Ecodevelopment

Journal homepage: http://ecodev.pasca.unpad.ac.id/

Effect of Urbanization on Changes in The Upstream Citarum River Ecosystem Services (Case Study of Majalaya District and Babakan Village, Ciparay District, West Bandung, West Java Province)

Rina Martyana[1]*, Sunardi[1], Teguh Husodo[1]

[1]Graduate Program on Environmental Studies, Postgraduate School, Universitas Padjadjaran, Jl. Dipati Ukur No. 35, Bandung 40132, Indonesia

ARTICLE INFO

Article history:
Received 13 August 2018
Revised 13 September 2018
Accepted 26 November 2018

Keywords:
Ecosystem services, Residents, Strategy Upper Citarum River, Urbanization.

ABSTRACT

This paper discusses the effect of urbanization on ecosystem services in the Upper Citarum River , precisely in Majalaya Village, Majalaya District, and Babakan Village, Ciparay District, West Bandung District, West Java province. This study applied a qualitative method used to determine the form of ecosystem services provided by the river in the Upper Citarum River . The results showed that urbanization has affected the biophysical conditions in the form of increasing average river water discharge, loss of water supply areas in the form of rice fields due to increased land use for settlements, and decreasing river water quality below the standards. Urbanization has also affected available ecosystem services. Majalaya Village which was a dense urban area received fewer ecosystem services compared to Babakan Village which was still a rural area.

1. Introduction

The concept of urbanization is actually not only in a narrow sense such as population growth because of the migration of people from villages to cities. The concept of urbanization can expand into a socio-economic process of society where there are changes such as changes in lifestyle, a livelihoods from agriculture to industry, to changes in the shape of landscapes from villages to cities (Pivovarov 1972; Bintarto, 1983; Daldjoeni, 1981).

Urbanization will certainly affect the environmental conditions. This happens because humans with their social systems and nature with their ecosystems are a unified system, not separate (Rambo, 1983). Environmental problems are not something that stands alone but is closely related to population problems in the context of population and development (Utina and Berderan, 2013). Mantra (2000) states that population growth and changes in the social system are one of the causes of environmental damage.

Today's population growth has experienced relatively fast growth, so it is alleged that it has implications for changes in environmental biophysical conditions. Changes in environmental biophysics mean making services provided by the environment. This service we are familiar with ecosystem services (*Ecosystem Services)*. Ecosystem services are benefits or benefits obtained by humans from an ecosystem that can be in the form of meeting basic needs, protecting against extreme climates, regulating microclimate, filtering waste and pollutants, and as a source of inspiration, spiritual and recreational fulfillment (MA, 2007). One ecosystem service that is utilized by humans is the River ecosystem service.

Based on the explanation above, it is important to see the relationship between urbanization and ecosystem services. This

* *Corresponding author.* Tel.: +62 813 2141 8807
E-mail address: *rinamartyana@yahoo.com*

study will look at river ecosystem services in the Upper Citarum River precisely in Majalaya Village, Majalaya District, and Babakan Village, Ciparay District, West Bandung Regency, West Java Province.

2. Materials and Methods

This study was conducted in January 2018 - February 2018. The objects in this study were the Upper Citarum River Area and the community on the banks of the upper citarum river in Majalaya Village, Majalaya District and Babakan Village, Ciparay Subdistrict, which benefited from the River ecosystem services. The choice of the community in Majalaya and Ciparay Subdistricts is because administratively it is located in the upper Citarum River area, the map of the research location can be seen in Fig. 1.

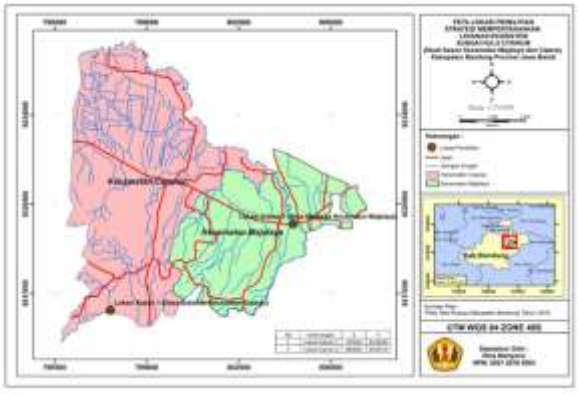

Figure 1. Research Location

The qualitative method is used to find out the form of ecosystem services provided by the upper Citarum river by using the interview method to key informants. The indicators used to view these ecosystem services use indicators from *Millennium Ecosystem Assessment* (2007). The data will be supported by data on population, river water debt, changes in land use, and water quality to see the relationship between the condition of ecosystem services and urbanization.

3. Results and Discussion

A rise of development in Indonesia can spur economic growth. As a result, these cities will become a magnet for residents to come looking for work and live. This is often called urbanization. But this urbanization raises various problems because there is no control over it. This problem that is currently faced by the Indonesian State is the high growth of population concentration. Even worse, this is not followed by a speed comparable to the development of industrialization. This problem eventually led to the phenomenon of excessive urbanization.

The process of urbanization (urbanization) of an area will certainly be associated with increasing population. The population in Babakan and Majalaya Villages experienced a trend of increasing population in the 2012-2016 range. The population of Babakan Village is 7,120 people (2012) increasing to 9,331 inhabitants (2016). While the population of Majalaya Village numbered 1.1816 (2012) increased to 1.2139 (2016) (Figure 2). Based on observations in the field, Majalaya Village had a large population because it was encouraged that the condition of Majalaya Village was more advanced and had transitioned into a city compared to Babakan Village.

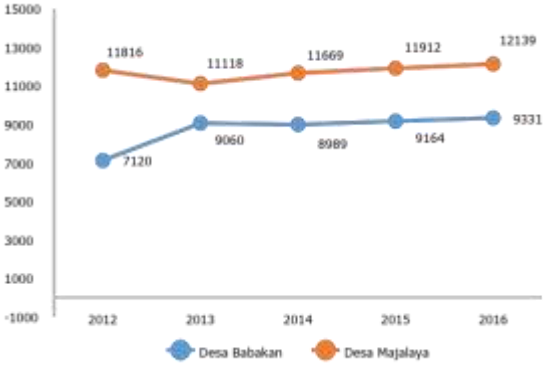

Figure 2. Graph of population growth

Population growth in these two villages will inevitably affect the environmental conditions in the Upper Citarum River . Population growth usually has an effect on environmental problems such as changing the quality and quantity of water. This is indicated by the change in the average water discharge of the Majalaya Citarum and Cisarea rivers in the 2012-2016 range. The average flow rate of Majalaya River in 2012 was only 7.91 m^3/ sec, but increased in 2016 by 12.24 91 m^3/ sec. In Cisarea River the increasing of flow rate were not too significant, even relative decline, in 2012, the average river discharge at 3:57 cisarea 91 m^3/ sec, whereas in 2016 the average discharge of 3.34 91 m^3/ sec (Fig 3).

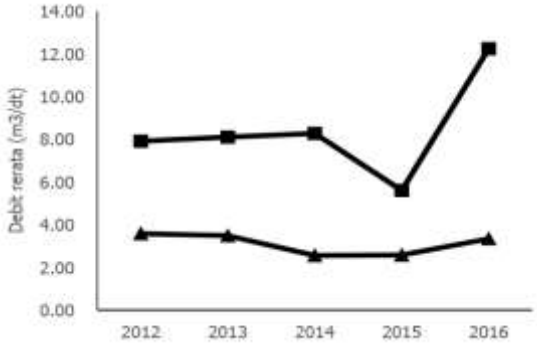

Figure 3. Graph of average river water flow

There are several observations made to determine water quality. In calculations (TSS) that do not meet the class II water quality criteria, namely in the Citarum Majalaya river in 2016 (Table 1). While the outlet locations of the Cirasea river all year

from 2014 do not meet the class II water quality criteria. The increase in TSS in Majalaya was due to the high level of industrial and domestic waste.

In general, the levels of BOD in the Citarum Majalaya river in 2012, 2013, 2014 and 2016 and the Cirasea river in 2012, 2013, 2014 and 2015 have exceeded the class II water quality criteria of the year (Table 1). The high level of BOD in the upstream area is thought to be due to the disposal of livestock manure that is owned by the community, and starting Majalaya is a densely populated and industrial area that dumps its waste into the river and lacks the efficiency of the existing WWTP.

The COD parameter is used to measure the number of chemical compounds in water, and one of the applications is to determine the number of organic pollutants in the river. COD levels in the Citarum Majalaya river in Majalaya Village, COD levels in 2013 and 2016, did not meet the class II water quality criteria. Cirasea River in Babakan Village in the period from 2014 and 2016 did not meet the class II water quality criteria (Table 1).

DO levels in the Citarum Majalaya river that do not meet the class II water quality criteria, among others, in 2014 and 2015, do not meet the quality standard criteria. Whereas in the Cirasea river in all observations from 2012 to 2016, it still meets the class water quality standard criteria (Table 1).

Table 2. Quality of Majalaya Citarum River River and Cirasea River 2012-2016

Population growth also affects the condition of land cover in Babakan and Majalaya Villages. Increasing population means an increase in land requirements for settlements. This is seen where there is an increase in the need for land in settlements and a reduction in the number of rice fields in both villages. Settlements in Majalaya Village increased by 15.19 ha in the span of 2006-2016, while in Babakan Village increased by 29.55 ha. This automatically led to a reduction of 15.19 ha in paddy fields in Majalaya Village, while in Babakan Village, rice fields were reduced by 16.24 ha and dry land agriculture was reduced by 13.31 ha (Table 2).

Ecosystem services of the Upper Citarum River consist of four services, namely provider services, regulatory services, cultural services, and support services. Provider services in the upper reaches of the Citarum river, especially the upper Cirasea river in Babakan Village, are widely used by the community to irrigate rice fields for irrigation, for drinking water, washing and bathing. Meanwhile, the provider services obtained in Majalaya Village only cover irrigation, bathing, and washing. Communities in Babakan and Majalaya Villages get the same thing in regulatory services in the form of DAM, cultural services in the form of education, and support services in the form of waste disposal sites. Specifically, the ecosystem services obtained and their numbers are presented in Table 3.

There is a noticeable difference in the ecosystem services received by the people of Babakan and Majalaya Villages, especially in ecosystem services providing services. Babakan Village, which has a smaller population of 9,331 people in 2016 and in the situation of "villages" can enjoy 5 types of services

Table 1. Land use changes

Land cover class	Changes to the land cover of Majalaya Village, Majalaya District				
	Year 2006 (hectare)	**%**	**Year 2016 (hectare)**	**%**	**change (hectare)**
Secondary dryland forest	-	-	-	-	0
Settlement	57.36	55.65	72.55	70.38	15.19
Dry land agriculture	-	-	0	-	0
Rice fields	45.72	44.35	30.53	29.62	-15.19
Total area	**103.07**	100	**103.07**	100	

providers of ecosystem services. Meanwhile, Majalaya Village, which is in a "city" situation and has a population of 12,139 people, can only enjoy 3 types of ecosystem services. In quantity, the amount of water that can be used is also greater in Babakan Village, compared to Majalaya Village.

Table 3. Ecosystem services in the Upper Citarum River

No.	Ecosystem Services	Parameter	Quantity Utilizing the Babakan Village river	Quantity Utilizing the Majalaya Village river
1.	Provisioning service	1. Irrigation 2. Swimming 3. Watering 4. MCK 5. Drinking and cooking water	1. 32,798 l / sec 2. 15.8613 liters 3. 1,053 l / sec 4. 5,200 liters / day 5. 250 liters/day	1. 23.14 l / sec / 2. 361 liters 3. - 4,740 liters / day 5. -
2.	Regulating service	Water regulator (Dam)	2 units of dams	4 units of dams
3.	Cultural service	Education	Research	Research
4.	Supporting services	waste disposalTertiary	260 liters / day	72.5 liters / day

Babakan Village management services include setting up 2 units of water. While Majalaya Village is a water management system in the form of a dam to irrigate 4 units of rice fields. Cultural services in the village of Babakan and Majalaya Village are in the form of education and research facilities. Support services in Babakan Village are in the form of tertiary waste disposal, while the temporary services of the village support services are also tertiary waste disposal.

4. Conclusion

Urbanization is characterized by an increase in the number of people somewhere. Urbanization affects the biophysical conditions of the Upper Citarum River in the form of increasing average river water discharge, loss of water supply areas in the form of rice fields due to increased land use for settlements, and decreasing quality of river water under quality standards. Urbanization also affects available ecosystem services. Majalaya village, which has been crowded and has become a city, has fewer ecosystem services than Babakan Village, which is still a village.

ACKNOWLEDGMENT

Acknowledgments author give to Mr. Sunardi, M.Si., Ph.D and Mr. Dr.Teguh Husodo, M.Si. who has provided guidance and direction in the implementation of research and writing of research result, and Mr. Mochammad Dian Alma'ruf, S.SI. ST, MT. Head of operations and maintenance of BBWS Citarum, Mr. Asep Kusumah. S.Sos,. M.Si. Head of DLH Bandung Districts, Mr. Robby Dewantara SH. M.Kn. Head of the legal section Bandung Districts, and Mr. H. Ate Saepudin the village head of Majalaya, Mr. Dadang Holiludin the village head of Babakan. who has given information, and all parties who have assisted the author in completing and writing the research.

REFERENCES

Bintarto (*1983*). City Village Interaction and Problems. Jakarta: Ghalia. Indonesia.

Daldjoeni, N (1981). Problems of Population in Facts and Figures. Bandung: Alumni.

Mantra, I.B. (2000). General Demographics. Yogyakarta: Putaka Pelajar.

MA. (2007) *Millennium Ecosystem Assessment: A Toolkit for Understanding and Action*. Washington DC: Island Press.

Pivovarov (1972) A problem of Contemporary Urbanization. Statistica. Moscow

Utina R., Baderan D.W.K (2013). Impact of Population Density on Environmental