Gender role in climate change adaptation on the peat swamp ecosystem in Pulang Pisau Regency Central Kalimantan

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Abstract. Climate change has the most severe impact on women, but studies on adaptation in a gender perspective are still limited. The purposes of this study were to find out: (1) gender role changes in response to climate change, and (2) the impact of gender role changes on the vulnerability of women. This study was conducted on the peat-swamp ecosystem in Pulang Pisau Regency, Central Kalimantan. Gender roles in natural resource management in adapting to climate change in the peat-swamp ecosystem were descriptively qualitatively analyzed which emphasized relations and gender roles in the household. Data were collected using structured questionnaires. This study used documentation methods with secondary data types. From the results of the study, it can be seen that the gender role of women is divided into three, namely productive roles, reproductive roles, and social community roles. Climate change in Pulang Pisau Regency will interact and be sustainable with gender inequality and which disadvantages women than men, especially among the poor community, so that access to the availability of natural resources is needed in order to solve existing vulnerabilities and increase more real participation in the current climate change adaptation process.

1. Introduction
Climate change either directly or indirectly is caused by human activities that change the components of the global atmosphere, causing global warming and climate change to occur naturally. The rapid progress of economic development through the massive burning of coal, petroleum, wood, and deforestation has a serious impact on the global climate. 3.4 million poor communities, children, indigenous people, farmers, and fishermen are disaster-prone groups. Climate change has the most severe impact on women from the lowest social groups [1]. For each disaster (climatic or not), the number of women victims was greater than men with a ratio of 4:1. The results of the analysis showed that disasters that occurred in 141 countries had differences in the number of victims due to natural disasters which closely related to the economic and social rights of women [2].

Efforts to adjust development programs to climate conditions which are caused by climate change due to global warming. The gender-responsive climate change impact prevention strategy is carried out by positioning climate change adaptation action programs in various fields to improve family resilience. At present, considerations of gender have not been explicitly stated in various climate change policies.
The number of studies on the relationship between gender and climate change, especially in wetland ecosystems (peat) is still very limited. Several studies were conducted in the Jayawijaya Mountains but limited to the agricultural sector. A study on gender differences and public opinion on climate change in America [3]. A study on adaptation patterns of men and women in 3 (three) types of livelihoods (farmers, fishermen, and charcoal production) and on the adaptive capacity of women to water scarcity due to climate change [4]. A study by Suzuki (2011) recommended gender as an indicator of REDD standards and guidelines. In-depth studies on gender at a particular ecosystem level are still not enough to be used as a basis and policy input at the local level. Admittedly, there is growing research on climate adaptation across the world [5][6][7][8]. However, considering the significant role of gender in development, it is required that research within the climate change domain should address gender concerns. As such, research into identifying how gender groups, especially women, can adapt effectively to climate change is required [9] and the failure to include gender in projects or developmental interventions would lead to outcomes that are not optimal.

Studies on the condition of vegetation in peat-swamp forests in Central Kalimantan and Berbak National Park, Jambi Sumatera [11][12]. Ecosystem damage including the peat-swamp forest ecosystem will form gradations in the ecosystem [13]. Ecosystem recovery will follow the gradations that occur so as to reach the climax ecosystem. Many sectors are affected by climate change in terms of water, food, energy security to potential biodiversity damage and threats to other development fields. This can be seen from the lack of water during the dry season but flooding during the rainy season. The agriculture, plantation, and fisheries sectors are affected by climate change where the dry and rainy season is uncertain so that the growth and development of commodities become disrupted. Another affected aspect is public health, where climate change has created erratic temperatures and causes the body to experience health problems [14].

Peatland fires in South Kalimantan every year can cause climate change. Handling land fires has a different pattern and is not easy to do, this is because peatland fires do not occur only above ground level but also in the subsurface because peatlands have sediment [15]. The fire usually starts above ground layer and then continues to spread to subsurface layer which are often referred to as ground fires. Peat from organic material will continue to burn and cause white smoke. Because of the subsurface fires, handling is not easy because the fire-fighting process must reach the subsurface layer of peat [16]. Peat fires in Indonesia are a complex socio-environmental problem that have motivated a large number of diverse fire management interventions (FMI) from government, industry, and civil society over the past three decades [17][18].

Peat swamp ecosystem was chosen as a study location because peat swamp has a strategic value that is an indicator of climate change and land use integration. The peat-swamp ecosystem is very sensitive to climate change, so failure to handle climate dynamics will have serious impacts on the forestry and agriculture sectors. The purposes of this study were to find out: (1) gender role changes in response to climate change, and (2) the impact of gender role changes on the vulnerability of women.

2. Method

2.1. Design, time and location of study

This study used a cross-sectional design with questionnaires filled out by communities in peat-swamp ecosystem. This study was conducted in 2020 in 3 (three) Districts in Pulang Pisau Regency, namely: (1) Kahayan Hilir District, (2) Banama Tingang District, and (3) Kahayan Tengah District.

2.2. Data collection and analysis

Data collection was carried out using interview and observation techniques with a purposive sampling method, which is intentional selection of informants based on their ability to elucidate a specific concept, theme, or phenomenon [19]. Interview were conducted with 50 respondents in each district.

Data used in this study were life expectancy of women data, average education duration of women, women labor data, and economic growth data [20]. Secondary data used were obtained from relevant
agencies, namely the Central Statistics Agency of Pulang Pisau Regency (online and print publications) and Pulang Pisau Development Planning Agency (online publications).

The assumption of this study is inspired by farmers and women perceptions on climate change, focusing on temperature and precipitation changes from droughts and floods encountered over the past 5 years about forest fires on peatland in Pulang Pisau Regency. Some farmers perceive change, while others do not. Likewise, not all farmers adapt to climate variability [21][22]. This study used descriptive analysis. Descriptive analysis is carried out to find out the value of independent variables, either one or more variables without making comparisons, or connecting with other variables [23]. Descriptive analysis was used to analyze the role of life expectancy of women, average education duration of women, and the level of participation in climate change adaptation in the peat-swamp ecosystem of Pulang Pisau Regency in 2020-2021.

2.3. Sampling technique
The population in this study were villagers around the peat-swamp ecosystem in 3 (three) districts namely Kahayan Hilir District, Banama Tingang District, and Kahayan Tengah District. The samples were differentiated by sex for each district consisting of 20 men and 30 women.

2.4. Data type and collection technique
The sample population in this study is the village community in Pulang Pisau Regency. Examples are distinguished by sex for each district as many as 50 respondents consisting of 20 (twenty) men and 30 (thirty) women. This study used primary and secondary data (Rahmawati et al., 2017). Primary data were obtained by filling in structured questionnaires on (1) Individual characteristics in the form of education, employment, and income; (2) Perception of community on culture and gender role in climate change adaptation in Central Kalimantan [29].

3. Results and discussion
Gender is an interpretation of the roles, functions, and responsibilities of women and men by the community in the long term in accordance with the times and the environment so that it becomes a culture that can influence interactions between communities, including interactions between men and women. Gender serves to identify differences between men and women in terms of social and cultural aspects, values and behavior, mentality and emotions, and other non-biological factors.

Gender is one of the considerations for determining roles in natural resources management, which is known as gender roles. The gender role is a concept of behavior in each community and certain social groups that make certain activities, tasks, and responsibilities that are perceived as the role of women and men. The role is performed by individuals. Gender roles are carried out by women and men according to status, environment, culture and community structure.

Fakih (1996) explained 3 (tiga) gender roles namely:
1. The productive role is the role of women and men to get paid cash, including market production with an exchange rate and household production or subsistence with use-value. For example, working in the formal and informal sectors.
2. Reproductive roles are related to childcare responsibilities and domestic tasks to ensure the care and reproduction of workers. Example: giving birth, caring for children, fetching water, cooking, washing, cleaning the house, repairing clothes, and others.
3. Community and political management role consists of 2 categories namely:
   a. Community management role (social activities) includes all activities in the community as an extension of the voluntary and payless reproductive role.

The political management role relates to the role in community organizing at the formal political level which is usually paid (directly or indirectly) and increases power or status. If the gender role is managed well, it can be a strategy for community adaptation to climate change, but if it is not managed properly, it can increase vulnerability. Based on the gender roles above, the gender roles in this study...
can be seen by discussing these three roles which include reproductive activities, productive activities, community management activities, and political management activities.

This study used the Harvard gender analysis model and Moser gender analysis model. This study analyzed gender role changes in response to climate change and the impact of gender role changes on vulnerability of women. In this study, gender roles were analyzed based on perception. Perception is the process of sharing and interpreting information. Perception will make someone interpret the world around and give sensory input meaning. Perception is a view or assessment of someone on a particular object that is produced by the ability to organize the senses of observation. Perception is the process of finding information and a process of organizing and interpreting stimulus patterns in the environment.

3.1. Climate change in Pulang Pisau Regency
The Average rainfall (a comparison between the amount of rainfall for a month and the average value of rainfall for a month) over a period of 2019 shows the variation in each month [30]. The differences can be seen in the following month where there was a significant decrease in rainfall (Figure 1). The dynamics indicate atmospheric disturbance on a local and regional scale so that it can affect rainfall in Pulang Pisau and surrounding areas throughout the year.

The average monthly rainfall for the last 1 (one) year at Tjilik Riwut Meteorological Station showed a significant increase. Rainfall intensity has a significant decrease from May to September, then had an increase in early October. Figure 1 indicates that in 2019 there was an unstable rainfall pattern, which there were a forest and peatland fire at the end of 2019. The highest change in air temperature can be seen in 60-70 ° N which exceed to 2 ° C. Tropical regions, such as Indonesia, have an average increase of 0.3 ° C. The increase in air temperature due to global warming in Indonesia, particularly in Pulang Pisau Regency is rather difficult to quantify because long period data on air temperatures are not available [2].

Gender-responsive is consistent and systematic attention to the differences between women and men in the community by removing structural and cultural barriers to achieve gender equality. While gender issue is a condition that shows the gap between men and women or gender inequality. This gender inequality condition is obtained by comparing the expected condition and condition as it should. At the study location, the community felt the impact of climate change, such as an increase in temperature and changes in rainfall.

![Figure 1. Average rainfall and rainy days every month in Pulang Pisau Regency 2019 [30].](image-url)
Almost all respondents felt an increase in temperature over the past decade. As many as 95% of respondents stated that there was a change and instability in rainfall patterns with high rainfall intensity but with a lower duration (Figure 2). This can be seen in the percentage of respondents who showed changes in temperature which greatly affected the surrounding environment and natural resources in the peat area of Pulang Pisau Regency.

Changes in rainfall patterns and temperatures have a very significant effect on the livelihoods of the community such as agriculture and fisheries, where:

1. The development of crop pests on agricultural land caused by changes in climate patterns throughout the year is relatively erratic, for example, leaf wilting, stem rot, new types of beetles, and root rot.
2. Forest or peatland fires. In Pulang Pisau Regency there is Tumbang Nusa Village as the largest area in Jabiren Raya District, in 2015 around 50% of the village area was burned down. Uncontrolled tropical fires are increasing in prevalence globally [31], including severe fires in the Indonesian peatlands a few years ago. The vast peatlands cannot be utilized maximally by the community due to the lack of knowledge of plants suitable for planting. The condition of the village which is always flooded during the rainy season makes the community not so interested in utilizing the land, but during the dry season, the land becomes very vulnerable to the fire which makes the community become worried and anxious. The fire that often occurs in Tumbang Nusa Village does not originate from the local community, because they do not burn the land, especially with customary laws and state laws that are very strict, the community avoids to burn the land.

3.2. **Change in gender role**

Climate change impacts include various aspects of human existence, such as social, economic, political, ecological, and environment [32]. Gender roles are formed by a culture that starts in the family, where children observe differences in behavior among family members. Thus, the perception of a role starts with the behavior forming in the family. Family structure in a community is a source of data, which a child uses to form gender role stereotypes [33]. Systems in family structures such as patrilineal or matrilineal will play a role in determining the roles and positions of men and women in the community. Matrilineal and patrilineal communities do not create egalitarian positions of men and women. At the individual level, analyzed human behavior that influenced by or influence climate change. The focuses are on the identification of literacy, education, and livelihood as basic factors that represent the knowledge of individual and influence the attitudes, behavior, and skills at the further levels [34].

The social response to the decline in agricultural production and agricultural land due to fires because of changing temperatures and rainfall patterns is carrying out a reconstruction of gender roles [37]. Changes in gender roles in the study location are as follows.
1. Reproductive activities are still dominated by women based on community norms such as childbirth, parenting, cooking, cleaning the house, washing clothes. Respondents stated that before going to the field on peatland, they must first finish work at home, women also sometimes bring and care for their children by bringing to the field.

2. Women have a better gender perspective compared to men in gender roles in domestic work and in public and social work. This can be seen that women are more flexible in implementing gender roles in the domestic and public sectors, and tend to have perceptions of gender roles that can be changed. Although some roles in the family (domestic) are perceived as neutral, which is permissible for men and women, there is still strong segregation in perceiving roles in the family (domestic roles). Based on the results of the study, Domestic roles related to instrumental or heavy work are perceived as masculine roles. Domestic roles related to emotional work are perceived as feminine roles.

3. Basically in Pulang Pisau Regency, especially the Tumbang Nusa village community is not very familiar with plantations and agriculture, because almost 90% of the community are fishermen. Every day, the community especially the men go fishing in the Kahayan River. They leave in the afternoon until the evening to put up nets or fishing, at dawn until morning they go to take fish and sell it to collectors in the village. Their income as fishermen is uncertain, this is inseparable from the influence of the weather, rainfall patterns, and tides of the Kahayan River. During the rainy season or flood, their income is very minimal and even suffer losses due to operational costs that exceed fish sales revenue and even they finally do not go fishing.

In Kahayan Tengah Subdistrict, especially in Tanjung Sanggalang Village, the role of women is dominant in helping household income. Most of the women in the village are skilled at cultivating oyster mushrooms, which are additional income for each family. All women in the farmer groups have a routine agenda to hold meetings every month to see the progress of mushroom cultivation in each group member. This creativity is an example for other villages and sub-districts in empowering the villagers. The proceeds from the sale of oyster mushrooms can meet daily economic needs. Women in Tanjung Sanggalang village are also active in facing climate change, women in the village are members of an organization formed jointly by stakeholders called *Masyarakat Peduli Api* (MPA). This community is a place for women in Kahayan Tengah District to play an active role in overcoming and dealing with the danger of fires in peatlands.

3.3. Impact of gender role changes on vulnerability of women

The uncertain change in temperature and rainfall indicates an imbalance between men and women in facing changes in gender roles.

1. *Marginalization*, this is usually considered as the economic impoverishment of women. This happens in the management of agricultural natural resources on peatlands. Women who work as farmworkers generally have lower incomes compared to men despite having the same productive workload. The wage of women farmworkers ranges from Rp40,000 to Rp45,000/day, compared to the wage of men farmworkers ranges from Rp 50,000 to Rp 60,000/day.

2. *Negative labeling*, this is addressed to women in managing agricultural and plantation lands which is still underestimated because they are unable and not fit to do heavy work. This is based on the physical abilities of women and men which are different.

3. *Dual responsibility*, climate change in Pulang Pisau Regency also directly impacts on gender development. The impact of climate change on women occurs in all aspects, for example food, environment, energy, health, social, culture, and economy, which can be seen in Table 1.

| Impact of climate change | Impact of women                          |
|-------------------------|-----------------------------------------|
| Crop failure            | Provision of household food and increased agricultural work |
Scarcity of fuel | Provision of household fuel and conflict over fuel use
---|---
Lack of clean water | Provision of household clean water and water contaminated with hazardous chemicals
Disease | Lack of access to health services and increasing burden to care for children
Migration | Loss of livelihood
Scarcity of natural resources | Livelihoods that depend on resources and drop out of school
Natural disasters | Increased mortality and decreased life expectancy

Climate change has an impact on crop failure in agricultural land so the results are far from expectations. The women tend to have to spend more time looking for household food supply, this results in an increase in agricultural work where they also have to take care of children in the fields. Whereas men are more likely to be considered not worthy of replacing the work of women such as caring for children and so on [43].

3.4. Potential and problems of woman in managing peat swamp ecosystem

In the interview of respondents, women farmers in peat village explained that almost 3 years the former community paddy fields were deliberately left because the land was dry and difficult to plant, especially during the dry season. Thus, to meet the daily needs of the family, men often work as laborers, both as construction workers or laborers outside the region. Most women work as laborers on oil palm plantations located around the village [39].

Most women explained that conditions due to environmental and ecosystem changes occur so fast. Many children are witnessing changes in the peat ecosystem which has a reduced function and purpose. Regulations on land burning were issued since peatland fires in 2015. As a result of these regulations, most agricultural land cannot be cultivated and farmers believe that land burning is an effective way of managing rice farming in peat ecosystems. The livelihoods of the peat ecosystem area communities in Pulang Pisau Regency can be explained as follows.

In Jabiren Raya district, most communities have a livelihood as fishermen during low tide or dry season, where catches will increase 2-3 times compared to normal days. If on an ordinary day the fishermen only make 150-200 thousand rupiahs per day, during the dry season they can reach 500 thousand rupiahs in a day. Fish catches are sold to collectors, cultivated, and processed into cork fish crackers, salted fish, and shredded fish. The processed products have been marketed to the central souvenirs and even at Tjilik Riwut Airport.

3.4.1. Adaptation strategy. The women are underestimated in climate change knowledge than men, but women have a greater concentration on climate change than men [3]. The anticipation of climate change is mostly performed as a mitigation measure for climate change which is very important, but the impact is very influential on women and children.

For this reason, adaptation requires the care and attention of all interested parties, both the government, regional governments, non-governmental organizations, and international institutions. To be implemented easily, efforts to anticipate the impact of climate change require clear socialization and guidelines, including adaptation strategies and action programs. The observed difference in gendered climate adaptation are as a result of gender barriers and not a preferred decision by men and women [43].

Women experience major obstacles on their capacity to adapt to the impacts caused by climate change in the present and in the future [44], so it is necessary to have a special strategy in promoting women in climate change adaptation. Adaptation needs and priorities are grouped into 3 (three) aspects [44], namely: (1) comfort of residence, (2) easy access to climate change and impact information, health services, and transportation access, (3) selection of livelihoods by increasing technical knowledge and availability of natural resources for food diversification, local assistance, and counseling for community villages. While some find no effect of gender, others find that men and women indeed choose different
adaptation strategies, although some of these effects may be mediated by gender related differences in other socio-economic variables such as education [45][46].

The impact caused by climate change varies in each country as well as socio-economic strata, age, and gender. Based on the above explanation, strategies that can be taken as a gender-based adaptation to climate change in the peat ecosystem at the study site, namely Pulang Pisau Regency is one of the regencies in Central Kalimantan Province which is located inside a peat hydrological area. The life of transmigrants on peatlands is quite difficult because of the very different nature compared to Java Islands. Several groups of women in the discussions conducted in these villages came with school-age children so that access to education (schools) was one of the problems that had to be solved especially in the wetlands which at that time could only be accessed using a small boat. In reproductive roles, women are responsible for most of the roles in caring for the family and taking care of the house and yard. For productive roles, women are involved as the main family labor, both in the management of peatlands and in post-harvest processing. While in the role of social community, various sacred and religious ritual activities continue to live with the role of women who actively carry out these activities [47] [48].

Groups of women in Jabiren Raya District play a role in caring for families, but must also have a big role in productive roles and social roles. Lepironia (Purun) weaving is a hereditary skill in which results are sold to meet daily needs. In addition, women also process fish catches in swamps to sell for living needs. The close relationship between the role of women and nature greatly influences sustainable natural resources management so that the functions and benefits can be felt in the future. Generally, the group of women transmigrants in this area manage peatland as a family inheritance, which was originally passed on to the men. However, land access for Lepironia plants (Purun) is used together. Besides that, there are also many kinds of fish that are useful as local snacks.

4. Conclusion

Natural resource management in the peat ecosystem in Pulang Pisau Regency is based on gender-responsive which distinguishes the roles between men and women. Gender roles are divided into three, namely productive roles, reproductive roles, and social community roles. Climate change in Pulang Pisau Regency will interact and be sustainable with gender inequality and which disadvantages women than men, especially among the poor community, so that access to the availability of natural resources is needed in order to solve existing vulnerabilities and increase more real participation in the current climate change adaptation process. Climate change in the form of rainfall patterns and changes in temperature will further worsen conditions of inequality and discrimination against women. The vulnerability of women to natural disasters and climate change in the peat ecosystem is higher than men because, in addition to biological and social factors, the economic factor of women is also not optimal in decision making.

Acknowledgements

There are a range of people that have supported us during the project’s development. Special thanks go to the reviewers of this manuscript and to my supervisors in directing the author to be able to do research better, and be thorough so that it can benefit the community and the surrounding environment.

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