Community-Based Conservation Effort In Totango River Post Dam Development

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Abstract— **The role of the community in maintaining biodiversity, especially in the environment or in areas such as protected forests, conservation, national parks, etc. plays a vital role. As with development, human activities in general will directly or indirectly disturb natural ecosystems. And when the disturbed ecosystem is an area that has a particular role and function, the priority of protection must be reinforced. Community involvement is not only in the maintenance function but also in monitoring and usage. To prevent damage to biodiversity and help the government maintain protected ecosystem areas, the community is empowered through several methods. In this study, an analysis of conservation efforts using the community-based natural resource management approach was conducted on the watersheds of the Aketajawa Lolobata National Park area. The data was collected through bibliographic studies, observations and interviews directly in the field. The findings indicate that locals in the surroundings of Aketajawa Lolobata National Park already have ecological knowledge and awareness. The community aims to achieve better outcomes with this watershed resource in order to promote well-being and continue to pay attention to and expand the carrying capacity of the environment. This shows that the natural resource management efforts were successful and that the community is capable of managing the natural resources in a participative and self-sufficient way.**

Keywords— **Put your keywords here, keywords are separated by semi colon.**

I. INTRODUCTION

Watershed sustainability may be ensured if all management activities are undertaken in accordance with the principle of sustainability, which combines a balance between production and conservation to fulfill the following watershed management objectives [1].

1. improve the stability of the water system,
2. improve soil stability, in particular by controlling land degradation processes,
3. increase farmers' incomes, and
4. improve community behavior towards conservation activities that control runoff and flooding

River siltation is the process of depositing solid sediments at the river's bottom. This phenomena is mainly generated by the buildup of many natural elements such as dirt, sand, or mud, but it can also be caused by human actions such as waste dumping in rivers. River siltation is one of the environmental challenges that attracts less attention, and it has an influence on the people whose life rely on the river.

The phenomena of river siltation can occur naturally. For example, siltation caused by mud deposition during the rainy season. The majority of river siltation, however, is produced directly or indirectly by human activity. River siltation in metropolitan settings is often caused by the buildup of garbage from human activities. Meanwhile, significant soil erosion from illicit logging can create river siltation in rural regions [2].

Another factor that contributes to river siltation is the existence of obstacles in the watershed, such as weirs. Generally, weirs serve the function of increasing the water level. Weirs allow water to overflow from the top, allowing the water flow to stay constant even before the river is dammed. Weirs are important for preventing flooding, monitoring river flow, and decreasing river flow to allow for easier river crossing.

Siltation around weirs can create issues such as disruption of irrigation canals, disruption of drinking water canals, and changes in river morphology, all of which can have a relatively broad influence on the environment surrounding the watershed.

This research was carried out as a case study on river siltation caused by dam construction in Indonesia. The watershed zone of Totango River, one of the rivers in Aketajawe-Lolobata National Park in Halmahera, North Maluku, Indonesia, is the topic of this research. BirdLife International considers the park essential to the survival of 23 indigenous bird species. While a result, the influence of development on the environment in this place is of special importance, so that the local natural resource is preserved even as development proceeds.

II. LITERATURE STUDY

A. Water Resources Management

Water resource management is the process of planning, producing, distributing, and managing water resources for best usage. Water cycle management is a subset of water resource management [3]. Under ideal conditions, water resource management planning takes into account all water demands and allocates water in an equitable manner that meets the needs of all water users. In actuality, this is rarely the case. Water is a crucial resource for all life on Earth. Only 3% of the world's water resources are fresh water, with the other two-thirds frozen in the polar ice caps and glaciers. One-

fifth of one percent of the population lives in inaccessible or unsuitable areas (for example, water flows like a flood due to heavy rains) [4]. Humans can only consume roughly 0.08 percent of total fresh water, and this demand is growing for a variety of reasons [5].

With the idea that integrated water resource management should be carried out in a complete, integrated, environmentally friendly, and sustainable way, the usage of integrated water resource management should take the following into consideration [6]:

1. The utilization of water resources for various purposes is interdependent in the setting of upstream-downstream watersheds, which is the foundation of integrated water resource management.
2. Integrated management is a procedure that takes into account the interests of all water users at the same time.
3. Each use must consider the influence on other uses.
4. Consider social and economic factors, as well as long-term management goals.
5. Water resource management must assure the availability of sustainable water resources in addition to focusing on resource growth.

B. Watershed Management

Watershed management is the management of the last natural resources in a watershed, such as vegetation, soil and water, so that they can provide optimal and sustainable benefits. Watershed management targets are areas that naturally have the potential for environmental damage, particularly soil erosion in the upper and middle parts of the watershed, and that have a slope greater than 8% [7].

Current watershed management issues that are becoming a benchmark in determining the scope of watershed management include [8]:

1. Watershed management is still fragmented, both in terms of planning, protection and watershed management.
2. Deforestation occurs in the upstream watershed area.
3. Land use planning in downstream watersheds is not environmentally friendly.
4. Waste disposal in rivers is not controlled.
5. Sustainable water use is increasingly under threat.

For this reason, the scope of watershed management includes [9]:

1. Water catchment areas, including land use control, erosion control, water and soil conservation, and monitoring and evaluation.
2. Water resources management, including management of water quantity and quality.
3. Maintenance of infrastructure and irrigation facilities, including preventive, corrective and precise maintenance.
4. Flood control, including flood monitoring and forecasting, flood control and prevention, and flood prevention.
5. Management of the river environment, including planning and control of river boundaries.
6. Community empowerment.

The promotion of community activities comprises a variety of advising and training initiatives for local communities that rely on natural resources in their everyday lives, so that they are aware of and participate in vegetation, land, and soil management activities.

Since agriculture and water management are inextricably linked, soil conservation, which is the primary component of upstream watershed management, will have an impact on the state of downstream watersheds, particularly in terms of optimal use of water for various purposes and flood control.

C. Conservation of water resources

The problem of water resource conservation cannot be solved just by focusing on water and its sources; more should be done outside of natural resource management practices [10]. Drought is caused by a lack of water, which is caused by climate change and damage to catchment areas that are no longer able to store water; flooding is caused by damage to catchment areas and uncontrolled land use patterns; and water pollution is caused by the entry of external pollutants into the water source [11]. Natural resource management does not address any of these underlying problems [12]. As a result, other from conservation strategies, there aren't many items that may be governed as provisions in the Natural Resources Law [11].

In principle, the conservation of natural resources has three objectives [10]:

1. Water source: with care and maintenance to ensure that its role as both a water absorption and a water reservoir is maintained.
2. Physical water: conserving the presence and availability of water for the present and future by storing (e.g., in reservoirs) and effectively utilising water.
3. Water quality is concerned with quality management and water pollution control, i.e. avoiding water pollutants from entering water sources and associated infrastructure [13].

D. The phenomenon of river siltation in Indonesia

River siltation is a major environmental issue in Indonesia. The annual flood calamity in Jakarta is a direct outcome of the siltation of the rivers that run through the city. How not, 70% of Jakarta's water flow is choked with waste, preventing it from flowing correctly. Of all, it's normal for 20 percent of Jakarta's rubbish to wind up in the city's rivers and streams.

Several main rivers in Indonesia are already in severe condition outside of Jakarta owing to a huge quantity of items interfering with water movement. The Musi River, for example, suffers mud deposition at a rate of two to three million cubic meters per year as a result of soil erosion. This phenomena is said to be caused by deforestation upstream of the river for oil palm plantations. The river's siltation makes it impossible for ships to traverse and generates losses for those whose livelihoods rely on the Musi River [14].

III. METHODOLOGY

This study focuses on the watershed zone of Totango River, one of the rivers in Aketajawe-Lolobata National Park in Halmahera, North Maluku, Indonesia. The data was collected through bibliographic studies, observations and interviews directly in the field.

The strategy seen as an approach that prioritizes community participation in watershed management is community-based management effort, known as community-based natural resource management (CBNRM) [15]. This approach began to develop since the end of the 1990s with the passage of the era of decentralization and democracy. Here are the aspects in CBNRM [16];

1. Equitable community-based natural resource management through tourist villages provides more equitable socio-economic benefits to rural communities.
2. Empowerment, community management of natural resources makes the community more politically and economically autonomous.
3. Conflict resolution, tourism-oriented natural resource management cannot be separated from conflicts, but can be properly managed through the CBNRM program that is being implemented.
4. Knowledge and awareness, CBNRM unlocks new economic opportunities that do not harm the environment, but rather support environmental conservation. Existing local wisdom is combined with modern knowledge in ecology and management to manage the potential of natural resources.
5. Protecting biodiversity is one of the achievements of CBNRM. Use of natural resources to encourage communities to manage the environment and protect biodiversity and their habitats.
6. Sustainable use, continued use and collaboration with surrounding villages to increase income [12].

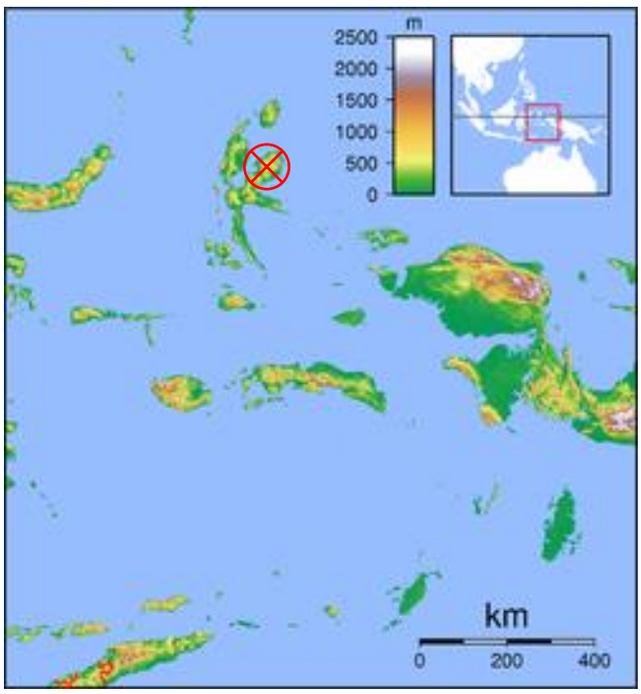

Fig. 1 Location of The Study

IV. RESULT AND DISCUSSIONS

A. *Profile of Aketajawe-Lolobata National Park*

Aketajawe Lolobata National Park or TNAL is a conservation area located in Maluku, on the island of Halmahera to be exact. This 167,300 hectare area features quite a diverse landscape due to the collision of two islands millions of years ago [17].

The diverse landscape conditions that make this national park a habitat for various types of flora and fauna. There are many species of plants and animals that are endemic species that grow and live in this region. With its biodiversity and animals, as well as the charm of a beautiful landscape, this national park is also an attractive tourist destination. The reason is that various tourist activities can be done in Aketajawe Lolobata National Park.

The administrative location of Aketajawa Lolobata National Park spans two districts and one city, namely Central Halmahera Regency, East Halmahera Regency and Tidore Islands City. While geographically this area is located at the coordinates 01°27'34" - 00°58'47" Latitude South and 128°12'37" - 129°40'49" Longitude East. The topographic conditions of this national park are quite diverse, ranging from flat, hilly to mountainous [18].

The climate of this area is influenced by monsoons and tropical marine climates with rainfall in the range of 2,000 to 2,500 mm per year. Climate variation is influenced by the ocean and there are differences in each region. The rainy season generally extends from October to March, then passes from April and the dry season from April to September.

Fig. 2 DAM in Totango River, Aketajawe-Lolobata National Park Area

As the largest island in northern Maluku, Halmahera Island is a union of two islands that collided around one to two million years ago. The materials that make up the landscape are limestone, alluvium and ultramafic rock formations. The types of soil in this zone can be divided according to the block. The soil types in Lolobata are rendolis and tropopepts while the soil types in Aketajawe are halplothox and tropopepts. There are seven types of ecosystems in this national park, namely mangrove forest ecosystems, coastal forest ecosystems, lowland swamp forest ecosystems, river cliff ecosystems, lowland rainforest ecosystems, lowland rainforest ecosystems, tropical mountain and subalpine meadows.

B. Eco-Tourism Activity

Panorama Resort Tayawi in Aketajawe Lolobata National Park is able to attract visits from domestic and foreign tourists, the various potential resources in it contribute to the development of ecotourism as a tourist attraction offering recreational activities and educational. Tourists can observe the flora in the use area of Tayawi Resort which is covered by a relatively pristine lowland forest ecosystem, which is an important habitat for various types of flora that make up the lowland forests.

The flora in the utilization area generally consists of the families Dilleniaceae (flowering plants) and Dipterocarpaceae (large trees). Tree species include Gosale (Dillenia, sp), Bintangur (Calophylum sulatri), Mersawa (Anisoptera costata), Hiru (Vatica papuana), Samama (Anthocephalus macrophylla), Nyatoh (Palaqium sp), Walnut (Canarium vulgare), Matoa (Pometia) . pinnata) and other types. Besides trees, there are also other non-tree plants, such as palms and ferns. Other plants are orchids and begonias. Besides observing flora, tourists can enjoy the beauty of wildlife in the form of endemic birds of northern Maluku and endemic of Halmahera Island in the utilization area [19].

Halmahera Bidadari (Semioptera wallacii) bird attraction, is one of the main tourist destinations. These attractions can only be found in the morning from 06:00 to 09:00 and in the afternoon from 17:00 to 18:00. Therefore, tourists are required to leave as early as possible so as not to miss these attractions. On the way to Halmahera Bidadari attraction, tourists can also enjoy the attraction of birds playing along the viewing path.

Resort Tayawi's attractiveness as an ecotourism destination is not only due to the wealth of abundant natural resources, Resort Tayawi is also inhabited by the Tobelo Dalam (MTD) community who lived in the area long before the creation of the national park, MTD at Le Resort Tayawi has a strong interaction with the region. Their interaction is achieved by using forest products to meet their daily needs. Additionally, they have also established gardens in the area to plant cassava, sweet potatoes and coconuts along with other crops. MTD life can have its own value for the tourists who come. MTD always maintains culture and traditions as well as local wisdom to preserve nature from generation to generation. Tourists who come to Tayawi Resort often learn and feel the atmosphere and daily activities of MTD, such as learning history, medicine, hunting methods, traditional clothing, etc.

C. Community-Based Conservation Effort

1. Equity
   Community-based natural resource management through ecotourism in Aketajawa Lolobata National Park provides more equitable socio-economic benefits to rural communities. The economic benefits derived from management activities directly or indirectly benefit the village community [20]. These management activities will create jobs and additional income to sustain people's lives.

2. Empowerment
   Mass acknowledgement, especially the ability of villages to empower themselves and their environment, are able to attract tourists to visit. Not only tourists who want to enjoy the natural attractions, but also those who want to know the management model carried out by the village, either through comparative studies or research. Apart from being a means of promotion, the media coverage position is also a means of advocacy for Suka Maju village to gain support from other parties. Also, mass media is a powerful way to influence someone to do something. This harmonious relationship with the mass media is one of the keys to the success of CBNRM [21].

3. Conflict Resolution
   Until now, the conflict caused by the silting of the river due to the construction of the DAM on the Totanga River has not yet existed and the local community remains optimistic and always cooperates with one another to support this place so that it can become a tourist spot.

4. Knowledge and Awareness
   CBNRM opens up new economic opportunities that do not harm the environment, but rather support environmental conservation. Existing local wisdom is combined with modern ecological knowledge and

management to manage natural resource potential. Through CBNRM, they realized that improving well-being should not sacrifice the environment. On the other hand, the community derives economic benefits from the conservation of the environment and its natural resources [22]. They combine local wisdom that has been passed down from generation to generation with modern knowledge gained through interaction with other parties as well as learning from the management practices carried out. The village community also realizes that the sustainability of the village environment is closely related to neighboring villages in an ecosystem, so they also try to build cooperation to preserve the environment [14].

5. Biodiversity Protection
   Biodiversity protection is one of the achievements of CBNRM in Aketajawa Lolobata National Park. The utilization of natural resources as a tourist destination encourages people to manage the environment and protect biodiversity and their habitats [23]. Some of the activities carried out are stopping stone mining, banning taking fish with poison and electricity, reforestation.

6. Sustainable Utilization
   Aketajawa Lolobata National Park has not collaborated with other villages to manage so that the Totango River watershed area can develop further. CBNRM with an ecotourism approach in Aketajawa Lolobata National Park will bring significant economic benefits to rural communities. Apart from providing employment opportunities to the community, it also contributes to the development of the village. The sustainable use of these natural resources is closely linked to the protection of biodiversity [24].

V. CONCLUSSION

Residents around Aketajawa Lolobata National Park already have ecological knowledge and awareness. With this watershed resource, the community wants to achieve better results to improve well-being and continue to pay attention and increase the carrying capacity of the environment. Currently, Aketajawa Lolobata National Park performs natural resource management functions/activities including planning through construction of facilities and infrastructure, identification and mapping of national park potential for 'Aketajawa Lolobata, the identification of problems that arise in the process of development, organization (organization), implement (action) with the active participation of the community, and control (control). This indicates that the natural resource management activities have gone well and that the community is able to manage the natural resources in a participatory and independent manner.

REFERENCES

[1] T. Gebregergs, K. Teka, G. Taye, E. Gidey, and O. Dikinya, "Status and challenges of integrated watershed management practices after-project phased-out in Eastern Tigray, Ethiopia," *Model. Earth Syst. Environ.*, vol. 8, no. 1, pp. 1253–1259, Mar. 2022, doi: 10.1007/S40808-021-01108-5.

[2] S. Mondal, D. P.-N. R. C. and A. for, and undefined 2022, "Challenges in natural resource management for ecological sustainability," *Elsevier*, Accessed: May 04, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/B9780128229767000041

[3] O. F. Balderama, "Climate Change Adaptation Practices Towards Sustainable Watershed Management: The Case of Abuan Watershed in Ilagan City, Philippines," pp. 33–44, 2022, doi: 10.1007/978-3-030-81207-2_3.

[4] X. Tang, J. A.- Water, and undefined 2022, "Integrated Watershed Management Framework and Groundwater Resources in Africa—A Review of West Africa Sub-Region," *mdpi.com*, Accessed: May 04, 2022. [Online]. Available: https://www.mdpi.com/1456094

[5] J. Felipe *et al.*, "Fostering co-operation through participation in natural resource management. An integrative review," 2022, Accessed: May 04, 2022. [Online]. Available: https://www.econstor.eu/handle/10419/253261

[6] M. Suthar, M. Bhoite, M. Mane, and M. Jayram, "Watershed Management of Purandar Taluka by Remote Sensing and GIS: A Review," *researchgate.net*, doi: 10.22214/ijraset.2022.39906.

[7] S. Crausbay, H. Sofaer, A. Cravens, … B. C.-, and undefined 2022, "A science agenda to inform natural resource management decisions in an era of ecological transformation," *academic.oup.com*, doi: 10.1093/biosci/biab102.

[8] S. H.-E. S. & Policy and undefined 2022, "Power to the people: Collaborative watershed management in the Cuyahoga River Area of Concern (AOC)," *Elsevier*, Accessed: May 04, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1462901121003750

[9] F. Naderi, B. Naseri, … Y. K.-J. of G., and undefined 2022, "Prioritization of Flood Risk in Ganjvan Watershed of Ilam Province Using ELECTRE MODEL," *geoeh.um.ac.ir*, Accessed: May 04, 2022. [Online]. Available: https://geoeh.um.ac.ir/article_41815.html?lang=en

[10] D. Coppock, L. Crowley, S. D.-… E. & Environment, and undefined 2022, "Community-based rangeland management in Namibia improves resource governance but not environmental and economic outcomes," *nature.com*, Accessed: May 04, 2022. [Online]. Available: https://www.nature.com/articles/s43247-022-00361-5

[11] K. Frank, T. Chen, E. Brown, A. L.-S. Networks, and undefined 2022, "A network intervention for natural resource management in the context of climate change," *Elsevier*, Accessed: May 04, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0378873322000387

[12] D. Ekowati and W. Nawarcono, "Utilization Of Resources Through Community-Based Tourism," *researchgate.net*, Accessed: May 04, 2022. [Online]. Available: https://www.researchgate.net/profile/Dhiana-Ekowati/publication/357795848_Utilization_Of_Resources_Through_Community-Based_Tourism_UGEFIC_2018_DHIANA_WINANTOpdf/data/61e00e875c0a257a6fe6a5a8/Utilization-Of-Resources-Through-Community-Based-Tourism-UGEFIC-2018-DHIANA-WINANTO.pdf

[13] T. E.-I. J. of E. R. & Social and undefined 2022, "Constitutional and Jurisdictional Review of Natural Resource," *ijersc.org*, Accessed: May 04, 2022. [Online]. Available: https://www.ijersc.org/index.php/go/article/view/251

[14] W. Wiratno, S. Withaningsih, B. Gunawan, J. I.- Sustainability, and undefined 2022, "Ecotourism as a Resource Sharing Strategy: Case Study of Community-Based Ecotourism at the Tangkahan Buffer Zone of Leuser National Park, Langkat District," *mdpi.com*, 2022, doi: 10.3390/su14063399.

[15] N. N.-P. and C. of Community-Based and undefined 2022, "Application of Geoinformation Technology to the Management of Community-Based Natural Resources for Tourism Development in Northern Tanzania," *igi-global.com*, Accessed: May 04, 2022. [Online]. Available: https://www.igi-global.com/chapter/application-of-geoinformation-technology-to-

the-management-of-community-based-natural-resources-for-tourism-development-in-northern-tanzania/289267

[16] N. Kurniawan, P. Lujala, … S. R.-T. E. I., and undefined 2022, "The role of local participation in the governance of natural resource extraction," *Elsevier*, Accessed: May 04, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2214790X21002069

[17] M. Setiadi, A. Hamidy, Z. Abidin, … D. S.-C., and undefined 2010, "Genetic Structure of Herpetofauna on Halmahera Island, Indonesia: Implications for Aketajawe-Lolobata National Park," *Wiley Online Libr.*, Accessed: May 04, 2022. [Online]. Available: https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/j.1523-1739.2009.01384.x

[18] A. Yakub, A. Leksono, J. B.-I. J. of Environment, and undefined 2019, "Ethnobotany of Medicinal and Edible Plants of Tobelo Dalam Tribe in Aketajawe Lolobata National Park Area," *jpal.ub.ac.id*, vol. 10, no. 1, pp. 2087–3522, 2019, doi: 10.21776/ub.jpal.2019.010.01.08.

[19] M. Nikmatullah, M. Rahayu, … S. S.-J. of T., and undefined 2021, "An Ethnobotanical Study on the Farming System of the Makian Ethnic Group in Halmahera Island, North Maluku," *jte.pmei.or.id*, vol. 4, no. 1, pp. 49–57, 2021, doi: 10.46359/jte.v4i1.91.

[20] K. Fisher, … M. D.-U., and undefined 2022, "The Rise of Community-Based Natural Resource Management Strategies as Explained by Transaction Costs," *digitalcommons.iwu.edu*, vol. 18, Accessed: May 04, 2022. [Online]. Available: https://digitalcommons.iwu.edu/uer/vol18/iss1/5/

[21] A. H.-E. Management and undefined 2022, "Development, Conservation, Empowerment: The Trilemma of Community-Based Natural Resource Management in Namibia," *Springer*, Accessed: May 04, 2022. [Online]. Available: https://link.springer.com/article/10.1007/s00267-021-01589-1

[22] A. Shaw, T. Steelman, R. B.-J. of C. Geography, and undefined 2022, "Evaluating the efficacy of GIS maps as boundary objects: unpacking the limits and opportunities of Indigenous knowledge in forest and natural resource management," *Taylor Fr.*, vol. 39, no. 1, pp. 90–116, 2021, doi: 10.1080/08873631.2021.2011683.

[23] Y. Walle, D. N.- Trees, F. and People, and undefined 2022, "Factors determining the participation of natural resource cooperative members in forest management: A study of dry forest area in Ethiopia," *Elsevier*, Accessed: May 04, 2022. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2666719322000504

[24] H. El Bilali *et al.*, "Examining the Socio-Economic and Natural Resource Risks of Food Estate Development on Peatlands: A Strategy for Economic Recovery and Natural Resource," *mdpi.com*, 2022, doi: 10.3390/su14073961.