

Optimization of integrated watershed recovery: comparison of management systems in Japan and Indonesia

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Received Date: June 20, 2023

Revised Date: July 29, 2023

Accepted Date: July 30, 2023

Cite This Article:

Siagian, K., Sidabutar, I. F., & Koestoer, R. H. (2023). Optimization of integrated watershed recovery: comparison of management systems in Japan and Indonesia. *Journal of Placemaking and Streetscape Design*, 1(1), 12-18. <https://doi.org/10.61511/jpstd.v1i1.2023.184>



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Abstract

As a country prone to hydrometeorological disaster and demographic problems, Japan is very concerned about integrated watershed sustainability, as a preventive and sustainable water resource in the future. In contrast to Indonesia, the rapid population growth encourages various activities in the upstream such as encroachment, conversion to agricultural land, settlements, and other economic activities causing land degradation and environmental quality to decline. The critical watershed recovery program has been carried out for a long time, but until now this problem has not been resolved. This study aims to determine the best integrated watershed management system that can be applied to accelerate the recovery of critical watersheds in Indonesia. This study uses a qualitative approach, with a comparative descriptive method to compare watershed management in Japan and Indonesia based on a literature study. It was found that land rehabilitation activities through replanting upstream watershed areas require collaboration in comprehensive and integrated management from upstream to downstream. The practice of inter-regional cooperation and community involvement through cross-subsidized funding and joint restoration activities is a scheme that needs to be considered for accelerating watershed recovery, accompanied by the integrity of the parties and a transparent and accountable monitoring system.

Keywords: collaboration; damaged watershed; recovery; watershed restoration

1. Introduction

The river is a source of surface runoff that is important to human life. Besides environmental aesthetics, river water is still a natural resource used to supply domestic raw water, agricultural activities, and transportation. Management of areas around rivers, known as watersheds (DAS), is an important key in the existence and quality of river ecosystems because the biophysical processes and various aspects of community activities are located in these locations.

Regional development and increased development, accompanied by population dynamics over time, have both good and bad effects on the watershed, namely the fulfillment of water needs and flood control. One of the countries considered successful in handling and managing watersheds, Japan has a geographical location that is very vulnerable to hydrometeorological disasters, especially floods. Initially, flood management was carried out by building dams, piling gravel in the body of the Tama River, and laying concrete on the river walls. Degradation, pollution and pollution of rivers in Japan in the 70-80s due to various industrial activities (chemical factories and mining) endangered public health and a clean water crisis in urban areas (Kinzel, 2002; Otsuka et al., 2009; Wada, n.d.). In addition, the trend of population depopulation in Japan raises concerns regarding the lack of labor and the increasing age of the elderly, which has pushed watershed management to be prioritized from an early age (Otsuka et al., 2009). These conditions have

raised government and community awareness and changed the paradigm regarding concreting water bodies and watersheds into the restoration of watershed areas to control floods and guarantee urban water availability (Kompas.com, 2020) and produced several policies and strategies involving the role of interregional to achieve watershed recovery success.

Likewise, in Indonesia, forest destruction and land cover upstream, settlement development, the service sector, and industrial and trade activities along the watershed have disrupted the stability of the ecosystem, including the function of the watershed as a regulator and controller of the water system. Disasters in Indonesia have been dominated by hydrometeorological events (98%) in the last ten years, especially floods, flash floods and landslides, indicating damage to forests and watersheds in Indonesia. The recovery of critical watersheds in Indonesia started in 2009, namely the establishment of 108 Critical Watersheds (SK. 328/Menhut-11/2009). Meanwhile, out of 17,076 watersheds, 2,145 critical watersheds were recovered, especially in the Sulawesi and Maluku regions in 2018, and 15 critical watersheds became a national priority, namely the Asahan, Siak, Musi, Sekampung, Ciliwung, Cisadane, Sitarum, Serayu, Solo, Brantas, Kapuas watersheds. , Moyo, Limboto, Saddang and Jeneberang (BNPB, 2019). KLHK data until 2021, the number of watersheds in Indonesia is 42,210 units, consisting of 37,721 watersheds that are maintained, 4,489 watersheds that are restored and 108 priority watersheds restored in 2020-2024 (KLHK, 2021). Rehabilitation of forests and critical land covering an area of 14 million hectares starting in 2019, namely 14 priority watersheds, 15 priority lakes, and 65 dams, requires a budget of IDR 200 trillion from the state budget (Betahita, 2018). Efforts to restore critical land have long been carried out through vegetative and civil technical rehabilitation. However, the improvement of the watershed ecosystem still needs to be visible. Meanwhile, the number of floods, flash floods, sedimentation, and landslides continues to increase (bnpb.go.id). This paper aims to analyze the causes and obstacles to critical watershed recovery in Indonesia and propose alternative recommendations based on best practices for integrated watershed recovery and management.

2. Methods

2.1. Literature Review

2.1.1. Environment

The definition of the environment, according to Wiryono (2019), is a combination of all things around, namely all elements and outside factors that affect human life. The environment based on the environmental sociology approach, according to Barry (2006), consists of the natural environment, which is formed naturally; the artificial environment, which is formed from human activities and the social environment, which is formed from the socio-cultural system of a group of people. The natural environment, for example, flora, fauna, soil, rivers, sea, savanna, mountains, swamps and others; the artificial environment, for example, agriculture, plantations, industrial forest plantations, lakes and others); social environment, for example, urban, rural, customary lands and others.

2.1.2. Continuity

Sustainability in environmental science is a key principle, in addition to the principles of interaction, interdependence, diversity and harmony (Karuniasa, 2020). Sustainability can be interpreted as a condition that can withstand continuous changes (Miller et al., 2016). Sustainability of life is achieved when the main system components of life, namely the Earth's Life Support System consisting of the atmosphere, hydrosphere, lithosphere and biosphere and human life systems (Human Culturephere), work without interruption (Miller et al., 2016). The principle of sustainability is used to develop renewable energy, recycling and nature conservation (Miller & Spoolman, 2010).

2.1.3. Watershed

A watershed (DAS) is a land area topographically limited by mountain ridges that collect and store rainwater and then channel it to the sea as the main river (Asdak, 2010). Based

on its function, [Ekawaty et al. \(2018\)](#) said that the watershed area is divided into three, namely the upstream, middle and downstream. The upstream area is a conservation area with a more than 15% slope and dense vegetation (forest). While the downstream area is an area with a very small slope, less than 8%, so this area is used for various human activities. Meanwhile, the middle area is a transition area from upstream to downstream. The sustainability of watershed management needs a good partnership between the community or society, the government, and other stakeholders ([Prasetyo et al., 2021](#)).

2.2. Method

The approach used in this study is a qualitative approach with a literature review method. The data collected is secondary data obtained from published research results, relevant and recent books and reports related to watershed management in Japan and Indonesia. Then a comparative descriptive analysis was carried out, namely comparing the three aspects that have become the focus of watershed recovery in the two countries: environmental, economic and social. Based on the analysis, we will describe the best strategies and appropriate recommendations for restoring watersheds in Indonesia.

3. Results and Discussion

The division of regional zoning is based on hydrological functions, namely watersheds (DAS), namely upstream, middle and downstream. Watershed management objectives consider local and national priorities, land use and characteristics of the watershed system, including the causes and impacts of the local community's environmental, social and economic aspects. However, many challenges arise, including the influence of different stakeholders in handling the interests of resource utilization. So watershed management should be carried out with an integrated approach, which combines forest and land conservation activities in the upstream part, utilization and absorption of runoff water in the middle and downstream parts following natural processes ([CIFOR and FAO, 2005](#)). The role of forest land cover upstream is very important in soil and water conservation. However, attention to this area generally receives less attention than the downstream part of the river. The focus of activities is in the form of vegetative rehabilitation without regard to the welfare of the local community ([Effendi Pasandaran et al., 2006](#)).

3.1. Scheme Of Integrated Watershed Management In Japan

Modern watershed governance mechanisms have changed the vertical pattern of "decentralization and participation" into multi-stakeholder participation in multi-level partnerships that form independent watershed management committees of central and regional governments and various elements of society ([Otsuka et al., 2009](#)). The restoration of the Tama River, rated as the fifth worst national river in Japan in 1975, was carried out in a public partnership to form the Tama River Nature Conservation Association. Applying the principle of free discussion, thorough discussion and approval/agreement of stakeholders.

Following the amendments to the 1997 Japanese River Law, river improvement according to the characteristics of the watershed and local communities through a planning system includes procedures for accepting the government's and local communities' aspirations. The central and local governments include social capital in river management policies, namely participatory watershed management, including institutional reforms, which open opportunities for the community to participate and facilitate participation. The reciprocal interaction between government and society with a division of focus, namely the government on a larger scale and local communities on a regional scale ([Ohno et al., 2010](#)).

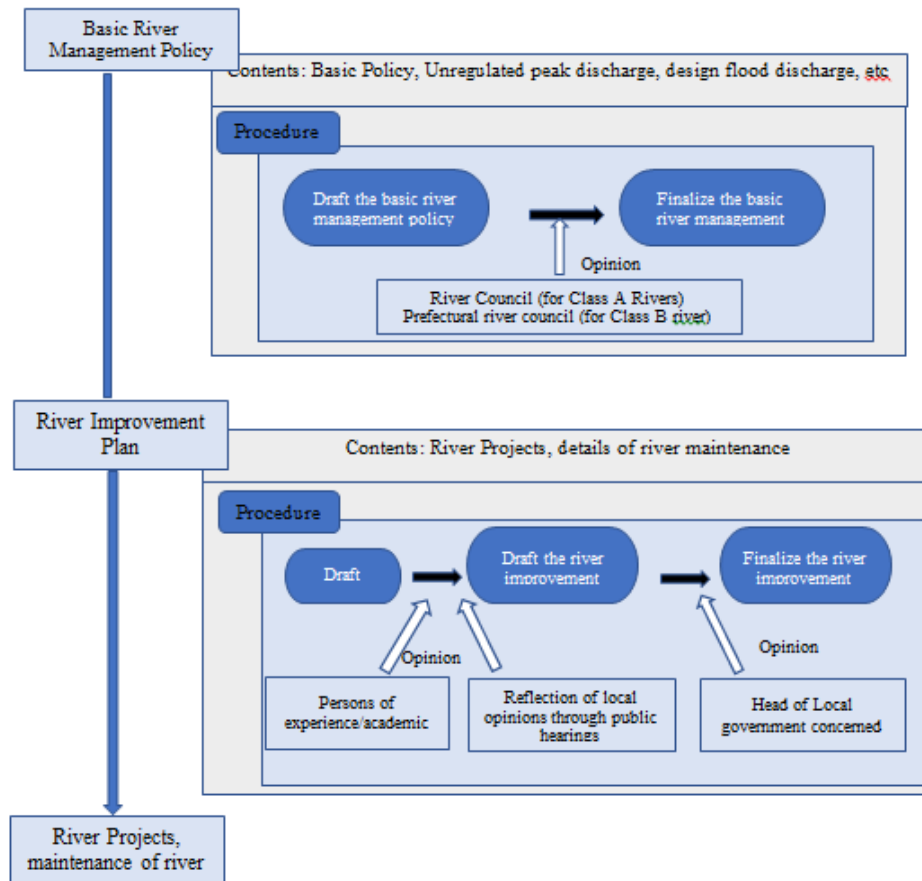


Figure. 1 River improvement policy scheme
 (Source: River Bureau Ministry of Land Infrastructure and Transport, 2006)

In terms of financing, Japan has implemented collaborative and cooperative payments for environmental services (PES), including the imposition of an agreed forest environmental tax in the form of fees for using community water downstream for forest conservation in the upstream watershed (Ishizaki & Matsuda, 2021). For example, the Waterworks Bureau allocates JPY 1/m³ of water (JPY 0.5 of water fee revenue and JPY 0.5 of the city budget) as a watershed-based partnership fund with local water supply areas. In addition, the Yokohama Waterworks Bureau purchased 2,873 hectares of privately owned forest land around the water source. It established a water conservation forest management office involving stakeholders, including local communities and experts in various fields, companies and non-profit organizations that sell water bottled drinking, part of which is donated to forest conservation activities (Sukhwani et al., 2019).

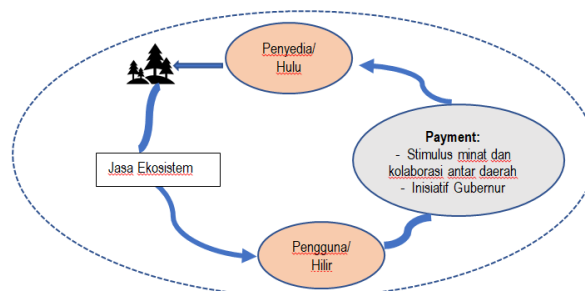


Figure 2. The environmental tax system in Japan (Ishizaki & Matsuda, 2021)

3.2. Constraints and Challenges of Integrated Watershed Management in Indonesia

Watershed area arrangements for managing water resources in Indonesia are listed in Law No. 7 of 2004 Water Resources. Presidential Decree No. 12 of 2012 stipulates 131 river basins across countries, provinces, districts/cities, within districts/cities and national strategic river basins. Its management is carried out by organizations under the authority of the Government, such as the Central/Balai Besar for Watershed Management as managers in forest areas, the Central/Balai Besar for River Areas, and Public Company Jasa Tirta in the utilization of river water. In the forestry sector, institutional forms in DAS are divided into three: coordinating bodies, authority bodies, and business entities (Decree of the Minister of Forestry No. 52/Kpts-II/2001). The watershed management system in Indonesia is still vertical, which is entirely implemented by the Government, but the institutional approach tends to be sectoral (Suradisastra, 2004). Inconsistency in river management, due to the arrangement according to administrative boundaries, causes the unsustainability of the watershed (Budi A & Marfu'ah Amriyah Umi, 2018).

Watershed management in Indonesia faces a major problem, namely the socio-economic level of the community, which is classified as low. Hence, the orientation is to fulfill primary needs while the level of concern for the environment is still low (Aryani et al., 2020). Meanwhile, juridically, the regulations regarding the authority to manage DS still need to be synchronized and consistent. The division of tasks and authorities of the central and regional governments (provincial and district/city) is detailed in Law No. 17 of 2019 concerning Water Resources. Contradictory with Law No. 23 of 2014 concerning Regional Government is not in line with the vision of watershed management (Budi A & Marfu'ah Amriyah Umi, 2018). One of them is that watershed management falls under the authority of the provincial Government, thus limiting the authority of district/city governments. These factors hinder local governments from understanding the characteristics and problems of the watershed (Aryani et al., 2020). Establishment of a watershed management institution following the memorandum of understanding between the central and regional governments for handling watersheds at the macro level, but at the micro level, this is not accompanied by a memorandum of understanding but a decree from the district leadership to allocate village finances/funds for environmental conservation and improvement activities (Sriyana et al., 2020).

Meanwhile, the decentralization of authority of the Provincial Government, including the forestry sector, has implications for the distribution of budget allocations and financing from the APBN originating from non-tax state revenues in the form of profit-sharing funds (Provision of Forest Resources and Reforestation Funds), general and special allocation funds (DAU/DAK). Only now, DAK incentives have been given to areas that have experienced forest damage during areas with less forest cover, so efforts to restore forests and critical land, including the DAS, are not optimal (Manurung, 2019; Hariyanto, 2017). So, managing the watershed seems to be a "project for channeling the budget".

Based on research on Payment of Ecosystem Services (PES) schemes to restore forests as a source of drinking water availability, Pirard et al. (2014) found that funding support from international organizations (USAID, UNDP and the Ford Foundation) in 2001 for the rehabilitation of Mount Rinjani and the local Government imposed a tax on drinking water tariffs allocated for forest restoration and provision of seed assistance to farmers, but the program was ineffective. Likewise, PT Krakatau Tirta Industri (PT KTI) funding for the restoration of the Cidanau River, providing free seeds and encouraging reforestation efforts in the watershed, is constrained by a lack of coordination and governance. The downstream PES concept by PT KTI provides restoration funds through an intermediary, namely the DAS Communication Forum, which enters into contracts with farmer groups in the highlands to plant on their land. However, these initiatives do not guarantee the expected success of upstream watershed restoration (Pirard et al., 2014). Innovations in governance include regulations, intermediation and participation facilities, and funding and payment schemes, which are aligned with the local context and require the involvement of local Government to deliver change.

4. Conclusions

Different paradigms regarding the important functions of watersheds affect the management of these watersheds. Watershed management in Japan is horizontal and has reached a psychological aspect marked by awareness and concern for the importance of the existence and quality of watersheds in water conservation. Integration of regulations implemented in collaboration and cooperation of multilevel parties and willingness to pay both materially in the form of taxes and vegetative restoration activities by downstream communities as incentives for upstream communities as forest managers. Meanwhile, watershed management in Indonesia is still vertical by the government. However, the inconsistency and lack of synchronization of regulations and the socio-economic characteristics of the people who rely on land use have caused problems in management, including the restoration of forests and critical land in river basins. For this reason, it is suggested that Indonesia's forest and watershed governance policies be improved, which are aligned with economic policies, governance and the involvement of the government and local communities throughout the watershed, starting from the downstream, middle and upstream.

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