

## **EFFORTS THE CLIMATE CHANGE MITIGATION AND ADAPTATION : THE CONTRIBUTIONS OF TORO COMMUNITIES IN LORE LINDU NATIONAL PARK**

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### **ABSTRACT**

*In the last few decades, the global temperature increase is something society cannot avoid. Thus, each country's international policies at COP 26 deal with this phenomenon. Among these international policies to minimize the temperature rise that has occurred, are the presence of non-party-stakeholders, one of them indigenous peoples with a variety of local knowledge in maintaining the sustainability of forest ecosystems. In case of that, this study discusses efforts for the climate change mitigation and adaptation of Toro customary communities in Lore Lindu National Park. This study used a qualitative descriptive approach with a Delphi study. The results of our study show the Toro Customary Community uses their local wisdom to utilize the forest. This is in line with several policies of Indonesian Government aimed at decreasing the rate of climate change. In order for the community to know the values of local wisdom can applied by LLNP as the owner of conservation area around the forest must be able to understand this potential efficiently, so can be applied to its buffer villages.*

**Keywords:** Contributions, Local Community, Climate Change, Mitigation, Adaptation.

### **INTRODUCTION**

The debate over climate change and how it affects human life is still a fascinating subject to research, particularly in relation to how people interact with forest resources (Ariez et al., 2022; Rahayu et al., 2020). In addition to their ecological function, forests play a role in preserving the ecosystem's balance (Golar et al., 2022), sustaining social, cultural, political, and economic roles, particularly for those who live around the forests (Fisher et al., 2018; Savath et al., 2014; Shrestha et al., 2018).

Interconnected links in Indonesia have generated variances in how individuals utilize forest resources (Golar et al., 2021) and impact already severe environmental damage (Fatem et al., 2018; Sahide et al., 2020). The phenomenon of forest destruction that occurs is caused by many factors, including land conversion and illegal logging. This phenomenon is also still common in conservation areas (Hakim et al., 2016; Määttänen et al., 2022). The dynamics of interest in the management use of land and forest products lead to forest destruction in protected areas, notably National Parks (Ehrhart & Schraml, 2018). The effects of climate change and natural disasters, such as drought effects from watershed erosion, landslides, and flash floods, have been felt extensively (Verma, 2019).

Currently, Indonesia is in the group of three countries that have the most significant risk of the impacts of climate change (Asteria et al., 2021; Rijal et al., 2022), particularly to the issues resulting from floods and the warming of the earth's surface. Many people believe that the impact of climate change will have an impact on human civilization (Stern, 2016; Thornton et al., 2014). This is evidenced by the global establishment of 17 indicators of the Sustainable Development Goals (SDGs). One of the 17 (seventeen) global goal indicators discusses urgent action to combat climate change and its impacts (Bruce M et al., 2018). Global warming that has resulted in climate change has now been felt globally (Stadelmann-Steffen et al., 2021; Zhao et al., 2021). Therefore, efforts are needed to reduce the rate of climate change by

mitigating and adapting.

From 31 October to 12 December 2021, the 26th Conference of Parties (COP) was held in Glasgow and issued a more ambitious agreement than the Paris Agreement in which temperature increases are limited to a maximum of 1.5°C through halving world emissions by 2030, prompting governments in each country to think of ways to prepare for the policy. According to (Löw, 2020), climate change can be minimized by using local wisdom approaches that already exist in communities, especially indigenous peoples. Local wisdom varies in each region caused of the process of interaction between humans and their environment in order to meet the various needs of their lives according to the geographical, social and cultural location of the community.

The Alliance of Indigenous Peoples of the Archipelago has registered 2.371 indigenous communities (Astera et al., 2021), which is spread almost throughout Indonesia, including in the Province of Central Sulawesi (Golar et al., 2019). A variety of practices and activities, such as the use of agroforestry techniques to utilize forest land, grazing animals in forest areas, and gathering non-timber forest products like honey and rubber (Butt et al., 2021; Cuni-Sanchez et al., 2019). This shows that the viability of indigenous people is inseparable from the surrounding environment. The availability of these natural resources is utilized according to their designation. In managing and utilizing forest areas for their living needs, indigenous peoples have guidelines about the values and culture that they have had for generations.

In Lore Lindu National Park (LLNP), there are three indigenous villages that have received customary forest management approvals including: Lindu, Toro, and Moa Indigenous community. Through this approval, they already have legal access and opportunities to utilize their customary managed areas socially and economically within the LLNP area. However, the debate over the role of indigenous peoples in reducing the impacts of climate change remains a long debate, particularly regarding their contribution to climate change adaptation and mitigation efforts. There are a number of studies that have yielded results on the ability of indigenous peoples to manage their forest resources sustainably, and some have shown the opposite result (Amenu et al., 2022; Bele et al., 2022; Grix & Watene, 2022; Tarigan et al., 2021).

Another thing is the importance of the prudential aspect, considering that the locus of management access is conservation forest areas, LLNP which has a very high level of vulnerability to damage (Adeyeye et al., 2019; Blicharska et al., 2020; Ehrhart & Schraml, 2018). This paper aims to provide information on how indigenous peoples are carrying out climate change mitigation and adaptation efforts, as a form of traditional sustainable forest management.

## METHOD

The Delphi method is used in this research, which takes a qualitative approach. The research conducted in Toro Village from April to September 2022. Primary data and secondary data were the two types of data used in this investigation. Voice recorders were used to record interviews and cameras to capture the research. However, the material used is a questionnaire. The results of expert assessments related to adaptation and mitigation based on the local wisdom of the Toro customary community are among the primary data. It also includes information on diverse local wisdom connected to the management and usage of forest resources.

This research begins: 1) identifying and mapping local wisdom related to the management and land use of forest products in Toro Village; 2) assessing adaptation and mitigation efforts carried out by the Toro indigenous community, using climate change instruments based on local wisdom 3) reviewing the results of expert assessments (Delphi) related to mitigation and

adaptation efforts carried out by the Toro customary community. The explanation of the flow chart this research can be seen at Figure 1.

Data collection used snowball sampling through in-depth interviews with 20 key informants, to explore more in-depth information to support the validity of the research data obtained. In addition, focus group discussions were also held to the expert group determined by this study, consisting of representatives of LLNP (5 persons), Village Governments (7 persons), Academics (3 persons), local wisdom researchers (2 persons), and NGO's (3 persons).

According to the initial criteria that have been specified according to the criteria: level of comprehension of the problem, expertise, mastery of field concepts, and experience of interacting, informants are purposefully chosen. The acquired and verified data is next subjected to a descriptive analysis.

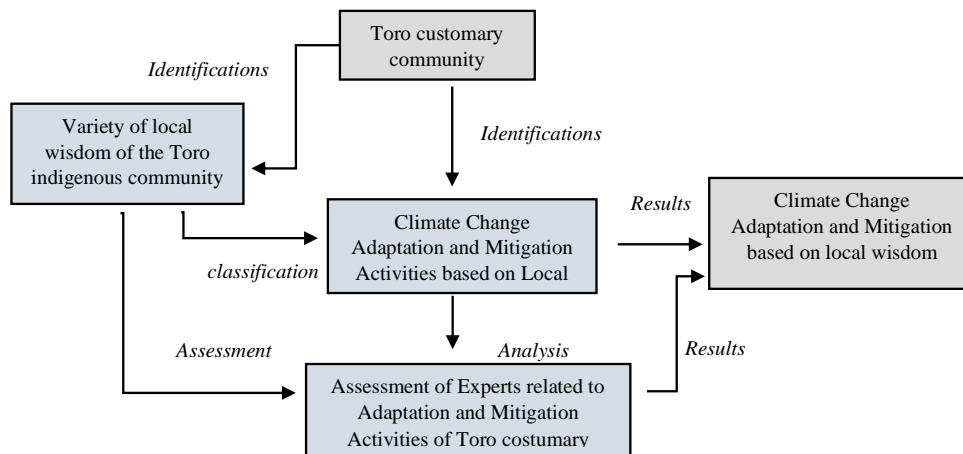


Figure 1. Research flowchart

## RESULTS AND DISCUSSION

### Variety of Local Wisdom of the Toro Community

One of the indigenous villages remaining with tremendous potential is Toro, particularly for its forest products. The Toro Customary Institution oversees collective forest management in this community. The utilization of forests is regulated and protected by customary institutions (Asteria et al., 2021; Cuni-Sanchez et al., 2019). For communities that want to make use of forest products and new land clearing, they must go through a permit process, and comply with the rules set by customary institutions.

In Toro, there are a number of traditional ways of using and managing utilization of forests that are still practiced today. Philosophically, in Toro, the mention of *hintuwu*, *katuwua*, and *petukua* indicates knowledge in forest management. "Something that rules the relationship with the creator," "something that governs the interaction between man and man," "something that governs the relationship with nature" (Golar et al., 2019). So far, it has been demonstrated that naming the form of local wisdom has ensured the community's safety and comfort for usage of the area, as well as contributed to the preservation of the region in line with the objectives stated by LLNP.

There are two types of land tenure that the Toro community accepts. Basically, all land in indigenous territories is communal as a form of control of the community as a whole over its territory (*huaka*). Private ownership (*dodoha*) of certain lands in this area can only occur in people who first clear primary forests to be processed into agricultural gardens (*pampa*). Based

on the history of land clearing and the rotating cultivation system practiced, the Toro community distinguishes 6 traditional land use categories (Figure 2), namely *Wana ngkiki*, *Wana*, *Pangale*, *Pahawa Pongko*, *Oma* and *Balingkea*.



Figure 2. Division of Land Use Space in Toro Community

*Wana ngkiki* is a region on a mountaintop that resembles a primary forest and is primarily populated by grasses, mosses, and bushes. They value this place greatly, especially as a supply of air, and believe that it should not be affected by human activity. There is no individual control in this area, thus the likelihood of being examined is very low.

Under *Wana ngkiki*, there is a primary forest called *Wana*. In this region is often found the habitat of endemic animals of Sulawesi and rare plants, and as a catchment area. In this location it is forbidden to open agricultural land, as it can cause natural disasters. *Wana* should only be used for hunting activities and taking resin, fragrances and medicines, and rattan. Private ownership within the area only applies to resin trees whose determination depends on who first cultivates them. Meanwhile, the rest of the natural resources are the right of collective control as part of the living space and traditional management area of the community.

*Pangale* that is a semi-primary forest area that was once cultivated into a garden but has been abandoned for decades so that it has been reforested. This area in the long term is prepared to be made garden land, while the plain is to be used as rice fields. *Pangale* is also used to take rattan and wood for home and household purposes, forest pandanus to make mats and baskets, medicinal materials, resin and fragrances.

A former garden forest called *Pahawa pongko*, or a blend of semi-primary and secondary forests, has been left abandoned for at least 25 years and already resembles *Pangale*. The trees you encounter are typically quite enormous, therefore you must use pongko to cut them down (footings made of wood). This logging is being done at a somewhat high elevation in order for the stump to regrow (hence the so-called "substitute"). Similar to *Pangale*, only the resin trees in this area are subject to private ownership rights.

*Oma* is the rotational farming technique, a thicket forest is created from a former garden and is purposefully left for re-cultivation within a specific time frame. Because this land is an area that is ready to be farmed again in accordance with the order of turnover, private ownership rights (*Dodoha*) are attached and collective ownership (*Huaka*) is no longer legitimate. Three sorts of *Oma* are created by this rotational pattern, namely:

- *Oma ntua*, if this land is left for 16 to 25 years, given its age, this type is old so that the soil fertility level has recovered and can be cultivated dense forest (*Pangale*) again as a garden,
- *Oma ngura*, the younger category because it is left for 3 to 15 years. This land is dominated by grasses and thickets. The trees that grow are still small so they can still

- be slashed using a machete without much difficulty.
- *Oma nguku* is a former garden not until 3 years abandoned. The land is still dominated by grasses, weeds and shrubs.

*Balingkea*: former gardens that have reduced fertility and have to be rested. Even so, this land can still be cultivated for crops such as corn, cassava, beans, chilies, and vegetables. *Balingkea* belongs to the land that can be used as private property rights (*Dodoha*).

Over time, the dynamics of management in this region began to erode from the indigenous values that had been instilled by its ancestors. This is clearly seen, the massive land clearing, especially in hamlets. Land clearing in some locations is no longer through customary institutions, thus ignoring sustainable land use patterns. This has been responded to by customary institutions and will soon hold a customary meeting (*notagara*), by presenting the parties in deciding on the handling and imposing customary sanctions on the perpetrators.

The insistence on subsistence and the financial requirements of families in Toro are the main driving forces behind land destruction. They began managing new territories on the basis of that. The majority of the encroached territories are in *Oma and Balingkea*, a village reserve site set aside for Toro future generations.

### **Adaptation and Mitigation Activities Based on Local Wisdom**

The forest is seen as the entrustment of the almighty for the continuation of the life of future generations. Toro indigenous community classifies natural resource ownership rights into two categories, namely:

- Collective-communal property rights; Where all natural resources in the Toro customary area can be utilized by all levels of Toro society. However, there are exceptions to resin sap that has been tapped by the first person. This right of common ownership is not allowed to be traded, rented to anyone. This right is limited to the use of forests regulated and established by local customary institutions.
- Private property rights; Natural resources in Toro can belong to individuals if they have been managed (the first land clearing), and cannot be claimed by after-parties. Space patterns that can belong to individuals are in *Pahawa Pongko, Oma, Balingkea*, and non-timber forest products found in *Wana*.

The use of this space is a mitigation and adaptation action based on local wisdom owned by Toro indigenous community in maintaining and protecting forest areas in its territory so that the use of forest products can still meet economic needs, however, still pays attention to sustainability aspects. The activities in the context of climate change adaptation and mitigation include:

#### **a. Nature School of Ngata Toro**

One of the villages currently constructing a nature school is Toro (Figure 3). The villagers developed this concept independently, and it has gained backing from a number of sources. This nature school is still in the early stages of development, so it does not yet have a learning orientation based on its knowledge of local wisdom.



Figure 3. Nature school of Ngata Toro

The idea that emerges in the field of education by adopting a strategic and appropriate approach to transmit values is related to the existence of nature schools as a new institution that offers alternative educational service products. the convergence of wisdom values with academic values from science and academia to prepare future generations for resilient and environmentally sustainable growth.

b. Ombo

In the context of climate change that impacts people's food. There is a ritual performed by the Customary Institution to ensure the survival of its citizens. The ritual is known as *Ombo* (Figure 4). The activity was opened when the village was hit by famine, so that people were allowed to take rattan in the forest area which lasted for 2 to 3 months. The components of sustainable forest management are still given priority in the clearance of *Ombo*.

In the daily activities, customary institutions cannot display documents in the form of writings or photo documentation related to customary law institutions. It application can be sanctions for women who have become pregnant first before legal marriage or the application of other sanctions that apply in the community by customary institutions, like a stealing wood and others.

The community in Toro has also carried out a system of utilizing forest areas that are still being preserved today. Community activities towards forest areas are quite high, but still pay attention to the conservation rules that have been set by the Toro Customary Institution. Due to massive community activities, in the village it is normal to encounter a move. This activity is carried out by clearing land that was once a former garden that is no longer optimal. The clearing of land for gardening activities only cuts down small trees while still paying attention to the surrounding situation and conditions.



Figure 4. Ombo's ritual on Toro Community

However, this does not mean that the village does not experience a threat to the existence of existing forest areas. The threat to the sustainability of the area does not come from the people who have inhabited the village, but a group of people from outside the village carrying out activities to use the forest area illegally.

To stem the destruction of illegally committed forests, Toro Village has formed forest partner officers from customary institutions who will see, monitor and deal with violations in customary forests. Customary institutions also cannot do much when there are outsiders who enter the area of customary territory within on the grounds that there are already people guarding it, namely officers from LLNP. The *lobo* (meeting place for customary rules) seems to have long been unused with the marked amount of dust in the area.

### Expert Assessment

The Delphi method is a systematic, interactive survey process that presents a panel of experts' perspectives (Canessa et al., 2022; Moral-pajares et al., 2022; Walker et al., 2022). In this study, Delphi's modified arguments were adopted jointly to investigate expert understanding of climate change adaptation and mitigation at Toro customary community. A total of 14 experts from various aspects were asked to consider according to their expertise in the activities that have been carried out by them. After answering the questions, the experts were then asked to give a gradual assessment of the daily activities carried out by Toro customary community. The results of expert agreement spelled out in the following Table 1.

Table 1. Expert Agreement on Climate Change Adaptation and Mitigation Activities Using the Delphi Method

The activities of Toro Community	Criteria for Assessment of Climate Change Adaptation and Mitigation	Agree	Percentage (%)	No opinion	Percentage (%)	Disagree	Percentage (%)	Total
Nature school of Ngata Toro	Reducing of deforestation and degradation of forest	8	57	3	21.5	3	21.5	14
	Sustainable forest management	10	71.5	3	21.5	1	7	14
	Augmentation of carbon stock	6	43	2	14	6	43	14
	Augmentation the role of conservation	11	78.5	1	7	2	14.5	14
	Forest and land fire control	9	64.5	4	28.5	1	7	14
Ombo	Reducing of deforestation and degradation of forest	13	93	1	7	0	0	14

	Sustainable forest management	11	78.5	2	14.5	1	7	14
	Augmentation of carbon stock	7	50	5	35.5	2	14.5	14
	Augmentation the role of conservation	12	85.5	2	14.5	0	0	14
	Forest and land fire control	7	50	6	43	1	7	14
<b>Distribution of Forest Utilization Patterns as Carbon Stock</b>	Reducing of deforestation and degradation of forest	13	93	1	7	0	0	14
	Sustainable forest management	11	78.5	3	21.5	0	0	14
	Augmentation of carbon stock	13	93	1	7	0	0	14
	Augmentation the role of conservation	13	93	1	7	0	0	14
	Forest and land fire control	8	57	1	7	5	36	14

Source: primary data

In general, 3 (three) community initiatives for climate change adaptation and mitigation were noted. The following evaluation criteria were also used to study the three activities: 1) reducing the rate of deforestation and forest degradation; 2) sustainable forest management; 3) increased carbon stocks; 4) increased conservation roles; 5) forest and land fire control.

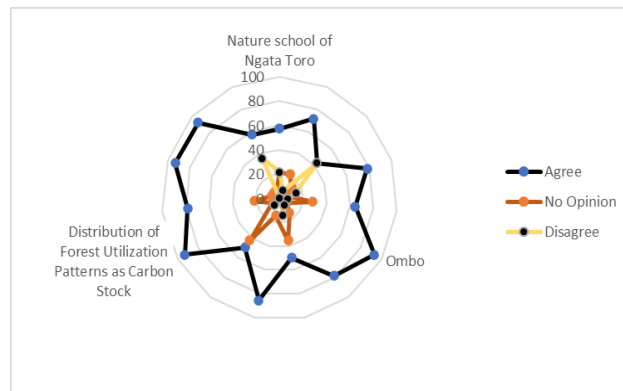


Figure 5. Spiderweb Climate Change Adaptation and Mitigation Activities

The analysis findings (Figure 5) that experts generally agree on the activities carried out by Toro customary community in mitigating and adapting climate change with its local wisdom approach. It is known that experts agree that the Nature School of Ngata Toro, *Ombo* and the distribution of forest utilization patterns as carbon stock can reduce the rate of deforestation and degradation. They believe that these three activities are effective against the succession of vegetation in the forest. Then, the assessment of criteria for aspects of sustainable forest management, experts also agree but not as large as in the previous assessment.

Meanwhile, the Nature School of Ngata Toro did not produce a direct impact on the increase in carbon stocks. This nature school prioritizes the principles of forest management based on local wisdom through knowledge transfer to children who are members of the school. This is an effort in the context of transforming local wisdom in the sustainable use of natural resources to next generations in Toro. This transformation can increase awareness of the importance of protecting the forest environment (Miah et al., 2021).

The next criterion is an assessment of the increased role of conservation. All three according to the results of the analysis contributed quite a lot to mitigation and adaptation to climate



change. The role of conservation, especially the use of spatial patterns, is very clear how respect is regulated through mutual agreement on the principles of local wisdom inherited to maintain the sustainability of the forests in their area.

Then, the assessment of forest and land fire control is not spared to be sought. However, the assessment results of experts provide values that do not differ much from one another. They are habit when land clearing or carrying out shifting activities begins with small-scale burning. Usually the burning is carried out in the dry season and is guarded by the perpetrator. In the future, it is hoped that the implications in land use by minimizing combustion will be able to reduce the release of carbon into the air (Abram et al., 2021; Doelman et al., 2020).

## CONCLUSIONS

Toro Customary Community uses their local wisdom (ombo, nature school of ngata toro, and division of land use space) to utilize the forest. This is in line with several policies of Indonesian Government aimed at decreasing the rate of climate change. In order for the community to know the values of local wisdom that can be applied in forest management on the context of mitigating climate change. The LLNP as the owner of the area around the forest must be able to understand this potential efficiently and can be applied to its buffer villages.

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