

The Resilience of Indigenous People in Sereh Village, Papua Province, to Disasters

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Abstract

The number of casualties of indigenous people during natural disasters in several areas in Papua Province indicates that the level of indigenous people resilience is low. This research will examine how the resilience of indigenous people in the northern coastal areas of Papua to disasters and the factors that influence the resiliency. The study location was determined to be Sereh Village, Sentani District, Jayapura Regency, which was hit by flash floods in March 2019. This research used quantitative and qualitative approaches. In addition to in-depth interviews with informants which were deliberately selected, questionnaires were also distributed to residents of Sereh Village to obtain primary data. Data were analyzed using descriptive methods that present narrative and tables as a result of data processing. The results showed that the level of resilience of the Sereh villagers is low. The majority of indigenous people are low economic groups, work as traditional farmers, depend on the surrounding forest resources, and their life patterns tend to be subsistence. The villagers were able to survive after the disaster and recovered because the village location was in an urban area and close to Jayapura City as the center of the Papua Province government, so they immediately got help from outside parties.

Keywords: Resilience, Indigenous people, Natural disaster, Sentani culture, Disaster mitigation

Introduction

The epidemics of measles, malnutrition, and starvation which resulted in a large number of child deaths in Asmat District, Papua Province became national news in 2018. This then became a matter for the central government because both the regency and provincial governments were unable to handle it themselves. Other disasters that often occur in the interior

or mountainous areas of Papua are landslides due to heavy rain and hail that destroy food-producing gardens and then cause famine there. Due to the isolation of many villages in mountainous areas, the local government was often late in dealing with disaster-affected areas so because of that many victims died due to hunger and disease. The number of victims who have died shows how vulnerable the Papuan population is when natural disasters occur. The character of indigenous Papuans who depend on nature and whose lifestyle is still subsistence is the cause of the low resilience of indigenous Papuans when large-scale damage occurs due to disasters. It is estimated that the level of resilience of the indigenous people living in the northern coastal areas is higher because it is much more developed than the relatively isolated central highlands in Papua Province.

The study of indigenous people in the northern coastal areas of Papua that were affected by the disaster will show the resilience of the indigenous people to natural disasters and what factors affect their resilience to disasters. This analysis is necessary so that the policies made by the local government in disaster mitigation efforts can then be right on target. The low resilience of the community can be improved through various policies. Analysis of the resilience of a community group can be assessed from the two systems that cover their lives, namely the social system and the ecological system.

Literature review

The resilience of indigenous population

Indigenous people are people descended from the original population or who inhabited an area for the first time, having their cultural traditions that have been passed down from generation to generation. Indigenous people are also known as people or indigenous communities. Indigenous communities are groups of people who have ancestral origins (from generation to generation) in certain geographic areas and have their value, ideological, economic, political, cultural, social, and territorial systems (Siscawati, 2014).

It is referred to as a 'customary law community' according to Law Number 41 the Year 1999 concerning Forestry because it still fulfills the following elements: (a) the community is still in the form of an association (rechts-gemeenschap); (b) there is an institution in the form of an apparatus of customary rulers; (c) there is a clear customary law area; (d) there are legal institutions and instruments, especially customary courts, which are still adhered to; (e) still collecting forest products in the surrounding forest area to fulfill their daily needs (Ministry of National Development Planning/BAPPENAS, 2013, p. 9). Indigenous peoples in many countries have lived in harmony with the natural environment, have ecological values, and can meet basic human needs through social, economic, and political structures that are essentially community-based (Ife & Tesoriero, 2008).

Vulnerability is a condition of a community or society that leads to or causes the inability to face a disaster threat (NPB, 2012) while resilience is the opposite of vulnerability, which is a community condition that leads to the ability to face disaster threats. Studies on the resilience of indigenous people are more related to the impact of colonialism on their territory. The social realities that exist in indigenous people are their attachment to their customary land,

their communities, and their transactions with their environment, while they are displaced by occupation, loss of autonomy, political oppression, and bureaucratic control by other parties (Fast & Collin-Vezina, 2010). About natural disasters, recovery efforts for indigenous people using modern methods include efforts to increase their resilience to disasters that may occur or also known as mitigation. Mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness and increased capacity to face disasters (BNPB, 2008). Usually, each indigenous group has its mitigation measures (traditional mitigation) that are applied when a disaster occurs, but these mitigation efforts are more spiritual in nature because they believe that the disaster is a rebuke from gods or natural rulers for mistakes that have been made. This spiritual recovery provides peace of mind and fortitude and strength for disaster victims.

Ecological social system

If the occurrence of a disaster according to the belief of the indigenous people, it was “caused by the anger of the natural rulers for their mistakes in the past” then according to modern understanding every disaster event can be explained scientifically. One of the concepts that can explain a catastrophic event is the social-ecological system (SES) because there is always a link between humans (social systems) and nature (ecological systems) and the contribution of both to the occurrence of disasters in a region. SES is an integrated system between humans and nature in a reciprocal relationship (Berkes & Folke, 1998; Carpenter & Folke, 2006). The conceptual model of SES consists of: resources, resource users, public infrastructure providers, and infrastructure (Anderies et al., 2004).

The more vulnerable a system is, lower the capacity of institutions and communities to adapt and shape change. The concept of vulnerability is defined as the level that describes a system that experiences a disaster due to its open position so that it is susceptible to pressure and disturbance (Adrianto, 2007). Vulnerability is the opposite of resilience, where a social or ecological system loses its resilience, the system becomes vulnerable to changes that could previously be absorbed (Kasperson & Kasperson, 2001).

In a resilient system, change has the potential to create opportunities for novelty and innovative development, whereas, in a fragile system, small changes can cause major damage. Society is conceptualized as a system that has the functions of adaptation (economy), integration (society), self-defense (culture), and provides a life orientation (policy). With adaptation and integration processes to deal with the influence of exogenous and endogenous factors, social dynamics remain (Kartodirdjo, 1993). Adaptation is the ability of interconnected social and ecological systems to face new situations without reducing future choices, or the keyword is resilience (Folke et al., 2002). Resilience is the ability to sustain life against changes, either suddenly or gradually. With resilience, social and ecological systems will be able to absorb shocks and at the same time maintain their functions (Suryawati, 2012).

Resilience in the social system will increase the human capacity to anticipate and plan for the future, wherein the human-nature system this resilience is referred to as adaptive capacity. Community resilience is the act of learning to live in change and uncertainty,

maintaining diversity for reorganization and renewal, combining various kinds of knowledge, and creating opportunities for community organization independently in the face of ecological change (Suryawati, 2012).

Method

This research uses quantitative and qualitative approaches in data analysis. Quantitative analysis or analysis of the flood vulnerability index uses the 2012 BNPB calculation method and the data analyzed is secondary data. Qualitative analysis is carried out to support the results of the quantitative analysis and the data analyzed is primary data. Primary data were obtained by distributing questionnaires in Sereh Village, one of the villages affected by the disaster in Sentani District, with a total sample size of 45 household units. The unit of analysis is the community in the affected village and the questionnaire is distributed to household units in the community. Data analysis using descriptive analysis that displays narrative and tables, the results of data processing. The village or in Papua is called "kampung" was chosen as the study location because the majority of its residents are local indigenous people. Sereh was chosen because it is located in an urban area on the northern coast of Papua, and is thought to be a resilient village because the number of casualties is relatively small when compared to other villages affected by the flash flood disaster in Sentani District.

Vulnerability Index

All vulnerabilities are the result of social, economic, physical, and environmental vulnerability products, with different weighting factors for each type of disaster threat (BNPB, 2012). The vulnerability index obtained is divided into 3 threat classes, namely: low (score ≤ 0.33), middle (score $> 0.33 - 0.66$), and high (score $> 0.66 - 1.00$). The parameters for the conversion of the vulnerability index shown in the equation for the type of flood threat are as follows:

$$\text{Flood Threat Vulnerability} = (0.4 \times \text{social vulnerability score}) + (0.25 \times \text{physical vulnerability score}) + (0.25 \times \text{economic vulnerability score}) + (0.1 \times \text{environmental vulnerability score})$$

Social Vulnerability

Social vulnerability is determined from indicators of population density and indicators of vulnerable groups in an area when affected by a disaster. The data obtained were then divided into 3 threat classes, namely low, medium and high (see Table 1).

Table 1 Components of Social Vulnerability due to Flooding

Parameter	Ratio (%)	Index Class		
		Low	Middle	High
Population Density	60	<500 people/Km ²	500-1000 people/Km ²	>1000 people/Km ²
Vulnerable Groups	40	<20%	20-40%	>40%

Social Vulnerability = (0.6 x population density score) + (0.4 x vulnerable groups score)

Source: BNPB (2012)

²⁵ Environmental Vulnerability

The indicator used for environmental vulnerability is landcover (protected forest, natural forest, mangrove forest, swamps and shrubs). The index of environmental vulnerability due to flooding can be seen in Table 2.

Table 2 Components of Environmental Vulnerability due to Flooding

Parameter	Ratio (%)	Index Class		
		Low	Middle	High
Protected Forest	30	< 20 Ha	20-50 Ha	> 50 Ha
Natural Forest	30	< 25 Ha	25-75 Ha	>75 Ha
Mangrove Forest	10	< 10 Ha	10-30 Ha	> 30 Ha
Shrubs	10	< 10 Ha	10-30 Ha	> 30 Ha
Swamp	20	< 5 Ha	5-20 Ha	> 20 Ha

Environmental Vulnerability = (0.3 x protected forest score) + (0.3 x natural forest score) + (0.1 x mangrove forest score) + (0.1 x shrubs score) + (0.2 x swamp score)

Source: BNPB (2012)

Physical and Economic Vulnerability

The indicators used for physical vulnerability are the density of houses, the availability of public facilities, and the availability of critical facilities. The physical vulnerability index due to flooding can be seen in Table 3.

Table 3 Components of Physical Vulnerability due to Flooding

Parameter	Ratio (%)	Index Class (in million rupiah)		
		Low	Middle	High
Housing	40	<400	400-800	>800
Public Facilities	30	<500	500-1,000	>1,000
Critical Facilities	30	<500	500-1,000	>1,000

$Physical\ Vulnerability = (0.4 \times housing\ score) + (0.3 \times public\ facilities\ score) + (0.3 \times critical\ facilities\ score)$

Source: BNP (2012)

The indicators used for economic vulnerability are the area of productive land in rupiah (rice fields, plantations, agricultural land and fishponds) and GRDP (Gross Regional Domestic Product). The economic vulnerability index due to flooding can be seen in Table 4.

Table 4 Components of Economic Vulnerability due to Flooding

Parameter	Ratio (%)	Index Class (in million rupiah)		
		Low	Middle	High
Productive Land	60	<50	50-200	>200
GRDP	40	<100	100-300	>300

$Economic\ Vulnerability = (0.6 \times productive\ land\ score) + (0.4 \times GRDP\ score)$

Source: BNP (2012)

Findings

Cycloop Mountains Nature Reserve

The Cycloop Mountains stretching 36 kilometers in the City of Jayapura and Jayapura Regency are nature reserves and water catchments (see Picture 1). The Cycloop Mountains were designated as a nature reserve in 1978 through Decree No.56/Kpts/Um/I/1978 and inaugurated in 1987 through Decree No.365/Kpts-II/1987 which covers an area of 22,500 hectares. In 2012, the area increased to 31,479.89 hectares with the Minister of Forestry Decree number 782 / MenHut-II / 2012. There are five Tribal Adat Councils in the Cycloop Mountains, namely: Sentani, Moi, Tepera, Ormu and Elema. The Sentani region consists of a nature reserve area, a buffer zone and a lake area. In the Sentani area, four large rivers originate in the Cycloop Mountains and end at Lake Sentani, namely: Taruna River in Hinekombe Village, Makuway River in Doyo Baru Village, Sereh River in Sereh Village, and Eboy River in Toladan Village.

The pressure on the Cycloop Mountains began in 1980 when the capital of Jayapura Regency was split into the Administrative City of Jayapura in 1979 and then the capital of Jayapura Regency was planned to move to the Sentani area. Forest encroachment to find wood,

hunting for endemic animals, gravel-sand excavation, clearing land and building office facilities in the Sentani area have started to occur. Forest encroachment is not only carried out by ordinary people but also by businessmen and the government, who build houses and offices on a large scale in the buffer zone, such as the office complex of the Regent of Jayapura Regency and the offices of the Mayor of Jayapura which are in the Cycloop buffer area.

Sereh Village

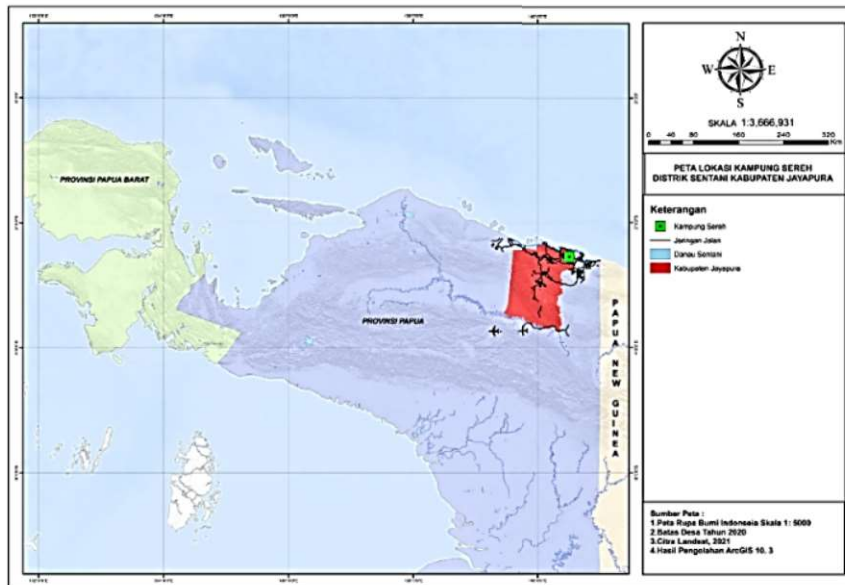
Sereh Village is located in Sentani City which is the capital of Jayapura Regency with rapid economic growth and is also the gateway for Jayapura Regency and even for Papua Province due to the existence of Sentani Airport there. The majority of the residents of Sereh Village are indigenous people, ethnic Sentani. In Sereh Village there is also a traditional government led by an ondofolo who is assisted by khoselo (elders from each clan). Each khoselo has duties in the fields of economy, surveillance, security (war), and welfare (distribution of natural resource products). The original tribe of Sereh Village consists of the Eluay, Ondikeleu, Assa, Tirake, and Daima clan groups, with the position of ondofolo being held by the Eluay clan group.

The area of Sereh Village is 11.50 Km² or 1,150 Ha, covering residential areas at the foot of the Cycloop Mountains and protected forest areas from the foot to the top of the Cycloop Mountains (see Picture 2). In the picture, Sereh Village is an area bordered by a red line. The Cycloop Mountains stretching 36 kilometers in the Sentani area are nature reserves, catchments and water catchments. The use of land by villagers can be seen in Table 5.



Figure 1 Cycloop Mountains Area

Source: <https://www.lestari-indonesia.org/id/lanskap-kami/papua-lanskap-cyclops>

**Figure 2** Sereh Village Area

Source: the Government of Jayapura Regency (2020)

Table 5 Land Use in Sereh Village

No	Objects	Land Area
a. Settlements & Buildings		
1	Public/field	0.6 Ha
2	Worship Place	3.5 Ha
3	Road	4.5 Ha
4	Settlements/Housing	55 Ha
5	School	3 Ha
6	Offices	5.5 Ha
7	Shopping & Commerce	1 Ha
8	Cemetery	5 Ha
9	Green Open Space	60 Ha
b. Agriculture		
1	Traditional Garden	25 Ha
2	Reed Land	50 Ha
3	Sago Forest	184 Ha
4	Protected Forest	200 Ha

Source: the Government of Sereh Village (2017)

The population of Sereh Village in 2017 was recorded at around 4,775 people consisting of 2,553 men and 2,222 women. Based on data from the government of Sereh Village in 2017, the number of households in Sereh Village was recorded as many as 500 households.

Table 6 Population of Sereh Village according to Age Group

Age	Population			Percentage (%)
	Male	Female	Total	
0-5	151	97	248	5.19
6-11	344	330	674	14.11
12-17	250	404	654	13.70
18-25	118	94	212	4.44
26-45	1,424	1,059	2,483	52.00
46-70	197	140	337	7.06
71+	69	98	167	3.50
Total	2,553	2,222	4,775	100
Percentage (%)	53.47	46.53	100	

Source: the Government of Sereh Village (2017)

The residents of Sereh Village work as civil servants, TNI/POLRI (army/police), entrepreneurs, and farmers. As city residents, most of the people lives from service businesses as laborers and trade. Most of the population live from traditional farming. The types of livelihoods of the people in Sereh Village can be seen more clearly in Table 7.

Table 7 Population Sereh Village, Age 15 and Over, according to Employment

No	Type of Employment	Total	%
1	PNS (civil servant)	110	20.12
2	TNI/POLRI (army/police)	25	4.57
3	Entrepreneurs	69	12.61
4	Farmer/Fisherman	267	48.81
5	Private sector	76	13.89
	Total	547	100

Source: the Government of Sereh Village (2017)

The majority of residents of Sereh Village work as farmers. This farming community consists of indigenous Sentani ethnicities and ethnicities originating from Nimboran, Kemtuk, Gresi, Central Highlands (non-Sentani ethnic Papuans) and Buton (immigrants), who also work

as laborers in the city to earn additional income. Although agricultural activities are still dominant, the existence of various types of service facilities in Sereh Village shows that the village has developed into a part of the urban area. Public service facilities and critical facilities in Sereh Village can be seen in the following tables.

Table 8 Educational Facilities in Sereh Village

No	Name	Unit
1	Kindergarten	1
2	Elementary School	1
3	Junior High School	2
4	Senior High School	2
5	College	2
6	Teacher's House	5
7	Laboratory	1
8	Playing Field	4

Source: the Government of Sereh Village (2017)

Table 9 Health Facilities in Sereh Village

No	Name	Unit
1	Puskesmas (district health facilities)	-
2	Pustu (support Puskesmas)	-
3	Polindes (support Pustu)	-
4	Posyandu (support Pustu)	3
5	Health Officer's House	-
6	Drug Store	-
7	Public Washing-Toilet Facilities	-

Source: the Government of Sereh Village (2017)

Table 10 Religious Facilities in Sereh Village

No	Name	Unit
1	Building of worship	10
2	House officer	6

Source: the Government of Sereh Village (2017)

Table 11 Sports Facilities in Sereh Village

No	Name	Unit
1	Football field	1
2	Basketball court	2
3	Volleyball court	2
4	Others	2

Source: the Government of Sereh Village (2017)

Settlements and housing conditions scattered in several points of the neighborhood (RW) are social assistance houses, namely the simple house (non-permanent house), which is currently in deterioration.

Table 12 Community Settlements in Sereh Village

No	Name	Unit	Percentage (%)
1	Non-permanent house	1.000	74.07
2	Semi-permanent house	200	14.82
3	Permanent house	150	11.11
	Total	1.350	100

Source: the Government of Sereh Village (2017)

Discussions

In March 2019, there was a flash flood disaster in the Sentani area and its surroundings with the severely affected areas being Dobonsolo, Doyo Baru, and Hinekombe Villages. The cause of this flash flood is natural factors in the form of weather anomalies, namely rain with high intensity for a long time and the collapse of natural weirs, which were formed due to landslides on narrow slopes in the Cycloop Mountains, due to not being able to withstand the volume of rainwater. The flood route when a disaster occurs is a river channel and natural canal that has changed its function to become a residential area. The Head of BNPB (The Disaster Management Agency), Doni Monardo, said that 100 years ago there had been flash floods in Sentani and its surroundings based on an article written by the Dutch media (Jubi, 08 July 2020) and therefore the same disaster might repeat itself there.

The Disaster Management Agency (BNPB) noted that 104 people died and displaced 9,691 people. BNPB data recorded 374 houses were heavily damaged and 104 shophouses were damaged. In addition, flash floods also damage educational facilities, places of worship, markets, roads, drainage and bridges. Sereh Village itself is inseparable from the flash flood disaster with 4 fatalities, 22 serious and minor injuries, and resulting in damage including:

water storage tanks, Marthen Luther YPK school, WWF office building, PAUD (pre-kindergarten) building, road infrastructure, dozens of houses, including 9 houses, were washed away, and 1 car was washed away.

The problem of environmental change that occurs in the Cycloop Mountains is the increasing area of critical land due to an increase in population. In 2017 the Center for Natural Resources Conservation (BBKSDA) recorded as many as 450 Ha of critical land in the Cycloop Nature Reserve area. The increase in the area of critical land is due to a large number of indigenous people and immigrants who use the Cycloop Nature Reserve area as a residential area, gardening land, and a source of wood materials. It is difficult to prohibit the local indigenous people from "disturbing" the Cycloop Mountains area because they can only garden there to fulfill their daily needs. The BBKSDA once confiscated wood that had been taken in the CA Cycloop area, but the people who had their belongings confiscated came back with a lot of people and held a demonstration at the hall office (Paino, 2017).



Figure 3 Settlement Damaged by Flash Flood in Sereh Village

Source: Jubi (July 8, 2020)

Customary spatial planning (*Khani He Kla He*) is a system of managing assets in the form of customary land, water and forests, which are controlled by a customary government area or *ondofolo* in the Sentani area. Territorial areas that belong to a village (*phuke khalele*) have economic functions (in the form of sago hamlets, land for farming, and forests that provide wood, game animals, etc.), political functions (belonging to certain villages that cannot be

utilized by other villages), and social functions (to ensure the welfare of village residents), (Suebu & Kendi, 2017). *Ondofolo* has the authority to grant permits to use various natural resources in his territory and *Khoselo Yoangka (Melam Ime)*, who plays a role in helping *ondofolo* in economic matters, is in charge of identifying the suitability of land for agricultural/plantation activities. *Khoselo Yoangka* uses magical powers to identify the suitability of certain land, for example, is it free from pests (wild boar). *Khani He Kla He* stipulates sacred places that should not be disturbed by villagers to avoid the anger of the spirits, which indirectly protects the natural environment in these locations and avoid natural damage that can lead to natural disasters. There are two sacred places in Sereh Village, namely *Yeuw Asheke* (protected forest area) and *Aye Bulu* (spring area), where local residents are prohibited from taking the natural resources that are there and if they are violated they will receive punishment from nature (Suebu & Kendi, 2017). *Khoselo Ondikleuw*, who is in charge of assisting *ondofolo* in the field of supervision so that all activities in the village run according to customary regulations, can be said to be a stakeholder in this traditional mitigation. Currently, the belief in the "magical" power of nature has ³⁵run to decrease so that the indigenous people of Sentani no longer "respect" nature and nature is treated as merely an economic resource to meet the needs of the villagers.

Ondofolo as a customary leader still plays an important role in regulating land use in customary areas or villages. Although there is an increase in land demand due to the development of urban areas in Sentani District, this land-use change still has to get permission from the *ondofolo* as the local customary leader so that more or less will restrain the rate of change in ⁶land-use change. As a result of customary provisions, land use by indigenous people is limited. In the event of a natural disaster that requires relocation of the population, the search for land as a new settlement cannot be carried out based solely on technical provisions but is also influenced by customary factors so that it cannot simply be moved to the customs territory of another tribe. However, it cannot be denied that the influence of urban area development is more dominant on land conversion in Sentani District. The indigenous people there, who mostly work as traditional farmers and still depend on natural resources, eventually encroached on protected forest areas in the Cycloop Mountains after their lands in the buffer zone were converted into residential areas.

Further analysis was carried out according to the BNPB method. The population in Sereh Village is 4,775 people with a residential area of 55 Ha, so the population density is 87 people/Ha or 8,682 people/Km², which is in the high index class because it is above 1,000 people/Km² (score 1). This means that the vulnerability of the population in Sereh Village to flood disasters is at a high level because with a high density which means that the population is large, the potential number of residents who become victims will also be large.

Groups of women, people with disabilities, children, and the elderly are categorized as vulnerable groups. The total population of Sereh Village, male sex is 2,553, female is 2,222, and the percentage of female to male sex ratio is 87% (the number of women is 13% less than men), is in the low index class because it is under 20% (score 0).

For the category of a number of people with disabilities, from the survey results in Sereh Village, there were no disabled residents. The age group that is said to be vulnerable is the age group 0-11 years and over 70 years. From the government data in Sereh Village, the age group of 0-11 years is 922 people, and those over 70 years old are 167 people so that the total number is 1,089 people or about 23%, who are in the middle index class, namely between 20% to 40% (score 0.38).

For the poverty index, the standard for poor families is determined according to the type of house inhabited by residents in Sereh Village, that is, those included in the non-permanent housing category. There are around 74.07% non-permanent houses, so the poverty index in Sereh Village is in the high index class because it is more than 40% (score 0.85).

Tabel 13 Index of Social Vulnerability Class in Sereh Village

No	Parameter	Results	Index Class	Score
1	Density Population	8,682 people/Km ²	High	1
2	Sex Ratio	-13%	Low	0
3	Poverty Ratio	74.07%	High	0.85
4	Disabilities People Ratio	0%	Low	0
5	Age Group Ratio	23%	Middle	0.38
$Score = (0.6 \times 1) + (0.1 \times 0) + (0.1 \times 0.85) + (0.1 \times 0) + (0.1 \times 0.38) = 0.723$				

Source: Analysis Results (2020)

The index class value for the social vulnerability parameter is 0.723 and is in the high index class (see Table 14). This shows that from a social perspective, the people of Sereh Village have a high vulnerability to the threat of flash floods or in other words, the level of community resilience is low.

The GRDP value of the agriculture, forestry and fisheries sectors in Jayapura Regency in 2017 was IDR 1,918,389,000,000, - with a total of 139 villages in Jayapura Regency, the GRDP of the agricultural sector in each village is IDR 13,801,359,710, - is in the high index class because it is more than 300 million rupiahs (score 1). The productive land area in Sereh Village consists of traditional garden land and non-traditional garden land. The area for traditional garden land is 25 Ha, while the non-traditional garden area is 434 Ha, so the total productive land area is 459 Ha. From the results of interviews with several residents in Sereh Village, when converted into rupiah for productive land per Km² per year, the value is Rp. 117,503,000, - in the middle index class, namely in the range of 50-200 million rupiah (score 0.48). The index class value for the economic vulnerability parameter is 0.688 and is in the high index class (see Table 14).

Table 14 Index of Economic Vulnerability Class in Sereh Village

Parameter	IDR/Year	Index Class	Score
Productive Land	117,503,000,-	Middle	0.48
GRDP	13,801,359,710,-	High	1
<i>Score = (0.6 x 0.48) + (0.4 x 1) = 0.688</i>			

Source: Analysis Results (2020)

²¹ The indicators used for physical vulnerability are types of houses (permanent, semi-permanent, and non-permanent), public facilities in the area, and the number of critical facilities, each of which values is converted into rupiah. If 1 housing unit is estimated to be worth IDR 200,000,000,- the value of the loss from the displacement of 9 houses of Sereh Village residents due to flash floods in 2019 is IDR 1,800,000,000,- then with the number of houses as many as 1,350 units, the potential loss will be even greater or in the high index class because it is worth more than IDR 800,000,000,- (score 1). Damage to public facilities, such as water storage tanks, school buildings, office buildings, and roads, is estimated to be in the high index class because it is worth more than one billion rupiahs (score 1) while health care facilities that are categorized as critical facilities are not yet available in Kampung Sereh. The total score for the physical vulnerability was 0.7 in the high index class (see Table 15).

Table 15 Index of Physical Vulnerability in Sereh Village

Parameter	IDR/Year	Index Class	Score
Housing	> 1,800,000,000,-	High	1
Public Facilities	> 1,000,000,000,-	High	1
Critical Facilities	-	Low	0
<i>Score = (0.4 x 1) + (0.3 x 1) + (0.3 x 0) = 0.7</i>			

Source: Analysis Results (2020)

Environmental vulnerability in Sereh Village, which was donated from the protected forest with an area of 200 hectares, is in the high index class, which is more than 50 hectares (score 1), sago forest covering an area of 184 hectares is in the high index class, which is more than 75 hectares (score 1), shrubs thickets covering an area of 50 Ha are in the high index class, namely more than 30 Ha (score 1), while mangroves and swamps do not exist in Sereh Village. The environmental vulnerability index in Sereh Village is in the high index class (score 0.7).

Table 16 Index of Environmental Vulnerability in Sereh Village

Parameter	Area (Ha)	Index Class	Score
Protected Forest	200	High	1
Sago Forest	184	High	1
Mangrove Forest	0	Low	0
Shrubs	50	High	1
Swamp	0	Low	0

$Score = (0.3 \times 1) + (0.3 \times 1) + (0.1 \times 0) + (0.1 \times 1) + (0.2 \times 0) = 0.7$

Source: Analysis Results (2020)

The vulnerability to the threat of flooding in Sereh Village is calculated as follows:

$$\begin{aligned} \text{Vulnerability index} &= (0.4 \times 0.723) + (0.25 \times 0.688) + (0.25 \times 0.7) + (0.1 \times 0.7) \\ &= 0.289 + 0.172 + 0.175 + 0.07 = 0.706 \end{aligned}$$

Based on the results of the above calculations, the flood threat vulnerability index in Sereh Village is 0.706 or in the high index class.

Table 17 shows the social characteristics of the residents, the level of sensitivity, the level of resilience of the population, the community's knowledge of the risk of flood disasters, early warning and evacuation, and post-disaster recovery in Sereh Village, which is the result of questionnaire data processing.

Table 17 Characteristics of Respondents in Sereh Village

No	Criteria	Number	Percentage (%)
1	Employment		
	a. PNS/TNI/POLRI servants/army/police)	(civil 10	22.20
	b. Traditional farmer	34	75.50
	c. Traditional fisherman	1	2.20
2	Education		
	a. No school	1	2.20
	b. Elementary School	7	15.50
	c. Junior High School	14	31.10
	d. Senior High School	15	33.30
	e. College	8	17.70
3.	Length of stay		
	a. 1-2 years	1	2.20
	b. 3-5 years	3	6.60
	c. 5-10 years	6	13.30
	d. 10-30 years	37	82.20

No	Criteria	Number	Percentage (%)
4.	House status		
	a. Government aid house	0	0
	b. Rent house	2	4.40
	c. Own house	43	95.50
5	Income (IDR/month)		
	a. < 500,000,-	23	51.10
	b. > 1,000,000,-	17	37.70
	c. 2,000,000 - 3.000.000,-	5	11.10
6	Health condition during a disaster		
	a. Healthy	40	88.80
	b. Unhealthy	5	11.10
7	A refugee post		
	a. Available	33	73.50
	b. Non-available	11	24.40
8	Source of disaster information		
	a. Neighbors	34	75.50
	b. Find out for yourself	10	22.20
9	Position when disaster strikes		
	a. House	41	91.10
	b. Other places	4	8.80
10	How to save yourself		
	a. Get out of the house	38	84.40
	b. Stay at home	7	15.50
11	Get help		
	a. Yes	34	75.50
	b. No	11	24.40
12	Injured during the disaster		
	a. Yes	10	22.20
	b. No	35	77.70
13	Losses incurred		
	a. Property (furniture, house, vehicle, etc)	24	53.30
	b. Fatalities	5	11.10
	a. Reduced income	16	35.50
14	Learn from a disaster event		
	a. Yes	45	100
	b. No	0	0
15	Reaction to disaster		
	a. Evacuate	45	100
	b. Work	0	0

No	Criteria	Number	Percentage (%)
16	House condition after flooding		
	a. The house can be occupied	45	100
	b. The house can not be occupied	0	0
17	Road condition after flooding		
	a. The road is passable	0	100
	b. The road is impassable	45	0
18	Livelihood after the flood		
	a. Disturbed	45	0
	b. Undisturbed	0	100
19	Village hall condition after the flood		
	a. It can be used	45	100
	b. It can not be used	0	0
20	Health facility condition after the flood		
	a. It can be used	45	100
	b. It can not be used	0	0
21	Educational facility condition after the flood		
	a. It can be used	45	100
	b. It can not be used	0	0
22	Consider disaster risk when choosing your current house		
	a. Yes	11	24.40
	b. No	33	73.30
23	The reason for choosing the current house		
	a. Close to work	2	4.40
	b. Close to family	8	17.70
	c. Been here for a long time	36	80
24	Learn from the past flood event		
	a. Yes	45	100
	b. No	0	0
25	Response in case of flooding again		
	a. Choose an evacuation route	35	77.70
	b. Setting up a house elsewhere	6	13.30
	c. Participate in evacuation training & simulation, if any	4	8.80
26	Disaster warning system		
	a. Nothing	42	93.30
	b. Warning through the information technology	2	4.40
	c. Traditional	1	2.20

No	Criteria	Number	Percentage (%)
27	Source of flood disaster information		
	a. See natural signs	39	86.60
	b. Information from neighbors	2	4.40
	c. Information from the local government	4	8.80
28	Where you & your family save yourselves when there is a flood		
	a. Another family house	31	68.80
	b. Disaster posts provided by the government	10	22.20
	c. Open field	5	11.10
29	Vehicle used		
	a. Motorcycle	42	93.30
	b. Car	3	6.60
	c. Bus	0	0
30	Resources in dealing with flood		
	a. Nothing	40	88.80
	b. Savings	5	11.10
	c. Bank loans	0	0
31	Have access to disaster relief		
	a. Yes, but not quite	29	64.40
	b. Yes, that's enough	3	6.60
	c. Nothing helps	14	31.10
32	Parties assisting in recovery		
	a. The government	33	73.30
	b. Family	12	26.60
	c. Others	1	2.20
33	The kind of relief provided		
	a. Food	33	73.30
	b. Clothes, blankets, etc	10	22.20
	c. Medical check-up	1	2.20
34	Time for recovery		
	a. 1-2 weeks	12	26.60
	b. 2-3 weeks	7	15.50
	c. > 1 month	25	55.50

Source: Analysis Results (2020)

¹⁶ The survey results show that the majority of respondents work as traditional farmers with low income, their livelihoods are disrupted after the disaster, and it takes a long time (more than one month) to recover. It can be said that the resilience level of the residents of Sereh Village to the flash flood disaster is in a low category.

The development of the village area which became an urban area did not have much influence on the lifestyle of the indigenous villagers who continued to farm traditionally and live subsistence (lifestyles). Due to the development of the city, traditional agricultural lands have been converted into residential areas, so they have to encroach on protected forests to open new gardens. The life of the indigenous people in the Sentani area is made more difficult because they are located in the Cycloop Mountains Nature Reserve which is prohibited from changing its land use by the government.

The indigenous people of Sereh Village themselves, in surviving the disaster, rely more on social relations between their own communities (indigenous communities), even though as indigenous people who still depend on natural resources and live with a subsistence pattern, each of them must also be heavily affected by the natural disaster. It's just that because of its location close to the center of government, they quickly get help when natural disasters occur so that no victims die after disasters, for example, due to famine and disease outbreaks that usually occur after disasters.

Conclusions³⁶

Based on the results of a study on the resilience of the indigenous people in Sereh Village, the following conclusions can be drawn:

1. The cause of environmental changes in the Sentani area, especially in the Cycloop Nature Reserve area, has become critical land due to the growing population and utilizing the nature reserve as a place for residential development, short-term plantations, and also the need for wood materials.

2. The indigenous cultural values of Sentani are starting to be abandoned as well as traditional disaster mitigation so that the preservation of natural resources in the Cycloop Mountains area begins to not be maintained as in the past when customary regulations were enforced. This traditional mitigation is also difficult to implement because the residents of Sereh Village are starting to vary, not only from local natives but also consisting of immigrants who do not understand local traditions.

3. The level of vulnerability of the people of Sereh Village to the threat of flooding is in the high index class or in other words, ³⁷ resilience level of the residents of Sereh Village is low in facing flash floods. This level of resilience is more influenced by social factors, such as the majority of indigenous people working as farmers with a subsistence lifestyle and dependence on nature (garden products). However, the residents of Sereh Village were able to survive the disaster and recover because of its location close to the administrative center of Jayapura Regency and Papua Province so they could immediately get help from various parties.

4. Ecological factors are the dominant cause of flash floods which are expected to recur in the Sentani area in the future and local residents, both indigenous and migrant, are expected to be able to improve and preserve nature in the Cycloop Mountains to reduce negative impacts if the same disaster occurs. The relocation of human settlements in river flow areas and natural canals is also an effort to restore land use in the Cycloop Mountains area. And with the running

of the traditional government in Sereh Village, traditional mitigation can be "revived" as part of disaster mitigation there.

References

- Adrianto, L. (2007). *Dimensi Sosial dalam Ko-manajemen Perikanan. Peningkatan Kapasitas untuk Pengarus-utamaan Ko-manajemen Perikanan di Indonesia*. Jakarta: FAO-Departemen Kelautan dan Perikanan.
- Anderies, J. M., Janssen, M. A., & Ostrom, E. (2004). A framework to analyze the robustness of social-ecological systems from institutional perspective. *Ecology and Society*, 9(1), 1-17.
- Berkes, F., & Folke, C. (1998). *Linking social and ecological systems: Management practices and social mechanisms for building resilience*. New York: Cambridge University Press.
- BNPB. (2008). *Peraturan Kepala BNPB Nomor 4 Tahun 2008 Tentang Pedoman Penyusunan Penanggulangan Bencana*. Jakarta: BNPB.
- BNPB. (2012). *Peraturan Kepala BNPB Nomor 02 Tahun 2012 Tentang Pedoman Umum Pengkajian Risiko Bencana*. Jakarta: BNPB.
- BPS Kabupaten Jayapura. (2018). *Kecamatan Sentani Dalam Angka 2018*.
- Carpenter, S. R., & Folke, C. (2006). Ecology for transformation. *Trends in Ecology & Evolution*, 21(6), 309-15.
- Fast, E. F., & Collin-Vezina, D. (2010). Historical Trauma, Race-based Trauma and Resilience of Indigenous people: A literature review. *First Peoples Child and Family Review*, 5(1), 126-136.
- Folke, C., Carpenter, S. R., Elmqvist, T., & Gunderson, L. H. (2002). Resilience and sustainable development: building adaptive capacity in a world of transformations. *AMBIO A Journal of the Human Environment*, 31(5), 437-40.
- Ife, J., & Tesoriero, F. (2008). *Community development: Alternatif Pengembangan Masyarakat di Era Globalisasi, Edisi ke-3*. Yogyakarta: Pustaka Pelajar.
- Kartodirdjo, S. (1993). *Pendekatan Ilmu Sosial dalam Metodologi Sejarah*. Jakarta: Gramedia Pustaka Utama.
- Kasperson, R. E., & Kasperson, J. X. (2001). *Climate change, vulnerability and social justice. Risk and Vulnerability Programme*. Stockholm Environment Institute. Retrieved from <https://stc.umsl.edu/essj/unit4/climate%20change%20risk.pdf>
- Kementerian PPN/BAPPENAS. (2013). *Masyarakat Adat di Indonesia: Menuju Perlindungan Sosial yang Inklusif*. Jakarta: Direktorat Perlindungan dan Kesejahteraan Masyarakat, Kementerian PPN/BAPPENAS.
- Paino, C. (2017). *Penting untuk Kota dan Kabupaten Jayapura. Tapi Mengapa Pegunungan Cyclops Malah Terancam?* Retrieved from <https://www.mongabay.co.id/2017/05/25>
- Siscawati, M. (2014). Masyarakat Adat dan Perebutan Penguasaan Hutan. *Wacana*, 33(XVI), 3-23.

- Suebu, M., & Kendi, I. K. (2017). Birokrasi Kampung Adat *Yo Hele Mabouw* dan Hubungannya dengan Tata Ruang (*Khani He Kla He*) dalam Mendukung Pengelolaan Lingkungan Hidup di Kabupaten Jayapura. *Jurnal Ekologi Birokrasi*, 5(3), 11-25.
- Suryawati, S. H. (2012). *Model Resiliensi Masyarakat di Laguna Segara Anakan* (Doctoral dissertation). Bogor: Institut Pertanian Bogor.
- Wenda, Y. (2020). *Banjir Bandang Sentani, Pengulangan dari Abad Silam*. Retrieved from <https://jubi.co.id/banjir-bandang-sentani-pengulangan-dari-abad-silam-papua>

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