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ECONOMIC RESILIENCE OF FARMER HOUSEHOLDS IN LEBAK SWAMPLAND TO THE IMPACT OF FLOOD DISASTER IN HULU SUNGAI UTARA REGENCY

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ABSTRACT
North Hulu Sungai Regency is a district located in South Kalimantan, with the potential for lebak swamp land cultivated for rice crops. In the last year, the amount of rice harvested in North Hulu Sungai Regency has decreased. The rice harvest area in 2019 was 26,048.60 ha, with a production of 143,403.02 tons with an average production of 55.05 quintals / ha. In 2020, there was a drastic decrease, namely the rice harvest area to 19,131.80 ha, with production of 103,749.20 tons with an average production of 54.23 quintals / ha. This decrease is one of the results of the impact of flooding caused by increased rainfall. This study aims to (1) analyze the vulnerability level of farmer households; and (2) analyze the resilience of farmer households when experiencing flooding in lebak swampland, North Hulu Sungai Regency. The number of samples used in this study was 100 rice farmers. The data analysis used is equation analysis LVI-IPCC (*Livelihood Vulnerability Index-Intergovernmental Panel on Climate Change*) and descriptive analysis. The results showed that the LVI-IPCC of rice farming households in North Hulu Sungai District amounted to 0.2059 so it can be said that these farmer households are vulnerable to flooding caused by climate change. In North Hulu Sungai District, it shows that the sensitivity factor is the highest LVI factor contributing to vulnerability, which is 0.5500. The average level of resilience of farmer households is low (three to four actions taken by farmers) at 69 percent, the rest is in the very low category (only one to two actions taken by farmers) at 31 percent.

KEY WORDS
LVI-IPCC, Hulu Sungai Utara, resilience, households.

Agricultural development in Indonesia is currently facing new challenges from strategic environmental changes, especially those related to food, bioenergy, and climate change issues. Increased variability and climate change are serious threats to the agricultural sector and are feared to pose new problems for economic sustainability and food production. Various studies have shown that the cause of climate change is human activities that cause increased emissions of Greenhouse Gases (GHG) such as carbon dioxide (CO2), methane (CH4), nitrogen (NO2) and chlorofluorocarbons (CFCs) which have an impact on global warming since more than 50 years (Haryono and Las, 2011).

Global warming as one aspect of climate change that has the potential to increase the process of transferring water vapor to the atmosphere which causes atmospheric humidity to increase. The consequence of this phenomenon is that spatially there will be an increase in rainfall in some regions and a reduction in some other regions. Temporally there will be the potential for an increase in rainfall in the rainy season and a decrease in the amount of rainfall in the dry season. This is felt by farmers and disrupts strategic food production (Handoko et al. 2008).

In recent years, the intensity of rainfall has increased. It is proven that in early 2021, the province of South Kalimantan was flooded, which resulted in hampered activities in agriculture. In fact, South Kalimantan greatly contributes to national food availability, through the potential of swampland, both tidal swamp land and lebak swampland.

Swampland is increasingly important in efforts to maintain rice self-sufficiency and achieve self-sufficiency in other foodstuffs, considering the shrinking of fertile land in Java due to its use for housing and other non-agricultural purposes. The potential of lebak swamp land throughout Indonesia reaches 13.281 million hectares, consisting of shallow lebak swamps covering an area of 4,166,000 ha, middle lebak covering an area of 6,076,000 ha and deep lebak covering an area of 3,039,000 ha (Widjaja Adhi et al., 1998). The potential of lebak swampland in South Kalimantan is estimated to reach 6,960,050 ha (Adimihardja et al., 1998). Most of this lebak land has not been utilized optimally for agricultural business so that the development potential is still very large.

The use of swamp land for agricultural business in South Kalimantan is estimated to have been carried out since 200 years ago. Although the use of swamp land in Kalimantan has been quite long, not all swampland in Kalimantan has been utilized. Of the 4,757,000 ha of swampland in Kalimantan declared suitable for agricultural business, only 2,170,000 ha have been utilized. The productivity of food crops in swamp areas that have been cleared is currently still relatively low when compared to productivity in irrigated land (Sabran et al., 1998).

North Hulu Sungai Regency is a district located in South Kalimantan, with the potential for lebak swamp land cultivated for rice crops. In the last year, the amount of rice harvested in North Hulu Sungai Regency has decreased. Data on the area of harvest, production and average rice production in North Hulu Sungai District can be seen in Table 1.

Table 1 – Rice harvest area, production and productivity per sub-district

District	Harvest Area (ha)		Production (ton)		Productivity (kw/ha)	
	2019	2020	2019	2020	2019	2020
Danau Panggang	2.467,2	1.761,1	13.483,45	9.670,7	54,65	54,91
Paminggir	86,1	132,0	464,94	712,8	54,00	54,00
Babirik	4.496,5	2.832,1	24.921,91	15.598,4	55,43	55,08
Sungai Pandan	3.688,7	3.088,3	20.524,27	17.089,6	55,64	55,34
Sungai Tabukan	2.302,0	1.588,0	12.880,54	8.743,1	55,95	55,06
Amuntai Selatan	2.801,7	1.557,9	15.509,89	8.327,7	55,36	53,45
Amuntai Tengah	2.929,8	2.152,5	15.719,54	11.420,7	53,65	53,06
Banjang	2.954,2	2.721,4	16.060,28	14.424,1	54,36	53,00
Amuntai Utara	2.604,3	2.075,2	14.391,23	11.202,6	55,26	53,98
Haur Gading	1.718,1	1.223,3	9.446,97	6.559,5	54,98	53,62
Total	26.048,6	19.131,8	143.403,02	103.749,2	55,05	54,23

Source: BPS Hulu Sungai Utara, 2019 & 2020.

The rice harvest area in 2019 was 26,048.60 ha, with a production of 143,403.02 tons with an average production of 55.05 quintals / ha. In 2020, there was a drastic decrease, namely the rice harvest area to 19,131.80 ha, with production of 103,749.20 tons with an average production of 54.23 quintals / ha. This decrease is one of the results of the impact of flooding caused by increased rainfall.

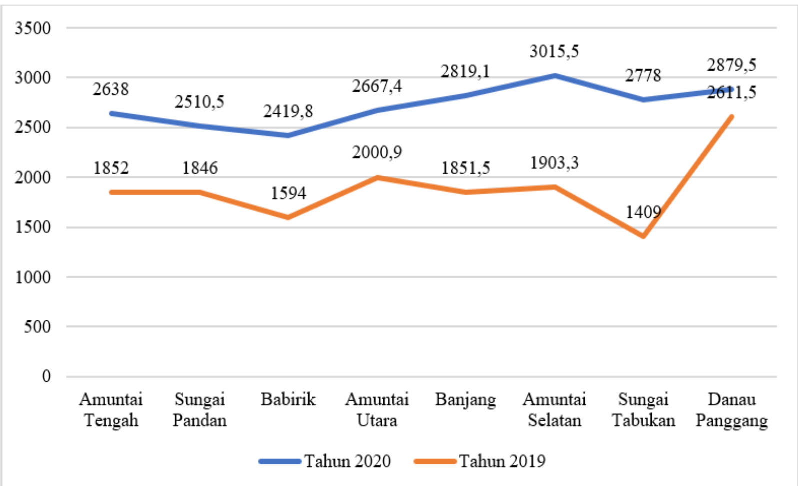

Figure 1 – Amount of rainfall in HSU District in the year 2019 & 2020 (mm)

Based on the data presented in Figure 1, it shows that the amount of rainfall during a year in 2020 was much higher compared to the amount of rainfall during a year in 2019. This amount of rainfall is the result of measurements at each location of the BMKG station measuring instrument located in the North Hulu Sungai Regency area. In 2020, the highest amount of rainfall in the South Amuntai region was 3,015.5 mm. Meanwhile, in 2019, the highest amount of rainfall in the Lake Panggang area was 2,611.5 mm (BPS HSU, 2019; HSU BPS, 2022).

According to BPS in 2022, the area of damage to rice plants in North Hulu Sungai Regency caused by flooding is 512 ha. Even worse, the area of rice plants that experienced extinction due to flooding was 345 ha. This is a disaster for farmers who really hope for abundant harvests. Based on this, it will have an impact on changes in the income obtained by farmers due to flooding. In addition, these farmers must be able to take resilience measures in dealing with the impact of flooding disasters due to rainfall variability. This is so that farmers can still produce and survive in these conditions.

Based on the background and formulation of the problem that has been explained, the objectives of this study are (1) Manalyze the level of vulnerability of farmer households in lebak swampland, North Hulu Sungai Regency. (2) Analyze the resilience of farmer households when they experience flooding in lebak swampland, North Hulu Sungai Regency.

METHODS OF RESEARCH

This research was conducted in Hulu Sungai Utara District, South Kalimantan Province. The site selection was chosen deliberately with consideration that the North River Upper District has a very wide potential for lebak swampland, and is very affected by flooding due to rainfall variability in the agricultural sector and farming households. The study was conducted from preparation to report expected from February to May 2023.

There are two types of data used in this study, namely primary data and secondary data. What is meant by primary data is data obtained from direct interviews with farmers who are research samples. Meanwhile, what is meant by secondary data is data obtained based on literature studies of institutions and related agencies in this study, such as the Central Bureau of Statistics of North Hulu Sungai Regency, the Agriculture Office of North Hulu Sungai Regency, the District Extension Center (BPK) and other related agencies.

The method of drawing examples in this study was carried out through several stages. These stages consist of determining the sub-district area, then determining the research sampling unit. The sampling determination process is carried out as follows:

- The first stage: choosing four sub-districts, namely Babirik, South Amuntai, Sungai Tabukan and Central Amuntai. These four sub-districts were chosen because in this region there was the highest decrease in harvest area (BPS HSU, 2020; 2022);
- The second stage selects a sample of farmers who carry out superior rice farming and are affected by floods as a sampling unit. The determination of the sample of superior rice farmers is by simple random sampling with the number of samples taken by 100 farmers. This number of samples is considered to be representative of the population because, the characteristics of sample farmers are not too diverse.

The problem restrictions set to focus this research are as follows:

- The subjects in this study were farmers who cultivated high-yielding varieties of rice;
- High-yielding varieties of rice farmers affected by floods.

To answer the first objective, namely analyzing the vulnerability level of superior rice farmer households in lebak swampland, North Hulu Sungai Regency, using *the Livelihood Vulnerability Index* (LVI) analysis. LVI analysis uses capital indicators consisting of natural capital, human capital, social capital, physical capital, and financial *capital*. According to Hahn et al. (2009) LVI consists of seven main components, namely: socio-demographic profile, livelihood strategy, social networks, health, food, water, as well as natural disasters and their impacts.

The model used in LVI analysis refers to models by Shah et al. (2013) and Hahn et al. (2009). This approach uses a number of sub-component indicators that are combined to produce each of the main components. A systematic combination of indicators is used to assess the degree of vulnerability. A number of indicators are used to measure household access to various forms of capital. A set of free unit indices with values between 0 (lowest) and 1 (highest) are used to compare households' access to various capitals. This index is calculated using values adapted from the standardization of all indicators comprising the human development index developed by UNDP (Madhuri et al. 2014). Hahn et al. (2009) describe the LVI calculation as follows:

$$\text{Index}_{S_d} = \frac{S_d - S_{min}}{S_{max} - S_{min}} \qquad (1)$$

Where:

- Index_{sd}: The value of each subcomponent of the main component;
- S_d: Number of subcomponents;
- S_{min}: Minimum Value (0);
- S_{max}: Maximum Value (100).

At the index, S d is the original sub-component of the d region and S_{min} and S_{max} are the minimum and maximum values for each component. The maximum and minimum values are transformed and the above equation is used to standardize each sub-component. The index of the subcomponent is at an interval of 0-1 because the unit of measurement of the subcomponent uses percentages. After all sub-components are standardized, the value of each major component is calculated by the following equation:

$$\text{M}_\text{d} = \frac{\sum_{i=1}^{n} index_{S_d}{}^{i}}{n} \qquad (2)$$

Where:

- Md: One of the seven main components (the main components referred to as X1, X2, X3, X4, X5, X6, and X7);
- $\text{Index}_{Sd}{}^{i}$: The value of each subcomponent of the main component;
- n: Number of subcomponents in the main component;
- X1: Socio-demographics;
- X2: Livelihood Strategy;
- X3: Social networks;
- X4: Land Tenure;
- X5: Food;
- X6: Water;
- X7: Natural disasters and their impact.

M_d is one of the seven main components for region D, indexed indicates each sub-component, indexed by I, that makes up each major component, and n is the number of sub-components in each major component. After the values of the seven major components are calculated, the LVI level of the region can be estimated by the formula:

$$\text{LVI}_\text{d} = \frac{\sum_{i=1}^{n} W_{M^i} M_d}{\sum_{i=1}^{n} W_{M^i}} \qquad (3)$$

Where:

- W_{M^i}: Key Component Values.

The writing of rummus LVI can be written with the equation:

$$LVI_d = \frac{W_{X1}X1_d + W_{X2}X2_d + W_{X3}X3_d + W_{X4}X4_d + W_{X5}X5_d + W_{X6}X6_d + W_{X7}X7_d}{W_{X1} + W_{X2} + W_{X3} + W_{X4} + W_{X6} + W_{X7}}$$

Where:

- W_{X1}: The value of the main components of socio-demography;
- $X1_d$: Number of socio-demographic sub-components;
- W_{X2}: The value of key components of livelihood strategies;
- $X2_d$: Number of sub-components of livelihood strategy;
- W_{X3}: The value of the main components of social networks;
- $X3_d$: Number of subcomponents of social networks;
- W_{X4}: The value of the main components of land tenure;
- $X4_d$: Number of sub-components of land tenure;
- W_{X5}: The value of the main components of food;
- $X5_d$: Number of food sub-components;
- W_{X6}: The value of the main components of water;
- $X6_d$: Number of water subcomponents;
- W_{X7}: Value of the main components of natural disasters and their impact;
- $X7_d$: Number of sub-components of natural disasters and their impacts.

LVId which is the LVI for region d is equal to the weighted average of the seven main components, WMi is determined by the number of sub-components that make up each major component. According to Hahn et al. (2009) the LVI scale is in the range of 0 (slightly vulnerable) to 0.5 (most vulnerable). Furthermore, the weight value of the LVI component is classified into the IPCC component in the form of exposure, adaptive capacity, and sensitivity with a final score between -1 (lowest vulnerability level) to +1 (highest vulnerability level). LVI measurement indicators are presented in Table 2.

Table 2 – Indicators of vulnerability measurement of rice farmer households when flooded in the model IPCC (Intergovernmental Panel on Climate Change)

Category	Main components	Main Sub-Components
Exposure	Natural Disasters and Their Impact	Standard revision of average monthly rainfall from 2019 – 2020 Percentage of households that lost all agricultural assets
Sensitivity	Land tenure	Percentage of households whose land ownership status is Non-Personal The percentage of households where the distance of rice fields to the source of water overflow is very close
	Food	The percentage of households that get food from their own land. Percentage of farmers who grow less than 2 crops Percentage of households that do not sell for other foods
	Air	Percentage of households experiencing excess water problems / severely flooded Percentage of households that are unable to accommodate clean water
Adaptive Capacity	Socio-demographics	Percentage of heads of households not attending school Percentage of elderly farmers
	Social Networking	Percentage of households receiving government assistance Percentage of households borrowing money
	Livelihood strategy	Percentage of households whose income is only from the head of the family Percentage of RTs whose income depends on agriculture Percentage of RTs without livelihoods other than agriculture

The LVI-IPCC (*Livelihood Vulnerability Index- Intergovernmental Panel of Climate Change*) equation is as follows:

$$LVI\text{-}IPCC_d = (e_d - a_d) * s_d \quad (4)$$

Where:

- LVI-IPCC: Vulnerability of households to the IPCC framework;
- e_d: Total exposure score;
- a_d: Total score adaptive capacity;
- s_d: Total score sensitivity.

The interpretation of the results of the final research score is that if the value shows a number close to 1, the more vulnerable the community is, so it is necessary to handle and take action by the government in the form of policies and community responses in order to be able to reduce the value of vulnerability that occurs. A value close to -1 indicates a community that is less vulnerable to flooding.

To answer the second goal, namely analyzing the resilience of superior rice farmer households when experiencing flooding in lebak swampland, North Hulu Sungai Regency, it is carried out by tabulation and calculation processes. Tabulation and calculation process using Microsoft Office Excel 2021. The results of the interview will be explained in a descriptive method.

Identification of the resilience of farmer households in the face of flooding disasters is carried out using the determination of observations that have been made. These actions will be carried out as a form of farmers' ability to survive the flood disaster. The actions taken by rice farmers can be seen in Table 3.

Table 3 – Operational definitions to determine the level of resilience of rice farmer households

No	Actions taken
	Non Agricultural
1	Farmers get help from other farmers when flooded
2	Farmers who make loans to relatives when flooded
3	Farmers who make loans to neighbors when flooded
4	Farmers who make loans to banks when flooded
5	Farmers who sell their livestock when flooded
6	Farmers who sell their assets (TVs, motorcycles, jewelry, etc.) when flooded
7	Farmers who mortgage their assets to certain parties when flooded
	Agriculture
8	Farmers who switched jobs to the off-farm sector when it was flooded
9	Farmers who switched jobs to the non-farm sector when it was flooded
10	Farmers who change the dose of fertilizer on rice plants when flooded
11	Farmers who change the time to plant rice when it is flooded
12	Farmers who replace rice seedlings when flooded
13	Farmers who change fertilizer for rice crops when flooded

The more actions taken by farmer households, the higher the level of resilience of farmer households to flood disasters. The level of resilience is obtained based on the calculation of the number of actions taken, which is as many as 13 actions taken in the middle value, and this value which then becomes a reference to determine the indicator of the level of resilience of farmer households in the face of flooding disasters can be presented in Table 4.

Table 4 – Indicators of resilience level of rice farmer households

Number of actions performed	Household resilience level
1-2	Very low
3-4	Low
5-6	Enough
7-8	Tall
>8	Very High

RESULTS AND DISCUSSION

In general, age can determine a person's physical condition in working / farming. If a person is outside the productive age, then the person's ability will be reduced in doing a job (farming). Based on data from the field, it shows that the most farmers in this study are in the age group of 41-50 years, which is as much as 30 percent. While at least in the age group ≤ 30 years, which is only 5 percent. When viewed as a whole, the average age of farmers is 50 years, meaning that many farmers in this study tend to still be at productive age.

Through education a person can improve self-quality, because education when viewed from the farmer's side is a process so that someone can change for the better, starting from knowledge, skills and attitudes. Formal education is a form of education that is officially recognized by the government. The higher a person's education, of course, the better the way of thinking for that person in making decisions. Based on data from the field, it shows that there are still farmers who do not go to school or do not finish elementary school, which is as much as 19 percent. The education level of farmers with those between primary school graduation and below is 45 percent. The level of farmer education is highest at the junior high school education level, which is 34 percent. Meanwhile, farmer education at the high school education level is still small, which is only 21 percent. According to some literature, education is one way to break the chain of poverty. So by looking at the condition of farmer education that is still low, efforts are needed to improve education through non-formal education such as extension activities, training, field schools and so on.

The number of household members is the sum of all existing members of the household, but excluding the head of the household. In general, the more members of the household, of course, the more expenses. However, the more household members who can play a role in helping in work or business, it can certainly add value to income. Based on the results of the study, it shows that farmers who have 3 household members, amounting to 30 percent of the number of farmers in this study. While the rest are distributed farmers with 1 person (10 percent), 2 people (14 percent), 4 people (24 percent) and ≥ 5 people (22 percent). The average number of household members in farmers in the study area was 3 people.

Farming experience can be seen from the length of farming activities carried out by farmers in this study. The longer the farming activities carried out by farmers, it will provide a lot of experience for these farmers. Farmers will go through an experiential process that will provide choices in their decisions based on the experience they have gone through. Based on the results of the study, it shows that the most farmers are in the group of farming experience between 16 - 25 years. While the distribution of farmers is the least found in the group of farming experience between ≤ 5 years. When viewed as a whole, the average farming experience is 23.35 years.

Jobs for some people are not only sourced from one job, but some have more than one job, so the terms main job and side job emerge. The main job is the work that is the main source of income for the subjects in this study. While a side job is an additional job to contribute additional household income. The distribution of farmers based on the main type of work and side jobs can be seen in Table 5.

Table 5 – Distribution of farmers by main and side occupation

No	Types of Jobs	Main (%)	Side (%)
1	Farmer	92%	8%
2	Farm worker	-	59%
3	Fish Finder	2%	4%
4	Non-farm workers	-	5%
5	Merchant	6%	5%
6	Other	-	19%
	Total	100	100

Source: Primary Data Processing, 2023.

Based on the data presented in Table 5, it shows that the distribution of farmers based on the main type of occupation is most work as farmers, which is 92 percent, while the rest as fish seekers 2 percent and traders 6 percent. When viewed from side jobs, the distribution of farmers in the study area worked the most as farm laborers, namely 59 percent, the rest as farmers 8 percent, fish seekers 4 percent, non-farm workers 5 percent, traders 5 percent, and those who did not have side jobs as much as 19 percent.

Land is a factor of production of a farm, the greater the area of land owned, the more production produced. Although it can be known, there are other production factors that determine the production results of a farm. This also applies to every farm, as well as to farms carried out in the research area. Farmers in this study have an average land area of 0.79 ha. The distribution of farmers is most found in the group of agricultural land between >1 ha, which is 32 percent of farmers. While the distribution of farmers is the least in the group of agricultural land < 0.25 ha, this is only 5 percent of farmers. The narrowest area of farmers' land is 0.14 ha, while the largest is 2.86 ha.

Flooding that occurs in agricultural land in North Hulu Sungai Regency poses a threat to farming households who feel the impact of the flood, so it is necessary to know how much vulnerability (*Vulnerability*). The level of vulnerability of farmer households to climate change is identified using the Livelihood Vulnerability Index developed by (Hahn et al., 2009).

LVI is divided into 3 factors, namely exposure, sensitivity, and adaptive capacity. Exposure consists of the components of natural disasters and their impacts. Sensitivity consists of three main components, namely land ownership, food, and water. The adaptive capacity factor consists of three main components, namely socio-demographics, social networks, and livelihood strategies. The description of the LVI calculation based on the factors can be seen in Table 6.

Table 6 – Factors in LVI

Factors	Vulnerability Value
Exposure	0,5387
Sensitivity	0,5500
Adaptive Capacity	0,1643

Source: Primary Data Processing, 2023.

Based on the data presented in Table 6, it shows that the value of the exposure factor is slightly lower than the sensitivity factor. The value is 0.5387. The value of the most contributing factor is the sensitivity factor, which is 0.5500. This shows that sensitivity factors are more vulnerable than other factors. Therefore, it is necessary to improve these conditions by increasing land ownership, planting more diverse food crops, and building clean water storage facilities. The value of the Adaptive Capacity factor is 0.1643. This value is due to the percentage of households that depend on income on agricultural enterprises.

Table 7 – LVI-IPCC Calculation

Category	Main components	Key Component Index	Vulnerability Value
Exposure	Natural Disasters and Their Impact	0,5387	0,5387
Sensitivity	Land tenure	0,5400	0,5500
	Food	0,5833	
	Air	0,5100	
Adaptive Capacity	Socio-demographics	0,1800	0,1643
	Social Networking	0,0850	
	Livelihood strategy	0,2067	
LVI-IPCC			0,2059

Source: Primary Data Processing, 2023.

Based on the results of the LVI-IPCC calculation presented in Table 7, the vulnerability value of farmers in North Hulu Sungai District is 0.2059. The vulnerability value for LVI-IPCC is in the range of -1 (low vulnerability) to 1 (high vulnerability). Thus, it can be said that the vulnerability of farmers in North Hulu Sungai District is in vulnerable areas. For more details on the LVI-IPCC intervasl class of farmers in North Hulu Sungai District can be seen in Figure 2.

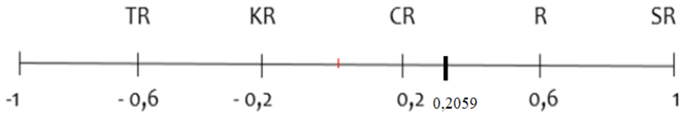

Figure 2 – LVI-IPCC values based on interval class (Note: TR - Not Vulnerable; KR - Less Vulnerable; CR - Quite Vulnerable; R – Vulnerable; SR - Very Vulnerable)

North Hulu Sungai District has a high value in food components. The susceptibility value in the food component is 0.5833. This value shows that North Hulu Sungai District is vulnerable to the food component because farmers depend on the produce grown on their agricultural land and the types of crops grown are still less diverse. The more diverse the types of crops grown, the more alternatives farmers can make when one of the commodities is disrupted due to climate change.

The vulnerability value in the land ownership component is 0.540. This value shows that North Hulu Sungai Regency is vulnerable to the ownership component, because the percentage of households that distance rice fields to close water overflow sources has a high value of 0.650 percent. In addition, the percentage of households whose land ownership status is non-personal is also quite large, which is as much as 0.430 percent.

The vulnerability value of natural disasters and their impact is 0.5387. This value shows that North Hulu Sungai Regency is fairly vulnerable to the component of natural disasters, because the flood disaster that occurred in 2020 caused an impact on farmers' rice fields as a whole. The loss caused farming households to lose assets from agricultural products due to damage and most of them experienced crop failure.

The susceptibility value in the water component is 0.510. This shows that North Hulu Sungai District is vulnerable to water components. This vulnerability is caused by the rice fields cultivated by farmers are lebak rice fields, so they often experience flooding problems if there is an increase in rainfall. The majority of farming households in North Hulu Sungai District do not have clean water reservoirs. The dependence of farming households on natural clean water resources makes farming households vulnerable to the availability of these clean water resources.

Table 8 – Index of farmer households in Hulu Sungai Utara Regency

Category	Main components	Main Sub-Components	Sub-component index	Main component index
Exposure	Natural Disasters and Their Impact	Standard revision of average monthly rainfall from 2019 – 2020	0,5975	0,5387
		Percentage of households that lost all agricultural assets	0,4800	
Sensitivity	Land tenure	Percentage of households whose land ownership status is Non-Personal	0,4300	0,5400
		The percentage of households where the distance of rice fields to the source of water overflow is very close	0,6500	
	Food	The percentage of households that get food from their own land.	1,0000	0,5833
		Percentage of farmers who grow less than 2 crops	0,4400	
		Percentage of households that do not sell for other foods	0,3100	
	Air	Percentage of households experiencing excess water problems / severely flooded	0,7300	0,5100
		Percentage of households that are unable to accommodate clean water	0,2900	
Adaptive Capacity	Socio-demographics	Percentage of heads of households not attending school	0,1300	0,1800
		Percentage of elderly farmers	0,2300	
	Social Networking	Percentage of households receiving government assistance	0,0900	0,0850
		Percentage of households borrowing money	0,0800	
	Livelihood strategy	Percentage of households whose income is only from the head of the family	0,1700	0,2067
		Percentage of RTs whose income depends on agriculture	0,3200	
		Percentage of RTs without livelihoods other than agriculture	0,1300	

The value of the livelihood strategy component has a vulnerability value of 0.2067. This value shows that Hulu Sungai Utara District is quite vulnerable to livelihood strategies because there are still many farming households whose income is derived from the income of the head of the family and depends on agriculture.

The socio-demographic component has a low vulnerability compared to the previous component, which is 0.1800 because in this study most heads of families have education even though only basic education and only a few are elderly.

In the social network component, the vulnerability value is 0.0850. This value shows that North Hulu Sungai Regency is still relatively vulnerable to this component because many farming households receive assistance from the government when floods occur. In addition, quite a lot, farmer households are borrowing money either to neighbors, family, friends, or financial institutions. The description of the calculation of LVI-IPCC North Hulu Sungai District can be seen in Table 8.

Resilience is the ability of a system to survive in times of change or disruption. The level of resilience of farming households in Hulu Sungai Utara District in the face of climate change that causes flooding is estimated by calculating the number of actions taken by farming households when their farmland is affected by flooding due to climate change. The more actions taken by households, the higher the level of resilience. Resilience measures are inversely proportional to vulnerability. The higher the vulnerability of an area or region, the lower the resilience measures taken. The vulnerability of farmer households in Hulu Sungai Utara District has a high vulnerability due to several actions taken by low farmer households. Resilience measures taken by households in Hulu Sungai Utara Regency in dealing with the impacts of flooding due to climate change can be seen in Table 9.

Table 9 – Resilience measures of rice farmer households

No	Actions taken	Amount (action)	Percentage (%)
	Non Agricultural		
1	Farmers get help from other farmers when flooded (A)	6	2,47%
2	Farmer who made a loan to a relative when it was flooded (B)	26	10,70%
3	Farmers who make loans to neighbors when flooded (C)	2	0,82%
4	Farmers who make loans to banks when flooded (D)	4	1,65%
5	Farmers who sell their livestock when flooded (E)	32	13,17%
6	Farmers who sell their assets (TVs, motorcycles, jewelry, etc.) when flooded (F)	5	2,06%
7	Farmers who switched jobs to the off-farm sector when flooded (G)	12	4,94%
8	Farmers who switch jobs to the non-farm sector when flooded (H)	44	18,11%
	Agricultural		
9	Farmers who change the time to plant rice when it is flooded (I)	100	41,15%
10	Farmers who replace rice seedlings when flooded (J)	12	4,94%
	Total	243	100,00%

Source: Primary Data Processing, 2023.

Based on the data presented in Table 8, it shows various actions taken by rice farming households when they experience flooding due to climate change. The agricultural action carried out is to change the planting time and change seedlings. Meanwhile, non-agricultural actions taken are switching jobs to the non-farm and off-farm sectors, selling assets, selling livestock, borrowing from banks, relatives, neighbors and other farmers. Judging from the resilience actions taken by farmer households, in agriculture, farmers took the most resilience actions in the form of changing rice planting time, which was 41.15 percent. Meanwhile, in the non-agricultural sector, the most forms of resilience actions taken by farmers are switching jobs to the non-farm sector when floods are in progress.

Based on the data presented in Table 9, it shows various actions taken by rice farming households when they experience flooding due to climate change. The agricultural action carried out is to change the planting time and change seedlings. Meanwhile, non-agricultural actions taken are switching jobs to the non-farm and off-farm sectors, selling assets, selling livestock, borrowing from banks, relatives, neighbors and other farmers. Judging from the resilience actions carried out by farmer households, in agriculture, farmers took the most resilience actions in the form of changing rice planting time, which was 41.84 percent. Meanwhile, in the non-agricultural sector, the most forms of resilience actions taken by farmers are switching jobs to the non-farm sector when floods are in progress.

Table 10 – Distribution of farmers based on the number of farmer household resilience measures

No	Combination of Resilience Measures	Number (of people)	Percentage (%)
A	Low Resilience Rate	69	69%
1	Action C + E + I	2	2%
2	Action A + E + I	6	6%
3	Action D + F + I	4	4%
4	Action B+F+I	1	1%
5	Action B + I + H	25	25%
6	Action E + I + H	17	17%
7	Action E + I + G	7	7%
8	Action G + I + J	5	5%
9	Action H + I + J	2	2%
B	Very Low Resilience Level	31	31%
10	Action I + J	5	5%
11	Action I	26	26%
	Total	100	100%

Source: Pengolahan Data Primer, 2023.

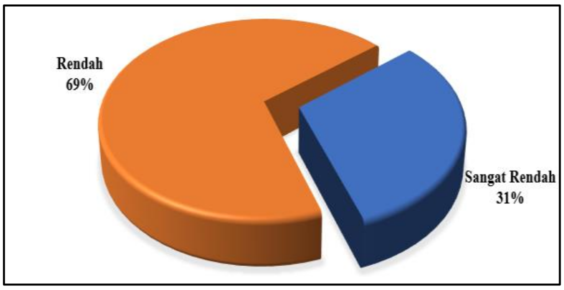

Figure 3 – The level of resilience of rice farmer households

The level of resilience of farmer households in North Hulu Sungai District was determined from the number of actions taken by farmer households, where in this study farmers as a whole farmers carried out three to four which had a low resilience level of 69 percent, while the remaining 31 percent of respondents had a very low level of resilience, namely taking only one to two actions when flooding occurred. The distribution of farmer household resilience levels can be seen in Figure 3.

CONCLUSION

Based on the results of the discussion that has been done, the author can draw the following conclusions:

- LVI-IPCC rice farming households in North Hulu Sungai District amounted to 0.2059 so it can be said that these farmer households are vulnerable to flooding caused by climate change. In North Hulu Sungai District, it shows that the sensitivity factor is the highest LVI factor contributing to vulnerability, which is 0.5500;
- The average level of resilience of farmer households is low (three to four actions taken by farmers) at 69 percent, the rest is in the very low category (only one to two actions taken by farmers) at 31 percent.

We recommend that the government through related agencies need to make efforts to prevent losses that can be experienced by farmers when they are flooded, for example with rice farming insurance packages that can cover losses to farmers. Make irrigation canals open and close, for water disposal when overflowing. In addition, further research is also needed, especially for the resilience of farmers' household livelihood strategies in North Hulu Sungai District. This is a form of government support in order to mitigate flood disasters in North Hulu Sungai Regency. In addition, it is also necessary to adapt to various actions that can be taken by farmers, so as to minimize the negative impact of flooding disasters in North Hulu Sungai Regency.

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