

Watershed Management Through Sustainable Development Concept: Literature Review

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ABSTRACT

To ensure the future existence and survival of fish resources in river waters, it is necessary to manage resources, especially watersheds covering aquatic habitats with various species, as well as multi-species habitats. Watershed management considerations must include a variety of factors, including area/ecology, sector, scientific field, and stakeholders. Watersheds are a method of managing river water resources to preserve the viability of aquatic resources in the long term. One of the elements needed for management is how the current state of aquatic resources. Reduced flood swamp areas, sedimentation, decreased water discharge and water levels, and difficulties for some fish species to migrate are all effects of environmental modifications such as damming rivers for irrigation and hydroelectric power and changing the mass of water. In the middle and lower reaches of the river, the addition of anthropogenic materials from various industrial activities can have an impact on aquatic life, fish, and fishermen's catches.

Keywords: Watershed Management, Inhibiting Factors, Sustainable Development.



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INTRODUCTION

All parties must show gratitude and pay attention to the natural wealth that the Creator has given to mankind so that it can be maintained and managed properly. Spatial planning of waterways and land that is directly related to waters must be based on the alignment of various interests. Conflicts of interest that often arise in different contexts can have significant negative impacts on aquatic ecosystems, particularly in public waters (Banha *et al.*, 2022). In line with Law No. 7/2004 concerning "Water Resources", a collaborative effort is needed in the form of reciprocal concern or attention to the adverse impacts of each development in each sector or sub-sector (Fulazzaky, 2014).

A watershed is an area enclosed by topography that separates watercourses and is drained by rivers or other connected systems such that all streams falling within the area emerge from the same loose channel (Putra *et al.*, 2018; Rinaldi & Herdi, 2021). According to Government Regulation No. 37/2012, which regulates the management of watersheds, a land area containing rivers, and their tributaries that naturally collect, store, and dispose of rainwater into lakes or seas is known as a watershed (Andini & Maynard, 2019). Hermon *et al* (2021) add the topographic separator serves as its land border, and the sea areas that are still affected by land operations serve as its sea border. Sustainable development of watersheds, which aims to protect watersheds, is a growth method that sustainably maximizes the advantages of social and natural resources. The ability of natural resources to support space consisting of land, sea, and air with human activities

must be balanced to ensure the sustainable development of watersheds. Therefore, the spatial exploitation of watershed areas and the potential of existing resources for community development cannot be separated from sustainable development. Well-managed watersheds Watersheds are very important. To achieve certain social goals, watershed management is carried out through the process of developing and implementing several activities related to natural resources and human resources. The management of watersheds continues to pay attention to social, political, economic, and institutional factors (Dixon, 1986). To achieve sustainability and harmony of ecosystems and increase the benefits of natural resources for humans sustainably, efforts have been made to manage the relationship between natural resources and humans. Watershed Management with all its activities through Government Regulation No. 37/2012. Watershed Management can be seen as a natural system in which social processes, complex economic, and cultural coexistence with biophysical-hydrological ones (Paimin *et al.*, 2012).

Through the construction of reservoirs, water transportation, flood area management, canal maintenance, reforestation, and replanting watershed ecosystems can be effectively used to deal with floods (Putra *et al.*, 2021). Guidelines for making plans for integrated watershed management are outlined in the Regulation of the Minister of Forestry of the Republic of Indonesia No. P.39/Menhut-II/2009. The basic principles of watershed management include (Pambudi, 2019): 1) Watershed management is carried out consistently by treating the river circulation area as one ecosystem, one plan, and one art of management; 2) Stakeholders are involved in integrated, coordinated, comprehensive and sustainable management of river basins. By the features of the watershed, management of the watershed is carried out in an integrated manner that can be adapted to the dynamics of changing conditions. In managing integrated river circulation areas, stakeholders are divided fairly between tasks, functions, expenses, and rewards. Where the power to manage its territory belongs to the government. A proper plan is needed for watershed management according to Asmoro & Samputra (2021). A strategy, according to Osborn *et al* (1981) is a comprehensive and integrated plan that links organizational advantages with environmental constraints and is developed to ensure that the main goals of the organization can be achieved through efficient execution. Where programs and activities can be used as a strategy to achieve goals and objectives.

METHODS

This literature review was created by utilizing secondary data, which includes various study findings and papers, information gathered from official, authoritative sources important to river water ecology, including journals, publications, and related opinions. The information is then examined, presented as tables and figures, as well as graphical images that might offer concrete justifications for the biological growth of streams.

FINDINGS

The relevant laws and regulations are the Decree of the Minister of Maritime Affairs and Fisheries No. 58 concerning "the Implementation of People's Supervision Systems in the Management and Utilization of Fisheries and Law No. 45/2009 regarding "the

supervision of marine fisheries". This law provides an overarching framework for citizen participation in government (Siregar, 2020). According to Nasution *et al* (2018), water resources are found in almost all countries and/or regions, industries along riverbanks, and illegal fishing that uses electricity or poison also has the tragedy of common property. Definition in FAO (1989) describes sustainable development as "Sustainable Fisheries Development" which is defined as the management and conservation of the natural resource base, and the orientation of institutional change and technical progress to ensure the fulfillment and satisfaction of human needs for both present and future generations. Fisheries that are developed in a sustainable manner protect water resources, and plant and animal genetic resources, do not damage the environment and are also technically healthy, financially feasible, and socially acceptable.

The natural resource aquaculture sub-sector must be seen not only as an economic resource but also as a resource that must be handled responsibly because aquaculture activities are very important to encourage courageous contributions to environmental change, especially in the agricultural industry being one of them (Newton *et al.*, 2021). Sustainable aquaculture must be considered from a sustainable development perspective, which is serious on five (5) elements, including ecology, economy, social, technology, infrastructure, and policies and institutions (Putra *et al.*, 2023). These five (5) variables serve as a guide for sustainable aquaculture management techniques.

Citing the results of the United Nations conference on environment and development that took place in Rio de Janeiro in 1992, and other relevant concepts. The most important factor is sustainable development, which understandably means that aquaculture management must comply with several criteria (Hermon, 2021), including 1) By guaranteeing the availability of resources both in quality and quantity, the principle of intra- and inter-generational equity ensures that aquaculture management must be carried out wisely and without compromising the future of the next generation; 2) The precautionary principle states that all management plans and business activities related to aquaculture must be measured and prioritize risk analysis as a way to stop the potential effects of business activities related to aquaculture before it has a long-term impact on resource sustainability; 3) In addition, the function of aquaculture is very important in restoring biodiversity that is starting to disappear, especially by supporting the spread of eco-friendly aquaculture biotechnology. Aquaculture management must ensure that biodiversity is maintained; and 4) Environmental costs are currently only external costs, aquaculture business management must also include them in production costs. Internalizing environmental costs into the production process is something that needs to be done in the future as a kind of environmental responsibility (compensation for environmental services).

In Indonesia, watershed management has been practiced for a long time, especially since the Dutch era. This is especially true with forest management methods where forest land is divided according to watershed units. In 1961, the First National Green Week was held in Gunung Mas, Puncak, and Bogor as part of a large-scale environmental effort (Etherington, 1974). Haeruman (1979) defines integrated management as the creation of objective harmony between various methods of managing natural resources. When one object is managed by several managers, each of whom is assigned a different level of relevance and relationship to the managed object. In essence, the aim of managing watersheds is to ensure that natural resources are used sustainably in a way that does not harm the local, regional, national, or even global environment (Fig 1).



Figure 1. Visualization of watershed shapes from various sources

Research on Integrated Watershed Management Planning: The Foundation of Sustainable Aquatic Ecosystems was conducted by Soedaryanti *et al* (2021), stated that stakeholder commitment is the main motivating element for making management plans for the upstream Brantas sub-watershed, while the main inhibiting factor is the lack of coordination between these parties. To draw up a management plan for the upstream Brantas watershed in Batu City for the benefit of the legislature, executive, judiciary, private sector, community leaders, universities, and NGOs, a well-documented integrated plan is required.

Many challenges may be faced by managing a watershed. In 2020 it was claimed that legal restrictions on the management of watersheds in Indonesia were related to the repeal and replacement of the Law on Water Resources and the inconsistencies between the Law on Water Resources, the Law on Local Government, and the Law on Soil and Water Conservation. This finding is based on a study by Aryani *et al* (2020). To achieve the aspirations of Watershed management, it is necessary, among other things, to move quickly and effectively through District/City regional policies as well as coordinate actions through policies that take the form of mandates and tasks to support sub-affairs of Watershed Management.

The area of vegetative land cover in watersheds only reaches less than 20%, which is an indicator that the majority of watersheds in Java Island are heavily damaged and in critical condition (Anggalini *et al.*, 2021). This is supported by research conducted in 2010 by Mawardi, which found that the damage and criticality of watersheds have a significant impact on the carrying capacity of water resources, with signs of increased frequency of floods, landslides, and drought affecting availability for public use.

According to the author, several activities can be carried out to reduce the danger and criticality of the Watershed, including 1) Functional strategies that include regeneration, afforestation, and prevention of land use change; and 2) the Production of maps showing how vulnerable each important watershed is to erosion and sedimentation, which can be used as a guide for rehabilitation of watersheds.

It is important to remember the goals to be achieved when managing a watershed, one of which is to establish safe socio-economic conditions, productive land conditions, and good quantity, quality, and continuity of water. According to Putra *et al* (2018) on the management of the Arau Watershed in Padang City, the management of the Watershed

includes the planning, implementation, monitoring, assessment, training, and supervision stages. The factor that interferes with the implementation of integrated, synchronous, coordinated, and synergistic management is the lack of understanding of stakeholders or work units regarding watershed areas.

CONCLUSION

The management objectives of watersheds must be achieved by managing the relationship between natural resources and the environment of watersheds using human activities for the preservation of environmental functions and the welfare of the people. This must be done in an integrated and holistic manner by taking into account various factors, such as region/ecology, sector, field of science, and stakeholders.

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