

## **Service Value of Protected Forest Environment at Western Mt. Lawu in Central Java Indonesia**

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### **Abstract**

Forest environment service is the result or implication of forest dynamics in the form of service in which having value or giving advantages for human being. The purpose of forest environment service utilization is to increase social welfare, such as: the fulfilment of forest environment service value utilization, increasing income and providing job opportunities, also more guarantying the forest resources sustainability as forest environment service producer. This research is conducted at protected forest area in the western part of Mt. Lawu, with its respondents are farmers who do activities surrounding the protected forest. They are joined as Forest Village Community Agency (LMDH) members. The respondents are chosen by surveying (200 persons).

This research shows that the environment service value, particularly at protected forest at the western part of Mt. Lawu with 6,038.5 ha width, are big enough. This will support above the interest for forest conservation, particularly for protected forest, and the increase income for farmers surrounding the forest, who are LMDH members. Identification and mathematics calculation shows that environment service value of protected forest at Mt. Lawu as many as Rp7,030,627,130,302 within a year. This means if protected forest area is damaged, thus it will lose its environment service value (value of woods/ pulp; water value of irrigation, drinking and industrial needs; value of flora fauna; and socio-cultural value) as many as Rp.1,164,300,261.704,- /ha / year

**Keywords:** Environment service, protected forest, Mt. Lawu

## **INTRODUCTION**

Formal forestry institutions in Indonesia face confusion in taking position of how forest resources should be maintained, utilized and conserved on the land of Indonesia. Various sequent disasters occur almost in every region in the country, such as floods, drought and landslide. Those are direct and indirect effect of the degradation-function phenomenon of forest and protected forest area. One of the protected forest area in Indonesia is Mt. Lawu (2,806 MASL), located in Karanganyar regency, Central Java or  $7^{\circ} 28'$  –  $7^{\circ} 40'$  south latitude and  $110^{\circ} 40'$ –  $110^{\circ} 70'$  east longitude, with its width is 77,378.63 ha or 77.38 Km<sup>2</sup>. This mountain elongated from north to south, its northern topography forms conical with Argo peak (Hargo Dumilah). Mt. Lawu also known for its thousands of springs. The springs never goes dry even when long drought hit the mountain. Mt. Lawu has significant role for surrounding area, such as: (1) The source of surface water and ground water, particularly for regencies of Karanganyar, Sukoharjo, Wonogiri, Sragen, Magetan, Ngawi, Ponorogo, and Madiun (2) The ecosystem of growing typical Flora and Fauna at Mt. Lawu (3) The centre of Javanese traditional pilgrimage culture (Salim, 2005). The part of forest area in Karanganyar regency at least 7,635.48 ha or 9.87% of the regency's total area. It consists of 126 ha of production forest, 7,509.48 ha of protected forest and 293.6 ha of conservation forest. The area of production forest and protected forest are under authority of Surakarta Indonesia State Forest Company (Perhutani), while the conservation forest is under authority of Central Java Natural Resources Conservation Agency (KSDA) (Karanganyar Food Crops Agriculture Plantations and Forestry Agency). All have the potential to produce forest environment service.

### **1. Forest environment service becomes important because:**

- a. It has greater benefits and greater economy value than forest value in the form of woods.
- b. Experts assess that forest environment service value has at least 95% economy value from the total economic potential of forests, while woods and non-woods are only 5%.
- c. The risks of forest damage and its ecosystem damage are relatively small.
- d. It is a great potential for supporting economy development and social welfare.

### **2. The kinds of forest environment service, according to Pagiola et.al (2004) are:**

- a. Water protection and management (water environment service)
- b. Biodiversity conservation (biodiversity environment service)
- c. Providing beauty landscape (ecotourism environment service)
- d. Carbon absorption and safekeeping (carbon environment service)

### **3. The advantages of protected forest and conservation**

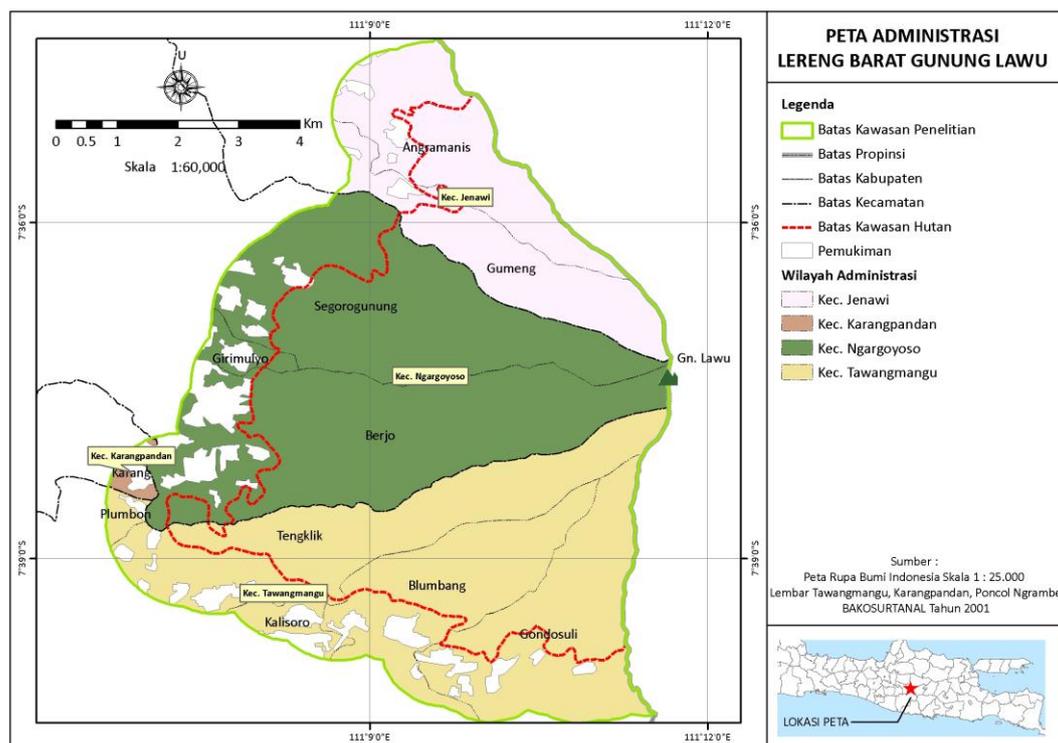
How to assess the advantages of forest could be done with (1) Using market price (2) Using 'surrogate market price', means using the price of goods related to other goods which its advantages is being assessed (3) Survey to ask the price of the advantages of forest, addressed to the number of people (survey based approach) (4) Cost based approach, which means counting the cost, in case that the advantages of forest, for example: water, could be produced by certain company. However, every assessment

approach depends on (1) Public perception towards forest (2) Ownership rights of forest resources and (3) Society knowledge of the advantages of forest (Purwanto, 2005). This research purposes are: (1) Identifying kinds of environment service of protected forest at western Mt. Lawu (2) Calculating and analysing environment service value of protected forest at Mt. Lawu

## Research Method

### 1. Location and time of the research

This research is conducted at protected forest area under authority of Perhutani, by taking case at protected forest area of KPH Mt. Lawu in the northern Karanganyar regency, Central Java. This experiment is conducted for six months.



**Figure 1:** Map of research locatin

### 2. Kind of Research

The basic method applied for this research is analysis descriptive with survey approach. The research's object is located at western Mt. Lawu in Central Java. Meanwhile, the research's population is a group of people or farmers and or agencies who are utilizing forest products at Mt. Lawu.

The converted 'Total Economic Value (TEV)' analysis tool is applied to recognize the environment service value of protected forest at western Mt. Lawu.

The required data are:

- a. **Primary data**, is obtained directly from interviewing respondents: farmers/ people activities at Mt. Lawu, officials of Perhutani, officials of village administration, and residents surrounding the protected forest area.
- b. **Secondary data**, is obtained from related agencies in the regency: Agriculture Agency, Forestry Agency and Perhutani, Water Company (PDAM), Forest Village Community Agency (LMDH).

**3. Data Analysis Method**

**a. Economical function/ Financial value of protected forest**

**1) Calculating economic value of woods/ firewood:**

The value of woods comprises woods and firewood which are utilized by residents across the forest.

**2) Notation assessment of Wood Pulp / Logs economic value**

Market value approach

$$NTKL = \sum \sum (PKLij \times HKLij) \dots\dots\dots (1)$$

Note : NTKL = Total value of pulp (Rp) ; PKLij = Potential of woods volume type-i at j forest area (m3); PKHij = Potential of woods volume type-i for every hectare at j forest area (m3/ ha) ; HKLi = Pulp price for every cubic type-I at forest area (Rp/m3) ; LAi = Width of protected forest area type-j (ha) ; i = Type of woods; j = Protected forest area (HTI)

**3) Calculating value of non-woods: Flora and fauna, agricultural products**

**Flora assessment (herbs, orchids)**

$$NTFL = \sum_{ij=1}^n (PFLij \times HFLj \times LAj) \dots\dots\dots (2)$$

Note : NTFL =Total loss value of flora (Rp) ; PFLij = Flora potential for every hectare at protected forest area j (unit/ ha) ; HFLij = Market price for every kind of flora (Rp/ unit) ; LAj = Width of protected forest area (ha) ; I = Kinds of flora (orchids, herbs, etc.) ; J = Protected forest area

**Fauna assessment (birds, mammals, reptile)**

$$NTFN = \sum_{ij=1}^n (PFNij \times HFNj \times LAj) \dots\dots\dots (3)$$

Note : NTFN = Total loss value of Fauna (Rp) ; PFNij = Fauna potential for every hectare at protected forest area (a fauna/ha) ; HFNij = Market price for every kind of fauna (Rp/ a fauna); LAij = Width of protected forest area ; I = Kinds of fauna (birds, mammals, etc.); J = Protected forest area

**b. Ecological functions (intangible value) of protected forest**

**1) Water economic value of protected forest**

Data of water economy both for irrigation and water company needs is calculated by using simple financial analysis in the form of revenue and expenditure to produce per unit product (1 m3 water).

The approach and analysis method for protected water value at Mt. Lawu by using market price approach. This approach applies actual market price as considerable price which closest to the value of environmental goods and service, produced by conservation area.

**2) For economic value of irrigation water:**

Calculated with paddy productivity approach and width of paddy plantation in the area watered from forest at Mt. Lawu.

Calculating farmers' income of rice field agribusiness:

$$Y (\text{income}) = \text{Total Revenue} - \text{Total Cost} \dots \dots \dots (4)$$

**3) Formulation for calculating economy value of drinking water (PDAM):**

$$\text{WEv} = \text{Bi} - \text{Ci} - \text{Npi} \dots \dots \dots (5) \text{ (Lukman 2005)}$$

Note : WEv = Water economic value ; Bi = Revenue of the i year

Ci = Cost of the i year ; Npi = Normal profits (25% x cost)

**4) For economic value as drinking water and daily needs (NEAM)**

$$\text{NEAM} = \text{NKAMij} - \text{BPAMj} \dots \dots \dots (6) \text{ (Lukman 2005)}$$

Note : NEAM = Economic value of drinking water (Rp/ year) ;

NKAMij = Value of needs for drinking water (Rp/ year);

BPAM = Cost of drinking water supply

**5) Value of needs for drinking water (NKAMij)**

$$\text{NKAMij} = \text{JPAMj} \times \text{KAMTij} \times \text{HAM} \dots \dots \dots (7)$$

(Lukman, 2005)

Note : NKAMij = Value of needs for drinking water (Rp/ year)

JPAMij = Numbers of customers of drinking water at land unit-j (person) ; HAM

= Price of drinking water for every cubic meter (Rp/ m<sup>3</sup>) ; KAMTij = Water

drinking needs for every person/ year (m<sup>3</sup>/ year) ; KAMHij = Water drinking

needs for every person/ day at land unit-j (m<sup>3</sup>/ day)

**c. Cost of forest and land damage control**

$$\text{BMK} = \sum_{j=1}^n (\text{BPKHj} \times \text{LAj}) \dots \dots \dots (8) \dots \dots \text{ (Lukman, 2005)}$$

Note : BMK = Cost of forest and land damage control (Rp) ; BPKHj = Cost of

forest and land damage control for every hectare (Rp/ ha) ; LaJ = Width of area-j

(ha); J = Protected forest

**d. Social Function**

**Economic value of recreation**

The approach applied to calculate the economic value of recreation is the approach of lost advantages due to quality degradation of forest environment.

**e. Cultural preservation value**

The approach of lost advantages of environmental quality is applied in this research. It is reviewed whether people's activity is depend on the forest existence or Mt. Lawuexistence.

**f. The valuation of protected forest's function and advantages/ environmental service value**

The valuation of protected forest advantages is by calculating total economic value (TEV)/ economic valuation with Simangunsong's approach. According to NRM calculation, the existed standard value will be converted with the value generated by survey data.

Calculating economic asset value of the environment, explained by calculating the total value (TEV)/ economic valuation (Munasighe, 1993), as the following:

$$\text{TEV} = \text{UV} + \text{NUV}$$

Note : TEV = Total economic value ; UV = Use value ;

NUV = Non-use value

**RESULT AND DISCUSSION**

The area of North Lawu BKPH of Surakarta Perhutani KPH including the entire government's forest area which administratively located at Karanganyar regency with 6,038.5 hectare of width and lies on the western part of Mt. Lawu. North Lawu BKPH conducts management activities of forest as an ecosystem which is suitable with the area's characteristic to obtain optimal benefits from the aspects of ecology, social and economy; for company and society; consistent with national and regional objectives.

**1. The value of Protected forest environment service**

**Table 1 : Service value of protected forest environment at western Mt. Lawu**

No.	Description	Potential width (m <sup>3</sup> / ha)	Price (Rp/ m <sup>3</sup> )	Area (Ha)	Economic value (Rp)
1	Woods: Pulp/ log				<b>6,535,343,053,327</b>
	a. Pine	1,370/21.5	850	6,039	3,287,331,314,000
	b. Mahogany	3,920/6	800	6,039	3,156,122,664,000
	c. Rosewood	18,310/4,6	3,823	6,039	91,889,075,327
2	Pine sap	54.581	75	6,084	<b>4,093,575,000</b>
3	Firewood				
	a. Market price method		2	6,039	347,817,600
	b. Productivity of collecting firewood method	62.571	2	200	25,028,576,000
	c. Workers fee for day-workreplacement method				204,768,000,000
4	Flora and Fauna				<b>149,000,964,700</b>
	a. Aromatic lemongrass	1.667	4	22,350	149,000,964,700

	b. Clove		0	
5	Cost of land and forest damage management			<b>3,124,665,000</b>
	a. Forest fire	150	905,775,000	
	b. Strong wind		2,218,890,000	
6	Water economic value			<b>342,189,537,275</b>
	Irrigation water economic value		233,766,000,000	
	Drinking water economic value for daily needs		108,423,537,275	
	<b>Direct value /DUV ( 1 )</b>			<b>6,539,436,628,327</b>
	<b>Indirect value /IUV.(4+6)</b>			<b>491,190,501,975</b>
	<b>TUV value /Environment service value = (DUV + IUV)</b>			<b>7,030,627,130,302</b>

Potential and value of protected forest could be obtained from the forest products value, such as: the value of woods/ pulp, firewood, the value of water (drinking water and irrigation water), the value of flora and fauna, the value of culture and social. The result of economic value of protected forest environment at Mt. Lawu could be observed in the table below

The table shows that the total value of protected forest environment service at Mt. Lawu is Rp. **7,030,627,130,302 (seven trillion, thirty billion, six hundreds and twenty seven million, one hundred and thirty thousands three hundreds two rupiah)**

## 2. Social Function

By utilizing forest for one of the tourism objects, forest is capable to increase the income for families surrounding the forest area (by opening restaurants, groceries shops and making various kinds of souvenirs).

The Lawu peak's forest tourist attraction at RPH Tlogodringo area in North Lawu BKPH forest is part of the area which is utilized for forest recreational sites. It is located in Gondosuli village, Tawangmangu district. Another sites are Priggodani forest tourist attraction at RPH Blumbang in Blumbang village, Tawangmangu district; Sekipan forest tourist attraction and Grojogan Sewu waterfall in Kalisoro village, Tawangmangu district; Mt. Bromo forest tourist attraction in Delingan village, Karanganyar district.

LMDH Dono Lestari is one of the area near forest area at RPH Tlogodringo, which is utilized for well known tourist destination called Lawu peak. Meanwhile, area at LMDH Sendang Mulya which is located at RPH Banjarsari has extreme landscape

topography, thus the residents utilize the area for motocross circuit arena. In addition, Gua Maria (Maria Cave) is also located at RPH Banjarsari. The cave is utilized for one of the religious tourism object, for visitors' religious activity purpose.

Meanwhile, a popular campground is located at LMDH SegoroGunung in RPH Nglerak. The campground's entry fees will be input to LMDH SegoroGunung regional treasury. It will be spent for social interests, related with LMDH members.

### **3. Culture preservation value**

Mt. Lawu is one of the sacred mountain in Indonesia. According to a folk developed from the society's myth, it is believed that Mt. Lawu was a place for escaping and hermitage for King Brawijaya V from Majapahit Kingdom. He was the last dynasty of Majapahit.

In addition, if someone is willing to climb Mt. Lawu, it is prohibited to disturb brown feathered starling he probably met in the forest. Residents believe that the starling is an incarnation of King Brawijaya's loyal man or is called KyaiJalak (Clerics Jalak), who protects and guards Mt. Lawu forest area. The bird is able to guard people to get the way out of the forest. Meanwhile, if someone disturbs the bird, it is believed that he will get bad luck. According to the myth, it is concluded that forest area at Mt. Lawu may be declared sacral. Thus, people is prohibited to damage the ecosystem in the forest area. Residents surrounding the forest at Mt. Lawu. Residents surrounding the mountain is permitted to utilize the forest products without damaging the forest environment. Thus, the forest ecosystem sustainability may be maintained well

## **CONCLUSION**

1. Activities of farmers living near the forest are accommodated in LMDH (Forest Village Residents Agency), including farmers of vegetables plant and breeders who have around 0.33 ha of cultivated land. They also help Perhutani in reforestation activity, protecting security of forest from forest fire and illegal logging.
2. The total value of protected forest environment service at North Lawt BKPH (western Mt. Lawu) with 6,038.5 ha width, is estimated at Rp. **7,030,627,130,302.-**. This means possible damage of protected forest and if protected forest at Mt. Lawu does not managed wisely, so that the total loss is at least **seven trillion, thirty billion, six hundreds and twenty seven million, one hundred and thirty thousands three hundreds two rupiah.**

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