

CONFIGURATION OF LAKE TOBA MANAGEMENT BASED ON PRESIDENTIAL REGULATION NO. 81/2014

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ABSTRACT

Utilization of lake area continues on expanding and, especially in multipurpose lake, has led to the vexing problems multi-dimensionally either in ecological, economical, and sociological aspect. Lake Toba, known as the largest lake in Indonesia and located in seven districts in North Sumatra Province, has a variety of functions with an intensive utilization rate. Management of the multifunctional lake requires profound attention towards the existing interests. The Indonesian Government through the Government Regulation number 26/2008, on the National Spatial Planning, has set a list of areas projected as National Strategy Region (NSR), and among them is Lake Toba area. The decision on incorporating Lake Toba as NSA is based on lake's location which is shared within seven regencies, various sectors' exploitation, as well as the presence of utilization associated with the national interest. Lake Toba management is a comprehensive activity that relates to how to support the sustainability of the ecosystem and benefit values for the locals in the surrounding area. Presidential Decree No. 81/ 2014 has authorized the management of Lake Toba area, which aims to: i) manage the catchment area pertaining to the maintenance of the water resources sustainability, and minimize the erosion to prevent sedimentation; ii) maintain the water quality and protect against the land and water contamination; iii) sustain the biological resources and the stocks through the biodiversity and endemic biota protection, as well as maintain the stability of biological production that bestows myriad benefit for locals. To conclude, Presidential Decree number 81/2014 synergistically binds together scientific and local wisdom aspects.

Keywords: Lake Toba, National Strategy Region, Presidential Regulation number 81/2014.

INTRODUCTION

Increasing utilization of waters, especially in multipurpose lakes, has arisen complicated problems with various dimension including in ecological, economic, and sociological aspects. Lake is common property area, having potential of economic resource which can be a livelihood source for the surrounding community. On the other side, lake as an ecosystem is a medium for inhabiting the variety of life in which susceptibility to changes has strong association to human activities. Various interests have utilized the available resources in the lake, which can cause conflicts because of different criterion needs and sensitivity level of each use. Toba, as the largest lake in Indonesia has various functions and intensive use. Lake Toba has a function as area of tourism and fishing area, Hydroelectric Power Plant (HEPP) and a source of raw water (**Fig. 1**). Centre of tourism has been growing in Lake Toba region and use its panoramic view as main object of the sites. In national policy, Lake Toba and several other lakes such as Lake Maninjau and Lake Batur are the basis of the National Tourism Development Master Plan (Ardika, 1999). The fishery activities in Lake Toba has been continuing for a long-time age, since 1950s, the dominant fish caught is tilapia (*Tilapia mossambica*) (Soerjani *et al*, 1979).

Another activity expanded in the Lake Toba is fish culture in floating net (cage aquaculture; CA), which was first tried in 1988 (Dharma, 1988). The total production of fish from CA in 2010 was 47,478 tons, which was dominant from the Regency of Samosir (24,420 tons), Toba Samosir (10,372 tons) and from Simalungun (9,807 tons) (Anonymous, 2011). River Asahan, the outlet of Lake Toba, has been used to support HEPP of Sigura-gura whose capacity reached 450 megawatts (MW). River Renun is the lake inlet and it has been used as another HEPP with capacity of 82 MW.

The utilization of the lake waters that is more concerning to the local community life is a source of raw water for drinking water. Approximately 70% of villages around of Lake Toba utilize lake water as a source of raw water and drinking water, besides, three Regional Water Companies also utilize of Lake Toba water for raw water, namely in Pangururan, Balige, and Laguboti cities.

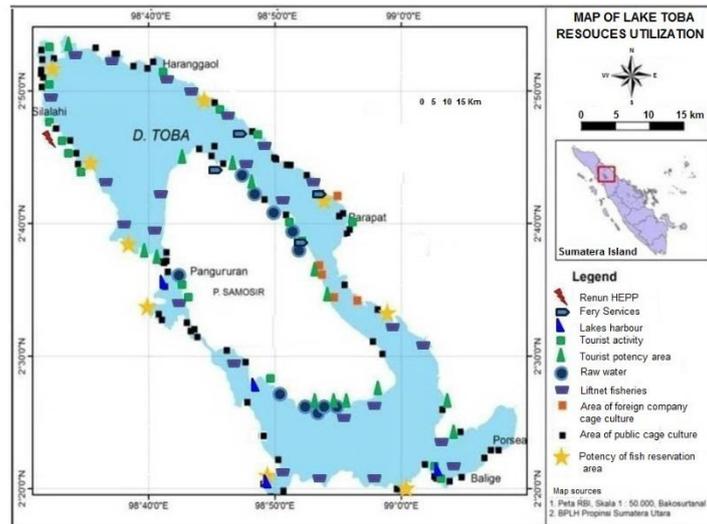


Figure 1. Map of Lake Toba water area utilization (Lukman, 2013).

In lake catchment area, the land use is intensive enough, not only agricultural but also the settlement. Large areas of land utilization for cultivation activity is around 48.6% of the catchment area, which is mostly for agriculture in dry land (27.6%) and open land (20.6%) area. The composition of forest land covered only 23% of catchment (BP DAS Barumun *in* Lukman et al., 2010). The agricultural activity in lake catchment reached 129,448 ha (Table 1), or approximately 53% of the total catchment area, with the highest proportion in Toba Samosir Regency that reached 56 138 ha.

Table 1. Agriculture land area on Lake Toba catchment in each regency

No.	Regency	Agriculture land area (Ha)
1	Toba Samosir	56,138
2	Samosir	48,971
3	Simalungun	12,699
4	Humbang Hasundutan	7,908
5	Dairi	2,062
6	Karo	1,670
Total		129,448

Source: Calculate from Earth Image Map (Bakosurtanal Map)

According to Klessig (2001), the lake can only provide optimal social benefits if the policy setting management fully recognizes the potential contribution of the lake for the community and the policy is integrated to provide a balanced attention on all the values that the lake can give. Thus, the utilization of the lake waters will be positive as long as its ecological balance, within the limits of carrying capacity consider the interests of others.

TOBA LAKE AS A NATIONAL STRATEGY REGION

The Government of Republic Indonesia through the Government Regulation number 26/2008 on the National Spatial Plan, has set 76 regions throughout Indonesia into the National Strategy Region (NSR). Lake Toba is one of 76 areas within NSR. The aim of Government Regulation declared was to achieve: i) the harmonization between the natural and manmade environment; ii) the integration of planning, utilizing and controlling of land use; iii) balance and harmonize of development between regions and between sectors. Categorization of Lake Toba as an NSR is appropriate because it refers to the lake physical characteristics which belong to seven districts in North Sumatra (Fig 2), lake utilization by various sectors, as well as utilization related with the presence of national importance such as hydropower-Sigura-gura.

Since the status of Lake Toba is as NSR, therefore, the spatial plan is on authority of the central government's. It refers to the National Spatial Plan (NSP), in which confirms the policy direction and utilization strategy of state space regions.



Figure 2. The map of regency distribution in Lake Toba area.

In article (Art.) 9 (1) of President Regulation No. 26/2008, it is stated about the policy of NSR development, including the preservation and improvement of environment function and carrying capacity, to maintain and improve the ecological balance, preserve biodiversity, maintain and improve the function of protection area, preserving the uniqueness landscape and national cultural heritage;

To support policies that Lake Toba and surrounding area as a National Strategy Region (NSR) area of national strategy (KSN), the Lake Toba spatial planning, as direction of its area utilization, determined by the Presidential Regulation number 81 of 2014, The Lake Toba Spatial Plan was set. Presidential Regulation number 81/2014 serves, among others, as a guide of: i) Development plans preparation in Lake Toba area; ii) Spatial planning at provincial and district area in Lake Toba; iii) Realization of the integration, interrelation, and balance development between district area, as well as the harmonization between sectors in Lake Toba area; iv) Determining the location and functionalism of investments in Lake Toba area; iv) Management of Lake Toba area; and v) Achievement the development plan integrity of Lake Toba with the surrounding area.

TOBA LAKE MANAGEMENT WITH REFERENCE TO THE PRESIDENTIAL REGULATION

Lake Toba management is a comprehensive activity related to how to support the sustainability of the ecosystem, the biota in it and utilization value for human being. Thus, such management should be directed to: i) the management of catchment area related to the maintenance of the sustainability of water resources and minimize erosion to prevent silting; ii) maintain water quality and protect against contamination from the land and water; iii) the sustainability of biological resources availability through the protection of biodiversity and endemic biota, as well as maintain the stability of the biological production for people utilization. President Regulation number 81/2014 of the President stated explicitly that the purpose of arrangement mentioned is related to the management of the lake that includes the preservation of the catchment region as the water of life the communities and ecosystems, as well as fish culture control, that has to correspond on lake carrying capacity and integrate to tourism development (Art. 6),

Watershed Management

Sustainability of the water supply is of major importance for the aquatic ecosystem of the lake, both in relation to aspects of preservation of aquatic and biological resources in it or linkage with the need for water resources for energy. Thus, catchment area management is directed at spatial arrangements that is relevant to each region carrying capacity and the implementation of environmental friendly land use.

President Regulation number 81/2014 concerns both water body, catchment and ground water recharge area (Art. 5). In Lake Toba area, there are 25 sub catchments (Art. 5; 3) and 9 water recharge areas (Art. 5: 4). Management strategy of catchment area that will be implemented include: i) The management of protected forest areas (Art. 8; 1a); ii) Management of groundwater recharge areas (Art. 8; 1b); iii) Control land use around water sources and riparian (Art. 8; 1c); iv) Setting an infiltration function on the slope of > 40% (Art. 8, 1d); v) Built the sediment trap (Art. 8, 1i); v) Control the residential development around protected forests (Art. 8 1h); vi) Control cultivation area in the ground water recharge (Art. 8.1i); and v) Restructure the tourism area in lake border area and on the land with a slope of > 40%

(Art. 8.4.b). The strategy in the cultivation area for regional preservation of crop and horticulture, through: i) Development of terracing system on lands with a slope of 25% -35% (Art. 8.6b); ii) Pollution control in cultivated areas by organic farming application (Art. 8.6d); iii) Control of protected forest destruction and water pollution from agricultural activity (Art. 8.7a); iv) The development of environmental friendly farms (Art. 8.7b). Management strategies of watershed will also be realized through maintenance cooperation pattern of environmental quality, in terms of: i) Management and maintenance of water resources in the catchment and water recharge area (Art. 8.8a); ii) Application of lake water quality standards based on water quality standard Class I (Art. 8.8b); and iii) Integrated management of waste water network system and solid waste (Art. 8.8g).

Pollution Management

The main concern of lake management is to maintain the water quality in a condition to fulfil qualification of related the water purpose. People activities in the waters and also in the terrestrial area will give impact on lake water quality. Activities in terrestrial area will increase the allochthonous matters into the water. The agriculture impact is characterized by elevated nutrients and pesticide level and domestic activities are characterized by increasing levels of organic material. Management to minimize the effects of pollution includes the development of environmental friendly farming systems, to set the border corridor as a buffer or transition zone which role as filter the entry of various pollutants from the mainland, and the development of waste management.

Activities on the lake that have the potential to provide pollution are transportation, cage aquaculture activity and washing and bathing activity. The policy on pollution management is declared in President Regulation number 81/2014, they are: i) Maintain the stability of lake water quantity and water quality control (Art. 7; a); ii) Control of cage aquaculture area in the lake (Art. 7; e); c iii) Control of livestock area, horticulture and development the community-based plantation and environmental friendly farming (Art. 7; g). The strategy to implement the pollution management policy, are: i) Provide the water quality monitoring facility (Art. 8.1.f); ii) Pollutant emission reducing vegetation development on the banks of lake (Art. 8.1.g); iii) Development of bio filtration on rivers to reduce pollutant load (Art. 8.1 h); iv) Development of wastewater treatment plant in the area of livestock (Art. 8.7c); v) Control of production process on the agricultural area in watershed which produce waste and hazardous waste (Art. 8.1o); vi) Development of waste management systems and the wastewater network (Art. 8.1p); vii) control the use of the lake water with reuse model (Art. 8.1k); viii) Control of lake space utilization for aquaculture (Art.8.1 m); ix) Recovery of lake water quality which polluted by fish farming activities (Art.8.1.r).

Management of pollutant on cage aquaculture activity becomes an important concern that is related to their activity in water body and people economic source. Therefore, special strategy was developed in President Regulation No.81/2014 through zone arrangement of cage location and the production that refers to carrying capacity of the lake. President Regulation mentioned the strategy for aquaculture development in lake area through: i) Cage aquaculture area control and water quality on this area need to fulfil the water quality standard on class I (Art. 8; 5a); ii) Prohibition of aquaculture activity in the lake banks until 30 m depth as littoral zone which has function as benthic animal habitats and fish spawning area (Article 8; 5b); iii) Control of cage aquaculture activity in open water with a depth of 30-100 meters and in lake outlet waters area, that refers to environment carrying capacity and the water quality need to meet the water quality standard on class I (Article 8; 5c); iv) Controlling cage aquaculture activity in depth waters (> 100 meters) as decomposer zone (Article 8; 5d);

Sustainability of Biological Resource Availability

Management is directed to ensure the sustainable utilization of biological resources through the establishment of protection zones, especially for endemic biota, endangered species, as well as settings the zone that keep reproduction processes continuity of biological resources, including establishment of protected zones for migration route and fish spawning ground. Lake management to support availability of biological resources continuously has been accommodated in President Regulation by setting conservation of important ecosystem (Art. 7b). The strategy to implement those policy, will execute by establishing the protected areas (Art.8.2 a), including conservation of local and natural protected area (Art. 30).

Local protected area consists of riparian (river bank) zone, around (bank) of lake, green open land area (Art.32). Area of natural conservation for conserve of biodiversity, ecosystem type and genetic resources, setting for spawning ground of Lake Toba endemic fish (Art. 33).

The implementation level of zone arrangement direction further has to consult to Detail Plan of Zone Utilization which is put up through Regional Regulation (Art. 117). It is also related to Lake Toba area located on seven of regency administration.

SCIENTIFIC REVIEW OF LAKE TOBA CONDITION

Direction of Lake Toba area utilization with refer to President Regulation No.81/2014, namely Space Planning of Lake Toba Area, it is expected that lake resource utilization should be sustainable. Science and technological information and local wisdom are useful to support the implementation of policy, for instance: to increase the awareness of hidrological dan geological condition. As known the topography of Lake Toba catchment characterized by slight elevation (slope degree 3-8%) it is just 30% from the total area, the rest is rather steep to very steep (70%) (BP DAS Barumun *in* Lukman et al., 2010). Regulation of land management have been written on President Regulation number 81/2014 stating that the use of land in the Lake Toba catchment must pay attention ton the hydrological factors.

President regulation in the utilization of land space, generally had regarded the nature susceptibility and ecological specific of utilization areas that should be protected. However, we must keep in mind that the ecological characteristics of the lake waters are different from other ecological sites. In lake area, there are some areas (habitat) need to be considered related to the purpose utilization regulation of lake space, such as the edges of the lake, littoral zone, lake inlets or area of rivers entering the lake, and wetland areas. Ecological importance of the lake edge is an ecotone zone and energy supplier. This area generally has high biotic diversity. The riparian vegetation that grows along the banks part is thought as fauna habitat land water specific, supplier of organic matter and nutrients to waters as lake energy source.

From the lake management point of view, the banks are part of border regions, which should be open for public access to carry out various activities in the waters. The banks area can be an inspection corridor and can be a hub to the processing of land-based activities, such as the treatment of sewage, raw water intake and environmental monitoring. Littoral zone is part the waters generally located on the lake edge, where the bottom waters are still on sunlight penetration (euphotic zone) which still support the development of autotroph photosynthetic organisms. This region develops a variety of aquatic plants, benthic biota, as well as being the main area of fish spawning zone. Littoral zone of Lake Toba is known to a depth of between 18-36 meters, or an average of 27 meters and its range is estimated at 10.64 km² or 0.95% of the entire of lake area (**Figure 3**) (Lukman, 2011).

The inlet area where river goes into the lake needs to be considered because it is an area where the influx of pollutants from land-based activities and fish migration way to spawning ground. Inlets of the lake can be used as monitoring stations of pollution from the land, and on the other hand, this area should be open so that it will not disturb the fish migrating activity. Wetland regions which are widely distributed on the lakes shores often become an important habitat of water birds, even among the migratory birds. The wetlands which also have quite high plant populations are generally the habitat for many animals who live between land and water.

The utilization of water area for the development of cage aquaculture has to concern the lake carrying capacity. Referring to Beveridge's (1984) criteria, the carrying capacity is the maximum production level that can be achieved based on the total phosphorus levels acceptable as appropriate of waters utilization, particularly it is related to the impact namely eutrophication. In fact, the criteria are ignoring the organic matter accumulation impact in the bottom waters causing anoxic conditions and changes in the structure of benthic habitat. It also needs to pay attention to avoid habitat benthic damage, especially in the littoral zone. In a more specific point, Bengtson (2012) also imposed the aspect of carrying capacity which pays more attention to the ecological and sociological conditions.

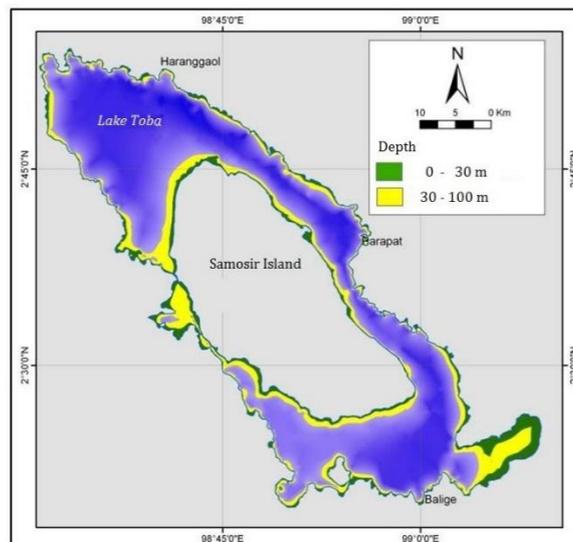


Figure 3. The littoral zone of Lake Toba (Depth of 0-30 m; green) (Source: Lukman, 2011)

Several ecological factors and the waters space utilization become determining criteria of cage aquaculture development area (Lukman, 2011a; 2013), they are: i) Hydro morphometric character and water mass flow patterns; ii) Outside the littoral zone; iii) Considering to the length of each regency coastline; iv) Agricultural land area and their activity in each regency; v) Considering the number of local residents; vi) Outside the territory of other activities that already exist such as raw water intake area, business activity and the port, outside of the tourism area and tourism potential; and outside the fish reservation zone. Considering to the water quality, water mass circulation factors and the estimated area use both the existing and potential use in the future, the grading direction of potential development area for cage aquaculture has been defined (**Figure 4**).



Figure 4. Potential area grade for cage aquaculture development in Lake Toba (Sumber: Lukman *et al*, 2013).

Referring to the Government Regulation (PP) number 28/2009 that is related to Water Pollution Load Capacity on Lake and/or reservoirs, with a range of phosphorus criteria for oligotrophic waters, scenarios for fish production from cage can be achieved until 35,282 tons / year (Lukman and Hamdani, 2012).

CONCLUSIONS

The Lake Toba which is included as one of the national strategy regions has become a major concern from the central government of the republic Indonesia. The policy of Lake Toba management has been directed to develop into one of the world's tourist destinations. Each activity will be and has been growing in the Lake Toba and that should be in line with and support to those policies. Government policies determined by Presidential Regulation are

comprehensive and sufficient to keep the implementation of target lake management also in line and accommodative to the characteristic the lake ecological and hydrological conditions. However, in implementation level has to consider the social and economic development aspects and how to build the balance between the regions. Lake Toba is one ecosystem but there are seven regencies using Lake Toba with different policies and requirements. On waters area utilization, especially for the cage aquaculture activities, we have to decide the target of fish production, which refers to the total production level based of carrying capacity, and also the specified allocation needed for each district. In addition, specific zones of cage aquaculture activity for each regency shall be established and does not interfere with other activities that will grow and have been growing in the Lake Toba. Finally, the implementation of government policies related to the management of Lake Toba should be the main mind set of stakeholders and the community. The successful management of Lake Toba can hopefully be the reference to the management of other lakes in Indonesia.

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