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Natural Resource Management based on Gender Perspectives and Integrating Traditional Ecological Knowledge of the Tepera in Jayapura, Papua

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Abstract. The Tepera in Jayapura Regency have a traditional ecological concept of managing their natural resources which evolved over generations. The spatial concept of their resources management is recorded visually on mental maps. The existing conditions of the landscape, forest, coastal area, and sea are considered heritage and have economic, ecological, and cultural values. The people have their own perspectives on the relationship between the resources management, cultural values, gender perspectives, and development. Thus, this research aims to identify the gender perspective in the natural resource management and environmental services; and to analyse the sustainable pattern of the land use and cultural zoning in the resources management. The methodology comprises grounded research and Participatory Action Research. This research has three findings, i.e., the tribe named the landscape; they have developed a zoning system to manage the forest traditionally; and there is a difference in perception between men and women regarding the type of forest and landscape related to food and traditional medicine sources. Therefore, it is important to incorporate the concept of managing the environment and the cultural zones of the Tepera in the programs of the local government to direct the development in sustainable way. In addition, the female participation in managing the environment should be improved, especially related to domestic aspects.

1. Introduction
Papua has an abundance of natural resources [1] and cultural diversity; it has at least 269 ethnic groups, the same amount of living local languages [2] and 1,068 clans [3]. Therefore, the perspectives of the indigenous people should play an important role in the decision-making of the development in the area.

On the provincial level, the government has developed the Mid-Term Regional Development Plan (RPJMD), a guidance that has considered the importance of culture by dividing Papua into five cultural zones based on geographical areas, i.e., Mamta, Ha-Anim, Lepago, Meepago, and Saireri. One of the tribes is called the Tepera which lives in the Mamta Area in Jayapura Regency. In Indonesian, the Tepera are also called Dewan Adat Suku Tepera (DAS) which mean tribal association. This tribe lives in the Cyclops Mountains together with other Dewan Adat Suku Tepera/DAS, the Ormu, Moy,
Sentani and Humbolt (Pt. PPMA, 2000). The map of the Cyclops Mountains Nature Reserve with the DAS can be seen in Figure 1.

The hierarchical decision-making process of the tribe follows the Ondoafian system (inherited power of leadership), although the formal institution of the tribe has not been formed yet. Generally, the indigenous people of Papua depend on the forest [3]. Therefore, deforestation has an immeasurable impact on them, which is why the management of the forest and natural resources should involve these indigenous people to reduce the negative impact of development on them. The Tepera have their own ecological concept to manage the natural resources that considers the abiotic, biotic, and cultural aspects, which has been developed intergenerationally. Both women and men understand the knowledge based on their perspectives to name their landscape environment. The relationship between the culture of people and the landscape is called geo-cultural landscape [4]. Mostly indigenous people have a relationship with the landscape and the environment such as in Australia [5] and in New Zealand [6], the Malind–Anim in Merauke [3], and the Asmat [7]. Cognitive maps describe the knowledge of an individual of the landscape, the environment, and the area, which generally is sketched on a sheet of paper, sand, or natural material [8]. This cognitive image is developed from the notion of the imaginary map by [9]. Moreover, Error! Reference source not found. stated that mental maps shape the human perspective of the environment. Thus, based on the mental maps, people understand the areas they interact with. Mental maps generally describe the behaviour of people to navigate their neighbourhood, city, country, or physical space. The actions of humans and their orientation shape the geographical knowledge.

Both the Tepera women and men understand the landscape and know how to play their role in managing their ecosystem. This depends on their task and daily activities; a World Bank report stated that the rural men and women differentiate their task and responsibility to maintain the biodiversity [11]. However, due to the patriarchy system, sometimes it places men higher than women in the society, including in the decision-making that is associated with land use and environmental management. A study that sets out to analyse property right without examining gender asymmetries in rights, responsibilities, and accessibility leads to partial understanding and incorrect conclusions [12]. Thus, this research aims to understand how the traditional lore guides the local people to maintain the nature and how the traditional values shape the environment. Therefore, the perspective of women should be involved in the decision-making because women are vulnerable to the impact of the environment. Finally, the research focuses on the traditional ecological knowledge of the Tepera to manage and mention the ecosystem from a gender perspective.

2. Study Area
The Cyclops Mountains have been established as a nature reserve since 1978. It is located in two regencies (Jayapura Regency and Jayapura City) with a total area of 31,479.84 ha, and 2160 m above sea level [13]. The government also established several conservation areas through Decree of The Forestry Ministry Number 782/Menhut-II/2012 and renew the status of the Cyclops Mountains as a nature reserve. According to the Government Regulation No 20/2011 article 33, the conservation status is not only for conservation but also for other purposes such as education and research, and carbon storage. In fact, the Cyclops Mountains supply water to Jayapura and the Sentani region. At the same time, the purpose of establishing the nature reserve is to protect the environment in a sustainable way. However, before the government designated the Cyclops Mountains as a nature reserve, indigenous people have been living in the area for a long time.

The authors conducted the study of the Tepera who live inside the conservation area (see Figure 2). The participants who engaged in the research mostly have similar social and cultural characteristics.
Figure 1. The Cyclops Mountains Nature Reserve (Balai Besar Konservasi Sumber Daya Alam Papua. Source: Bureau for the Conservation of the Natural Resources of Papua Province, 2016).

Figure 2. The Nature Reserve blocks of the Cyclops Mountains.
3. Methodology
The study is a qualitative research using the grounded approach where the researchers and the team conduct direct observations of the community. The guidelines of the research questions helped the authors to identify the concepts in the community, making it possible to compare properly the empirical approaches. In this study, the researchers collected data in a homogenous community and the respondents provided similar points of view in answering the questions. Thus, the conclusions are representative of the people as a whole.

Besides the grounded method, the research comprised participatory mapping. The guidance for the mapping is produced to arrange the steps in the research such grouping based on family members, to ensure the valid representation of the family name, gender, and the customary strata. The researchers also introduced to the participants how to produce a sketch of the planned map. Thus, the participants can understand the basic knowledge in drawing their own landscape. Finally, the participants were taught the general knowledge of the Global Positioning System (GPS), so they can draw their own map of natural resources based on their perspective. Figure 3 shows the process of participatory mapping.

![Figure 3. the process of participatory mapping.](image)

3.1. Data
The research used primary and secondary data collection. To collect the primary data, the field study was conducted in five villages, named Yewena, Wambena, Tablanusu, Yepase, and Dormena. In Yewena, there were 51 respondents, nine people who did mapping, and two people did the drawing, while five people helped to track the areas with GPS. In Wambena, there also were 51 respondents, while ten people did mapping and two who did the drawing. There were also four informants and four people checked the location with GPS. Meanwhile, in Tablanusu, Yepase, and Dormena, there were 91, 33, and 86 respondents respectively. To map Tablanusu and Yepase, nine were people employed and ten in Dormena. The field study was conducted in November 2016. Figure 4 shows several pictures to support the information.
Secondary data was collected from previous studies, either published or unpublished reports. The primary data was collected by the researchers through direct observations of the physical structure, and the different perspectives and attitudes on how the Tepera manage and name the landscapes. The research also comprises Focus Group Discussion and participatory mapping. To collect information, in-depth interviews were held with key informants consisting of the elderly, women, leaders, and youth. Each interview was conducted separately to avoid interference from other community members. Next, Focus Group Discussion was done to discuss the general issues in society related to the topic of the research. Then, participatory mapping was employed to understand the patterns of how the Tepera use and manage the resources and environmental services. In this case, the key persons drew the pattern of the land tenure such as the pattern of communal land, customary land, and land permitted to use.

3.2. Analysis Data

After collecting information, the data was analysed qualitatively in four steps. First, data reduction, where the researcher selected the important and useful information and concluded into essential substance. The information is representative of the elders, the village leaders, the community leaders, and the people who understand their local wisdom. The second process was to categorize the information into similar patterns and name it as unit information. The third step was the synthesis process to connect the similarity of each information unit and label it as “theme” (topic). Lastly, all the information was used to answer the research question that was supported by the previous theory to find a novel concept.

4. Results

The Tepera believe that the earth is like a mother who feeds her children with a part of her body, such as the sea and the land. In their vernacular, this is called Kani nekewena delrei Nameng. Nau su plre, nemeng nei kong bwo. De dalrite telrena de wali, de naute telrena de wari.

As explained before, the geo-cultural landscape shows the relation between the humans and the landscape. The people’s points of view influence the names of the landscape. Geographers are keen on how people utilise their nature [14]. The study shows that the tribe names the landscape as seko (mountain), meko bura (hill), eri bura (slope), paw (valley), meroway bu (river), buru rena bu baruna.
(spring), *kingkey bueanabu* (water fall), *meraway kera-kera* (dried river), *yemo* (cape), *yepa* (beach), *nau* (sea) and *kepou* (sea stones). These terms occur everywhere in the world. However, there is a difference between how men and women name the landscape (see Table 1).

| Landscapes         | Named by men | Named by women |
|--------------------|--------------|----------------|
| mountain           | seko         | sero           |
| hill               | meko         | meko           |
| river              | meroway      | meroway        |
| lake               | sensori      | sensori        |
| valley             | pau          | pau            |
| village            | yo           | yo             |
| old village        | yo sena      | yosena         |
| water spring       | butou        | butou          |
| beach              | boru         |                |
| rocked beach       |              | boru           |
| sea                | nau          |                |
| cape               | yemo         |                |
| bay                | duku pu      |                |
| coral reef         | sekare       |                |
| estuary            | buperu       |                |
| sacred place       |              | tempat keramat|

Table 1 shows that women have more names for the landscape than men. It seems that women are more connected to the environment in comparison with men. The understanding of the physical environment of the people who live around the Cyclops Mountains is closely related to how they use the forest, water, land, and resources to support life. It is known that primarily women who do domestic household jobs are close to the environment. The Tepera name the types of forest as in Table 2. The people classified the type of the forest according to how they use the forest to support life.

| Type of Forest                                | Mentioned by men | Mentioned by women |
|-----------------------------------------------|------------------|--------------------|
| primary forest                                | sena             | sena               |
| secondary forest                              | sena seke        | sena seke          |
| garden that no use anymore                    | seke             | seke               |
| garden                                        | emi              | emi                |
| previous garden                               | emi seke         |                    |
| dusun (a place in the forest often used for gathering sago and natural resources) | pau              | pau                |
| village                                       |                  | yo                 |

4.1. *The customary law in the natural resources management based on the types of landscape*

The Tepera value the mountain as a food basket, medical resource, and as a source of material for infrastructure. They believe if the forest is still in a good condition, which means having many big trees, this reflects positively on human beings. It also benefits the environment to reduce landslides and flooding and offers sustainability of human life and the ecosystem. Most indigenous people are inseparable from nature; they understand how to take care of Mother Nature by producing a customary law to protect their environment. First, this law prohibited cutting down the trees in the forest around the mountains for unnecessary purposes because it would reduce the fertility of the soil. This was followed by a prohibition to cut down the trees on the mountain due to a reduction in the number of
animals living in the area. The people are also not permitted to cut down the trees on the mountain that can decrease the variety and the number of the medicinal plants. They are concerned with the disasters that are affected by unwise human behaviours, so they should not cut down the trees on the mountain slope. They understand that his action would lead to an increased risk of landslides and flooding. In addition, they try to protect the forest around the mountain to avoid draught of the river.

If a member of the community breaks the law, she or he will obtain social punishment. For example, the person who breaks the customary law will be judged by the people, which influences the psychology of the person. Even worse, the Ondoafi (the leader of the tribe) will remind the person. The tribe also has a hierarchy of resource management; besides the Ondoafi, a person responsible for the economic aspects or welfare will handle the problem and will call the person who broke the law.

Beside the regulations related to the land, the Tepera also manage the water. They call river Meroway and water springs as Butou. They are very concerned with the waterways as they understand that one of the basic need of the life is water. There are several roles in managing the water in rivers, dried rivers, waterfalls, or water springs. For example, they do not cut down the trees on riverbanks that decrease the watershed level. The tribe is also not allowed to build houses along the river, above the water spring, or above the sea because they understand the risk to either humans or to the environment, especially in the rainy season. They also recognize the importance to protect the water bodies from solid waste or garbage because it causes not only flooding in rainy season but can reduce the resource from the water.

Another important landscape of the Tepera is the village. There are two types of village, the place people live in called yo (village), and the old village (yo sena) that the Tepera believe is a place where the ancestors used to live. Usually, it has been left by the villagers and returned to the forest. The old villages have historical and sacred values. For a village, in general, the customary law states that a villager has the right to build a house in the village according to the family name, but the people are not permitted to build on the riverbank and only one family can live in the house.

Next, the Tepera are strongly connected with marine landscape ecology such as capes, beaches, the sea, and rock beaches. The Tepera understand these as places of resources. They call a cape yemo, a beach yepa, a sea nau, and a rock beach boru. They know that the places that are rich in fish are around the rocks in the sea (boru). The areas have high economic values, so the Tepera mention food resources, medicinal resources, and sources of livelihood of the people. They also have a concept to maintain the sustainability of their natural marine resources, for instance, it is forbidden to use the resources for a certain period, called Tiyatiki [15]. Another role in the community is that if a member of the community catches fish, the person should share with the others; the Ondoafi (tribal leader) will help to distribute the fish to the community. Moreover, the people of the tribe are not allowed to throw garbage in the sea as their main natural resource. Next, the beach and the cape in Wambena Village have historical and sacred values related to the first missionary who came to the area. Lastly, it is not permitted to build a house above the sea, seashore, or cape.

Finally, a sacred place is called ayenekayenanou, a place with historical and sacred values. Only a few people can visit this place at a certain time.

4.2. The tribal roles to use the natural resources in the forest

The primary forest is called sena and is a place for native animals and an abundance of biodiversity. The areas of the primary forest are protected to sustain the life of the animals, plants, and, of course, the people. One of the customary regulations states that no hunting activity is allowed in the primary forest. The people can only hunt in the secondary forest, called seke.

The secondary forest is a good place for gardening because most of the soil is fertile and suitable for planting fruits and vegetables. Generally, the plantations are located on a slope are, to prevent damage by boars. Several roles are involved in this type of forest. First, to open a garden, the villager should get a permit from the customary government that has the responsibility for economic affairs. Then, the Tepera use a sasi that means it is forbidden to use the resources for a certain amount of time. Thus, to reuse the garden in this zone, people should wait for the sasi time, which lasts 5 to 10
years because this influences soil quality. Moreover, the people are not permitted to plant in waterways or in areas that are prone to landslides. Also, no one may hunt the Bird of Paradise except the Ondoafi. The people who hunt in this zone should share their prey. Also, they should understand the consequences of what they do, for example, the future negative impact of changing land use.

The land that is planned to be a garden is called moko. It is a place for food resources, so the people value it as an important place to provide their daily needs. The customary regulation is quite like the secondary forest. Both types of forest are responsible to provide resources for the people. Thus, the Tepera have developed a zoning system to manage the forest traditionally, called sena, seke, and moko. They developed based on the function of the forest to support life.

5. The gender perspective in the geo-cultural landscape of the Tepera.

The Tepera have an ecological concept to manage the natural resources with consideration of the abiotic, biotic, and cultural aspects, which has been developed over generations. The spatial concept of the resources management is recorded visually on mental maps. The existing condition of the landscape, forest, coastal areas, and the sea is considered heritage that has economic, ecological, and cultural values. The people have their own perspectives on the relationship between the resources management, cultural values, gender perspectives, and development. Both women and men understand the knowledge based on their perspectives.

As explained in the previous section, based on gender issues, the men understand nine types of landscape related to their daily activities, i.e., mountain (seko), hill (meko) river (meroway), lake (sensori), valley (pau), village (yo), old village (yo sena), water spring (butou), and beach (boru). Meanwhile, the women understand 15 kinds of landscapes that associated to their food resources, i.e., mountain (sero), hill (meko), river (meroway), lake (sensori), valley (pau), village (yo), old village (yosena), water spring (butou), rocky beach (boru), sea (nau), cape (yemo), bay (duku pu), coral reef (sekare), and estuary (bu peu).

Based on the USAID Lestari study, the participants of the Tepera were asked to develop a weighted ranking of the most important landscape based on their personal perspectives [16]. The men valued the most important landscapes for them to be the mountain, followed by water spring, the river, the village, and the sea. Meanwhile, the most important landscapes for women are the river, village, mountain, and valley.

A priority of the people for a landscape is related to their interest; it also depends on their needs and daily activities. For example, the landscape men most prioritize is the mountains. Probably, this is the case because men go to the forest more because one of their jobs is hunting. In comparison to the women, they said the most important is the river. Women are inseparable from water when they are doing their domestic tasks.

If we compare the ranking of the forest between men and women based on the function of the nature to support life, according to the study, men chose the primary forest as the most useful landscape to provide resources but the women chose the valley or the dusun as a place for food resources[16].

In our understanding men are more concerned with the landscaped that is associated to the land tenure, while women are associated with domestic tasks. This is influenced by the social strata in the community. Sometimes, the poor condition occurs that men are considered superior to women, so the female perspectives are not accounted for in the decision-making. The government should involve women in the planning process. If there is a mistake in planning, the women will face a problem or issue first. For example, if the government develops the conservation area in an unsustainable way, the water levels decrease significantly. If this occurs in the dry season, the first victims are women and children. Thus, local government should involve both women and men to make a decision regarding the planned development of an area.
6. The Traditional Ecological Knowledge in Using the Natural Resources

Based on the report of USAID Lestari [16], the Tepera named their own sacred and important places, the results of this can be seen in Figure 5.

![Image of important places for the Tepera in using the natural resources.]

**Figure 5.** Important places for the Tepera in using the natural resources.

In addition to the gender perspective, when the government involves the local people, it should understand the programs that are needed in those areas. Figure 5 shows that the indigenous people understand the programmes that can be done in their areas to increase their income, while still maintaining the sustainability of their environment. This shows that the local people understand their areas and if they are involved in the decision-making process regarding their landscape, such as spatial planning policies, this leads to correct decisions for the local people.

7. Conclusion

This research has three findings. First, the tribes name the landscape as seko (mountain), meko bura (hill), eri bura (slope), paw (valley), meroway bu (river), buru rena bu baruna (spring), kingkey bueanabu (water fall), meraway kera-kera (dried river), yemo (cape), yepa (beach), nau (sea) and kepou (sea stones). Second, the Tepera have developed a zoning system to manage the forest traditionally, called sena, seke, and moko. Third, there are differences in perception between men and women regarding the type of forest, the landscape related to food and traditional medicine sources. The zones are related to the function of the forest to support life. Therefore, it is important to incorporate the Tepera’s concept of managing environmental and cultural zones into the programs of the local government to direct the development in a sustainable way. In addition, the participation of women in managing the environment should be, improved especially associated with domestic aspects.
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