

Resource management issues of environmental services in a Changing upper watershed: the case of Cicatih-Cimandiri basin, West Java

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Abstract Development of the Cicatih-Cimandiri basin in the past decades has been characterized by burgeoning of bottled drinking water companies that utilizes springs and groundwater resources, along with the traditional agricultural uses and local domestic water supplies. The present paper tried to discuss the resource management issues and to describe the resources of the upper forested watershed and their environmental services. The biophysical conditions will be explored to find ways to understand the watershed functions and to find measures of environmental services. There is a strong indication that local community tends to utilize the Cicatih water resources efficiently and very willing to pay for environmental services such as to pay compensation for conversation cost to ensure the sustainability of upper watershed resources. The same thing needs to be done by the drinking water companies in the area that apparently would require more efforts to come to common understanding on sustainable resource management through accepted policy and principles.

Keywords upper watershed, resource management, environmental services

INTRODUCTION

Watershed as biophysical land system has a set of functions such as: production, ecological, habitat, esthetical, and social functions. The production function of a watershed not only in terms of wood of forest products or agricultural products, but also other material products, including water as flowing resources that plays essential role in maintaining life on earth and provide environmental services. Environmental services of watershed resources quite often are not realized by most people and these were more because of limited understanding of the resources and water resources were taken for granted as common goods. In the case of Cicatih-Cimandiri basin, surface water as streamflow and springs have been used by local people for all their water needs, such as for domestic uses, irrigation and other agricultural water uses, fisheries and recreation. Recent development in the area was characterized by the emergence of bottled drinking water companies that mainly make use of springs and groundwater resources. Spring waters play very important roles for the livelihood of the local people in the area, and this recent development poses potential conflicts of interest between parties, all the stakeholders consisting of local community, industries, government and non-governmental organizations, and the State Forest Company as the main player in managing forested upper watershed. Therefore to avoid these conflicts they become important issues to find proper management of the watershed resources based on accepted management principles.

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STUDY OBJECTIVES

The study objective is to provide description of the study area and its watershed resources, and to assess the resource management issues that determined environmental services of changing forested watershed.

THE STUDY AREA

The study area is located about 40 km south of the City of Bogor which is situated between the south slope of Mount Salak and Mount Pangrango. Figure 1 shows the schematic map of the study area relative to City of Bogor.

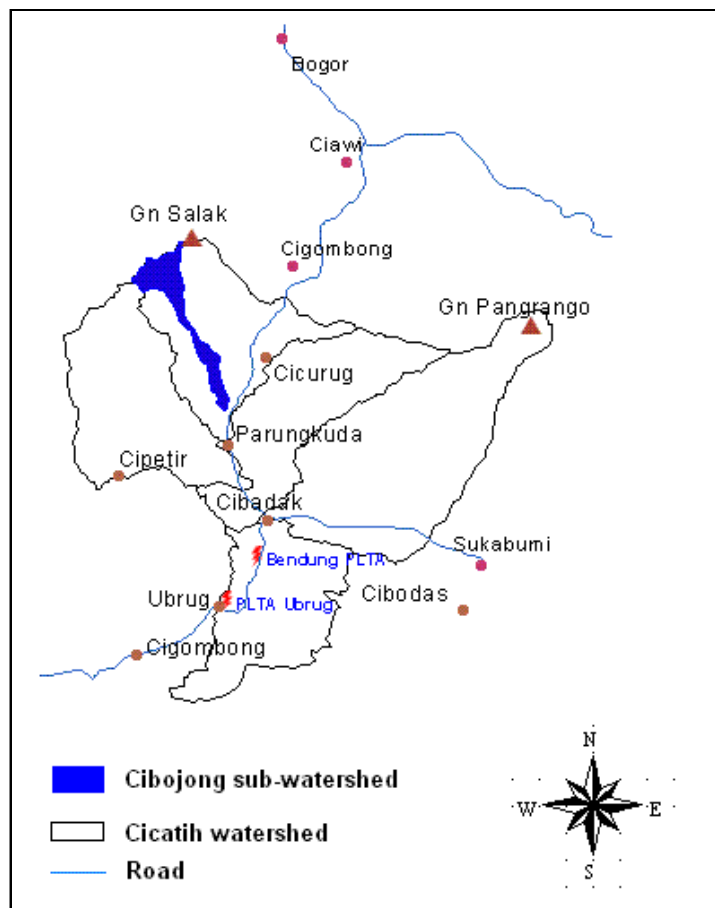


Fig. 1 Location map of the study area.

BASIN DESCRIPTIONS

This study area is the Cicatih-Cimandiri basin with an area of 530 sq.km which is the upper watershed of a major river basin in West Java and discharging its flow to the south coast direct to the Indian Ocean. The high points of Cicatih basin are marked by Mount Pangrango to the north east at 3018 m asl and Mount Salak on the north west at

2217 m asl and the downstream parts are characterized by densely populated valley with the lower point at 200 m asl with a hydropower station of PLTA Ubrug that was built in 1930s. Very steep lands of over 45% slopes represent only 7% of the basin area, with 60% areas have less than 15% slopes. Figure 2 shows the topographic picture of the Cicatih basin with locations of available rainfall stations. The low flows at Ubrug was expected at 12 m³/s, but biophysical changes in the last few decades had lower it to about 5.0 m³/s and average high flows at 230 m³/s. Annual average rainfall was 2970 mm with marked seasonal differences.

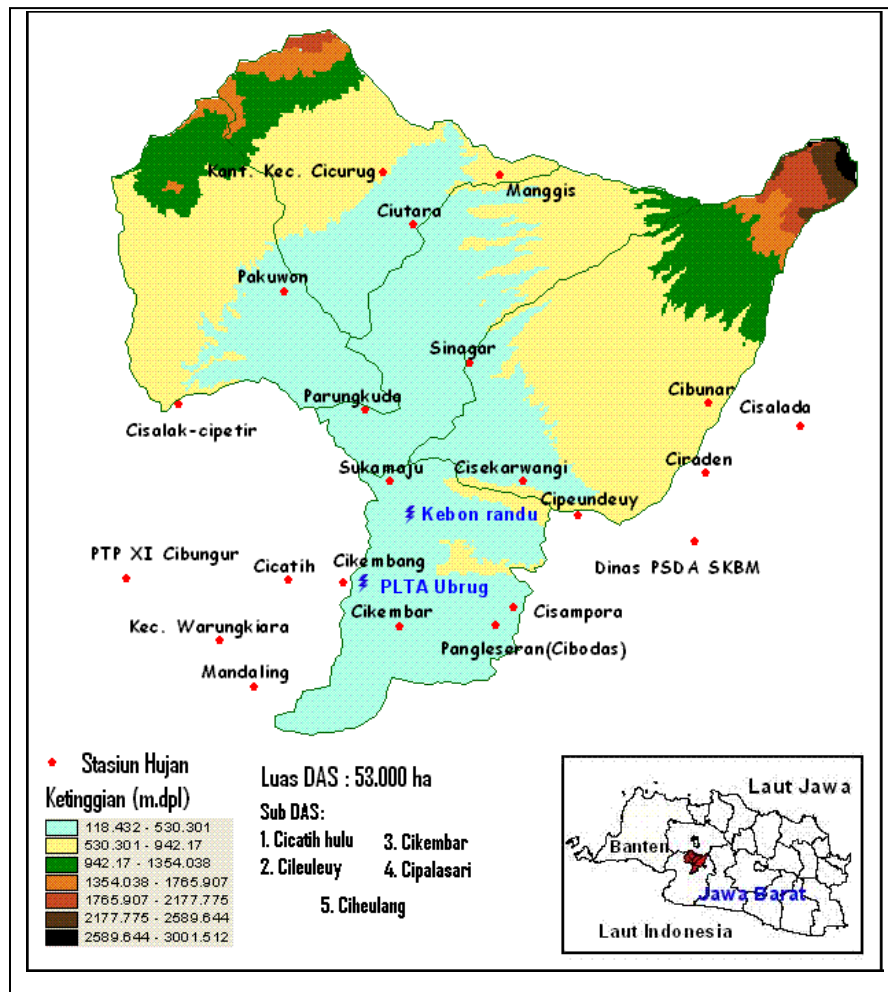


Fig. 2 Cicatih-Cimandiri basin topographic map with locations of rainfall stations.

The physiography of Cicatih basin with its geologic characteristics is endowed with abundance of water springs along the slopes and valley to satisfy the needs of local community, agriculture, and recent commercial development of drinking water companies of different economic scales. Two largest water springs are of Cipanas spring discharge outflow at 2.500 liters/s partly being used by local public water company and the other Cibuntu discharged at 695 liters/s that mostly is being used by local people for various needs, while many other smaller ones are occupied privately,

such as by: Aqua Danone, Tang Mas, Aquina, Tirta Sejuk, Ades Alpindo, Bakso Mas, Tirta Food, Aires, Tirta Babakan Pari, Tri Banyan Tirta, and Agrawira. Accurate descriptions of the basin biophysical features is necessary to understand the interrelationships between the different factors and water resource components of the basin and the beneficiaries of environmental services, among others to know the people perceptions on resource management issues to ensure their sustainability.

Present land uses are dominated by food crops and mixed garden, including tea and coconuts (45%), follows by natural forest (21%) at the upper parts, and the rests are paddy fields, scrubs, grasslands and settlements. The Cicatih basin consists of five subbasins: (i) Upper Cicatih (18.76%); (ii) Cipalasari (17.57%); (iii) Ciheulang (30.03%); (iv) Cileuleuy (17.43%); and (v) Cikembar (16.21%). Table 1 presents the breakdown of the different landuses according to the subbasins, indicating the nature of the basin and complexity of its landuses. Important recent development in the area is the burgeoning of bottled drinking water companies that reached more than 30 in number, including few largest ones, such as Aqua Danone and Ades. All these represent the biophysical background of the basin that is facing a declining capacity of the water resources in the middle of increasing conflicting interests. This paper would try to address the watershed resources management issues considering the environmental services in a changing land use settings in densely populated area.

Population: administratively, the Cicatih basin is represented by Cidahu subdistrict that accomodate around 54 thousand people distributed into eight villages with average population density of 2100 orang/km² (see Tabel 2). Low education background up to primary schooling represent 80% of the population and 88% are farmers that occupied 67% of basin area, and 65% of these farmers are landless.

Sources of domestic water are shallow groundwater for 4301 households and 444 households use local public water company. Land use change was recorded from PODES data (2003) to occur at Pondok Kaso Tengah village with 11% paddy field conversion and 2% for settlements. No change occured for other villages.

Table 1 Percentages of land use types according to the sub-basins.

<i>Land use type</i>	<i>Upper Cicatih</i>	<i>Cipalasari</i>	<i>Cileuleuy</i>	<i>Ciheulang</i>	<i>Cikembar</i>
Forest	15.34	13.10	12.70	25.69	0.68
Scrubs	7.08	7.52	9.60	12.89	2.26
Food crops	15.36	11.27	38.08	8.04	24.39
Grass	0.11	0.14	0.34	0.19	0.50
Mixed garden	18.33	44.89	22.19	12.47	45.85
Paddy fields	28.52	11.72	7.03	27.88	13.04
Settlements	15.22	11.35	10.06	12.84	13.21
Water bodies	0.04				0.07

Table 2 Characteristics of population by villages of Cidahu Subdistrict.

No	Village	Population			Area (ha)	Pop. Density	Sex Ratio
		Male	Female	Total			
1	Pondok Kaso Tonggoh	3.198	2.947	6.145	100	61	109
2	Babakan Pari	3.053	2.664	5.717	217	26	115
3	Pondok Kaso Tengah	2.679	2.646	5.325	259	21	101
4	Cidahu	4.831	4.232	9.063	1.224	7	114
5	Tangkil	3.967	3.414	7.381	319	23	116
6	Jayabakti	5.189	4.876	10.06	320	31	106
7	Girijaya	3.207	3.076	6.283	357	18	104
8	Pasirdoton	2.385	2.018	4.403	121	36	118
	Total	28.509	25.873	54.38	2.694.2	21	110

Source: Monthly population report Cidahu Subdistrict, 2005.

WATERSHED RESOURCES

Much of the watershed resources for Cicatih basin still needs further investigation, through field study of land use changes; investigate streamflow data and other biophysical aspects such as rainfall data availability that cover the watershed. The hydrologic budget of the basin would be the basic analysis to reveal the available water resources. Table 3 below presents a simple annual water balance indicating the high runoff index. Since 2002 annual streamflow data was below 2000 mm.

Table 3 Water balance of Cicatih watershed in mm/year.

Year	Rainfall (RF)	Discharge (Q)	RF-Q	RI
1999	2412 ¹	2075 ²	337	0.86
2000	2498	2062	436	0.83
2001	3223	3008	215	0.93
2002	2035	1816	218	0.89
2003	2299	1600	699	0.70
2004	1583 ³	1778	-195	1.12
2005	3121	1807	1314	0.58

Missing data: ¹Dec; ²Apr and Nov; ³Oct-Nov.

RESOURCE MANAGEMENT ISSUES

Water resources in Indonesia are bound to the recent Water Law issued as state law No.7 year 2004. The law stated that water resources management includes planning, implementation, monitoring and evaluation of water related activities that consist of conservation, utilization and control of damaging forces within any water resources region. It should managed integratively between surface water and groundwater, considering sustainability pinciple, balanced among social, environmental, and economic aspects. Resource management principles adopted are public welfares, fairness, self reliance, transparant and accountable, as a general rule the resource management should be elaborated in the form of management plan of the water resources. However in the field such as the case of Cicatih basin, all of this legal guidance is not recognized in existence. The limited resources with many growing stakeholders stance potential conflicts without proper management, and to facilitate

this it is instrumental the role of academicians with sufficient knowledge of limitations of available resources and perceptions of the different stakeholders, also with increasing awareness of the importance of environmental services of natural resources such as forested upper watershed.

The goals of resource management should be understood by all stakeholders through active participation and expressed as common efforts acknowledging the roles and responsibility of each party. The case of Cicatih basin, the upper most areas that are covered by forests are managed by state owned forest corporation called PT Perhutani. A buffer zone to the private owned areas should be established to avoid further encroachment to the forest, and the mosaics on the lower section of the basin should be managed following good management practices and these is obvious to the public due to their intensive uses. Though some field hydrologic studies had been done in the areas, better knowledge of the water resources is still necessary in role sharing among stakeholders and on water allocations. What are the roles and contribution of each stakeholder for sustainability of environmental services. It was recognized that the water resources have been experiencing heavy pressures from the many water users and the changing land uses, however there is no measure yet as to judge the sustainability of these natural resources in the near future. If exploitation of groundwater by new drinking water industries should be avoided or present level of agricultural practices should be reduced, and how much reforestation would be necessary and where? If reforestation is an effective and good decision? There are many issues and questions need to be answered yet and time is pressing to ensure not only resources sustainability but also survival and people welfare in the future, and it is considered necessary to generate basic information that would be needed to obtain good description of the biophysical condition of the basin, its socio-economic and community institutional aspects, and public perceptions of the resource management issues. Public access to information such as disbursement of water resources tax should be opened in the new era of regional otonomy policy. Serious issue concerning the environmental services is due to intensive water uses with dense population, however with low education level and high unemployment.

In general, most of population faced water shortage problem, even they had difficulties to take bath sufficiently. People used to take two or three times bathing a day were being asked for reducing the frequency into only once or so a day. This indeed the severest water shortage they ever face so far. Compared to other long drought of 1997, the shortage is considered worst which even makes upstream river completely drained.

Water shortage was not only posed population risk to health issue, but also faced even bigger problem in term of lost income opportunity of agricultural production, that accrued for more than 75 percent of people source of income. The problem population faced, in turn waking up community awareness on the roots of the problem.

Communities pointed out several main causes of the water shortage recently, such as illegal logging, land conversion, lack of income sources, with strong perception of local wisdom stated as “live close to forest commit logging, close to river collected stone, and close to the sea go fishing”.

CONCLUSIONS

Resource management of environmental services has become an important issue in the

study area due to conflicting interests of traditional and non-traditional water users considering the seasonal patterns of surface water availability, especially on springs and groundwater resources.

There is a strong indication that local community tends to utilize the Cicatih water resources efficiently and very willing to pay for environmental services such as to pay compensation for conversation cost to ensure the sustainability of upper watershed resources, but existing policy do not work in the same way for the water industries. Further indepth study is necessary on resources management issues for sustainable environmental services of forested upper watershed.

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