A NATIONAL POLICY ON INDONESIA'S INTEGRATED WATER RESOURCE CONSERVATION MANAGEMENT

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A NATIONAL POLICY ON INDONESIA'S INTEGRATED WATER RESOURCE CONSERVATION MANAGEMENT. Changes in global precipitation would affect Indonesia to improve its water resource management system. As most watersheds are in a critical stage nowadays, it is urgent to develop a new plan and policy on water conservation that integrates the most important parameters reasonably. It has the purpose of ensuring that water resources are available for all activities and purposes within the area, especially for future periods. Integrated Water Resources Conservation Management is one of the promising approaches that is being mainly developed, particularly through the participation of all stakeholders. This participation brings equal responsibility to protect and sustainably manage the water resources, which might differ from one area to another in Indonesia. This study shows that it is important to bring up local wisdom practices on water conservation management. These could help overcome the problems related to water management in different locations in Indonesia and encourage all the stakeholders to take responsibility. All the inputs from the stakeholders are very helpful to identify the strategy at the national level, and thus it would minimize the misinterpretation between local and national levels in terms of regulation or policy. Furthermore, the approach strategies provided in this paper could improve the water national policy in Indonesia and minimize the negative potential impacts due to the lack of precipitation in the upcoming years.

Keywords: Precipitation, integrated, local water conservation, national policy

KEBIJAKAN NASIONAL PADA PENGELOLAAN KONSERVASI SUMBER DAYA AIR TERINTEGRASI DI INDONESIA. Perubahan curah hujan global akan memberikan dampak ke Indonesia untuk melakukan improvisasi pada sistem pengelolaan sumber daya air. Sebagian besar daerah aliran sungai saat ini berada dalam kondisi kritis, dan sangat penting untuk mengembangkan perencanaan baru dan kebijakan pada sumber daya air yang terintegrasi dengan beberapa parameter penting. Hal ini bertujuan untuk menjamin bahwa sumber daya air tersedia untuk semua aktivitas dalam suatu kawasan, terutama untuk masa mendatang. Integrasi Manajemen Sumber Daya Air adalah merupakan salah satu pendekatan yang dikembangkan melalui partisipasi semua pihak. Partisipasi ini membawa tanggung jawab bersama untuk melindungi dan mengelola sumber daya air dalam arah yang berkelanjutan, yang mungkin dapat berbeda antara satu daerah dan daerah lainnya di Indonesia. Kajian ini menekankan akan pentingnya menggunakan budaya lokal terkait dengan pengelolaan konservasi air. Semua masukan dari berbagai pemangku kepentingan dapat membantu di dalam melakukan identifikasi strategi pada tingkatan nasional dan dapat mengurangi terjadinya kesalahpahaman antara daerah dan nasional terkait dengan kebijakan. Strategi pendekatan yang disediakan dalam jurnal ini diharapkan dapat menjadi masukan dan pertimbangan di dalam kebijakan air nasional di Indonesia dan mengurangi dampak negatiif akibat dari berkurangnya curah hujan pada tahun-tahun mendatang.

Kata kunci: Curah hujan, integrasi, konservasi air lokal, kebijakan nasional

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I. INTRODUCTION

Global warming has already intensified climate extremes around the globe. In the context of hydrology, the uncertainty of the occurrence of precipitation is very high on the temporal and spatial scales (Myhre et al., 2019; Trenberth et al., 2007; Yulizar & Bárdossy, 2020). In addition, a lack of precipitation could result in a significant effect on agriculture, for instance, where most of the world's population depends on this activity. Furthermore, a water resources issue could affect the stability of a country due to its relationship with neighboring countries in the future (water security). Meanwhile, some literature (e.g., Griggs & Noguer, 2002; the Intergovernmental Panel on Climate Change (IPCC), 2007) reported that the availability of water resources from the precipitation distribution is unequally distributed across the globe, where it shows an increase at mid- and high latitudes and a decrease in tropical and subtropical regions. Furthermore, the occurrence of future precipitation extremes is projected for both wet and dry regions (IPCC, 2021).

Indonesia is one of the countries located in the tropical region with a total amount of precipitation of around 2500 mm/year. This amount has great potential for different purposes, including a positive and significant impact on the community, environment, agriculture, and others. However, a lack of water management results in flooding and drought. These water problems will affect other fields (e.g., agriculture, health) and will be exacerbated if seen as a multivariate phenomenon, called compound events. From a hydrology point of view, the occurrence of floods and droughts is caused by limited infiltration of rainfall because of land use changes and/or poorly controlled ground coverage conditions (Asdak & Supian, 2017).

The growing number of critical watersheds in Indonesia is a reflection of the impacts of hydrometeorology, which frequently result from catchment area disturbance (Asdak et al., 2018). Asdak (2015) revealed that the number of disturbed watersheds in Indonesia is increasing to 108 in 2014, having previously increased from 22 in 1984 to 62 in 2005, and 68 in 2012. The disturbance in watersheds might be caused by a lack of water management, and thus it is very crucial to solve the current status and also consider future precipitation scenarios. Meanwhile, the negative impacts are also exacerbated by the increase in critical land. This can be seen in the three biggest watersheds on Java Island, where Brantas (East Java) with 100064 ha, Citarum (West Java) with 197626 ha, and Bengawan Solo (Central Java) with 103057 ha (Pandu Pradipta, 2023). In addition, due to climate change, the distribution of precipitation in Indonesia will change, as will as the consequences of the global variability of precipitation behavior. These situations are the main ones contributing to the occurrence of a lack of water resources in Indonesia in the upcoming years. The natural hazards that might occur due to changes in precipitation amount are not only increasing the number of disturbed watershed areas and critical land in the next few years but would also exacerbate the other natural hazards (e.g., drought) and affect the growth of Indonesia's economy. Therefore, this study highlights the importance of water resource management as integrated management to mitigate potential hazards and their future impacts.

In order to reduce the number of critical watersheds in the future, an immediate program in the context of national landscape management policies is also required. Additionally, as indicated in RPJMN 2020–2024, the recovery of critical watersheds is also a major task of strategic priority. Indonesia's government (GoI) issued Regulation No. 37/2012 on Watershed Management in 2012. According to this regulation, every watershed area must have an integrated watershed management plan. It is important to make sure that the conservation of water resources receives proper consideration when those plans

are put into action. The conservation of water resources should be given the highest priority in newly developed plans as well. These factors pushed Indonesia's National Development Planning Agency (Bappenas) to decide to formulate a national policy on Integrated Water Resources Conservation Management (IWCM).

IWCM and Integrated Water Resources Management (IWRM) are closely related, and IWCM is a crucial component of IWRM. The Global Water Partnership defines IWRM as "a process which promotes the coordinated development and management of water, land, and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment" (GWP, 2000; GWP, 2018). As a result, IWRM is an ecosystem-based resource management tool that includes the following components: 1) a watershed management unit approach; 2) a focus on the interactions between upstream and downstream areas, surface water and groundwater, as well as water quantity and quality; 3) an interaction between water, other natural resources, and the environment; 4) an interaction between socio-economic and environmental considerations; and 5) stakeholder engagement in planning, implementation, monitoring, and evaluation in order to meet pre-set goals and targets (Asdak, 2010; Al-Saidi, 2017; Barbosa et al., 2017; Smith et al., 2012). Based on the definition above, a process through IWRM targets an equitable balance between economic and social welfare (Fulazzaky, 2014) and a balance between water demand and supply (Li et al., 2019). There is a balance between the need for water for ecosystems (i.e., green water) and the need for water for human lives (i.e., typically in the form of blue water) when it comes to the demand for water resources (Calder, 2012; Falkenmark & Rockström, 2013). The supply of water resources is balanced through development activities, particularly through improved reserves in the form of resource conservation. It is an integral part of the IWRM that needs to be considered to ensure the IWRM performs or can achieve the optimum function of ecosystem management. In other words, this part is playing an important role in ensuring the IWRM works well in water resources management. For IWCM to be effective, all efforts to conserve and protect water resources are required to be applied in an integrated manner (GWP, 2000; APO, 2003). This includes both vegetative and structural interventions. Various scientific disciplines across sectors and management areas (in particular at the watershed level), as well as multiple national and local government line agencies, are required to be integrated. Therefore, the aims of this paper are: (1) to illustrate the elements of IWRM; and (2) to provide considerations for a national policy on IWCM based on the local characteristics of a region and some adopted approaches from international experiences.

II. METHODOLOGY

The conservation and management of Indonesia's freshwater resources face significant challenges due to a growing population, a growing demand for food, endless energy demands, and a perpetual yearning for new developments. It is now necessary for all societal groups, as well as for governments and non-governmental organizations, to implement more sensible regulations for managing the conservation of our water resources. Discussions with pertinent interests at the national and regional levels were very helpful in the development of this paper. A series of topical workshops were held in 2015 in Medan, Yogyakarta, Banjarmasin, Nusa Tenggara Barat, and Makassar, as well as line agencies based in Jakarta, with a number of participants ranging from 50 to 100 persons. The goal was to obtain specific input from regional stakeholders who have interests in and influence over water resource management. The reasons for conducting research in these locations are: 1) these locations are representative of different

locations in Indonesia concerning the local culture or wisdom and the complexity of water resources management; and 2) the policy that will be made from these locations related to integrated water resource conservation management will be more represented at the national level in the implementation. The qualitative approach used for this paper is to capture different perspectives from different regions on a national water resource management policy. Each of the participants is giving their perspective on the water management-related issue and the approaches or strategies that have been done or will be developed (long list). All of the approaches from long lists are then selected into a short list that is categorized into general scales or definitions. This will further help to identify the general strategy for national policy purposes.

III. ELEMENT OF INTEGRATED WATER RESOURCES MANAGEMENT

As water demand increases due to population growth and economic development, it is extremely important to have a suitable approach to managing water resources in the current and future periods. In this context, watershed management is playing an important role. Integrated watershed management does not use the administrative boundaries of districts and provinces but should be managed as a comprehensive upstream-downstream management approach. In addition, the climate issue is becoming an important factor globally. Therefore, information on the future behavior of precipitation, for instance, should also be taken into consideration. Meanwhile, some water management strategies that have been carried out in different countries are based on local characteristics and climate factors.

Figure 1 shows the cyclical process of the IWRM, which starts with setting policy goals and objectives and is completed with a stage of adaptation. These stages are important in order to have a comprehensive approach and integrated policy related to water resource management. In general, it can be described as follows: establishing status, goals, and objectives is the main target of the government in order to have a good water resource management system. Indonesia, through GoI Regulation No. 37/2012 on Watershed Management, already has a strong commitment to having an integrated system for water resource conservation based on watershed management. This regulation should be elaborated on each of the province's and regencies' regulations so that the water resource conservation activities can be implemented effectively. In addition, the target that will be achieved for, say 5 years, should also be clearly stated there. These goals

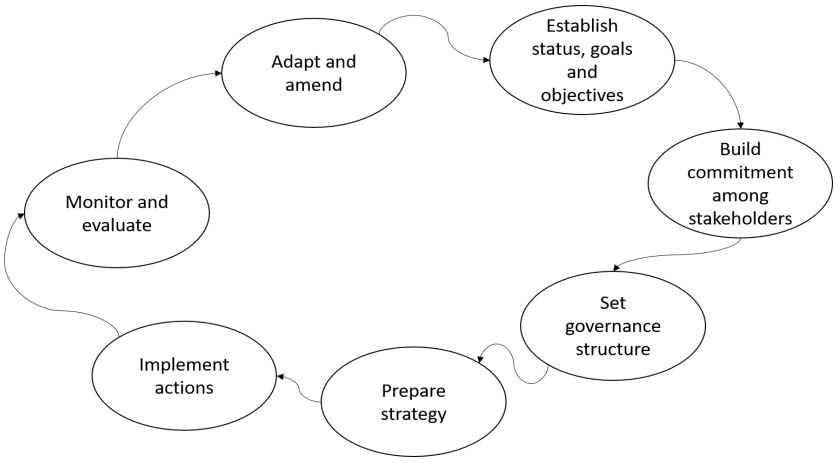

Figure 1. IWRM planning cycle (GWP, 2004 and 2005) (Adapted from Global Water Partnership. Integrated Water Resources Management Plans: Training Manual and Operational Guide, 2005)

and objectives of integrated water resources management should be made available to the public for possible comments.

Commitment among stakeholders is playing a critical role in this cycle. All stakeholders are required to actively participate and give a strong commitment to the water resources management system. The penta-helix approach involving governments, communities, private sectors, universities, and mass media should be actively involved and routinely communicated to achieve a common goal. In other words, these stakeholders should have the same perspective or direction related to the IWRM. The main concept here is to think in a long-term and as an integral part of upstream and downstream water resource management. The aims are to minimize misunderstandings about the water management strategies and communicate in advance to get an optimal joint result. The governance structure is playing an important role in ensuring that the province and district policies are in line with national policy. In addition, this structural approach is needed to avoid overlap between the institutions. If possible, it is important to have a'single' lead institution that has vertical authority to coordinate and synergize the implementation of water resource management programs.

The IWRM strategies need to be identified in order to have a strong link with the stage of stakeholder commitment described before. Different scenarios should be simulated to have an optimal strategy in order to achieve a target as mentioned in stage goals and objectives. In addition, these strategies will be locally different from each other, even within one region. Therefore, national policy should be aware of these local issues. The implementation actions, as a further stage, will require intense supervision and monitoring involving relevant stakeholders. These stages are required to ensure that the strategies can be implemented and that any problems that emerge can be solved immediately. The monitoring and evaluation actions should be conducted on a regular basis to see any particular changes.

For the reasons listed below (Asdak & Munawir, 2017; Asdak, 2015; Ackermann, 2012; Hardy & Koontz, 2010; Lenton and Muller, 2009; Bressers and Kuks, 2004), the following IWCM challenges remain prevalent in many countries, including Indonesia:

- Due to disturbed upstream watersheds, there is concern for food security as there is insufficient water available for agriculture.
- High rates of erosion at many catchments and sedimentation in major rivers are causing a threat to water resource infrastructure and having an impact on the economy.
- The system management of water resources in upstream and downstream areas is not being meticulously coordinated.
- Lack of participation from the local people in water conservation programs is due to less information and incentives from the local representative's government agencies.

To overcome these issues, a proposed improved IWCM considers the importance of environmental protection as suggested by the Global Water Partnership (GWP) in 2015. This study uses these parameters to develop an IWCM approach for Indonesia:

a. Stakeholder participation

This participation is formed in a focused group discussion (FGD) with a penta-helix approach. A different perspective can be seen from this stage, and it is very useful to have a strong policy formulation that accommodates all of these points of view (Asdak & Munawir, 2017).

b. Local characteristics

Each region has local characteristics on how to treat the environment sustainably. This information is very important to adapt to a continuous program in terms of water conservation management.

c. The understanding of climate change issues

The term climate change should always be integrated into government and private sector programs in their policies. This will help the communities increase their awareness about climate change and prepare for how to minimize

the impact of climate change for current and future periods.

d. Local and national water-related policiess

The water policy should be consistent among the government at the different levels (national, provincial, and regencies). It requires clear regulation to avoid misinterpretation and the implementation of the policy.

IV. RESULT AND DISCUSSION

It is widely known that precipitation is an important source of water availability in tropical countries such as Indonesia. The variability in the occurrence of precipitation is important to know in order to have a good understanding of water resource conservation management. Figure 2 shows the analysis of the current global precipitation behavior for the years 2010 - 2019 and projected global precipitation in the years 2090 - 2100 using the Global Climate Model (GCM) Coupled Model Intercomparison Project (CMIP) Phase 5 with Representative Concentration Pathway (RCP) 4.5. It shows clearly that in the period of 2010-2019, areas located near the equator (tropical region) tend to have high precipitation compared to the northern regions (see Figure 2a). However, in the time period of 2090-2100 (Figure 2b), the precipitation is projected to increase in some parts of the high latitudes and decrease in some regions of the tropical areas. This information is very important to be used

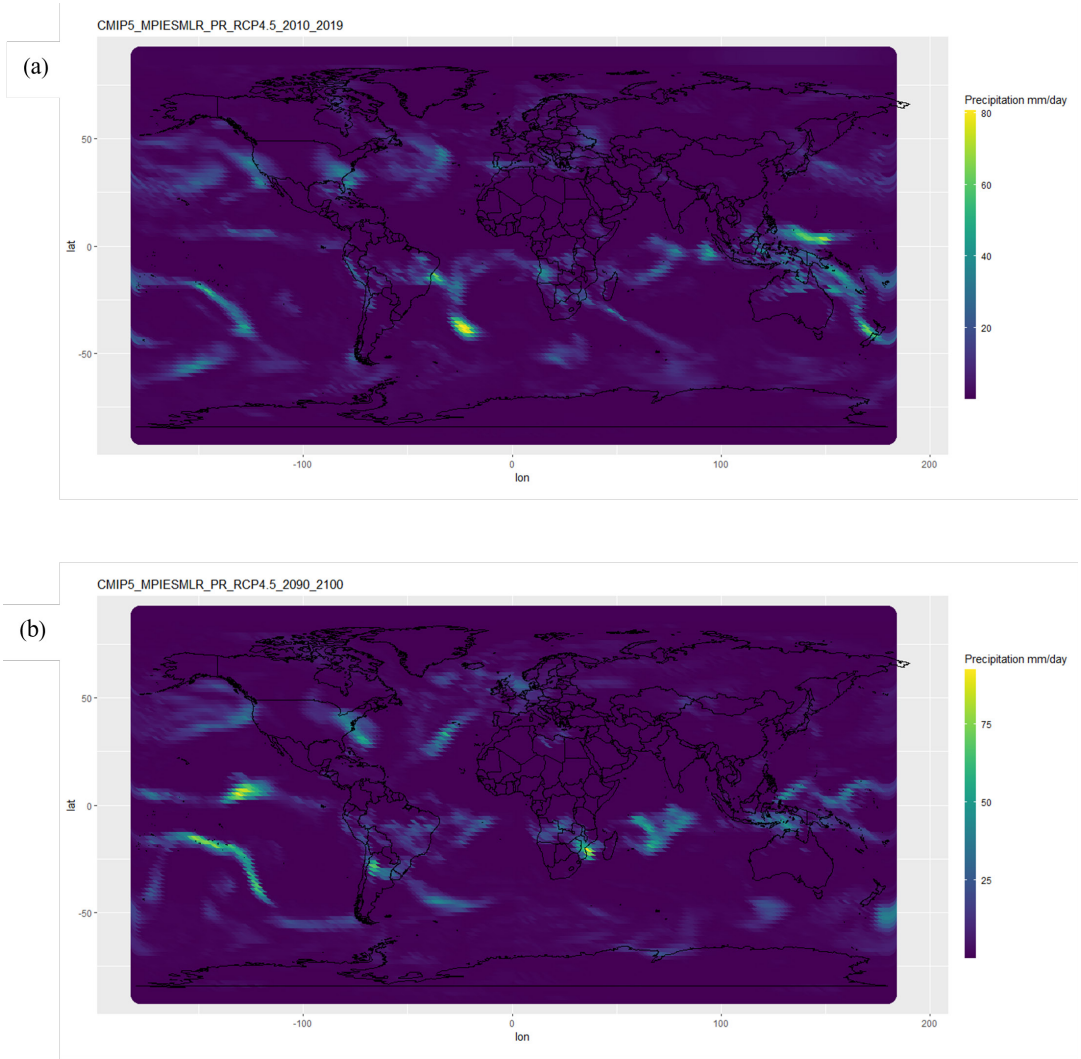

Figure 2. Current global precipitation (2010-2019) and projected global precipitation (2090-2100)

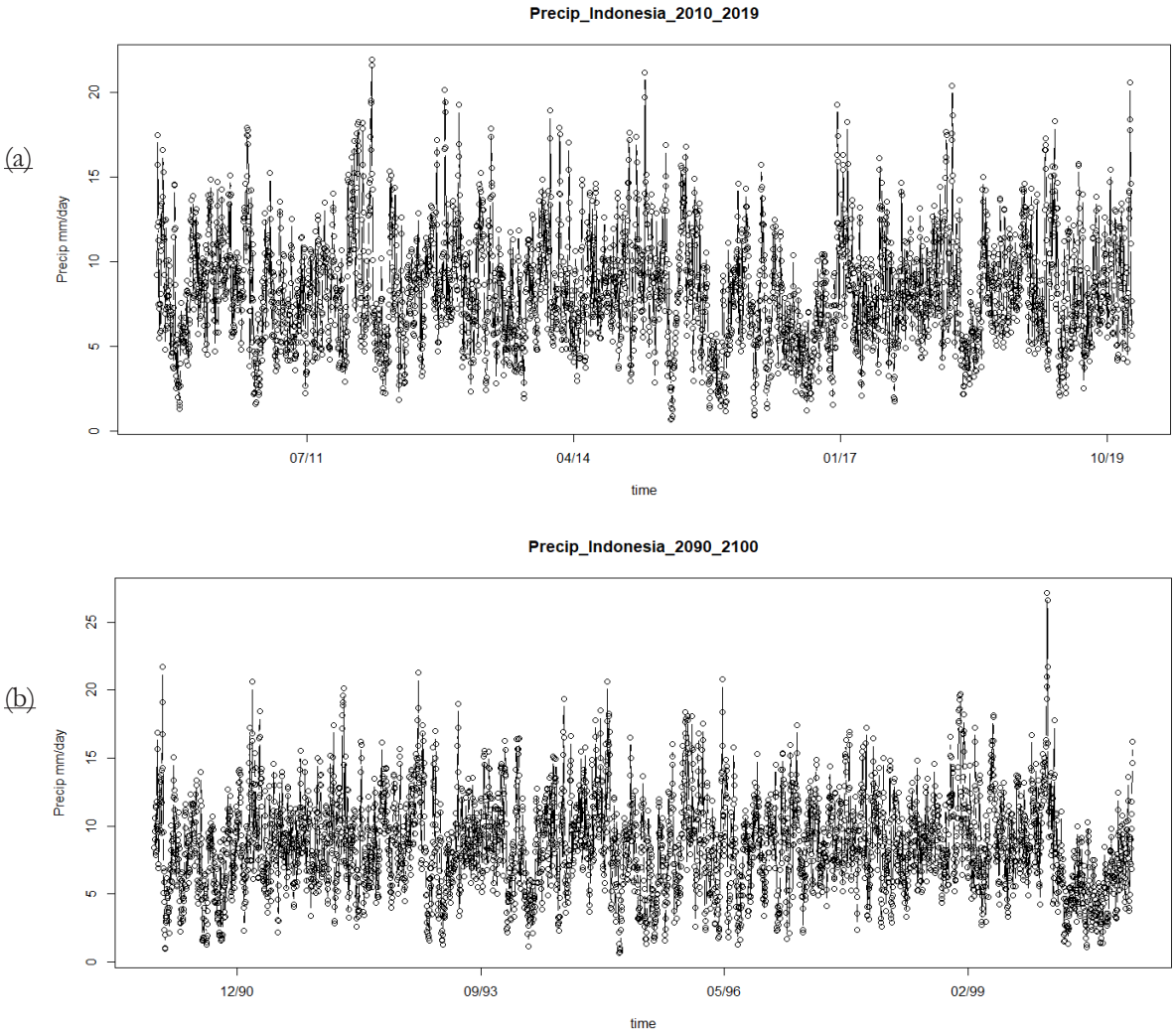

Figure 3. Current precipitation (2010-2019) and projected precipitation (2090-2100) in Indonesia

as baseline information in order to develop water conservation strategies.

Furthermore, the analysis of precipitation behavior in Indonesia from the two time periods is depicted in Figure 3. It shows that in the projected period in the years 2090 – 2100 (Figure 3b), the precipitation series varied highly between their extremes compared to the current period in the years 2010 – 2019 (Figure 3a). There will be some periods with very high precipitation and other periods with very low precipitation. Both of these situations would contribute significantly to the occurrence of floods and droughts. In addition, it is predicted that mean precipitation over the Indonesian region will decrease by 20–30% during the dry season period in June–July –August, particularly for Java, Sumatera, and Kalimantan islands, by the end of the 21st century (IPCC, 2021). This information should be considered by the government in preparing and designing the water conservation management to ensure that the water will be available proportionally for different purposes and areas in Indonesia.

The multi-stakeholder discussion series, which was conducted in five major Indonesian cities, reached the conclusion that other problems included institutional coordination and synchronization (local, regional, and central), as well as integration of water resource conservation programs (this research is consistent with that of Barbosa et al., 2017).

Furthermore, an integrated national policy is proposed (Asdak & Munawir, 2017) to reduce the gap between policies and programs for the conservation of water resources. The following are the adopted water policies that were modified and combined with the local culture in Indonesia.

a. The Green and Blue Water Concept for the National Policy on IWCM

In order to achieve global food security, the idea of "green and blue water" (see Figure 4) emphasizes the significance of an integrated approach to land and water (Falkenmark, 2008). Water utilized by plants to produce agricultural, forestry, and plantation products is referred to as "green water." Blue water, on the other hand, is a component of rainfall that is not utilized by vegetation throughout the production process and is found in groundwater, rivers, lakes, and other water bodies. Blue water is commonly utilized for non-vegetative purposes like hydropower, industrial, and home and domestic uses.

As mentioned before, the proposed national policy on IWCM was taken from a series of FGDs with the agreement that a proportional balance between green and blue water for food security is proposed to be around 60% and 40%, respectively. The coordination and integration across regions and sectors should be strengthened for the implementation of IWCM. This coordination can further be used to minimize the gap or overlapping policies and programs between national and local institutions. Furthermore, Table 1 shows the summaries of some country policies related to the implementation of IWCM/IWRM. It shows that each country has its own policy for water conservation management systems in the short and long term.

b. Policy on IWCM and Water Security

The Asian Development Bank (ADB, 2013) suggests the following five dimensions for developing national water security; water security for domestic, and economic activities, urban needs, ecosystem uses, and water security for environmental destruction prevention. It is emphasized that sustainable water resource management is determined by the following four factors: a) coordinated working collaboration between sectors and in a transboundary fashion; b) sustainable funding support; c) political stability and commitment; and d) good governance. First, synergistic working collaboration is to make sure that each government program should be discussed together so that a trade-off among parties involved can be achieved and counter productive water conservation programs may be avoided. Secondly, sustainable water conservation programs usually constrained by funding aspects due to conservation being

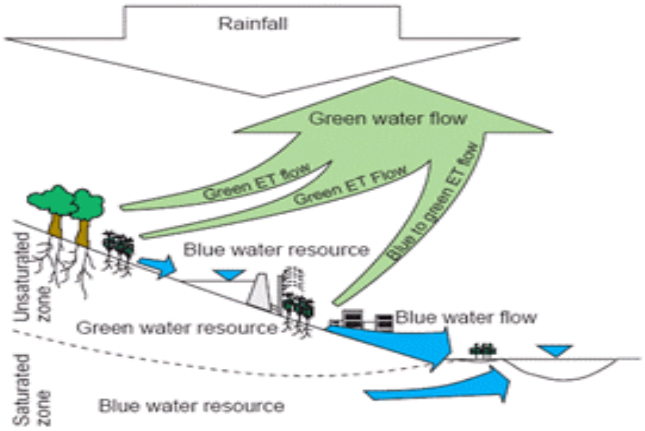

Figure 4. Green and blue water concept in the context of water security (Falkenmark, 2008)

Table 1. Summaries of national policy and commitments related to the implementation of water resource conservation management

Country	Policies	References
Indonesia	National Water Resources Development and Management (WRDM) policy approved by the National Water Resources Council (NWRC) in 2011; Integrating WRM in National Development Plan; Strategic Environmental Assessment in government medium development plan; Regulation on river basin management in 2008; Regulation on watershed management in 2008; Formation of National Council on Climate Change in 2008	GWP (2011); GoI Regulation no 46/ 2016
Europe	Water Framework Directive in 2000	https://ec.europa.eu/environment/water/water-framework/index_en.html
Japan	The Comprehensive National Water Resources Plan; The Basic Environment Plan	https://www.mlit.go.jp/tochimizushigen/mizsei/water_resources/contents/long-term_plans.html
Singapore	Active, Beautiful and Clean (ABC) Waters Programme	https://www.pub.gov.sg/abcwaters
New Zealand	National Policy Statement for Freshwater Management 2020	https://www.mfe.govt.nz/publications/fresh-water/national-policy-statement-freshwater-management-2020

regarded as a cost center. Thus, this funding aspect should be generated in creative and innovative ways, especially from public-private partnership sources. The third important factor is political stability and strong commitment, considering that Indonesia is in the process of building a fully democratic society. Therefore, a potential conflict over natural resource competition is still imminent and hence needs a fair and proportional political compromise. The fourth factor in determining water security is related to good governance, so that a synergetic working collaboration between government, private sector, and civil society can be established. The partnership between government agencies, private sectors, and research institutions (e.g.,universities) should also be strengthened in the future.

c. Local Best Practices for Water Conservation

Multi-stakeholder-focused group discussions held in five cities indicate that local wisdom is playing an important role in ensuring water conservation programs are successful at the local or field level. The local wisdom in water conservation is still practiced in different parts of Indonesia (see Figure 5), as can be seen in the following cases (Astriani et al., 2019; Bappenas, 2015).

- Gorontalo Province: local wisdom in this area is in the form of a widespread agroforestry system, a combination of seasonal crops and tree planting. This system is very much in line with water conservation principles, considering that agroforestry creates a multi-layer of vegetation canopies, thereby reducing run-off and soil erosion.
- Southeast Sulawesi Province: local wisdom, the so-called Kaindea, which is spring water protection based on the local belief that its surrounding forest area is a sacred place (for the spring water) and therefore should be kept undisturbed.
- North Sumatera Province: local wisdom in the form of Lubuk Larangan, where a village river is set aside as a communally owned resource. The local community uses the river as a communal fish pond, and consequently, they have to maintain the river with good water quality. This is achieved by maintaining the river's catchment area with

less soil erosion and landslides. Violations of this local "law" will be punished by the community.

- South Sulawesi Province: local wisdom in the form of the so-called Ma'pesung, each spring's water is used as a sacred place (a place for a religious event), so any disturbance of its surrounding areas, especially at the catchment area is prohibited by community law or agreement.
- South Kalimantan Province: local wisdom in the form of the prohibition of intensive agricultural practices and cutting trees in the uplands because it will disturb the water sources.

d. Institutional Issues and Challenges

Retaining as much and as long as possible of the water in the catchment area is referred to as water resource conservation. It involves numerous government sectors at the national and local levels and encompasses a wide range of disciplines (Mitchell et al., 2014; Shrubsole et al., 2017; Worte, 2017). As a result, the FGDs suggest that the national policy on integrated water resources conservation be developed participatorily by involving multiple stakeholders and should take into account the diverse biophysical as well as social, economic, local-national institutions, and cultural aspects of Indonesia. In particular, for the future, under the influence of climate change, these linkages would assist the Indonesian government in putting its water policy into practice.

IV. CONCLUSION

The above discussions provide current information related to the watershed areas in Indonesia and the strategy to identify the implementation of IWCM. It is urgently important to consider the future projection of global and local precipitation in water management policies in Indonesia. Apart from the precipitation, the following issues need to be considered : conflicts associated with water use, overlapping regulations between national and local levels, water resource conservation policies not being an integral part of regional development planning processes, and a lack of institutional capacity. Furthermore, the identification of green and blue waters should be defined specifically for each different location. This study shows agreement from FGD's that 60% and 40% of water need to be allocated as green and blue waters, respectively. In addition, the integration and coordination between local and national governments should be strengthened to avoid overlapping regulations. This strategy also involves research and collaborations on IWCM between government agencies, private sectors, and universities. Maintaining and encouraging local wisdom on water resource conservation should be

Figure 5. Locations of local best practices for water conservation (marked with red circle)

important parts of national policy on integrated water conservation. All of these efforts will play an important role in achieving the sustainability of integrated water management.

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