

# A Preliminary Study: Forest and Environment Governance Based on Hydronomic Zone and Authority Agency for Toba Water Catchment Area and Asahan Watershed, North Sumatera

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**Abstract** This preliminary study aimed to identify the forestry and environmental issues, initial delineation of "hydronomic zones" and typology of governance and the opportunity to develop an authority agency for Toba Water Catchment Area (WCA) and Asahan Watershed (W) management. This study was conducted by field visited, desk study, interviewing and discussion. There were 9 (nine) issues which related to forestry and environment, especially their impact to the water utilization, such as: 1) forest cover conversion; 2) water supply; 3) water and air pollution around Asahan W; 4) lake water body pollution; 5) erosion and sedimentation from catchment area; 6) land degradation on Samosir island; 7) customary forest; 8) family conflict and 9) ecotourism and geopark. The alternatives solutions to those issue can be used as the basic for initial delineation the "hydronomic zone" scheme and for strengthening governance and as the entry points to develop a vision and mission of authority agency to be formed. The proposed of an authority agency for environment and forestry not only to strengthen the power but it is also an opportunity to harmonize the powers and role between 9 districts around Toba WCA and Asahan W with the Ministry of Environment and Forestry.

**Keywords** Environmental, Water, Hydronomic, Governance and Authority

food, water, minerals, game/hunting, pharmaceuticals/medicine, industry and energy (water and biomass); (2) regulating: climate control (C sequestration), the decomposition of organic material/waste, purification of air and water as well pollination and disease prevention; (3) supporting: nutrient cycle/ food chain and pollination plants and primary products; (4) culture: recreational and (5) spiritual. Since its beginning, the development of forestry as mentioned by Nelson [1] that the relationship between man and nature since the time of Adam and Eve is written in the book of Genesis. They live in harmony with nature in the Eden Park and they have an authority on the whole of plants and animals in it. Besides, the Eden park was the source of 4 (four) rivers namely were Euphrates, Tigris, the Pishon and the Gihon. Later, in America appeared the spirit of efficiency and economic growth, as in 1905, Gifford Pinchot declared one of the missions of the forest that is based on the spirit of "building the kingdom of God back to earth". At that time, the using of forest resources by efficiency spirit and become part of saving the world from the sins that caused the damage that happened before. Gifford Pinchot became the apostle of forestry; he thought the forest must be utilized for prosperity. Therefore, man has the forest authority over physical, fauna and flora potentials and other services such as water regulation from the beginning has been to be kept and used without destroying it.

## 1. Introduction

### 1.1. Ecosystem and Spiritual Background

Forest and environment is a unity of ecosystem, economic and socio-cultural dynamic in accordance with the time. The services of forest ecosystem consist of five groups, as follow, namely: (1) provisioning: producing

### 1.2. Economic and Environment Background

The view of economists declared that forests should be utilizing for the prosperity, while the view of environmentalists said that the forest should be protecting, protecting the values stored (intrinsic) and protecting the endangered and threatened species. Special to the forest, the prevailing view is ecosystem-based management compared with multipurpose forest management (multiple

use management).

### 1.3. Watershed Governance

FAO [2] reported that until now there are two stages in watershed governance: in the beginning based on forestry and forest hydrology and later based on land-use management and economic activities (focused in beneficiary). In the future, the involvement of all stakeholders, not only one institution but also by participatory approach and integration of multi stakeholders are involved in the success of watershed management (FAO) [2]. Later, Sing [3] explained that for the watershed management, it is important to integrate the role of authority agency in local government with the involvement of all the stakeholders. In general, forest and environmental development in Indonesia over the last 40 years has led to environmental damages including for water catchment area and watershed. These environmental damages have been caused by anthropogenic factors (such as encroachment, illegal logging and slash and burn) and by climate change (forest fires, floods and landslides). In order to improve those damages, the Ministry of Environment and Forestry has set up 34 units of the watershed management institution that spread throughout Indonesia. The efforts to improve the critical land around water catchment area and watershed have been doing by rehabilitation programs for watershed ecosystems in various regions that require good governance concerning the rule of law, institutional, human resources and management capacity especially at the field level. Forest and environment governance should be based on goals of forestry development for generating a healthy ecosystem which is intact in quality, remain natural without any engineering. Since 2015, the Ministry of environment and the Ministry of forestry has become one ministry as the Ministry of Environment and Forestry. The division of tasks and responsibilities outlined in decree of P.18 / KemenLHK-II / 2015 [4] on organization and work of the Ministry of environment and forestry are mentioned in around 1500 articles that distributed to 9 (nine) technical echelon/division that 7 out of 9 related to watershed governance, namely: 1) the Director General of Forestry and Environmental Planning; 2) the Director General of Natural Resource Conservation and Ecosystems; 3) the Director General of Control Watershed and Forest Reserve; 4) the Director General of Pollution Control and Environmental Degradation; 5) Director General Waste Management, Waste and Materials Toxic Dangerous; 6) Director General of Social Forestry and Environmental Partnership and 7) Director General of Environment and Forest Law Enforcement. It is important to start the

integration efforts for the achievement of task of 7 (seven) above echelon/division through governance based on the unity of the water utilization on the upstream, midstream and downstream by "hydronomic zone" schema. Molden, *et al.* [5] mentions that hydronomic zone (hydro means water and nomus means management) is the management of water resources based on zones in a basin or catchment. Water management in a certain water catchment area or watershed can be composed in six (6) zones were divided based on common patterns of hydrological patterns of geology and pattern of topography, as follows: a) water source zone (WSZ) ; b) natural recapture zone/NRZ (zone of water capture back naturally); 3) regulated recaptured zone/RRZ (zone of water capture back with the various interventions); d) stagnation zone/SZ (zone impasse, cannot be used again); e) the final use zone / FUZ (final use zone) and f) environmental sensitive zone (ESZ).

### 1.4. The Purpose of Study

This preliminary study aimed to identify the forestry and environmental issues; initial delineation of "hydronomic zones" and typology of governance and the opportunity to develop an authority agency for Toba WCA and Asahan W management

## 2. Location, Framework and Methods

### 2.1. Location

This study was located at Toba WCA and Asahan W in North Sumatera, Indonesia as an unity of ecosystems that representing an unified economic development that require management innovations to achieve the balance of economic and the environmental development. Toba WCA was located at an altitude of 900-1900 m above sea level (asl) and Asahan W was located at an altitude 0-900 asl. The successful of Asahan hydropower electric by PLTA Asahan, pulp and paper mill by PT Toba Pulp and Paper and aluminum industry by PT Inalum are the examples of economic development that drive by water and forest resources. This study was conducted around Toba WCA and Asahan W (Figure 1). The whole area of the study belongs to 9 (nine) districts, as: North Tapanuli, Toba, Samosir, Simalungun, Karo, Humbang, West Pakpak, Dairi and Asahan.

### 2.2. Framework

Framework of this study is presented in Figure 1.

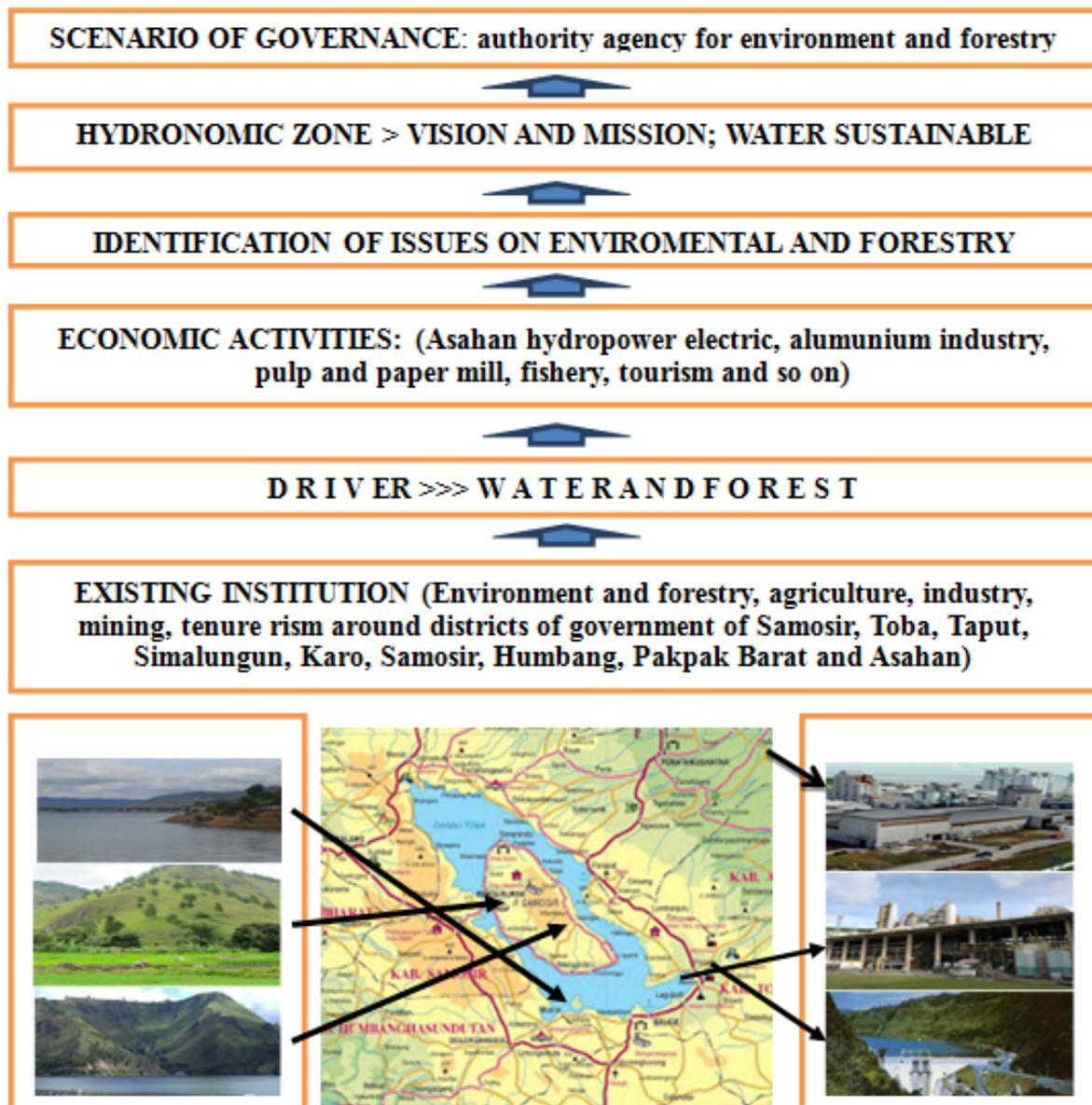


Figure 1. The framework of study for environment and forestry governance in Toba WCA and Asahan W

**2.3. Methods**

Data and information were collected by field visited, desk studied, informal discussion and interview. Interviewee consisted of: Asahan authority agency, Perum Jasa Tirta II (State Water Service), indigenous representatives, farmers, and Lintong forest restoration team. Those data and information related to issues in forestry and environment were used for pre-delineation of hydronomic zone, reviewing some water and environment legislation, typology of governance, vision and mission of authority agency and SWOT analysis.

**3. Results and Discussion**

This preliminary result was divided as: regulations

related to environment and forestry; water and as the driver for economics activities; economic activities around Toba; identification of issues on environment and forestry; hydronomic zone schemes; vision and mission; scenario of governance and authority agency and SWOT Analysis.

**3.1. Environment and Forestry Regulations**

Since 30 years ago, the central government and local government have been governing the Toba WCA and Asahan W, but the results still not satisfactory, especially related to the environment issues. The policies or regulations as the based for the implementation of environment and forestry aspects are shown in Table 1.

Table 1 has not shown an article that indicate a single entity to implement the existing legislation, but the articles

only mention of role and power of several sectors for planning, monitoring and coordination. Several attempts for coordination has been done, such as the establishment of working groups Toba WCA, Foundation for Conservation of Lake Toba, Toba Dream and others. Those efforts were hindered by various constraints such as administrative boundaries. In the future, the coordination result depends on the commitment of each party/cross-sectors. Even though, the existing 10 legislation in Table 1 for technical regulation and various legal basis for coordination, but there is no regulation/article that describes who will become the implementing agency related to environment and forestry issues.

### 3.2. Water as the Driver for Economics Activities

Since 30 years ago, the economic growth around Toba

water catchment area (Toba WCA) and Asahan watershed (Asahan W) has been driving by water for hydropower electric of PLTA Asahan and forest resources for pulp and paper milling of PT Toba Pulp Lestari, both are located at the upstream of Toba WCA. The hydropower electric also drives another economic activity of the aluminum industry (PT INALUM) in the downstream of Asahan W. In addition, others activities such as agriculture, fisheries, tourism not only increase the economic growth but also contributed to the negative environmental impact.

### 3.3. Identification of Issues on Environment and Forestry

Based on the field observations, discussions, literature study and interviews, there are nine (9) strategic issues in Toba WCA and Asahan W. The summary of those issues are presented in Table 2.

**Table 1.** Several legislations related to environments and forestry issues

Number	Name	The content
1	Government regulation (PP) 37 Tahun 2012 for watershed management	Mostly technical and 2 verse about governance
2	Constitution (UU) Number 27/2014 for soil and water conservation	Mostly technical
3	Constitution (UU) Number 7 Tahun 2004 for water resources	Amendment
4	UUUU Constitution (UU) Number 32 Tahun 1997 on the Environmental Management	Mostly technical
5	The Decree of Ministry of Environment Number 12 /2009 about Environment	Mostly technical
6	Constitution (UU) Number 26/ 2007 for Spatial	Mostly coordinated and power and role legislative
7	Government regulation (PP)/121/2015: Water resources management	Mostly coordinated
8	Government regulation (PP) Number 12/2015 for drink water management	Mostly technical
9	Presidential Decree (Perpres) Number 81/ 2014 for Toba lake spatial	Mostly coordination between sectors
10	Presidential decree(Perpres) Number 49/2016 for Authority Board for Toba Lake tourism	Mostly power and role of the authority for tourism

**Table 2.** Issues, negative impact and alternative solutions in Toba WCA and Asahan W

Environment and Forest issues	Negative impact	References	Alternative solution
1. Forest conversion (conversion from natural/protection forest to production/plantation of <i>Eucalyptus sp</i> in Lintong Forest, Samosir island and nearby) for pulp industries.	Water conflict between PT Toba Pulp and people nearby river. Conflict between government, company and community	Moedjono, 2003 and Borre, 2000. Field visited	Back to protection forest
2. a. Water supply for Hydropower electricity decrease: Toba lake discharge from 110.4m <sup>3</sup> in 1920-1930 to 104.4m <sup>3</sup> in 1957-1975 to 90 m in 1976-1988 (water level of Toba lake fluctuated due to the water regulated for turbine) b. water flushing retarded due to the dam construction	Conflict between local people, government and hydropower electricity company	Moedjodo, <i>et al</i> , 2003. Field visited	a. Collaboration for water rights b. Settings laundering lake at any given period by making a special drain
3. a. Asahan river pollution in the upstream (by pulp industrial waste ) b. Air pollution from pulp and paper mill, due to the chemical pulping processing	a. Conflict between company and local people (respiratory distress and disruption to fisheries and agriculture)	Field visited	a. Waste treatment b. Biological pulping processing
4. Water body pollution (water pollution by cage fishery with pellets for feeding about almost 10 tons/day for 150,000 cages) and phosphorus content in some places >2-4 mg/P/year	The local fish habitat and the scene of water body was disturbed	(Oakley, 2015). (Lemusluoto, 2000 in Okley, 2015). Bruijkere (1993) Oakley (2015) Moedjodo, <i>et al</i> . (2003). Field visited	Regulatory on the threshold of the waste in the lake
5. Erosion and sedimentation from Toba catchment area out of Samosir island (45 % land cover belong to agriculture activities such as rice field and coffea plantation. Generally, soil and water conservation techniques were limited, also due to the intensive using of chemical fertilizer, pesticide and herbicides	Pollution from residual fertilizer, pesticides and herbicides disturbed the waterbody scene and habitat for local fish.	Oakley (2015) Sinukaban and Kadri (2007) (Toy, <i>et al.</i> , 2002). Moedjoyo, dkk (2003). Field visited	The balance of using manure and chemicals, with a subsidize scheme (cost sharing) and incentive systems.
6. Samosir island (almost 64 % of Toba WCA is Samosir island, dominated by traditional farming which cause sedimentation and erosion soil and nutrients material)	Those activities contributed to the growth of algae and water hyacinth alongside lake	Moedjodo, <i>et al.</i> , 2003 and Oekley (2015). Lemmusluoto (2000).Field visited	Land use based on protection forest function (introduced agroforestry model in the middle basin)
7. Customary forest conflict between 'marga'/clans, between the clans with the government and with the company (e.g. Tele forest )	Those conflict contributed to low achievement of land/forest rehabilitation around Toba WCTa and Asahan WTS	(Oekley, 2015), (Moedjodo, <i>et al</i> . (2003), Field visited	The government has to make a regulation for customary forest in regional or district level, therefore the status of their forest become legal and clear.
8. Family conflict due to the the difference opinion in determining the species that will be developed in their common land/customary land, finally their land become abandoned	This conflict contributed to low achievement of land/forest rehabilitation around Toba WCT and Asahan WTS	Field visited and Interview	As above
9. Ecotourism and Geopark potency (trigger the uncertainty of land tenure and the involvement of local people)	These potency contributed to the political issues and land tenure policy	Bemmelen (1949); Butarbutar (1993); (Kompas Media Nusantara, 2014. Moedjodo, <i>et al</i> , (2003)	Proposed Toba geopark and Authority Board for tourism can be synergized with efforts to environment and forestry governance

The nine of negative impacts and the alternative solutions above were used as a basic factor to pre-delineate the "hydronomic zone" scheme. Those issues also used as an entry points or leverages activities to develop a vision and mission for a new policy. The new policy will be implemented by new institution as an authority agency for environment and forestry, especially for water utilization from the head of water (upstream) up to costal area (downstream).

### 3.4. Hidronomic Zone Models

Generally, the catchment area management was based on model of catchment area unified, but it didn't work properly. The unity the catchment area and linkage to the interaction between stakeholders of supply-demand water

from the upstream up to the downstream are keys approach for the successful of watershed management. This approach can be done with integrated management approach based on geographical zones called it as "hydronomic zones" by Molden, *et al.*, [4], these zones laid on 4 (four) main altitude, such as 1) upstream (headwaters); 2) plains; 3) urban (cities) and 4) coastal areas as shown in Figure 2. This model has been implemented in agricultural regions in various conditions, among others: basin Kirindi Oya in Sri Lanka, basin Nile in Egypt, around Bhakra command in Haryana, India and in the basin Gediz, Turkey. It is important to find also a formula for Toba WCA and Asahan W that can integrate all the alternatives solution for the nine issues above which started from upstream to downstream.

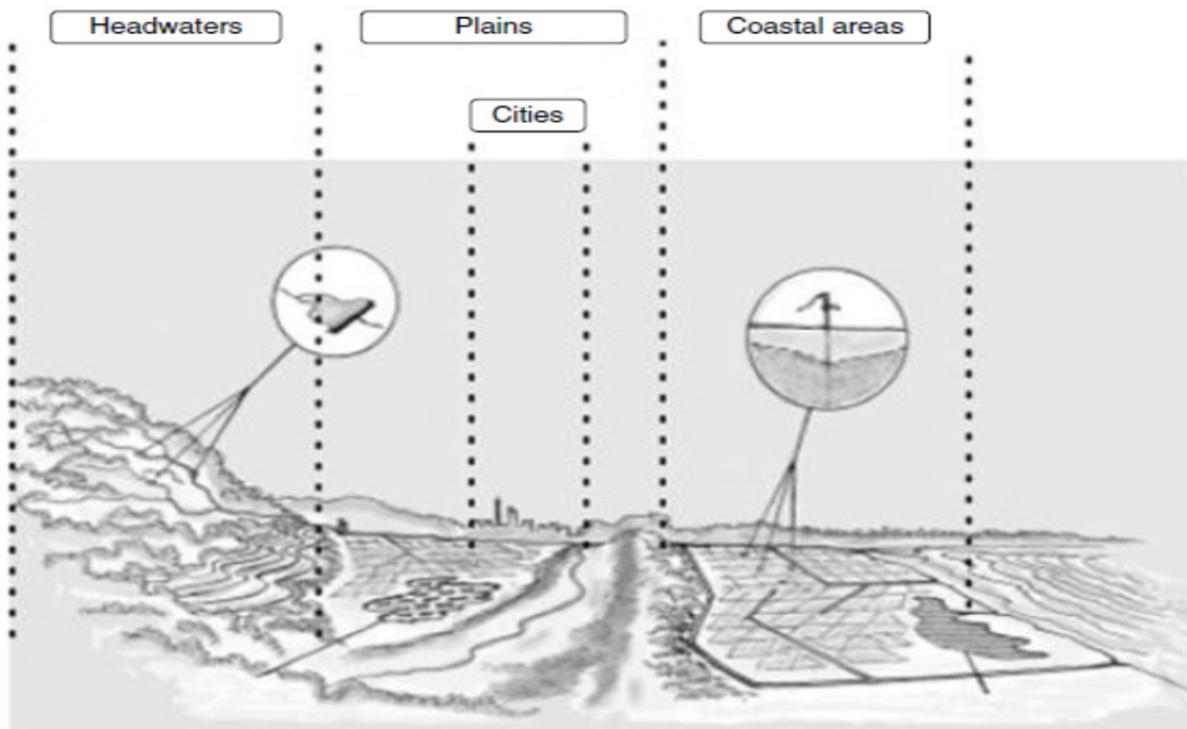


Figure 2. Hydronomic Zones (Molden, *et al.*, 2001)

Based on approach as the Figure 2, the hydronomic zone scheme in Toba WCA and Asahan W can be seen in Figure 3 below).

Figure 3 shows that the source of water supply for hydropower electric originated from the water body of Toba WCA and the upstream of Asahan W. The hydropower electric drives the economic activities of people around Toba WCA up to central urban areas and coastal regions in Asahan district. At the downstream (coastal beach) has been built the port to support the export of aluminum products from PT Inalum. The success of the economic functions of water and forest source in the study area need to be balanced with the solution for environmental and forestry issues that occur in hydronomic zones of Toba WCA and Asahan W.

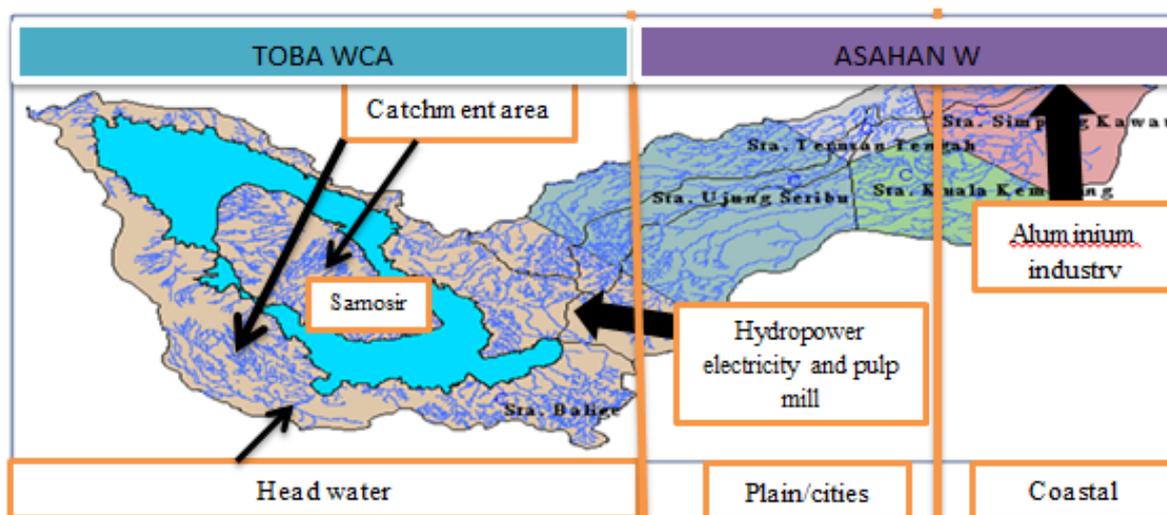


Figure 3. The Hydronomic zones approach in Toba WCA and Asahan W

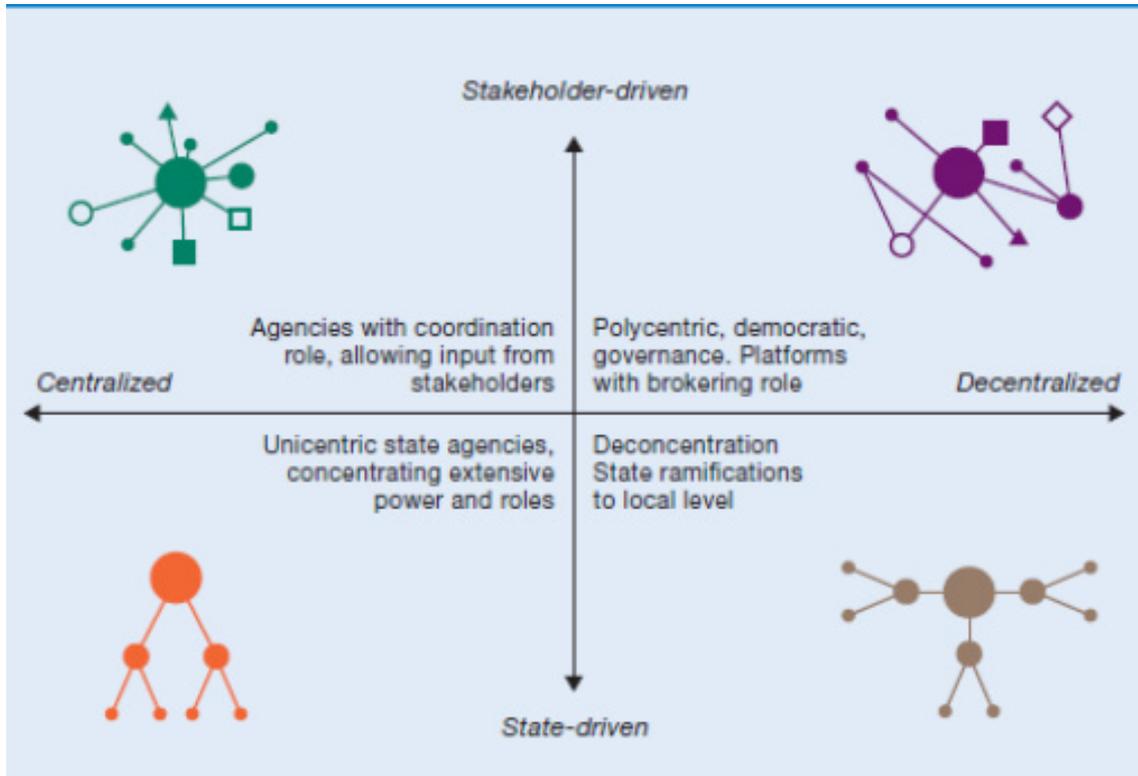
### 3.5. Vision and Mission

The Ministerial regulation (Permenhut) Number 18/2015 about organization and governance of the Ministry of environment and forestry consisted of about 1500 articles regulating the entire task of the Ministry. Those entire task were delegated to 9 (nine) relevant technical echelon. Therefore, it is necessary to harmonize the articles of Ministerial regulation with 10 (ten) regulations that mentioned in Table 2 and issues in Table 1. The success of the program or activities should begin with policy analysts conducted by preparing a policy framework that consists of a vision and mission, programs, activities and so on. Vision and mission is based on an agreement that tailor to the legal aspects (legislation, regulation and so on), effectiveness, efficiency, social aspect/cultural and political aspects in achieving a common goal. Situmorang [15] mentions that government's decision to establish an authority agency for tourism in Toba Lake has double mission that cannot be separated, namely conservation and utilization. The success restoration and preservation of the lake Chaplain in the United States with the theme of saving the life of the fish population in the lake need information and data about the biophysical, social, cultural and economic surrounding of the lake (Trzaskos and Malchoff, [16]). Based on the 9 (nine) issue which related to environment and forestry namely the ring of fire, the history of Batak and exploitation of natural resources ( Borre, [6]) for Toba lake restoration and the need to balance conservation and utilization (Situmorang, [15]), the proposed policy framework (vision, mission and program) for the Authority

Lake Toba as follows; **Vision:** Toba WCA can be sustainable for the people of North Sumatera, Indonesia and International; **Mission:** Managing water and land resources in a fair and sustainable; **Values:** Tough, Optimistic, Brave Action (TOBA); **Policy:** The use of land and water that is fair to the household, industry and the tourism; **Program:** 1) Elaborating Perpress Nomor 81 [17] and Perpres Nomor 49 [18]; 2) Detail delineation of Hydronomic zone for Toba WCA and Asahan WTS; 3) Utilization of forest by the involving local communities through indigenous forest scheme, Community Forest Plantation and conditional land with the cooperation with existing industry; 4) Waste management techniques in water body and catchment area; 5) Waste management by subsidies and incentives scheme; 6) Land use-based protection functions in Samosir Island; 7) Regulation of customary/clan/ other communal; 8) Revitalization of local wisdoms and 9) The master plan and landscape layout for geopark and **Working area:** 9 districts (8 districts in Toba WCA and 1 districts in Asahan W).

### 3.6. Scenario/Typology of Governance and Authority Agency

“Forest governance’ refers to new modes of regulation in the forest sector, such as decentralized, community-based and market-oriented policy instruments and management approaches “(Artsa, *et al.*, [19]). Molle, *et al.* [20] explain that the typology for basin governance it can be seen in Figure 4.



**Figure 4.** Typology of river basin governance (Molle, *et al.*, [10])

Figure 4 shows, the authority agency was drive by state and centralized, as power and role concentrating in one unicentric state such as authority agency. The authority agency is needed for achievement of the goal or to solve the issues. The authority agency is a government institutional that has authority to carry out various duties and functions specifically in an area or several areas of public administration, for example, inter-district/region. Formation body of authority agency based on several strategic factors include: the achievement of certain sectors such as; trade sector, industrial sector, energy sector or strategic projects, for example hydropower and others. Various success stories of some of the authority agency that managed natural resources are presented in the following description. Such as the authority agency for management of hydropower electric and Aluminum plant from 1976-2013 in Toba WCA and Asahan W and authority Jatiluhur for hydropower electric power and irrigation in West Java. In abroad, Kartodihardjo, *et al.* [21] reported that for the existence and performance of components institutional water resource management in the US and Japan should note the following: 1) The people's reliance on natural resources is not entirely, but the community is aware of the need for sustainability and the benefits of natural resources; 2) property rights to land recognized; 3) organization controller implementing programs that exist and clear duties, responsibilities and authority; 4) The power and the role the implementing organization also must be clear; 5) the role of

program/project on per capita income, can be directly and indirectly and 6) the role of the strongest supporters of state revenues indirectly. It was also stated that the management of the lake Yojoa in Honduras need to pay attention to the involvement of civil society and the role of government outside the water sector is important to the success of water sector reform. Anonymous [22] suggests that efforts to reduce pollution of the lake water, erosion and sedimentation and invasion species like water hyacinth were done by the younger generation in cooperation with Toyota in Lake Pokhara, Nepal. Benjamin and Giessen [23] mentioned that the importance of domestic actors illustrate that global governance arrangements cannot operate effectively, relative to their ambitious mandate and for tackling policy issues relating to the Anthropocene (political responses to global deforestation are a key field for scholarship and policy analysis), unless they are granted adequate resources and support by key domestic actors.

### 3.7. SWOT Analysis

The success of the vision and mission, program and all the activities also depend on typology of governance or institution that will implement/execute the vision and mission. There are 4 (four) alternative of typology for governance to achieve the vision and mission of the Development Toba WTC and Asahan W with the SWOT analysis (Table 3).

**Table 3.** SWOT Analysis for each typology of environment and forestry governance in Toba TCA and Asahan W.

Typology	Strengths	Weakness	Opportunity	Threats
State driven-centralized	Power and role concentrating in one institution (ex. authority agency)	Overlay in autonomy districts and weak coordination with 9 (nine) districts	Presidential Regulation (Perpres) about spatial in Toba and Perpres about Tourism in Toba and experience in Asahan Authority Agency and other place	Investment from a broad, lifestyle change, culture polluted
State driven-decentralized	Power and role are divided	Political conflict interest between state and local government	Increasing the local capacity	Execution quite slow
Stakeholder driven-centralized	Power and role concentrating but accommodate stakeholder suggestion	The interest of local potency doesn't maximal	Maximum stakeholders participation	Decision making quite slow
Stakeholder driven-decentralized	Power and role are divided with local government and stakeholders	Internal coordination complicated	Participatory is high and conflict minimum	Decision making is slow

Based on the entire description in Table 3, in the first stage it was important to consider for developing an authority agency for environment and forestry around Toba WCA and Asahan W.

### 4. Conclusions

The result the showed that the environmental issues around Toba WCA and Asahan W can be used as the basis for strengthening an authority agency to govern forest based on hydronomic zone. The environmental issues as entry point to elaborate a vision mission as Toba WCA and Asahan W can be sustainable for the people of North Sumatera, Indonesia and International.

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