a traditional village in Salawu sub district, where people live simply, and rich of traditional wisdom. Although located in disaster-prone areas, communities of Naga village until now are able to survive from the hazards that are threatened them. It is thought to be related to the traditional wisdom that belongs to the community in adapting the natural conditions of disaster-prone. Based on this, the aims of the study are (a) to identify the environmental and physical vulnerability in Naga village and, (b) to identify adaptability of communities of Naga village on disaster risk reduction.

## METHOD

The location of research is Naga Village, geographically at coordinates 7°21'49,024 " - 7°21'31,757" South Latitude and 107°59'24,753 " - 107°59'44,252" East Longitude. Administratively Naga Village is located in Nagara Tengah, Neglasari, Salawu, Tasikmalaya District, West Java Province. Based on the analysis of Landsat imagery (BING MAP 2010), interviews and field observations, Naga village areas is estimated ± 17.64 ha (Figure 1.)

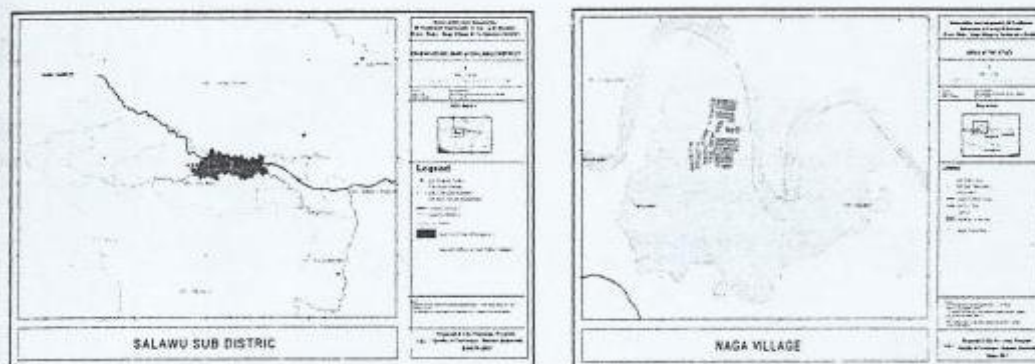


Figure 1. Location of Naga Village in Sub District Salawu

This research used primary and secondary data. Data are collected through literature studies, interviews and field observations. Primary data collection techniques are interviews with communities and field observations. Samples are taken by non-random with accidental technique. Respondents are Kuncen, tour guides, and people who know the customs of Naga village. Interviews are conducted in a structured, used a list of questions with open form. Field observations used camera and GPS device to ensure the position of an object.

Vulnerability analysis is focused on environmental and physical variables because Naga village in these terms is vulnerable of natural disaster. Accordance with the characteristics of Naga village, environmental and physical variables of vulnerability that measured are: Mass movement; Radius from epicenter; Distance from residential zone to riverside; Evacuation out of the village; Building Material; Building density; Building construction and housing patterns. Analysis of the vulnerability used score method. In this case score of the environmental and physical vulnerability variables are measured in scale 1-5. The



scale is determined by using guidelines and standards issued by various agencies. The levels of vulnerability are categorized into 3 categories, namely high, medium and low (Table 1).

**Table 1.** Environmental and Physical Variables of Vulnerability

No	Variable	Score of Vulnerability				
		1	2	3	4	5
1	Mass movement <sup>[a]</sup>	Low		Moderate		High
2	Radius from epicenter (km) <sup>[a]</sup>	>30	20-30	10-20	5-10	<5
3	Distance from residential zone to riverside (m) <sup>[b]</sup>	>100		50-100		<50
4	Evacuation out of the village (minute) <sup>[c]</sup>	5-10	10-15	15-20	20-25	>25
5	Building Material <sup>[c]</sup>	Non flammable		Partially flammable		Highly flammable
6	Building density (unit/ha) <sup>[c]</sup>	< 30		30-60		>60
7	Building construction and housing patterns <sup>[c]</sup>	Traditional construction, housing patterns spread out		Traditional construction, housing patterns clustered		Construction of reinforced concrete housing patterns clustered

Source : <sup>[a]</sup> West Java Provincial Government Regulations No. 2/2006 on RTRW Province of West Java 2012-2032; <sup>[b]</sup> Presidential Decree No. 32/1990 on Management of Protected Area ; <sup>[c]</sup> Ministerial of Public Works Decree No. 21 / PRT / M / 2007 on Spatial Planning Guidelines Prone Regions Volcano Eruption and Earthquakes.

For determining the value of H (high), M (medium), and L(low) is used the formula: GVV (great vulnerability value) = number of variables x highest weight; SVV (small vulnerability value) = number of variables x lowest weight; the number of categories are 3. Thus the interval is calculated by the formula  $(GVV - SVV) / 3$ .

Adaptability analysis is conducted qualitatively. Adaptation capabilities focused on traditional knowledge, as reflected by the philosophy of life. The philosophy of life of Naga village's communities is implemented in the form of mandate, testament, and taboo related to environmental management and building with its infrastructure.

## RESULT AND ANALYSIS

### 1. Physical and Environmental Vulnerability of Disaster in Naga Village

Morphology of Naga village is hilly, with an altitude of 593-660 m, and slope of 8-40 percent. Residential is located at altitude of 609-624 m with slope of 15-25 percent. The type of soil is ultisol with aggregate characteristics unstable and low infiltration. Based on these, so in terms of morphology, Naga village is a disaster-prone areas especially landslide.

North of Tasikmalaya District passed through by a fault, which elongated west east. These fault through Naga village's area. Related with this fault, area of Naga village included in the zone with the high mass movement. Impact of mass movement is subsidence and landslide. This means that the mass movement is a hazard that any time potentially threatening Naga village. So that, Naga village has high level of vulnerability from disaster. Tasikmalaya District is one of the region in West Java which vulnerable to earthquakes<sup>[1]</sup>. One of the epicenters is in the Cigalontang sub district, where location of Naga village is at radius of less than 5 km from the epicenter. Relatively close to the epicenter, causing Naga village vulnerable to earthquakes. So that, Naga village has high level of vulnerability to disaster.

Residential location of Naga village is in a riparian of the Ciwulan River. Height of the village from the river has ranged about 10-50 m. In the east, residential distance has ranged about 50-100 m from the Ciwulan river. If using standard of riparian based on Presidential Decree No. 32/1990 about protected area



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management, partially of residential in Naga village is in the riparian area. So that, Naga village has moderate level of vulnerability to disaster.

Naga village located in the valley of the Ciwulan river, to reach Naga village from the highway Garut – Tasikmalaya, takes an at least 15 minutes. But from Naga village to the highway takes at least 20 minutes. This is caused to go to Naga village must pass the stairs, that made of cement with a width 1 m. Number of stairs are estimated to reach 300 pieces. The slope of the stairs 45-60°. In the event of a disaster, it is an obstacle to escape of the village. So that, Naga village has moderate level of vulnerability to disaster.

Building density in residential areas is one of the factors that influence the risk of disaster. Based on Decree of Ministerial of Public Works No. 21 / PRT / M / 2007 the density of buildings in rural areas with a density is > 60 units / ha has high level of vulnerability. In Naga Village there is 113 buildings, building density in residential areas which covers 1,5 ha is 76 unit / ha, so that Naga village has high level of vulnerability to disaster.

High density becomes vulnerable especially in case of fire. Building materials that appropriate with the customs of Naga village, are timber, bamboo, palm fiber, reeds, and leaves of tepus. Building materials in dry conditions is very vulnerable to fire hazards. The distance between the houses relatively close, the distance between the front of the building 3 m, side and backside of the building 1-2 m. It caused fires in one of the houses can be spread to other houses and burn the entire building in Naga village. So that, building material in Naga Village has high level of vulnerability to disaster.

Residential pattern and building construction could increase the risk of disaster. Based on Ministerial Decree of Public Works No. 21 / PRT / M / 2007, for rural areas with clustered residential pattern and building with traditional construction, has moderate vulnerability. Naga village has traditional building with wooden construction and clustered residential pattern, so that it has moderate level of vulnerability to disaster (Tabel 2)

Table 2. Level of Physical and Environmental Vulnerability of Disaster in Naga Village 2014

No	Physical Variable	Condition of Naga Village	score	Category
1	Mass movement	High	5	High= 25, 67 – 35
2	Radius from epicenter	<5 km	5	
3	Distance from residential zone to the riverside	50-100 m	3	Med = 16.33 – 25.66
4	Evacuation out of the village	>20 minutes	4	
5	Building Material	wood, bamboo, reeds, tepus leaves	5	Low = 7 - 16.32
6	Building density	76 unit/ha	5	
7	Residential pattern and building construction	Clustered pattern; traditional (wooden) construction	3	
<b>Total Score</b>			<b>30</b>	<b>High</b>

(Source : [11] I.K. Dewi and Y. Istiadi, 2014)

## 2. Adaptability of Naga Village Community in Disaster Risk Reduction.

To reduce a risk of disaster, the community should have the ability, strength and potential that can make them able to prevent, reduce, and alert to disaster. Traditions of Communities of Naga village is always preserve nature, in order to create harmony between man and the environment. Creation of harmony between man and nature is one form of adaptation that can reduce the risk of disaster. Process of learning the values of living in harmony with nature as traditional knowledge, be done early in a family through the example of their parents, habituation, and solicitation. The tradition of living in harmony with nature, appropriate with their philosophy " Tri Tangtu di Bumi " which includes *Tata Wilayah*; *tata wayah* ; and *tata lampah* <sup>[12]</sup>. The philosophy is implemented through a guide of life, namely: mandate, testament, taboo and consequence<sup>[13]</sup>.



Mandate is a message from ancestors to keep the tradition of a simple lifestyle, peace and holding of ritual ceremonies<sup>[13]</sup>. Mandate is a form of traditional knowledge in disaster risk reduction. The mandate of the simple life in harmony with nature, as in terms of the pattern of housing; the construction of houses, material to built up their houses, pattern of mix gardens, rice fields and forest. Guided by mandate, communities of Naga village adapt to its environment, which is disaster prone area.

Testament is tradition that must be obeyed by all the communities of Naga village<sup>[13]</sup>. In framework of disaster risk reduction, testament is a form of traditional wisdom in adapting to disasters. Forms of testament as traditional wisdom for disaster risk reduction are testament of the house and the forest.

Taboo is a prohibition that is socially and culturally inherited from generation to generation within a society<sup>[14]</sup>. The trust in Naga village everything that is not come from the ancient doctrine is considered taboo. Taboo is a prohibited act in the form of words, deeds, and something tangible objects<sup>[13],[14]</sup>. In the life of traditional community, taboo is customs rules that must be obeyed and implemented in order to always get the safety and the quietness souls in social life. Communities of Naga village still believe, convinced, uphold and obeyed the taboo, especially in matters relating to the life or activities of their daily. Taboo in communities of Naga village as traditional knowledge in disaster risk reduction are Taboo act that enters sacred forests and forbidden forest and taboo objects in building a house.

### 3. Building and Infrastructure

Communities of Naga village adapt to natural conditions customary. Adaptation of buildings or houses against natural conditions indicated by its site and materials, and the placement of the kitchen. As mandated to live in harmony with nature, buildings or houses in Naga village has a unique construction, legacy from ancient tradition that is able to adapt to its environment. The pattern of the building site is linear, accordance to contours and elongated east west. Building or house taboo if is not facing to north or south. As a whole pattern of the housing are cluster, with center an open space and a mosque. The open space can be a meeting point for the communities in case of a disaster.

Buildings and houses are placed following the contour, and the contour reinforced with stone and clay so that is not easily eroded by rainfall. Each row of buildings, both in front and behind separated by an aisle, which also functioned as drainage. The aisle's floor position is lower than the building site. It has a simple structure in which its floor of soil, and its wall of stone. Drainage has a width of 0.5-1 m, and a depth of 20-50 cm. When is raining, the water permeated into the soil and partly flowed of west to east, following the slope, towards the Ciwulan River. In certain places that slope is very steep, is made drainage with walls of stone that cemented, with the floor of soil. The drainage system to prevent water logging, so that residential areas become dry quickly after rainfall. Besides as the drainage, the aisle also functioned to flow the strong winds from the east. So the layout of the building or house elongated west-east is the traditional wisdom to reduce disaster risk of strong winds.

According with the testament and taboo, houses or buildings must using the materials of wood, bamboo, palm fiber, reed, or tepus leaf without nails and cement, with the stage construction using stones placed on the ground. This caused buildings more flexible against the earthquakes shake<sup>[15]</sup>. The stage is made of rectangular stone sized 15 cm x 15 cm at the top, and 20 cm x 20 cm at the bottom, placed at each corner of the building. The roof is made of reeds or *tepus* and fibers that are arranged in a series of bamboo stand called *garumpal*. These materials did not burden the structure of the system, so when the earthquake it did not collapse (flexible), and it is elastic material<sup>[15]</sup>. When an earthquake shaken Tasikmalaya District on 2 September 2009 with magnitude 7.3 SR in Naga village, no building fall down and roof detached, so did not danger for its occupants. The stage house with a lightweight material is able to adapt to the natural conditions of disaster prone, especially earthquake, by reducing the risk of disaster, as house damaged or fatalities caused by collapsed roof. Besides resistant to earthquake, stage house can also avoid flooding. Stage height is 50 cm, so between the ground and floor of the house there



is a space namely, *kolong*, which can prevent water enter to the house. Based on these, the testament and taboo in built up a house are an adaptation shape of Naga Village's communities in order to reduce the risk of earthquake, flood.

In order to adapt to the fire disaster, kitchen as a part of the house, which became a source of fire-prone. So traditionally, the kitchen walls must made from bamboo, which is woven not tightly namely *bilik sasag*. Through the *bilik sasag*, activities in the kitchen can be seen from the outside by the neighbor of the house opposite, and smoke that produced when cooking can exit. Besides using *bilik sasag* kitchen also had window and door. The kitchen is located at the front of the house, next to the room to receive guests, namely *tepas*. One of the completeness of the kitchen is stove for cooking namely *hawu*. *Hawu* not put on the floor of the kitchen, but on a wooden tub containing soil namely *paroko*, made with the size of 1x1m, with height equal to the kitchen floor. Placement of *hawu* above *paroko* to avoid the fire of the stove burn the house floor. Thus adaptation of Communities of Naga village to reduce the risk of fire disaster is to set the layout of the kitchen and *hawu*, and manage the neighbor in order to monitor if there is a fire that burning in the kitchen. In addition, to prevent of fire disaster, used electricity and gas are taboo.

#### 4. Environmental Management

Naga village has rice fields, mixed garden, fishpond and forests. The mandate to live in harmony with nature is indicated by how communities to manage them.

##### Mix Garden and Rice Field.

Rice fields and mix gardens located in the hills so that rice fields and mix gardens made terraces. It is done so that the water can be drained from the rice field and garden at the top, to the rice field and garden at the bottom. It is a form of soil conservation technology. The water will be retained in the rice fields and mix gardens, then drain slowly from the highest to lowest swath, so it is not cause erosion, which has consequences landslide. In addition, in some parts of the rice fields and mix gardens planted with bamboo or palm to prevent landslide. The pattern of rice fields and mix gardens are adaptability of Naga village's communities in disaster risk reduction, especially landslide.

Rice is the basic foodstuff of the Communities of Naga village. Types of rice that planted in the rice field are various varieties such as: *Jablansang*, *bulu*, *cere*, *peuteuy*, *lokcan* and *seksrek*. This is meant, in order that the traditional rice, which is easy to fall, will be strong. Besides the traditional rice varieties, they also planted rice with new types such as IR. Traditional rice is planted earlier in January, while non-traditional rice is planted two months later, it is in order to harvest occurred simultaneously. Harvest simultaneously conducted to prevent the rice pests grew. Customary, communities of Naga village donated a little of the rice harvest to be stored in Village granary namely *Leuit*, for ceremonial purposes and anticipate if crop failure. The rice cultivation and customary for storing a little of the harvest in the *Legit* are adaptability of communities of Naga village in disaster risk reduction, especially disaster of food insecure.

##### Fish Pond

Customarily, Naga Village consists of three zones namely: the sacred zone, the clean zone and the dirty zones. The sacred zone is located in the western part, which is located higher than the east and adjacent to sacred forest. On the sacred zone there is Bumi Ageung a place to store sacred objects, and *Leuit* a place to store rice harvest from donation of communities. Clean zone is the area of the houses. Dirty zone is located around the clean zone, Dirty zone consists ponds, toilets, cattles pens and shelters for pounding paddy (*saung lisung*). The Toilet, cattle pen and *saung lisung* located above the fish pond. The fishpond



also function as natural waste pond that functioned to precipitate the waste before it drained into the Ciwulan River. Dirty zone, which is a fishpond in the eastern part directly adjacent to the Ciwulan River. The location of the fishpond is lower than a residential zone, but higher than the river. This fishpond becomes a barrier between residential zones with the river. When Ciwulan River overflowed, water is filling fishponds before entering into a residential zone. Thus this fishpond that dual function as a deposition of dirt and reduce the risk of flooding.

### **Forest**

Disaster risk reduction such as landslide, drought and strong wind are indicated by the existence of the testament and the taboo about the forest. Naga Village has sacred forests, and a forbidden forest. The sacred forest is a place where an ancestor is buried (shrine), and a sacred place that is respected. Forbidden forest is an area of chaos, which is inhabited by demons and evils. Communities of Naga village did not dare to violate the taboo to enter and take any of the sacred forest and the forbidden forest.

The sacred forest is located in the western part, physically have steep slopes (25-40 %), inaccessible except by Kuncen during traditional ceremonies. The testament and the taboo, caused sacred forest since ancient times until now is not change. Preserve the sacred forest is a traditional way of communities to adapt to the landslide hazards. The sacred forest, is also the place of water source for drinking and cooking, so that preserving the forest means conserving water resources. In this case the communities of Naga village said "*Leuweung mah imah kai*". It means that the forest is a place of trees, and the existence of trees preserves water resources.

Forbidden forest is located in the eastern part, these forests inaccessible by anyone, so that the trees here, remains preserve. This forest planted with bamboo and several of trees. If observed, the forbidden forest is able to restrain the rate of the wind that came from the east, from the fields to the hill. Speed of strong wind weakened by trees in the forbidden forest, so that its is not damage the housing. Forest preservation in Naga village, that traditionally conducted through the testament and the taboo are a form of disaster risk reduction, against the hazard of landslides, flood and strong wind.

### **CONCLUSION**

Based on seven (7) physical and environmental variables, vulnerability level of Naga village is a high category. This is related to the physical condition of the village, which is located on high mass movement zone, and close to the epicenter. In addition, the high density of buildings and building materials vulnerable to fire, also affect the level of vulnerability. Responding to physical and environmental condition that vulnerable, traditionally, communities of Naga village have a good adaptability. These is a legacy of their ancestors. Traditional wisdom in adapting to the environment is still upheld by the communities. Adaptability of Communities of Naga village are indicated through environmental management, buildings, and infrastructure. Spatial planning based on traditional wisdom as a form of mitigation and adaptation is conducted by the communities to reduce disaster risk.

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