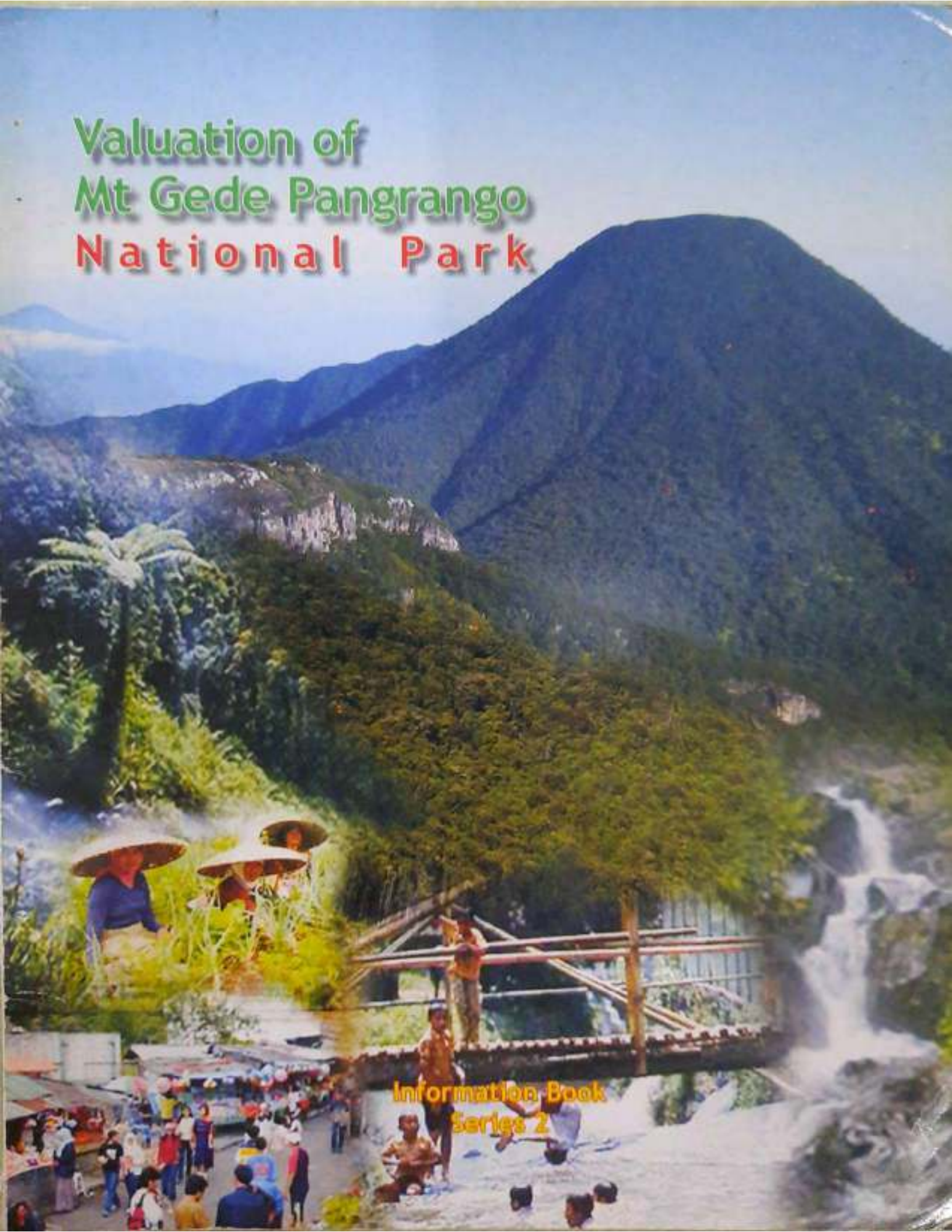
Valuation of Mt Gede Pangrango National Park



Information Book
Series 2

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Mt Gede Pangrango National Park

VALUATION
OF MT GEDE PANGRANGO NATIONAL PARK

Wiratno
Virza S Sasmitawidjaja
Harry Kushardanto
Saut M. Lubis

BALAI TAMAN NASIONAL GUNUNG GEDE PANGRANGO
DG FOREST PROTECTION AND NATURE CONSERVATION
DEPARTMENT OF FORESTY

VALUATION
OF MT GEDE PANGRANGO NATIONAL PARK

Author :
Wiratno
Virza S Sasmitawidjaja
Harry Kushardanto
Saut M. Lubis

Design and Lay-out:
Rini Rismayani

Fotografi :
Kenji Niwa
Rini Rismayani

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FOREWORD

Mt. Gede Pangrango National Park is one of the five oldest parks in Indonesia. This park was also declared as Biosphere Reserve by UNESCO in 1977 before its declaration as national park in 1980 in which investment has been started afterward. It covers the area of about 15,000 hectares of pristine mountain forest. In 2003, this park was expanded to include protection forest nearby and now the total area is about 21,000 hectares. Tracing back to the history, there are hundreds researches have been conducted and the classic reference book of "Flora of Java" was based upon the results of flora exploration in this park. Beside bio diversity values, the park located in the mountainous forest area and so the hydrology and watershed protection are another pivotal functions. Not less than 54 villages out of 149 villages in 3 districts of Bogor, Sukabumi, and Cianjur depend their continuous supply of water for daily needs and for agriculture on this park. This is the prove that park has very important direct benefits to communities living around it, outdoor tourism attraction around Puncak Area, to Cibodas Botanical Garden, environmental education for youth, fresh air, and healthy environment. At the same time, it contributes to more long-term indirect benefits such as for pure research, protection for soil fertility, flood prevention, water balance, and so forth.

From this point of view, the effort to study the ecosystem value of this park in 1998-1999 should be acknowledged. This

kind of study clearly shows that the benefits of park go beyond its boundaries. Thus, parks should be considered in the broader land use policy and sustainable development strategy of local and central governments. This issue has been launched in the Fifth World Park Congress in Durban, in 2003 and World Conservation Congress held in Bangkok in 2004: Benefits Beyond Boundaries.

Finally, I would like to express my deep gratitude to the authors who have shown the interesting results of their study, particularly in relation to improvement of decision making process of any land use planning. I would also appreciate the initiative of Park Manager to publish this study. The studies of park valuation also have been conducted in Kerinci Seblat NP, Manupeu - Tanah Daru NP, Lore Lindu NP and Sembilang NP. I do recommend that similar study should be conducted in other parks in Indonesia.

Jakarta, December 2004

Koes Saparjadi
Director General of Forest Protection and Nature Conservation
Ministry of Forestry.

PARK FOR ALL

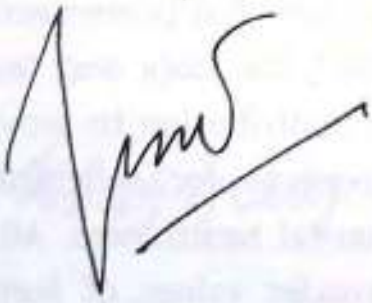
As one of the oldest park in Indonesia, Mt.Gede Pangrango NP is designid to be an example of how park can provide meaningful contribution both direct and indirect benefits. Back to 200 years ago, this 21,000 hectares of virgin mountainous tropical rainforest has became the important research center, particularly as an open laboratory of flora exploration. Until now, there are recorded 4,000 research works have been conducted in this park. Question can always be raised concerning the relevancy of research work in the park to park management.

Considering the autonomy era, research focused on the valuation is one of the priority. Based on this research, we can understand more about the value of park. As exposed in the study conducted by Wiratno, Virza S. Sasmitawidjaja, Harry Kushardanto, and Saut M. Lubis in 1998-1999. Park is in fact not an idle land. Benefits accrued from the park has proven across its boundary. Park is not only important for flora and fauna habitat conservation. Park give direct contribution to provide water for daily consumption, water regime for agriculture, watershed management and environmental healthiness. All of that benefits have contributed to broader values of human welfare and increasing quality of life.

The publication of this valuation study is intended to raise awareness to broader communities at various levels and interests: value of park goes beyond its boundaries. Administrative boundary can finally be irrelevant anymore. Ecosystem or watershed boundary will then be very important to be considered in the spatial land use planning. Again, in this context, Mt.Gede Pangrango NP will play as key role as shown in this study.

I would like to express my thank to the authors that has dedicated their professional and gives direct contribution to the conservation work through their interesting study. I do call for other studies or researches to be conducted in Mt.Gede Pangrango NP. Collaboration in research will still be one of our strategic agenda.

Cibodas, December 2004



Novianto Bambang W.
Park Manager

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INTRODUCTION

The structure of an ecosystem includes the species contained therein, their mass, their arrangement, and other relevant information. This is the ecosystem's standing stock nature's free goods. The functions of an ecosystem, on the other hand, are characterized by the ways in which the components of the system interact. They provide nature's services, maintaining clean air, pure water, a green earth, and a balance of creatures, enabling humans to obtain food, fiber, energy and other material needs for survival. Evaluating the contribution of ecosystem functioning to human welfare is a complex task, involving human social values and political factors. One of the key tools of economic analysis is the valuation of the costs and benefits of natural systems and human impacts on them.

In order for citizens to communicate to decision-makers their true desires about the maintenance of the natural environment and the pace of development, it is essential to have a clear idea of the benefits they obtain from nature in its undeveloped state in other words, the value of natural areas. The value of a natural or protected area depends greatly on the management regime applied to that area. In other words, value is influenced not only by biological and economic factors, but also by the institutions that are established to manage the resources contained in the protected area.

Protected areas are costly to establish and operate. However, it is less costly to protect their ecological integrity and manage the array of goods and services that they provide to the surrounding region, than it is to replace them once their biodiversity, watershed and other environmental values have been lost. Economists can help to quantify compensation when environmental damage is an inevitable side effect of development. Economics also helps to quantify alternative uses of protected areas, for example, through assessing the net alternative values of opportunities forgone. Economics also could help to identify the kinds of incentives that will encourage the maintenance of protected areas by society, whilst motivating private landowners to engage in conservation measures on their own land.

Protected areas represent "public" or collective goods, distinguishable from the private goods of market economics. For public goods, markets often do not reflect true economic values and the 'invisible hand' has to be supplemented by a social contract involving regulations. Such public goods need to be

Picture 1
Mt Pangrango cone behind
Mt Gede's cliff.

regulated through government interventions, because of the likelihood of market failure where market values do not reflect true social values.

Protected areas also serve a valuable 'insurance function.' Uncertainty is a crucial part of all environmental decision-making. For example, it is highly uncertain what the priorities of future generations might be. In the extreme case, it may be that conserving too many resources now and restraining investment in technology might make future generations worse off, even if they do have a larger endowment of biological resources. On the other hand, when budgets are tight, it is relatively easy to cut parts of the budget designed to benefit future generations, since they do not have an effective voice in decision-making.

Of course, economics has its limits. It is difficult to assign economic values to species preservation because of the factors of irreversibility accompanying species extinction, difficulties in measure the preferences of future generations, the problem of present costs and future benefits, and the distinction between commodity value and moral value. It is often necessary to contrast what is financially beneficial to private individuals against what is broadly beneficial to society as a whole.

Mt. Gede-Pangrango National Park NP land use is an economic issue, as each land use decision for this natural park will have economic costs and benefits. For example, if Mt. Gede-Pangrango NP forests are converted to other uses such as agriculture, important functions and resources are lost, such as watershed function and biodiversity. Conserving the forest area has its own costs such as the cost of establishing and managing the area as well as revenue foregone from not engaging in timber extraction.

A problem in trying to measure the economic value of Mt. Gede-Pangrango NP area is that many products of national parks have no market price, especially subsistence or underdeveloped non-timber products and the indirect use, option and existence values of forests. Thus many important values are generally ignored in conventional analysis and land use decisions. However, many environmental goods and services provided by Mt. Gede-Pangrango NP are highly significant. If these values are not accounted for in the assessment process, it is possible that the choice of its land use will wrongly favor uses with marketed outputs. Barbier (1991) notes that choice of land use is often biased in favor of land uses that have marketed outputs, e.g. ranching, timber exploitation, agriculture, monoculture estate, mining, hydroelectricity. This could mean too much conversion and over-exploitation of forest and too little preservation, conservation or management of natural areas.

If comprehensive valuation is not possible, partial valuation is still valuable in order to capture the order of magnitude of benefits that can be accrued from park areas and management. In the partial valuation, analysis is directed to the significant benefits and leaves the minor ones. In the case of Mt. Gede-Pangrango NP, tourism, water production, sediment control and timber are considered as the significant benefits, which should be valued.

If optimal choices are to be made, information on the economic value of environmental goods and services of Mt. Gede-Pangrango NP is important for decision-makers and resource users. By doing economic valuation in Mt. Gede-Pangrango NP, it is hoped that many lessons can be learned. The most important thing is that such valuation may contribute to improving the quality of decision-making among relevant

easier to comprehend. The information about this protection function is also important for those who live in downstream areas.

Economic valuation is one important tool, which can be used by decision-makers to improve the quality of policies as a result of applying quantitative analysis of land use options (conservation vs. exploitation). It is realized that such valuation is still in the early period. There is still a long way to go to make this sort of interdisciplinary, economic study of costs and benefits a regular part of NRM decision making. This study is a small effort to bridge the gap of demand in resource valuation.

The study is not based on primary data, but it is derived from a set of past studies conducted by various scholars based on field data collection. Several adjustments then have been taken to make the relevant data consistent between different sources to be used and presented into one report.

Objectives Of The Study

A central theme of environmental economics, crucial for sustainable development, is the need to place proper values on environmental goods and services. Information on the economic value of environmental goods and services is important for people who make decisions that affect the environment.

Decisions about how to use Mt. Gede-Pangrango NP lands and its surrounding area are economic issues. Every choice or land use options for the national park and its surroundings - to preserve it from all human uses, or to exploit it for timber or to manage it as a tourism attraction - has implications in terms of

economic values gained and lost. While the benefits of development options are easily identifiable, as they often comprise marketable outputs, many values of the natural areas have no market, and thus are generally ignored in land use decisions. For example, the market value of forest/park land converted to agriculture often fails to reflect environmental benefits such as protection of Ciliwung Watershed, which could be highly significant.

The task of this study is then to account for the main marketed and non-marketed environmental goods and services of Mt. Gede-Pangrango NP and to present these values in the context of regional management and development objectives. More specifically we aim:

- To measure the recreational values of the Mt. Gede-Pangrango NP as tourism site
- To study the importance of the Mt. Gede-Pangrango NP as a Biosphere Reserve, its buffer zone and its transition zone, to Ciliwung watershed regulation, such as its water characteristics and sediment control
- To estimate the economic values (opportunity cost) of the standing stock of timber in the Mt. Gede-Pangrango NP and Production Forest of *Perum Perhutani* as a buffer zone
- To compare the benefits and costs of the park from several different perspectives
- To give inputs to decision-making processes through the values obtained for better management of the park.

CHARACTERISTIC OF Mt GEDE PANGRANGO NP

Mt. Gede-Pangrango NP is one of the five oldest national parks in Indonesia, established in 1980. There is representation of sub-montane, ontane, and sub-alpine forests situated between an altitude of 1,000 and 3,019 m. The park is dominated by two volcanoes: Mount Gede and Mount Pangrango, the latter of which is extinct. Briefly, the main ecosystems of the park can be seen in Table 1 below.

Table 1. The Main Ecosystems of Gede-Pangrango National Park

Environment	Vegetation	Physical Conditions
Sub-Montane Forest	- Five layers of vegetation including giant trees, called emergent - Species rich	- Warm and humid - Deep rich well weathered soils
Montane Forest	- Medium size trees all about the same height - Medium size leaves - Plant growth slow	- Cool and cloudy
Sub-Alpine Forest	- Two layers : trees and forest floor - Leaves small - Plant growth very slow	- Cool and cloudy
Sub Alpine Grassland and Craters	- Dwarf form of trees - Heather family dominant	- Harsh conditions

Picture 2.
Suryakancana Meadow are growth eternally flower Edelweis

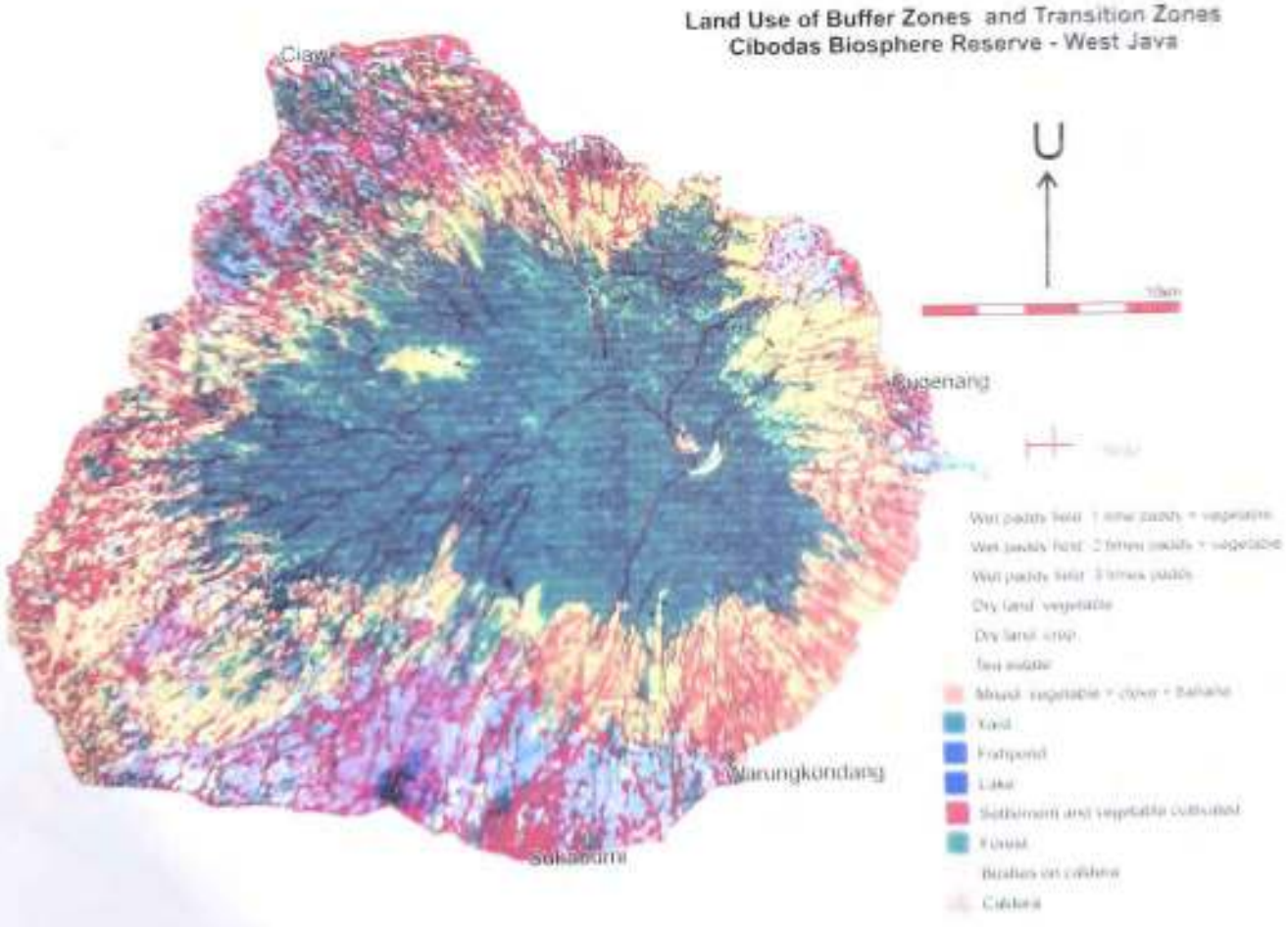
This magnificent forest reserve of more than 15,000 hectares extends from the Cibodas gardens to the crater of Mount Gede, 2,962 m, and the summit of Mount Pangrango, 3,091 m. Between Mount Gede and Mount Pangrango is the *Alun-alun* Suryakencana, a valley full of a species of edelweiss, which flowers in July-August. It lies within the administrative districts of Bogor, Cianjur and Sukabumi.

The Park provides a range of values to society: historical, biological, hydrological and tourism. Formerly, this area comprised Cimungkat, the first nature reserve (1889), and Cibodas botanical garden, which were explored by Raffles since 1811. The book entitled "Flora of Java" (1823-1824) was based on the study conducted in this park.

This area is also the habitat of 245 species of Java birds and many species of fauna such as *Panthera tigris sondaica, Bos javanicus, Hylobates moloch*, etc. From the point of view of

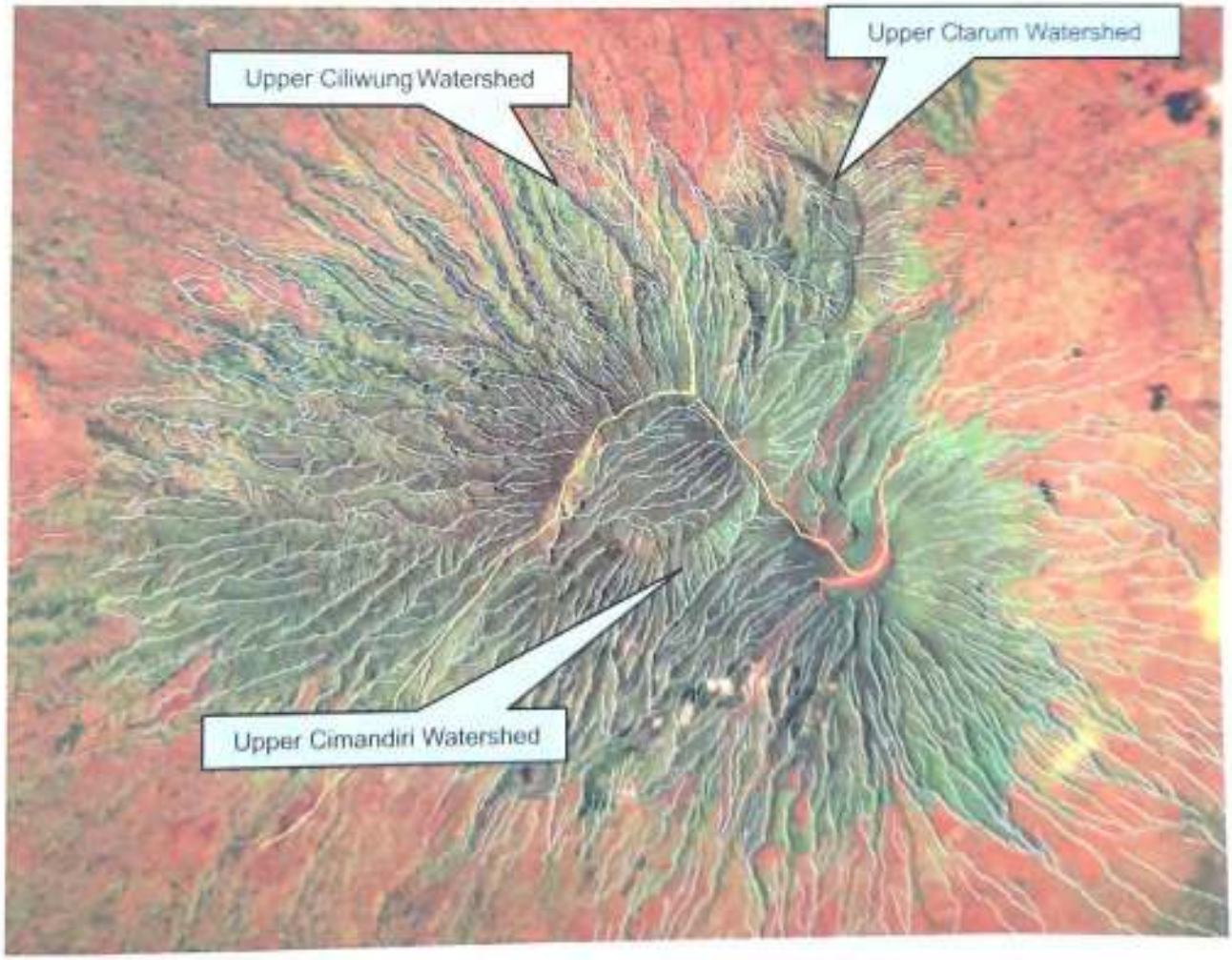
biodiversity, Mt. Gede-Pangrango NP is highly significant. In 1977, UNESCO declared it as a biosphere reserve. As a biosphere reserve, it consists of the core zone (GPNP), buffer zone (production forest of *Perum Perhutani*), and transition zone (tea estate and agricultural land). See Map 1.

Protecting this small patch of forest is very important due to the fact that all types of natural forest in Java have been deforested at a rapid rate over the years (AJ.Whitten in Suhirman, 1994). In Java, this condition causes erosion, sedimentation, and an increase in critical land in all watersheds (Hardjowitjitro, 1981).



Map 1. Land use of Cibodas Biosphere Reserve (Danudoro, 1993)

However, the value of the park is not only from its biodiversity richness. It also serves an important function in the hydrological support system to various stakeholders in down-stream areas. Two large rivers - Ciliwung and Cisadane - running through West Java originate from this park, as well as three main watersheds of Citarum (Cianjur District), and Ciliwung (Bogor District) which flow into the Java Sea, and Cimandiri that flows to Sukabumi District and Indonesian Sea. See drainage pattern and the terrain condition in Map 2.



Map 2. Drainage Pattern of Upper Citarum Watershed, Upper Ciliwung Watershed and Upper Camandiri Watershed (Santosa, 2004)

The multiple functions of the park need consideration to realize how valuable the preservation and conservation of Gede-Pangrango as a forest is for the preservation of human well being. For example, the many-layered canopies of the forest and its rich ground cover are emphasized. The removal of a forest cover would cause disruption in nutrient cycling and in forest hydrology, which in turn would destroy or slow down the ability of some natural resources to regenerate. The change in rainfall interception would alter the amount of run-off and lead to problems of leaching and soil erosion. The increased sediment in the rivers would disrupt aquatic ecosystems and degrade their usefulness and value to downstream users.

The easy accessibility of the park makes it a popular recreation area. However, its location within West Java makes it all the more susceptible to the pressures of the ever-increasing populations surrounding it. With the three large cities of Jakarta, Bandung and Bogor located not more than 80 km from it, the biosphere reserve is one of Indonesia's popular resorts for family picnics and camping. Greater efforts are required to prevent local populations and visitor pressures from becoming a threat to ecosystem conservation.

Picture 3
Parks headquarter office in Cibodas about 130 km from Bandung

Buffer Zone
(Production forest areas)

The buffer zone of Mt. Gede-Pangrango NP consists of three State Forest Corporations, i.e., Bogor Forest District (76,000 ha), Sukabumi forest district (107,660 ha), and Cianjur forest district (90,500 ha). The main species in the production forest of Bogor and Cianjur Forest Districts is *Pinus merkusii*, or pine, whereas in Sukabumi Forest District it is *Agathis loranthifolia*, or *damar*. Besides those, Tea Estates around the three State Forest Corporations can also be classified as a buffer area (see Map 1).

Production forest areas surrounding Mt. Gede-Pangrango NP are managed by three Forest Districts of Bogor, Sukabumi, and Cianjur. In relation to Ciliwung watershed, production forest area in Bogor Forest District is substantial. In this forest district, there are about 76,000 hectares of forest area which consists of protection forest (36,000 hectares or 48%), production forest of pine species (23,000 hectares or 23%), dipterocarp species or *meranti merah* (14,000 hectares or 18%), and many other species (3,000 hectares or 4%).

Picture 4.
Gedeh Tea Estate, one's of Buffer zone of Mtm Gede Pangrango NP

Transition Zone (Agricultural land areas)

The transition zone is the agriculture land. The land use practices are depended on the altitude. From 0-900 m above sea level, paddy, maize, cassava, and soybean are the common crops planted by farmers. In this altitude, mixed gardens are another land use type, which produces various timbers such as *Periserianthes falcataria* (*sengon*) and *Maeopsis spp*. From 900-1,500 m above sea level, vegetable-based farming is common. The land use types in transition zone can be seen in Map 1.

Based on the work conducted by Danudoro (1993), the acreage of the estate surrounding Mt. Gede-Pangrango NP is approximately 5,416 hectares. Meanwhile, the acreage of agricultural land (paddy field, dryland, mixed-garden, and homestead garden) is about 29,673 hectares. The area of paddy field that depends on fresh water from Mt. Gede-Pangrango NP is about 10,998 hectares or 37% of the agricultural land in the transition zone. Lunung, et al., (1995) stated that in the transition zone, there are 149 villages with a total population in 1992 of 920,065 people, or about 184,000 households, assuming an average household size of five persons.

Picture 5. Paddy fields depend on fresh water from Mt Gede Pangrango

Ciliwung Watershed

Ciliwung watershed is classified as one of the highly prioritized watershed to be managed properly (*SBRKLT Ciujung-Ciliwung*, 1997). The strategic value of this watershed is due to its function to protect all national assets in the downstream area, which covers the area of Bogor, and particularly Jakarta. Covering an area of about 28,639 hectares, this watershed is divided into three sub watersheds, namely: Upper Ciliwung (14,876 hectares), Middle Ciliwung (13,763 hectares), and Lower Ciliwung (8,200 hectares). The source of Ciliwung River is located around Mt. Mandalawangi, Telaga Village, Cisarua Sub-District, in the northern part of the Mt. Gede-Pangrango NP.

The Upper Ciliwung watershed comprises 1) Ciesek Sub-watershed (Cinangka, Cirangrang, Ciguntur, Ciesek and Cipaseban rivers); 2) Cibogo/Cisarua Sub-watershed (Citeko, Cisarua, Cijulang, and Cibogo rivers); 3) Upper Ciliwung Sub-watershed (Cilember, Cimandala, Cimegamendung, Cikoneng, Cicambana, Citameang, Cisampay and Ciliwung rivers); 4) Ciseuseupan/ Cisukabiru Sub-watershed (Cigadog, Cijambe, Ciseuseupan, and Cisukabiru rivers).

Picture 6. About two hundred stream water come from the park

SCOPE OF STUDY

The focus of this study is prioritized to Mt. Gede-Pangrango NP and the Upper Ciliwung watershed. However, analysis may be directed to the whole picture of Ciliwung watershed. This should be done in order to make comparison possible in many aspects of proposed and existing situations of environmental conservation and management scenarios.

Valuation of Natural Resources

As economic valuation of natural resources is the main objective of this study, several marketed and non-marketed commodities are assessed in order to derive the economic value of environmental goods associated with the national park. To value the natural resources, in fact, is easier said than done, however several approaches have been recognised to obtain the economic value of Mt. Gede-Pangrango NP.

From the economic point of view, values can be associated equally with the consumption of goods and services purchased in markets and with other services from environmental amenities for which no payments are made. Nevertheless, these non-marketed services have value as long as people are willing to give up some thing (money, time, resources) to obtain them.

Land Use

The land use of Mt. Gede-Pangrango is included in the spatial plan of Puncak region (Bogor-Puncak-Cianjur). The spatial plan is based on the function of Puncak region as a water catchment area. The municipality and relevant departments have issued some decrees and directives in order to regulate and manage the development of Puncak region.

Land Use Planning

The "Pattern of Land Rehabilitation and Soil Conservation" document (Pola RKLT Ciliwung-Cisadane 1986) gives direction that Upstream Ciliwung has to be managed properly on the basis of three main consecutive objectives. Those are improving erosion control, increasing the capability of the soil in water absorption, and controlling sedimentation.

Spatial planning and proposed management in Upstream Ciliwung watershed has been started since 1963. The chronologies are as follow:

- Government decree No.13, 1963 concerning development activities along the road from Jakarta-Bogor-Puncak-Cianjur.
- Presidential decree No.48, 1983 concerning special control in spatial utilization and development activities in Puncak areas in 11 Sub-Districts in Bogor, 2 Sub-District in Cianjur, and 1 Sub-District in Tangerang.

- Presidential decree No.79, 1985 concerning spatial plan in Bopunjur (Bogor-Puncak-Cianjur). According to this decree, the area was divided into three main functions:
  1. Protection areas in Sub-districts of Citeureup, Cisarua, Cugenang, Ciawi, and Pacet;
  2. Buffer areas in Sub-districts of Ciawi, Cisarua, Pacet, Cugenang, and Citeureup;
  3. Agricultural and development areas in Sub-districts of Gunung Sindur, Ciputat, Sawangan, Parung, Semplak, Cibinong, Cimanggis, Gunung Putri, Citeureup, Pacet, Cisarua, and Kedung Halang.

- Provincial Decree No.3, 1988 concerning detailed spatial planning for Puncak areas in Bogor District. This decree regulates spatial allocation in protection areas, river bank and water spring areas, buffer areas, agricultural and non-agricultural areas.

- Decree of Minister of Home Affairs No. 22, 1989 concerning regulation to conduct control of development in Puncak areas.

- Governor decree No. 413.21/SK 222-HUK/1991 concerning regulation for criteria of location, technical standards for spatial arrangement, and building requirements in Puncak area.

- Governor decree No.640/182/Bappeda/1995 concerning the decision to stop issuance of new location permit for villa construction in Sub-districts of Ciawi, Cisarua, and Megamendung di Bogor district, except in villages of Kopo, Leuwimalang, Cisarua and Citeko (Sub-district Cisarua), Sukamaju, Sukaresmi, Sukamahi (Sub-district Megamendung).

- Letter of decision from Head of Bappenas No.016/KET/4/1996 concerning establishment of working group for Bopunjur Spatial Management.

Existing Land Use

Geologically, Upper Ciliwung is dominated by volcanic formations. The soil is dominated by latosol with the effective soil depth of more than 90 cm that is quite resistant to erosion. This area is surrounded by a group of mountains such as Mt. Salak, Mt. Gede-Pangrango, Mt. Mandalawangi, Mt. Megamendung, Mt. Telaga, Mt. Limo, Mt. Luhur, Mt. Kencong, Mt. Kendeng, Mt. Malang, and Mt. Geulis. The terrain condition is dominated by 40 percent slope, at the highest altitude of 2,908 meters above sea level.

Existing land use in t he Upper Ciliwung is as follows:

- forest areas = 4,274 hectares (28.7%)
- agricultural land = 9,503 hectares (63.9%)
- settlement areas = 1,099 hectares (7.4%)

The forest areas can be divided into two groups. Forest area under production forest which is managed by Perum Perhutani of Bogor Forest District or KPH Bogor, and natural forest areas under management of Mt. Gede-Pangrango NP.

Picture 7.
Production Forest in Bogor

Agricultural land consists of tea-estate and clove-estate (2,407 hectares or 16.2% of total), mixed garden (1,775 hectares or 11.9%), dryland (1,543 hectares or 10.4%), and irrigated paddy fields (3,777 hectares or 25.4%). Vegetable-based farming is mainly dryland cultivation.

Danudoro (1993) has analyzed remote sensing images (TM Image 1991) in surrounding areas of Mt. Gede-Pangrango NP. He reveals that among the 144 villages around the Mt. Gede-Pangrango NP and the Buffer Zones, 51 villages are located very close to the park. There are 23 out of 51 villages in which the vegetable-based farming system dominates with more that 30% of total land use.

To support the agriculture activities in that area, six dams were constructed in the Upper Ciliwung watershed. These dams supply water to six blocks of paddy field covering a total area of about 3,500 hectares.

Socio-Economic Aspects

According to the censuses of 1980, 1990, and village data of 1992, the total population of villages located in Mt. Gede Pangrango region shows an annual growth of, on average, 2.01% per year. Luning, et.al. (1995) indicates that population growth in villages around Mt. Gede Pangrango NP is 2% or less over the period 1980-1982. Typically, the villages close to the buffer or core zones show a low population growth rate, for example Babakan Panjang, Cihanyawar, Pawenang and Seuseupan have an annual growth of around 1 percent.

The population growth rate is generally higher in the more urbanized villages such as Nagrak, Caringin Kulon, Cisande, and Gekbrong.The three highest ones (4 - 5% per annum) are found in Pacet sub-district (Ciherang, Ciloto, Cimacan, Cipanas, Cipendawa, Ciputri, Sindanglaya, and Sukatani).

Due to the mountainous character of the area, in which 9 mountains with the elevation of more than 2,000 m above sea level exist, Mt. Gede-Pangrango NP forms a good water catchment area, from which emerge three large rivers and many streams. Also, it is reported that area generates subsurface run-off. This hydrological system altogether provides vital water resources for the districts directly surrounding the area (Bogor, Cianjur, and Sukabumi) and even for the country's capital, Jakarta.

In the case of Ciliwung watershed, it is known that at the upper Ciliwung watershed the significant social aspects in relation to land use change is land tenure. Suyana (1989) reports that even though settlement at upper Ciliwung is still 2% of total land use, the rate of land conversion (from agriculture

Picture 8
Gunung Putris local people whose back from their daily farming activity

to settlement) is about 5.8% per year. At middle Ciliwung, the settlement has changed 20% of the previously agricultural land, to the point that there is no forest cover anymore.

There are many other sectors implied in economic development and found in the region, but over the last two decades the economic development has been truly towards a rural based economy. Luning et.al. (1995) shows that of the value added per hectare, two-thirds was produced in the farm and the rest added in processing and trading. Agriculture (in broad sense, incorporating horticulture, livestock, trees and other biomass, fish, etc.) can provide many consumer products and absorb labor. In 1994, it was reported that up to 75% of the population surrounding the park still depended on agriculture and agro-industry sectors as the source of their livelihood. About 40% of them are landless farmers. They work as laborers in the agricultural sector. Recently, total farmland has been decreasing because of conversion to other purposes. Demand for a great variety of vegetables, mushrooms, (cut) flowers, etc. have led to a higher demand for labor. Timber production, as well, has played an important role in generating income and

Picture 11. Cibodas is visited a lot of people moreover on the vacation and weekend

creating jobs. Another boost in employment and income generation lies in processing and marketing.

The natural heritage of the area provides many advantages to the people, especially to the local people. The area is strategically located in populous districts (three-angle regions: Bogor, Cianjur and Sukabumi) and in between two big cities, namely Jakarta and Bandung. Mt. Gede-Pangrango NP is very attractive to people. In terms of recreational use, this area contributes to the regional economic development by attracting tourist in the region. In the year of 1991/1992, 76,565 visitors were recorded at the park. Of these, 98% were domestic visitors and 2% were foreign visitors. Thus, in fact tourism has become more important than agriculture as the settlements that have become urbanized.

This economic development has magnified the income of the local community and motivated people to change their livelihood from agriculture-based economic activities to tourism -based economic activities. Subsistence agriculture has been changed into commercial activities related to tourism such as hotel and restaurant, recreation parks, gifts and souvenirs, etc.

Mt. Gede-Pangrango NP also plays an important role as a biodiversity reserve, an area of fine natural features or landscape reserve, and an area of scientific or educational use. It is reported that about 900 native and 30 exotic plant species, 245 bird species, 4 primate species, 2 wild boar species, 1 big predator (*Panthera pardus*) and other mammals are found in the area. The primary natural features found in the area consist of waterfalls (20 sites), lakes (2 sites), caves (3 sites), volcanic craters (3 sites), and high flat open spaces in between of two mountains (2 sites). However, for some reasons, not all of these sites are open for public use.

Water Characteristic

The characteristic of water to be observed in this study will be more on the physical characteristic rather than water quality. The annual flow, for instance, will indicate the change of Ciliwung watershed and land use in the river basin.

The length of Ciliwung watershed is 117 kilometers with the average slope of about 24,8% (+2,908 m in Upper Ciliwung and +8 m in Lower Ciliwung at Manggarai). Ciliwung watershed is divided into three main sub-watersheds e.g. Upper Ciliwung (146 km^2), Middle Ciliwung (94 km^2), and Lower Ciliwung (82 km^2). Monitoring of water resources in these three sub-watersheds is done in Katulampa (Bogor), Ratujaya (Depok), and Rawajati (Kalibata) respectively.

Picture 12. Local people use river for all their water needed

The water characteristics in Ciliwung watershed can be predicted from certain parameters, for instance the gap between maximum and minimum flow. This is a measure of the stability and resilience of the flow through the system. According to the research conducted by Munaf (1992), the maximum daily flow in Ciliwung watershed within several ten year periods tended to increase. In 1961-1970 the maximum flow was 56 m^3 per second. In 1971-1980 it increased to 93 m^3 per second and it reached 103 m^3 per second in 1981-1990. This indicates that the Ciliwung watershed is becoming worse particularly with respect to instability of the stream. Ciliwung watershed is classified as a perennial stream. This means that water always flows throughout the year.

A management evaluation conducted by DG RRL (Ministry of Forestry) in 1997 concluded that the gap between maximum and minimum flow in upper and lower Ciliwung in the period of 1986-1995) was still under the allowable limit according to the "Sutami criterion" (below 30). Meanwhile, in the middle Ciliwung, this gap was beyond 30. This means that the function of water regulation in the middle Ciliwung was getting worse. The high rate of land use change from agriculture to settlement, industry-based economic activities, and population pressure might be the main causes of this problem.

River Water Monitoring Station measurement conducted by *Sub Balai RLKT Ciujung-Ciliwung* in the period of 1993/1994 up to 1996/1997 in the Upper Ciliwung indicates an interesting phenomenon. The annual erosion rate per hectare is 249.25 ton, 91 ton, 27.25 ton, and 34 ton respectively. Consequently, within four years, the erosion rate decreased considerably. By using standards from Ministry of Forestry (DG. Reforestation and Land Rehabilitation, No.041/Kpts/V/1998) those conditions are

classified as middle to low. Thus, the hydrological condition in the Upper Ciliwung can be classified as relatively good.

LIMITATIONS

Analyzing samples of water from upstream to downstream along the Ciliwung River would be very important to predict the degradation of the environment and to measure the role of forest cover and agricultural land conservation-based activities in mitigating these problems. This activity will not be covered in this study. Fortunately, there are enough studies of the Ciliwung watershed and Mt. Gede-Pangrango NP that a secondary data approach could be adopted in this study. Most secondary data and reports are collected from the *Sub Balai RKLT* Ciujung-Ciliwung, DG.PKA, and Bogor Institute of Agriculture (IPB). However, there are several reports obtained form other sources such as Bandung Institute of Technology (ITB) and EEPSEA Research Report series.

FINDINGS

In this study, we attempted to illustrate the benefits and costs of various economic activities or goods for a representative year (1999) and the value of the benefit stream over 25 years, discounted to the present. Analyses of the financial performance of tourism, water regulation and sediment control are described in sections A, B and C respectively, while the economic value of timber (opportunity cost) subject to alteration of the forest area in the park is described in section D. In general, we used secondary studies from various years and adjusted the results to a common base year (1999) to form a uniform base of data for comparison. Where forward estimates were needed, we assumed 10% growth in expenditures due to annual inflation and demand increase. Where discounting of future values was needed, we used a discount factor of 10%, reflecting a commonly used social discount factor, not a market rate of interest. While these assumptions may not be completely accurate for all economic activities in all years, they are uniform, reasonable, and useful for the comparative purposes of this study.

Economic Value of Tourism

Tourism, recreation development, and related businesses are recognised as attractive investments and means of economic support for communities (job creation and regional development). The tourism industry in Indonesia correspondingly has grown rapidly. As known, Mt. Gede-Pangrango NP is the most attractive place for the people from Jakarta, Bogor, Bandung and other surrounding cities. Traffic congestion every weekend illustrates it. Fresh air, beautiful scenery, cooler temperature, for instance, are the environmental goods sought by the visitors.

Method

In fact, it is difficult to assess the economic benefits of some tourism activities due to lack of information on their market value. Unfortunately, underestimation will lead to mismanagement, which finally would causenature degradation.

In discussing the economic benefit of tourism, one should analyze the visitor profile in the form of number of visitors, purpose of visit, place of origin, etc. On the basis of five years data collected by Mt. Gede-Pangrango staff, the visitor profile can be shown in Table 2. The willingness to pay to visit Mt. Gede-Pangrango NP is inferred from travel expenditures of those who visited it. Data on actual travel costs (including food costs, accommodation costs and any forgone income) were collected by a random survey and willingness to pay to visit the site was derived from these data and analyses developed by Susmianto (1995).

Table 2. Visitor Profile and Park's Income (1992-1996)

Activities	Visitor Profile (people)						%
	1992	1993	1994	1995	1996	Total	
Recreation	27,482	33,176	15,916	15,287	13,645	105,506	50.0
Hiking	9,297	15,633	16,605	34,449	23,443	99,457	47.0
Research	60	109	27	44	45	429	40.2
Education	40	696	1,642	1,124	321	3,823	2.8
Total	36,879	49,644	34,190	50,904	37,463	209,080	100.0
	Ticket fare (million Rp) *)						
	73.75	99.29	68.38	101.817	4.934	18.16	

Note: *) entrance fee based on Ministry of Forestry Decree No. 878/Kpts-11/1992 is Rp. 2,000

Susmianto (1995) has recognised recreational economic values and impacts around Mt. Gede-Pangrango NP. His study shows that the estimated total average trip-related spending varied from Rp 6,889 to Rp 21,812 per person per day (current exchange rate in early 1994 was US$ 1.0 - Rp 2,150). He reports that the total average trip-related spending divided into two categories that are resident category (visitors from Bogor, Cianjur and Sukabumi) and non-resident category (outside Bogor-Cianjur-Sukabumi). The study covers 28 detailed expenditures aggregated into 5 spending categories: transportation, lodging, food and beverage, outside market and miscellaneous. The fare-ticket itself has been covered in transportation.

Picture 13.
Cibeureum Waterfall has visited more than 1000 people per year

Existing information and assumptions used in assessing the economic value of tourism are as follows:

1. Recently the destinantion of tourism sites has been expanding as the tourism sector adjacent to the park has expanded. Sukabumi is an example. The development of Sukabumi district to attract people grows rapidly, such as Pelabuhan Ratu beach, agrotourism, etc. On the other hand, the development of tourism sites within the region has also been attracting people as the other tourist destination. Lido and Kota Bunga in Bogor and Cianjur area are examples. Based on this assumption of continued development, we assume the number of visitor will not decline over time. As an estimate of annual visitors we use the average number of visitors (in 1992 1996), and assume that visits would remain at 42,000 visitors per year. This is a conservative assumption, since some years had much higher visitor numbers and visits could just as well increase in the future.

2. Trip-related spending represents the total expenditures of visitors for the period of analysis. This amount reflects the basic needs of the visitor but not the willingness to pay of the visitor to preserve the tourism sites. This amount depicts per capita expenditure. As development occurs, increasing amenities, and price inflation continues, we assume 10% growth in expenditure per year. Extending these unit and per capita estimates to the common base year of 1999, per capita expenditure according to the trip-related spending above (Susmianto, 1995) would range from 10,086 to 31,935 Rp/person/day, or on average 21,011 Rp/person/day in 1999. This expenditure included the entrance fee to enter the Mt. Gede-Pangrango NP, albeit the entrance fee remains at 2,000 Rp/visitor/visitation. The entrance fee will be appraised every five years; however, it is difficult to determine the change of the entrance fee over the future 25 years.

3. We assume length of stay of the visitors on average is 2 days since the peak period of visiting Mt. Gede-Pangrango is on Saturday and Sunday, albeit there are indeed visitors that stay on others days (Monday Friday).

4. Current *Profit* was determined as a percentage of *Annual Revenue*. Susmianto (1995) has indicated that the profit was 50% of revenue in the tourism and commerce sectors.

5. For comparison purposes, it is also useful to know what was the cost of operating the park, relative to these benefits derived from tourism. During the mid-1990s, Wiratno (1998) reports that park management costs borne by the Ministry of Forestry/DG Forest Protection and Nature Conservation were about Rp. 1319 million per year. We assume that these expenditures would continue and represent the

primary operation and management costs associated with preserving the park. We make no judgment on whether these expenditures are sufficient to maintain, preserve and conserve the park in an optimal or sustainable manner.

Result

Tables 3 and 4 below show the detailed calculations to determine the economic benefits generated from the tourism sector.

These results show that the net value of economic activity associated with tourism in the area around Mt. Gede-Pangrango Park approaches a billion rupiah per year, with relatively conservative estimates. Actual revenues are much higher. Also, we have not calculated the value of the tourists' intangible enjoyment of the park (willingness to pay or to preserve). We have only calculated what they normally spend on visiting the park. Clearly, the value of their enjoyment must be larger than what they spend on visiting the park.

Tables 3. Tourism Data

Variable	Data	Units
Number of visitor, in average	42,000	Visitor/year
Per capita expenditure, in average21,011	21,011	Rp/day/visitor
Trip length	2	days/tourist

Table 4. Economic Valuation of Tourism Sector

Figure	Calculation	Result
Annual Revenue	per capita expenditure x trip length x number of visitors	
	21,011 Rp/day/visitor x 2 days x 42,000 visitors	1.76 billion Rp
Annual Profit	50% x Revenue	
	50% x 1.76 billion Rp	0.88 billion Rp
NPV 10%*	Over 25 years, constant profit	8.01 billion Rp

* Calculation of the net present value, using a 10% discount rate, is reported in a table in Appendix B. This calculation illustrates the present value of a future stream of net benefits. This calculation answers the question, what would one pay now for money to be received in the future?

These results show that the net value of economic activity associated with tourism in the area around Mt. Gede-Pangrango Park approaches a billion rupiah per year, with relatively conservative estimates. Actual revenues are much higher. Also, we have not calculated the value of the tourists' intangible enjoyment of the park (willingness to pay or to preserve). We have only calculated what they normally spend on visiting the park. Clearly, the value of their enjoyment must be larger than what they spend on visiting the park.

Tourism is only the first and most obvious economic value associated with the presence of the park. Yet, this value alone compares favorably to the investment in operation and maintenance of the park, estimated at about 1.3 billion rupiah per year. Although the park returns only a small amount in terms of entrance fees, it generates a much larger stream of economic benefits that accrue to the tourists and the businesses in the area.

Economic Value of Water Regulation

The role of Mt. Gede-Pangrango NP as a water catchment area for surrounding villages, should be categorized as a service provided by Mt. Gede-Pangrango NP and expressed in monetary terms. Although not all of these water use values can be attributed to the continuing presence and management of the national park, the values derived here help to provide some perspective on the environmental services produced by the forest cover and natural area preserved in the park. The basic environmental services and their value to downstream users, to households, and to agricultural production need to be better recognized and understood so that the protected areas of the upper watershed are properly managed and protected. This anlysis also helps to highlight some of the impacts and costs that might occur if the forest and ecosystem of the park were somehow damaged or reduced in size.

Method

Market price can often be employed as an approach to assess the value of an environmental good. The productivity, in monetary terms, will represent the benefit of the environmental good in providing services related to the productive factor. Environmental change then will cause changes in productivity. If the quantity of water to irrigate paddy fields is decreasing or the service provided by Mt. Gede-Pangrango NP as water control area cannot be preserved, the productivity of paddy fields will be declining accordingly. The value of water for household consumption can also be assessed in a similar manner.

To develop reasonable estimates of these environmental services, we have first tried to use transparent assumptions and calculation methods to ensure credibility. We have also limited the assessment of benefits in two major ways to ensure that the estimates are conservative, not exaggerated. First, we have limited the analysis of water resource benefits to the transition zone only. Although the benefits of water quantity and quality spread to downstream users in many areas and sectors, we have focused the calculations on irrigation of paddy in the transition zone and upper watershed, not all crops in all areas. Second, to provide an estimate of the benefits of good quality water to households, we have focused the calculations only on the few households that live closest to the park's borders, not all households in all areas. Thus, it seems clear that the estimates produced will be a minimum value for water quality and water quantity. These will be suitable for the purposes of comparison of relative values, but not as a basis for claiming an exact overall value for the environmental services produced by the park.

Result

The value of water for paddy fields

According to the analysis of remote sensing images (TM Image) done by Danudoro (1993), the areas of paddy field in transition zone is about 10,998 hectares with 2,620 hectares located in Upper Ciliwung. From the 10,998 hectares of paddy fields, 934 hectares is one season, 5,209 hectares is two seasons, and 4,855 hectares is three seasons of paddy cultivation.

Dumairy (1992) in Widarti (1995) predicted that water requirement for paddy field is 125,000 m^3/hectares/season.

Based on this, the total irrigation water for the whole paddy fields is about 3,894,625,000 m^3. Widarti (1995) calculates that the water price was 0.18 Rp/m^3, this amount represents operation and maintenance costs. Taking 10% growth in expenditure per year, the water price would be 0.27 Rp/m^3 in 1999. These data are summarized in able 5 below.

Table 5. Water Resurces/*Paddy Field Irrigation*

Variable	Data	Units
Water requirement for paddy field	125,000	m^3/ha/season
Area of paddy field		
Upper Ciliwung (2 seasons)	2,620	Ha
Transition zone:		
One season cultivation	934	Ha
Two seasons cultivation	5,209	Ha
Three seasons cultivation	4,855	Ha
Cost of providing water	0.27	Rp/m^3

The basic data can be used to produce an estimate of the value of irrigation water for paddy production in the area. The calculations show that irrigation water has a value of about a billion rupiah per year only for the production of rice.

Production of other crops would produce other benefits that are not valued here.

Table 6. Economic Valuation of Water Resources for *Paddy Field Irrigation*

Figure	Calculation	Result
Annual Water demand	Area of paddy pield x season (s) x water requirement	
	(2,620x2) + (934x1) + (5,209x2) + (4,855x3) x 125,000	3.89 billion m^3
Water price		0.27 Rp/m^3
Annual value of water	Water demand x water price	1.05 billion/yr
NPV 10%	water 25 years, constant price	9.53 billion Rp

The value of water for household's consumption

As noted previously, there are 149 villages, 920,065 people, or about 184,000 households in the transition zone around the park. The environmental services and water filtering functions of the park provide potable water to these households. If the park did not provide these services, the society or the government would have to find and pay for another method of delivering water to these households (just as in an urban area). A case study in Upper Ciliwung (Widarti, 1995) used the "contingent valuation" method to estimate consumer "willingness to pay" for good quality water at 183 Rp/m^3 (which would be 268 Rp/m^3 in 1999 (taking the 10% growth in expenditure into account). Widarti (1995) also estimated that household water consumption was 204.6 m^3/yr.

For the purposes of a comparative estimate, we have assumed that only those households closest to the park (say a sixth or 34,689 households) derive significant water quality benefits directly from the environmental services produced by the park. The point of this assumption is to ensure that we do not overstate the environmental values produced by the park. These estimates are summarized in Table 7a.

Table 7a. Water Resources Data/ *Household Consumption*

Variable	Data	Units
Number of households	34,689	Household(s)
Water demand/per household	204.6	m^3/ year/hh
Total water demand	7,097,369	m^3/ year
Willingness to Pay (WTP) of water	268	Rp/m^3

Using these estimates, we can calculate the economic value of household water consumption in the Upper Ciliwung area, as summarized in Table 7b. The calculations show a value of about 1.9 billion rupiah annually. Remember that these figures do not represent the value of clean water to all consumers, only to the 34,689 families living closest to the park. The total value would potentially be higher.

These two results together show that even conservative estimates of the values associated with water resources are in the range of 2 to 3 Billion Rupiah per year, far more than the cost of maintaining the park or the value of tourism activities. This is just an estimate of the values that can be attributed to the water regulation and filtering functions provided by the natural forests and ecosystems of Mt. Gede-Pangrango National Park. We have tried to make the calculations clear enough that one could consider other scenarios. For example, if we assumed that half the households in the area (rather than a sixth) derived substantial water quality benefits from the park, the value estimate would be three times larger, or 4.9 billion rupiah per year. If the smaller group of households were only willing to pay 60% as much, the lower estimate would still be over a billion Rp. per year.

Table 7b. Economic Valuation of Water Resources for *Household Consumption*

Figure	Calculation	Result
Water demand		7,097,369 m^3
Water price		268 Rp/m^3
Value of water	Water demand x water price	1.90 billion Rp
NPV 10%	Over 25 years, constant price	17.28 billion Rp

Economic value of sediment control

As described earlier, Mt. Gede-Pangrango NP plays an important role in sediment control and protection in the upstream areas of Ciliwung. Taking note that 40% slopes are dominating the terrain condition, this area has high potential for erosion that could create sedimentation problems a far distance away at the lower Ciliwung River. One of the activities that could trigger high erosion is the change of the forest condition such as from logging activity. According to a study by Lai (1993) and Mohd Shahwahid et.al. (1997) the total sedimentation yield from undisturbed forest is about 1 m^3/ha per year, while yield due to logging is 27.31 m^3/ha per year. Although many parameters could influence the rate of erosion, it is still reasonable to use that number in the case of Mt. Gede Pangrango NP. At least it could give an indication of the potential size and value of problems arising from changes in the forest condition at the park. If we apply this number to the forest of Mt. Gede-Pangrango NP, it is one measure of the benefit of maintaining the forest at the park.

Method

Willingness to pay to prevent damage to the environment (and so defend the existing level of enjoyment from it) can indicate the benefit of protection. Such expenditure will only be made when it is believed that the benefits from the damage that is avoided exceed the payments to prevent it. In brief, money spent to prevent damage to the environment will represent the least cost of protection of natural function. Based on this assumption, the value derived is then similar to the expenditure cost of preventing damage to the natural system.

Economic Value of Timber (Opportunity Cost)

Timber has explicit use benefits as goods provided by the forest in the region. Up to 53% of forest area in the region is classified as production forest. Many commercial species are planted to be harvested and marketed. Furthermore, these activities generate domestic income and create jobs. In the park, the standing timber is not cut or marketed, though there may be a ready market for it. Leaving the timber standing and enjoying its amenity value is an implicit choice to forego the opportunity to harvest it. Economists refer to this as an "opportunity cost." That is, the commercial value of the timber represents a profit opportunity that is not taken, which can be thought of as a cost.

Method

Recognizing the economic value of timber can be done in a very simple technique. The value is derived by multiplying the market price of commercial species by the total (potential) production volume per year. However, this can only be applied for production forest, while for the protection forest several modification and adjustment should be taken into account.

By identifying vegetation in the protection forest, commercial species could be found. Prediction of total volume then can be applied. The value of commercial species in protection forest can be assessed accordingly. Forest areas in this park are the representation of:

- Sub montane forest (> 1,500 meter above sea level) = 8,800 hectares
- Montane forest (1,500 - 2,400 meter above sea level) = 5,300 hectares
- Sub Alpine (above 2,400 meter above sea level) = 1,190 hectares

Kosasih (1991) has conducted vegetation analysis in those three forest types at the Cibodas, Bodogol, and Situgunung resorts. From these forest types 59 species are found, 7 species are commercial ones. Table 10 below shows the dominant species found and recorded on three forest types.

Table 10. Dominance species found on three forest types

Forest types	Cibodas resort	Bodogol resort	Situgunung resort
Sub montane (0-1,500 m)	- Castanea argantea - Litsea noronhae	- Altingia excelsa - Schima wallichii - Quercus spp.	- Altingia excelsa - Schima wallichii - *Quercus* spp
Montane (1,500-2,400 m)	- Altingia excelsa - Schima wallichii - Quercus spp	- Altingia excelsa - Schima wallichii - Quercus spp	- Quercus spp. - Litsea noronhae
Sub Alpine (> 2,400 m)	- Schima wallichii - Vaccinium	-	-

Result

Different land uses have varying physical impacts to downstream sedimentation. The impacts of timber harvesting on hydrological attributes have been well documented in several catchment studies. Natural erosion in the undisturbed forest area or unlogged forest contributes only a small amount of sediments generated mainly by rainfall impact. However, logging operations, such as harvesting, which includes road construction, tree felling, and log extraction, have much larger sedimentation yields. If we want to know the total value of the sediment control services produced by the park, we must attempt to determine the amount of erosion that could occur if the forest ecosystem were not present.

Table 8. Sediment Control Data

Variable	Data	Units
Sedimentation rate (difference)	26.31	m^3/ha/yr
[27.31 m^3/ha (logging scenario) vs. 1.0 m^3/ha (natural state)	7,500	Ha
Area affected (assume half steep forested)	197,325	m^3/yr
Sedimentation rate per year	6,700	Rp/m^3
Cost of dredging	6,700	Rp/m^3

We have to make some assumptions to apply this annual erosion rate to the Mt. Gede-Pangrango NP forest reserve of more than 15,000 hectares to determine the value of sediment control services provided. To be conservative, we might assume that half the area of the park is covered in forest on steep slopes that provide substantial erosion protection. Translating these assumptions into costs, we assume that 7500 ha would erode 26.31 m^3/ha, or 197,000 m^3 of sediment into the Ciliwung River system each year. This sediment would add to the problem of flooding in downstream areas as far as Jakarta. Flooding is a significant problem to Jakarta which suffers substantial inundation at some part of its area every year. (Average annual flood damage in the Jakarta urban area has been estimated as US$ 200 million JUDP3, 1994.) If this additional sediment introduced from the park area (in this scenario) had to be dredged to prevent flooding (perhaps not conservative), the cost could be as much as Rp. 1.32 billion each year. If only half the sediment had to be dredged to prevent flooding, the annual cost would be about Rp. 0.66 billion.

Table 9. Economic Valuation of Sediment Control

Figure	Calculation	Result
Annual sedimention cost	7500 ha x 26.31 m3/ha x 6700 Rp/m3	Rp. 1.32 Billion/yr
Assumptions:	Assuming all sediment needed to be dredged: Assuming half sediment needed to be dredged	Rp. 0.66 Billion/yr
NPV 10%	over 25 years, constant annual cost (low scenario)	Rp. 5.99 Billion

[1] Note that since we are valuing the total erosion control services provided by the park, we did not use a "project appraisal" scenario based on a realistic rate of forest harvesting. This would result in a smaller estimate of costs, but an increase in erosion each year and a cumulative increase in the amount of sedimentation. An analysis of this sort would determine the likely cost of dredging under a particular scenario, not the hidden value of all the erosion control services produced by the park.

The dominant species in three resorts in various altitudes seems to be rasamala (*Altingia excelsa*), puspa (*Schima wallichii*) and pasang (*Quercus spp*). These commercial species have markets and so their economic values are considerable. This analysis is designed to illustrate the value of timber for comparison to other relative values. The following assumptions put in the calculation are:

Table 11. Basic Forestry Assumptions

	Assumption
Harvestable area (not too steep, etc.)	50% x 14.100 (sub montane+montane) = 7,050 ha
Commercial Volume/ha (")	50 m³/ha
Net price	125,000 Rp/m³
Cutting cycle	25 years

Based on basic assumptions above, the value of timber is calculated as follows:

Table 12. Economic Valuation of Timber

Figure	Calculation	Result
Value of timber	Harvested area x volume per hectare x commercial timber x net price = 7,050 x 50 x 125,000	44.0 billion Rp
Annual value	Value of timber / cutting cycle	1.76 billion Rp
NPV 10%	25 years, constant cost15.97 billion Rp	15.97 billion Rp

[1] Pers. Comm., A. Khan, Ph.D., DepHutBun. Ten commercial quality trees/ha that meet size and species requirements could be expected. If each contained a marketable volume of 4 cubic meters, yield would be 40 cubic meters/ha. We assumed more to err toward overestimating costs.

This hypothetical annual value is based on an assumed harvesting cycle, i.e., a potential gain. But cutting the forest would create other impacts, such as reduced forest cover, more run off and sedimentation, reduced water quality for drinking, and reduced tourism. The benefits of commercial forestry in this area would have to be evaluated relative to the benefits of the environmental services produced by the park and the negative impacts produced by cutting the forest. We can see in the prior example calculations that the value of runoff control, water production, and tourism, are in the same order of magnitude as the potential profits from commercial forestry. If forestry activity reduced tourism substantially, or reduced the quality of water reaching downstream users, or resulted in greater dredging costs, then it might not seem profitable at all from the perspective of the entire society including both upstream and downstream gainers and losers.

It is difficult to make a direct numerical comparison, since the exact annual impacts associated with forestry would have to be assumed. For example, how much might tourism be reduced in which year if commercial forestry proceeded? Still, we can note that the annual values of tourism and environmental services (calculated so far) together are about twice the value of forestry. Thus, if forestry activity reduced the environmental services associated with the park by only half, the costs to society, tourism operators and downstream users, would be greater than the value of the commercial forestry activity. This is an important relative value to understand, even though the timber is not under direct logging threat at this time. Also, it is important to keep in mind that we have not placed values on a large number of environmental goods and services. We simply started with those that could be calculated using readily available market data and secondary sources. This issue is addressed qualitatively in the next section.

OTHER VALUES NOT QUANTIFIED

As noted, this is a partial valuation study. The park area produces a number of intangible benefits or tangible ones that are difficult to quantify, or monetize. Some of these benefits can be described qualitatively.

Non Timber Forest Products
(Resin, Fuelwood, Medicinal Plants, Food Plants)

Other than the values mentioned above, Mt. Gede-Pangrango NP is also supporting the community as the provider of various non-timber forest products. Some important types that have already been harvested by the community living in the surronding areas include: resins, fuelwood, medicinal plants, food plants (various kind of fruits), eatable fungus, etc. There are, indeed, markets for these non timber products, however the value of the forest in providing such products has not been assessed, partly because production data are difficult to obtain or estimate.

estimates and procedures for valuing the carbon stored in forests and other ecosystems, for example, the Intergovernmental Panel on Climate Change (IPCC). Based on projects conducted by World Research Institute (WRI), the average amount of carbon in wood products as a percentage of total carbon sequestered was 1.5 percent, the maximum being 2 percent, while strategies focusing on storing carbon in living biomass yielded greater greenhouse gas reductions. Placing concrete values on the carbon stored in Mt. Gede-Pangrango NP would require complex assumptions and calculations that would go beyond the context of the study, which is to provide relevant values for government planners and decision makers.

Risk Management Value

Risk and uncertainty are an inherent part of economic decisions. Risk represents the likelihood of occurrence of an undesirable event, such as an oil spill. In the case of uncertainty, the future outcome is basically unknown. Therefore the risk of an event may be estimated by its probability of occurrence. The risk probability and severity of damage could be used to determine an expected value of potential costs that would be used in the cost-benefit analysis. However, the use of a single number (expected value of risk) does not indicate the degree of variability or the range of probability values that might be expected.

In the case of uncertainty, it is not possible to estimate the expected value of costs or insure against unknown eventuality. The increasing scale of human activity, the

Complexity of environmental and ecological systems might be affected all emphasize the need to deal with uncertainty more explicitly. The key to dealing with uncertainty is a cautious approach. An illustrative example is global warming. In the past, the greenhouse effect of carbon dioxide emissions was not known or recognized as a risk. At the present time, there is still considerable uncertainty about the future effects of global warming, but given the large magnitude of potential consequences, caution is warranted.

The traditional and simple way of incorporating risk and uncertainty considerations in project level cost-benefit analysis has been through sensitivity analysis. Using optimistic and pessimistic values for different variables, we can indicate which variables will have the most pronounced effects on benefits and costs.

The issue of uncertainty plays an important role in environmental valuation and policy formulation. Option values and quasi option values are based on the existence of uncertainty. Option value is essentially the premium that consumers are willing to pay to avoid the risk of not having something available in the future. Quasi option value is the value of preserving options for future use in the expectation that knowledge will grow over time. Regarding this issue, Mt. Gede-Pangrango NP will play an important role to avoid land-slides or siltation of river basin, flooding or other natural catastrophes. There is a value (unmeasured in this study) in preserving the park, forest, and ecosystem against future uncertainties or catastrophic events.

Picture 15. Research and education activity

Research and Education

With the functions provided by the forest described above, the forest ecosystem is very unique and very interesting for education and research. Valuable medicinal plants, for instance, are often found in the forest, research can only be conducted if the forest ecosystem is kept properly. The park also has role as education site for field study, it is very good as a living laboratory for biology and ecology.

Less tangible benefits that could only be measured through extensive and complex survey and econometric procedures include:

Existence Value

Existence value is a non-use value that is totally unrelated to human use of a public good, now or in the future. An example would be the value people hold for the remaining stocks of blue whales. Most people would not value these whales for the

option that they might see or otherwise use one. Rather, they value the whales because they exist, which is unrelated to use (although the way they obtain the knowledge for their value to exist may be through a photograph or film). Altruism is one underlying motive that drives existence value. People are willing to pay to preserve a habitat out of concern for the residents of that habitat, whether human, plant, or animal.

Option Value

Option value is the value of a public good as a potential benefit or future use, as opposed to actual present use. It is a preference to preserve a public good against some probability that the individual will make use of the good at a later date. If the uncertainty regarding future use is related to the availability or supply of the good, option value is likely to be positive.

Bequest Value

The desire to bequest all or part of a public good to a future generation is referred to as the bequest value. This is similar to passing on accumulated personal assets to one's heirs. Since the bequestor expects the future generation to use the inherited goods, this passive use, it is strongly attached to the concept of future use or the option of others to use. Bequest value represents the value individuals assign to a resource for future generations to use. Bequest values are often significant for indigenous people who value the continuation of their way of life such that it can be passed onto the future generations.

Picture 16.
Forest has benefits more than we have ever measured

The point of this qualitative discussion is to note that the park produces more benefits than we have measured in this study. The benefits, costs, and opportunity costs that we have identified (summarized in the final chapter) clearly indicate that the value of preservation of the park (tourism, water regulation, sediment control) far exceed the cost of managing and maintaining the park, even including the opportunity cost of its standing timber. If we were to quantify these additional intangibe benefits, it would only increase the benefits side of the equation. Thus, for decision-making purposes and basic understanding, the quantified values presented here are sufficient for most purposes.

ECONOMIC VALUES OF NATIONAL PARK AS INPUT TO PROTECTED AREA MANAGEMENT

The importance of economic valuation of natural resources (or protected areas, national park in this respect) as introduced presently has a direct use within the policy development process. It is worth noting that an economic value or estimate, in itself, is an input to policy making processes, not an end point. Values within policy are useful. As well as within project and program appraisal, valuation is central to the identification and comparison of investment costs, opportunity costs and benefits. Values of national parks therefore, have a role in informing decision-makers on the relative efficiency of alternate public and private sector investments. Setting priorities and policies for the national park can be improved if economic values are known in advance simply by increasing the degree of certainty within the prioritization process. The underlying objective of sustainable development requires that decision makers understand the values of resources under alternative scenarios. Without an understanding of the value of environmental services there is no coherent manner that the concept of sustainable development can be interpreted.

Ultimately economic valuation estimates provide an opportunity to improve the cost efficiency of public choices, so that public income is expended in the most efficient manner. The efficiency can be improved with the inclusion of estimates of the total economic value as opposed to a partial economic value based on market priced use values. The assessment of choices using values that closer represent the true social costs and benefits of those choices is one of the tools for developing sustainable development routes. Other tools are well-designed resource right systems, appropriate institutional arrangements, enforceable regulations, knowledge of ecological thresholds. There are several policy issues where economic valuation of environmental goods and services have a direct relevance to the policy-makers, such as:

Spatial and Regional Development Planning

The sectoral, regional and national planning agencies are confronted with the task of establishing growth routes that improve welfare as well as sustain economic development. Policies for this development need to understand the basis for growth and it is such simple things that often get overlooked. Growth is largely about combining a country's human resources, i.e., labor and skills, with the available natural resources to derive income streams. In Indonesia this has relied heavily on the combination of a relatively unskilled labor force with a very large endowment of natural resources. The main problem that looms is that both sides of the equation are changing, the unskilled labor supply has continued to grow at relatively high rates and the natural resource base is being reduced equally rapidly.

The policy issue is how to evaluate economic growth strategies on a comparable basis when different strategies have a range of costs - both in monetary and non-monetary terms. The important point is the need to develop policy analysis of choices that provide for the greatest efficiency in publicly funded projects or programs. Equally importantly, is that the valuation process facilitates policy makers and analysts to improve their understanding of natural resource utilization options and often any tradeoffs that may exist.

Examples of the tradeoffs, which could occur, are the distribution of benefits from forest utilization (logging of the timber) versus preservation and how this links to regional development goals. In Mt. Gede-Pangrango National Park, uninformed observers or private development interests may believe there exists an opportunity to derive economic growth from harvesting the forest. Yet, a regional planner, with broader social objectives and some basic information on relative values and environmental services, would recognize that the values attributable to conservation are much higher (as shown in this study).

The study emphasizes the need to understand the functional and complementary linkages between competing utilization and how these links can be included within regional and spatial planning procedures. Therefore, it is an urgent need to develop a consistent evaluation framework for public projects and programs, which captures the wider social values that are involved with such programs. This will become increasingly important in the era of decentralization.

Natural Resources Management

Concern about natural resources management has in many cases been assigned only to protected areas. A natural resources management regime may protect small discrete areas of naturalness, whilst depleting the surrounding areas to the point where natural resources become a growth (and in some instanc es income maintenance) constraint. This is what most policy makers would consider as unbalanced economic development.

The question is then how to include the value of natural resources in wider sectoral policies and how to build more integrated development plans that make allowances for environmental goods and services. Most environmental economists believe that economic representation of wider values will at least start enabling policy makers to understand the tradeoffs and the distribution of the impacts of some sectoral policy choices.

Conservation Policy

There are a number of issues where natural resource valuation could contribute in the area of conservation policy. The first important point regarding conservation policy that it is about managing people, not the parks. The need to understand why people (from different parties, i.e., government, private and community) behave and threaten conservation objects is the real basis for future management of the national park. Too often we have seen park management approaches that miss the underlying economic threats that local people and extractive

resource users face. The result of course is continued encroachment and a continual call for more staff for ineffective enforcement, sometimes even leading to illegal practices.

With regard to achieving conservation objectives, there are a number of issues that benefit from understanding the relative economic values and related attitudes are:

- What are the economic efficiency aspects about the size of the conservation estate
- Understanding economic threats so that people (or behavior) management mechanisms can be designed
- Zonation based on functions that are based on people and their values - both use and non-use
- Understand economic development and the need to shift labor away from extractive resource activities
- Economic market instruments may be one means of linking resource extraction to resource preservation and cobservation
- Community or resource rights are not an answer in themselves, they need to be designed within a better institutional context
- Private sector vested interest in preservation objectives can be used to minimize and mitigate impacts. For example, tourism activities should use codes of practices etc.
- Industrial development policies often limit the ability of local communities to move labor from resource extractive/dependence activities resulting in encroachment.
- Increasing incomes may not help to preserve forest or marine resources.

CONCLUSION AND RECOMMENDATION

Conclusions

This valuation analysis of Mt. Gede-Pangrango NP in dicates that the net benefits of this national park exceed the costs of maintaining and preserving it. Further, these benefits accrue to a wide range of stakeholders, economic sectors, and geographic areas. In its present condition, the streams that originate from this national park support almost 14,000 ha paddy field in the transition zone around the park. These streams also support 920,000 people or 184,000 households in the transition zone. The beneficial effects of this national park go a long distance to much larger downstream areas of the Cisadane and Ciliwung River basins, where sedimentation occurs. Sediment control would be reduced and downstream effects worsened, if the forest area on Mt. Gede-Pangrango is not well managed as a conservation area.

The positive role of Mt. Gede-Pangrango NP as shown by this study -- watershed management, sediment/erosion control, water pollution control, tourism development and other related services illustrates the importance of this national park to its surrounding areas and to the downstream Ciliwung river. Although it is not included in this study, it is reasonable to assume that the park plays a similar role for Cisadane River and

other smaller streams. This means that any plan or action taken regarding this park should take into account its multilple functions to very large areas and to various purposes.

The study's valuation results are summarized in Table 14. These results confirm the need to support conservation and maintenance of Mt. Gede-Pangrango NP. The results show that benefits of conservation exceed the costs associated with conservation on many levels. Most clearly, this shows that benefits from nature protection and management are not the simple responsibility of a single government agency. At the simplest level, the table shows that the quantifiable, market-based economic values generated by the park far exceed the operational budget allocated to the Park from the Directorate General of Nature Protection and Conservation (and from the Central Planning Agency). That is, central government investment in the park is justified many times over in terms of benefits to society as a whole.

Beyond the operational costs, there is a cost to the society of economic opportunities not taken. However, in this case, even if we include the substantial opportunity cost associated with leaving the commercially valuable timber standing in the forest ecosystem, the benefits of conservation and preservation still outweigh the costs. Note that we have used to lower end estimates for the value of benefits from sediment control (small impact), for tourism (no growth), and for household water (limited area of benefit). Any of these values could be twice as high. Since the main purpose of this study is to illustrate and compare relative values, we did not report the possible upper and lower range of each of these estimates. Instead, we tried to select reasonable, conservative values on the benefits side, and reasonable, optimistic values on the opportunity cost side. Still,

it is not necessary to determine the exact economic value or the exact number of households that benefit, unless we need these exact values from some decision making purpose. In this case, the relative values are sufficient to illustrate the big picture clearly: conservation of the forest and maintaining the park produces more benefits than costs to society as a whole.

Table 13. Cost-Benefit Analysis of Mt. Gede-Pangrango NP (in billion Rp)

	1999	Over 25 years (NPV 10%)
Costs:		
Park management	**1.32**	11.97
Opportunity cost of timber	**1.76**	15.97
Total costs (C):	3.08	27.96
Benefits:		
Tourism	0.88	8.01
Water for agriculture	1.05	9.53
Water for household	1.90	17.27
Sediment control	0.66	5.99
Unquantified benefits: NTFPs, biodiversity, air quality, carbon sequestration, risk mgmt., research & education, existence, option, bequest		
Total quantified benefits (B):	4.49	40.80
Benefits/Cost = B/C	1.46	1.46

[1] Based on data from Wiratno (1995), the annual management cost (incl. investment and operational cost) of Mt. Gede-Pangrango NP in 1999 is 1.319 billion Rp.

DISTRIBUTION OF BENEFITS

More importantly, the table shows that important benefits accrue at the provincial, district, village, and household level. The results indicate that West Java and even Jakarta Provincial Governments take benefits from the function and impact of the Mt. Gede-Pangrango NP in regard to sediment control and rice production. For the Bogor, Sukabumi and Cianjur Districts, Local Governments should give attention to the changing of land use, land conversion and any development near the national park because of the large function and impact to the local economy in terms of tourism and household benefits. This also shows to the management of the Mt. Gede-Pangrango NP and to the Local Government the potency of the tourism activity for income generation, directly and indirectly. This study also shows the importance of resource valuation as an input for the decision making process in national, regional and local development planning.

Many parties obtain benefits from Mt. Gede-Pangrango NP, such as communities and visitors (consumers), local, provincial and central government. However, some beneficiaries do not realize that they have taken benefits. Moreover, very little of these benefit streams or payments return to the park or facilitate its management. This is an important point for autonomous provincial and district governments to recognizein the era of decentralization: Development is a shared enterprise. Benefits and costs are produced upstream and downstream of any project. Natural areas provide services and values that contribute to regional development, both directly (like tourism) or indirectly (by reducing the cost of sediment management).

Table 14 below shows in general terms where the costs and benefits coming from Mt. Gede-Pangrango NP mainly end up, in terms of various levels of government and stakeholder groups. These benefits come in the form of direct economic activity and employment generation and in the form of taxes and fees levied on the economic activities, such as tourism facilities.

Table 14. Distribution Cost and Benefits of Mt. Gede-Pangrango NP

	Consumers	Local Government	Provincial Government	Central Government
COST				
Park Management			X	X
Opportunity cost of timber	X	X	X	X
BENEFITS				
Tourism	X	X	X	X
Water for agriculture	X	X		
Water for household	X	X		
Sediment control		X	X	X

Recommendations

This study shows the important function of Mt. Gede-Pangrango NP and its surrounding areas as water control and water catchment area. Accordingly, the spatial plan, land use and land conversion in the surrounding areas such as around Puncak Region should be regulated properly.

This study only covered several values of the Mt. Gede-Pangrango NP, particularly because of limited availability of data. Therefore there is a need to conduct more comprehensive studies to obtain more primary data and to update secondary data especially on non timber resources such as biodiversity to obtain total economic valuation in Mt. Gede-Pangrango NP and other protected areas in general.

The benefits of the Mt. Gede-Pangrango NP to downstream areas in general is still undervalued, mostly because of lack of integrated economic valuation, added by lack of coordination among various related sectors and also among sector at downstream and upperstream of the watershed.

Looking at the result of this study on Mt. Gede-Pangrango NP it is recommended to conduct similar or even more comprehensive resource valuation studies in other national parks. One of the reasons is that because of lack of information regarding the benefit of the national park, especially indirect benefits, in some areas the national parks are treated as cost center and opportunity losses of regional development. In contrast, this study shows that a park area can produce substantial benefits, but they are less tangible and well-recognized than certain uses that produce visible market values.

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Appendix A

CALCULATION OF NET PRESENT VALUE

(million rupiah)

Year	Tourism	Water Provision		Sediment Control	Opportunity Cost of Timber	Park Management
		Agriculture	Household			
0	882.46	1051.55	1902.09	661.04	1762.50	1319.00
1	802.24	955.95	1729.18	600.94	1602.27	1199.09
2	1531.55	1825.00	3301.16	1147.26	3058.88	2289.17
3	2194.55	2615.05	4730.23	1643.91	4383.08	3280.16
4	2797.29	3333.27	6029.38	2095.40	5586.89	4181.05
5	3345.23	3986.20	7210.44	2505.86	6681.26	5000.05
6	3843.35	4579.77	8284.12	2879.00	7676.15	5744.59
7	4296.19	5119.38	9260.19	3218.21	8580.59	6421.44
8	4707.87	5609.93	10147.54	3526.59	9402.81	7036.77
9	5082.12	6055.89	10954.21	3806.94	10150.28	7596.15
10	5422.35	6461.31	11687.55	4061.80	10829.80	8104.68
11	5731.64	6829.87	12354.22	4293.49	11447.55	8566.99
12	6012.82	7164.93	12960.29	4504.11	12009.13	8987.26
13	6268.44	7469.53	13511.26	4695.59	12519.67	9369.33
14	6500.82	7746.43	14012.14	4869.67	12983.79	9716.66
15	6712.08	7998.16	14467.48	5027.91	13405.72	10032.42
16	6904.13	8227.01	14881.44	5171.77	13789.29	10319.47
17	7078.72	8435.05	15257.76	5302.56	14137.99	10580.43
18	7237.43	8624.18	15599.86	5421.45	14454.99	10817.66
19	7381.72	8796.12	15910.87	5529.54	14743.17	11033.33
20	7512.90	8952.43	16193.61	5627.80	15005.16	11229.39
21	7632.14	9094.52	16450.64	5717.12	15243.32	11407.63
22	7740.55	9223.70	16684.30	5798.33	15459.84	11569.66
23	7839.10	9341.14	16896.72	5872.15	15656.67	11716.97
24	7928.70	9447.90	17089.84	5939.26	15835.61	11850.88
25	8010.14	9544.95	17265.39	5949.28	15998.28	11972.62

Appendix B

Mount Gede-Pangrango National Park and Kebun Raya Cibodas

General

Mt. Gede-Pangrango NP is a combination of several former protected areas: Cibodas Nature Reserve; Cimungkat Nature Reserve; Situgunung Recreational Park and Mt. Gede-Pangrango Nature Reserve. The park comprises an area of only 15,000 ha which makes it one of the smallest national parks in Indonesia. It is named after the two volcanoes in the park: Gunung Gede (2,958 m) and Gunung Pangrango (3,019 m). The Gunung Gede is still active. Its last eruption took place in 1957.

Mt. Gede-Pangrango NP comprises a variety of landscapes. Although small the site has beautiful waterfalls, lakes and rivers, rugged volcanic landscapes, quiet alms, montane swamp and tropical mountain forest. On the heigher grounds there are vast alpine grassy areas.

Cibodas Botanical garden

Cibodas Botanical Gardens

These gardens of 80 hectares contain a collection of sub-tropical trees plants from Indonesia and other parts of the world. Australian and New Zealand plants are well-represented. The gardens are situated on the slopes of *Gunung Gede* at an altitude of 1400 m and may be reached by turning off the main Puncak road at Pacet, 30 km from Bogor at the sign to Mt. Gede-Pangrango National Park.

Mount Gede-Pangrango National Park

This magnificent forest reserve of more than 15,000 hectares extends from the Cibodas gardens to the crater of *Gunung* Gede, 2962 m, and the summit of *Gunung* Pangrango, 3091 m. A track leads from the park office to a lake, a waterfall (Cibeureum fall) and steeply up the mountain to hot springs, the crater and the summits. The path to the waterfall takes about an hour and is suitable for children. Everyone entering the park must register at the office as the rangers need to know how many people are on the mountain in case of emergencies. If you want to climb the mountain, seek advice from experienced hikers. Guides can be found in the Puncak Pass hotel and in Cibodas. It can be very cold, especially at night, and fog may descend rapidly, making it very difficult to find the path. It takes 6 to 7 hours to reach the top of the Gede and 7 to 8 hours to reach the top of the Pangrango. Between *Gunung* Gede and *Gunung* Pangrango is the *Alun-alun* Suryakencana, a valley full of a species of edelweiss, which flowers in July-August. Beautiful and serene. The descent from *Gunung* Gede can be made through (*Alun-alun* Suryakencana to) *Gunung* Putri, ends in Cipanas.

Access

Mt. Gede-Pangrango NP lies near Bogor on the Puncak-pass and is easy accessible. During the weekends the place is overrun by local residents from Jakarta. There are four entrances:

- *Cibodas Gate* (Cianjur) is the main entrance. Between Bogor (main terminal) or Jakarta (Kampung Rambutan terminal) and the Puncak-pass there are several buses. Get out at the Cibodas road junction. From there, catch a minibus to the national park.
- *Gunung Putri Gate* (Cianjur), 15 km Cibodas. The Gunung Putri gate can be reached by minibus from Cipanas.
- *Selabintana Gate* (Sukabumi), 60 km from Bogor. Take the bus from Bogor to the Sukabumi bus station. From the bus station get on a minibus to the town centre. From Sukabumi town centre the Selabintana minibus will bring you to the Pondok Halimun turning, from where you have to charter an other minibus, motor bike or walk the last 6 km.
- *Situgunung Gate* (Sukabumi), 15 km from Selabintana. From Bogor take the Sukabumi bus and get out in Cisaat; catch the minibus to Situgunung.

Permits and guides are available from the PHKA office at the main entrance. For the permit you need a copy of your passport. Guides are not really neccesary because Mt. Gede-Pangrango NP has an extensive web of foot-paths. If you want to trek through the area or climb one of the mountains you need a special permit, available at the PHPA offices in Cibodas, Selabintana or Gunung Putri. The park is best visited during the dry season: May-October. From Januari till March the park is closed.

Mt. Gede Pangrango national Park

Flora

Most of the Mt. Gede-Pangrango flora is comparable to that of the Gunung Halimun National Park. Only around the craters of Gunung Gede and Pangrango the flora is very different. Due to poisonous volcanic gasses only plants adapted to this kind of environment, such as *Myrsine avensis*, *Rhododendron javanicum*, *R. retusum*, *Selliguea feei* and *Vaccinium varingiaefolium* will grow here.

The numerous orchids, of which there are 208 species, some endemic to Gunung Gede, mostly live as epiphytes. The mosses cover the branches and trunks of the trees and the forest floor. The large vine or liana, which grows in the tropical rain forests, needs the support of other plants to reach the upper canopy of the forest. This is also the case with the rattan plants which have thorns and hooks on the sheath and main nerves of their leaves to help fasten themselves onto other trees. Another interesting plant is the

strangler. This plant first develops on tree branches as an epiphyte. Its roots grow rapidly down the host tree trunk until they reach the soil, grow bigger, and eventually strangle the host tree. Most of the conspicuous plants inCibodas are trees. The forest floor is covered with grass, herbs, mosses and seedlings.

- *Aeschynanthus angustifolius*
- *Aeschynanthus horsfieldii*
- *Aeschynanthus longiflorus*
- *Aeschynanthus radicans*
- *Agalmyla parasitica*
- *Albizia lophantha*
- Rasamala - *Altingia excelsa*
- *Amomum coccineum*
- Javan Edelweiss or Bunga Abadi - *Anaphalis javanica*
- *Antidesma tetandrum*
- *Arisaema filiforme*
- *Arisaema inclusum*
- *Ardisia fuliginosa*
- Bird's Nest Fern - *Asplenium nidus*
- *Asplenium spp.*
- *Balanophora elongata*
- *Begonia robusta*
- *Begonia spp.*
- *Brugmansia suaveolens*
- *Bulbophyllum cernuum*
- *Calamus spp.*
- Silver Chestnut or Saninten-*Castanopsis argentea*
- Javan Chestnut - *Castanopsis javanica*
- *Chelonistele sulphurea*
- *Coelogyne speciosa*
- *Curcurligo capitulata*
- *Cyathea contaminans*
- *Cyathea latebrosa*
- *Cyathea tomentosa*
- *Cymbidium lancifolium*
- Jamuju - *Dacrycarpus imbricatus*
- *Daemonorops rubra*
- *Daemonorops melanochaetes*
- *Dendrobium hasseltii*
- *Dendrobium mutabile*
- Jelatang - *Dendrocnide stimulans*
- *Dianella javanica*
- *Dichrea febrifuga*
- *Dicksonia blumei*
- Jantri - *Elaeocarpus sphaericus*
- *Epigeneium triflorium*
- *Equisetum debile*
- *Eria multiflora*
- *Euonymus javanicus*
- *Eupatorium riparium*
- *Eupatorium sordidum*

- *Eurya acuminata*
- *Fagraea blumei*
- *Ficus alba*
- *Ficus ribes*
- *Ficus sinuata*
- *Ficus variegata*
- *Freycinetia insignis*
- *Gaultheria nummulariodes*
- *Gaultheria leucocarpa*
- *Gaultheria punctata*
- *Gentiana quadrifaria*
- *Hedychium roxburghii*
- *Hypericum leschenaultii*
- *Gunnera macrophylla*
- *Impatiens chonoceras*
- *Impatiens javensis*
- *Impatiens platypetala*
- *Impatiens radicans*
- *Isachne pangrangensis*
- *Juncus effusus*
- *Kadsura scandens*
- *Leptospermum flavescens*
- *Liparia bootanensis*
- Oak - *Lithocarpus spp.*
- Laurel - *Litsea spp.*
- *Lobelia angulata*
- *Lobelia montana*
- *Lycopodium clavatum*
- *Manglietia glauca*
- Banana - *Musa acuminata*
- *Mussaenda frodosa*
- *Myrica javanica*
- *Myrsine avenis*
- *Nepenthes gymnamphora*
- *Nicolaia solaris*
- *Pandanus furcatus*
- *Paphiopedilum javanicum*
- *Passiflora edulis*
- *Passiflora suberosa*
- *Phaius flavus*
- *Phragmites karka*
- *Pinanga coronota*
- *Plectocomia elongata*
- *Podocarpus imbricatus*
- *Podocarpus neriifolius*
- *Polygonum chinense*
- *Primula prolifera*
- *Oak - Quercus spp.*
- *Ranunculus blumei*
- *Rapanea avenis*
- *Rhododendron javanicum*
- *Rhododendron retusum*
- *Rubus spp.*
- *Saccharum sp.*
- *Saurauia pendula*
- *Schefflera rugosa*
- *Puspa - Schima walichii*
- *Scirpus mucronata*
- *Selaginella opaca*
- *Selliguea feei*
- *Sloanea sigun*
- *Sphagnum gedeanum*
- *Strobilanthes cernua*
- *Symplocos cochinchinensis*
- *Thalictrum javanicum*
- *Trevesia sundaica*
- *Trichoglottis pusilla*
- *Beardmoss - Usnea spp.*
- *Cantigi - Vaccinium varingiaefolium*
- *Viola pilosa*
- *Xyris melanocephalus*
- *Zingiber inflexum*
- *Zingiber ordoriferum*

Fauna

Notwithstanding the small size of the park a variety of animals can be seen. The park is a bird-watchers paradise as more than 250 species can be spotted.

Mammals

- Malayan pangolin - *Manis javanica*
- Lesser moonrat - *Hylomys suillus*
- Southeast Asian white-toothed shrew - *Crocidura fuliginosa*

- *Crocidura orientalis*
- House shrew - *Suncus murinus*
- Common treeshrew - *Tupaia glis*
- Javan treeshrew - *Tupaia javanica*
- Malayan flying lemur - *Cynocephalus variegatus*
- Javan tail-less fruit bat - *Megaerops kusnotoi*
- Javan mastiff bat - *Otomops formosus*
- Javan thick-thumbed pipistrelle - *Glischropus javanus*
- Schreibers' bent-winged bat - *Miniopterus medius*
- Long-tailed macaque - *Macaca fascicularis*
- Javan leaf monkey - *Presbytis comata*
- Ebony leaf monkey - *Trachypithecus auratus*
- Javan gibbon - *Hylobates moloch*
- Asiatic wild dog - *Cuon alpinus*
- Leopard - *Panthera pardus*
- Leopard cat - *Prionailurus bengalensis*
- Oriental small-clawed otter - *Aonyx cinerea*
- Javan stink badger - *Mydaus javanensis*
- Yellow-throated marten - *Martes flavigula robinsoni*
- Common palm civet - *Paradoxurus hermaphroditus*
- Barking deer - *Muntiacus muntjak*
- Wild boar - *Sus scrofa*
- Javan warty pig - *Sus verrucosus*
- Lesser mouse deer - *Tragulus javanicus*
- Javan short-tailed porcupine - *Hystrix javanica*
- Sody's tree rat - *Kadarsanomys sodyi*
- Bartel's rat - *Maxomys bartelsii*
- Javan shrew-mouse - *Mus vulcani*
- *Niviventer lepturus*
- Bartels's flying squirrel - *Hylopetes bartelsi*
- Red giant flying squirrel - *Petaurista petaurista*
- Black-striped squirrel - *Callosciurus nigrovittatus*
- Three-striped ground squirrel - *Lariscus insignis*
- Black giant squirrel - *Ratufa bicolor*
- Possibly:
- *Crocidura paradoxura*

Birds

- Chestnut-bellied Patridge - *Arborophila javanica*
- Red Junglefowl - *Gallus gallus*
- Green Junglefowl - *Gallus varius*
- Barred Buttonquail - *Turnix suscitator*
- Rufous Piculet - *Sasia abnormis*
- Sunda Woodpecker - *Sunda Woodpecker*
- Fulvous - breasted Woodpecker - *Dendrocopos macei*
- Rufous Woodpecker - *Celeus brachyurus*
- Banded Woodpecker - *Banded Woodpecker*
- Crimson-winged Woodpecker - *Picus puniceus*
- Checker-throated Woodpecker - *Picus mentalis*
- Orange-backed Woodpecker - *Reinwardtipicus validus*
- Grey-and-buff Woodpecker - *Hemicircus concretus*
- Lineated Barbet - *Megalaima lineata*
- Brown-throated Barbet - *Megalaima corvina*
- Black-banded Barbet - *Megalaima javensis*
- Flame-fronted Barbet - *Megalaima armillaris*
- Blue-eared Barbet - *Megalaima australis*
- Coppersmith Barbet - *Megalaima haemacephala*
- Dollarbird - *Eurystomus orientalis*
- Rhinoceros Hornbill - *Buceros rhinoceros*
- Wreathed Hornbill - *Aceros undulatus*
- Blue-tailed Trogon - *Harpactes reinwardtii*
- Orange-breasted Trogon - *Harpactes oreskios*

- Common Kingfisher - *Alcedo atthis*
- Blue-eared Kingfisher - *Alcedo meninting*
- Javan Kingfisher - *Halcyon cyanoventris*
- Collared Kingfisher - *Todirhamphus chloris*
- Blue-tailed Bee-eater - *Merops philippinus*
- Chestnut-headed Bee-eater - *Merops leschenaulti*
- Large Hawk-Cuckoo -*Large Hawk-Cuckoo*
- Hodgson's Hawk-Cuckoo - *Cuculus fugax*
- Indian Cuckoo - *Cuculus micropterus*
- Common Cuckoo - *Cuculus canorus*
- Oriental Cuckoo - *Cuculus saturatus*
- Banded Bay Cuckoo - *Cacomantis sonneratii*
- Plaintive Cuckoo - *Cacomantis merulinus*
- Rusty-breasted Cuckoo - *Cacomantis sepulcralis*
- Horsfield's Bronze-Cuckoo - *Chrysococcyx basalis*
- Drongo Cuckoo - *Surniculus lugubris*
- Asian Koel - *Eudynamys scolopacea*
- Red-billed Malkoha - *Phaenicophaeus javanicus*
- Chestnut-breasted Malkoha - *Phaenicophaeus curvirostris*
- Greater Coucal - *Centropus sinensis*
- Lesser Coucal - *Centropus bengalensis*
- Yellow-throated Hanging-Parrot - *Loriculus pusillus*
- Red-breasted Parakeet - *Psittacula alexandri*
- Waterfall Swift - *Hydrochous gigas*
- Glossy Swiftlet - *Collocalia esculenta*
- Cave Swiftlet - *Collocalia linchi*
- Volcano Swiftlet - *Collocalia vulcanorum*
- Mossy-nest Swiftlet- *Collocalia salangana*
- Black-nest Swiftlet - *Collocalia maximus*
- Edible-nest Swiftlet - *Collocalia fuciphagus*
- Asian Palm-Swift - *Cypsiurus balasiensis*
- House Swift - *Apus nipalensis*
- Grey-rumped Treeswift - *Hemiprocne longipennis*
- Barn Owl - *Tyto alba*
- Oriental Bay-Owl - *Phodilus badi*
- Javan Scops-Owl - *Otus angelina*
- Sunda Scops-Owl - *Otus lempiji*
- Barred Eagle-Owl - *Bubo sumatra*
- Buffy Fish-Owl - *Ketupa ketupu*
- Spotted Wood-Owl - *Strix seloputo*
- Brown Wood-Owl - *Strix leptogrammica*
- Javan Owlet - *Glaucidium castanopter*
- Javan Frogmouth - *Batrachostomus javensis*
- Grey Nightjar - *Caprimulgus indicus*
- Large-tailed Nightjar - *Caprimulgus macrurus*
- Salvadori's Nightjar - *Caprimulgus pulchellus*
- Spotted Dove - *Streptopelia chinensis*
- Island Collared-Dove - *Streptopelia bitorquata*
- Barred Cuckoo-Dove - *Macropygia*
- Ruddy Cuckoo-Dove - *Macropygia emiliana*
- Little Cuckoo-Dove - *Macropygia*
- Emerald Dove - *Chalcophaps indica*
- Zebra Dove - *Geopelia striata*
- Pink-necked Green-Pigeon - *Treron vernans*
- Sumatran Green-Pigeon - *Treron oxyura*
- Wedge-tailed Green-Pigeon - *Treron sphenura*
- Pink-headed Fruit-Dove - *Ptilinopus porphyreus*
- Dark-backed Imperial-Pigeon - *Ducula lacernulata*
- Slaty-breasted Rail - *Gallirallus striatus*
- White-breasted Waterhen - *Amaurornis phoenicurus*
- Baillon's Crake - *Porzana pusilla*
- Ruddy-breasted Crake - *Porzana fusca*
- Band-bellied Crake - *Porzana paykullii*
- White-browed Crake - *Porzana cinerea*
- Watercock - *Gallicrex cinerea*
- Rufous Woodcock - *Scolopax saturata*
- Pintail Snipe - *Gallinago stenura*
- Wood Sandpiper - *Tringa glareola*

- Common Sandpiper - *Tringa hypoleucos*
- Greater Painted-snipe - *Rostratula benghalensis*
- Pacific Golden-Plover - *Pluvialis fulva*
- Osprey - *Pandion haliaetus*
- Oriental Honey-buzzard - *Pernis ptilorhyncus*
- Black-winged Kite - *Elanus caeruleus*
- Brahminy Kite - *Haliastur indus*
- Crested Serpent-Eagle - *Spilornis cheela*
- Crested Goshawk - *Accipiter trivirgatus*
- Chinese Goshawk - *Accipiter soloensis*
- Japanese Sparrowhawk - *Accipiter gularis*
- Besra - *Accipiter virgatus*
- Black Eagle - *Ictinaetus malayensis*
- Changeable Hawk-Eagle - *Spizaetus cirrhatus*
- Javan Hawk-Eagle - *Spizaetus bartelsi*
- Black-thighed Falconet - *Microhierax fringillarius*
- Spotted Kestrel - *Falco moluccensis*
- Oriental Hobby - *Falco severus*
- Peregrine Falcon - *Falco peregrinus*
- Little Grebe - *Tachybaptus ruficollis*
- Oriental Darter - *Anhinga melanogaster*
- Yellow Bittern - *Ixobrychus sinensis*
- Cinnamon Bittern - *Ixobrychus cinnamomeus*
- Javan Pond-Heron - *Ardeola speciosa*
- Banded Pitta - *Pitta guajana*
- Banded Broadbill - *Eurylaimus javanicus*
- Asian Fairy-bluebird - *Irena puella*
- Blue-winged Leafbird - *Chloropsis cochinchinensis*
- Tiger Shrike - *Lanius tigrinus*
- Brown Shrike - *Lanius cristatus*
- Long-tailed Shrike - *Lanius schach*
- Mangrove Whistler - *Pachycephala grisola*
- Crested Jay - *Platylophus galericulatus*
- Short-tailed Magpie - *Cissa thalassina*
- Racket-tailed Treepie - *Crypsirina temia*
- Slender-billed Crow - *Corvus enca*
- Large-billed Crow - *Corvus macrorhynchos*
- White-breasted Woodswallow - *Artamus leucorynchus*
- Black-naped Oriole - *Oriolus chinensis*
- Black-and-crimson Oriole - *Oriolus cruentus*
- Sunda Cuckooshrike - *Sunda Cuckooshrike*
- Javan Cuckooshrike - *Coracina javensis*
- Lesser Cuckooshrike - *Coracina fimbriata*
- Pied Triller - *Lalage nigra*
- Small Minivet - *Pericrocotus cinnamomeus*
- Sunda Minivet - *Pericrocotus miniatus*
- Scarlet Minivet - *Pericrocotus flammeus*
- Black-winged Flycatcher-Shrike - *Hemipus hirundinaceus*
- Rufous-tailed Fantail - *Rhipidura phoenicura*
- White-bellied Fantail - *Rhipidura euryura*
- Black Drongo - *Dicrurus macrocercus*
- Ashy Drongo - *Dicrurus leucophaeus*
- Lesser Racket-tailed Drongo - *Dicrurus remifer*
- Black-naped Monarch - *Hypothymis azurea*
- Common Iora - *Aegithina tiphia*
- Large Woodshrike - *Tephrodornis gularis*
- Sunda Whistling-Thrush - *Myophonus glaucinus*
- Blue Whistling-Thrush - *Myophonus caeruleus*
- Orange-headed Thrush - *Zoothera peronii*
- Siberian Thrush - *Zoothera sibirica*
- Sunda Thrush - *Zoothera andromedae*
- Scaly Thrush - *Zoothera dauma*
- Island Thrush - *Turdus poliocephalus*
- Eyebrowed Thrush - *Turdus obscurus*
- Lesser Shortwing - *Brachypteryx leucophrys*
- White-browed Shortwing - *Brachypteryx montana*
- Asian Brown Flycatcher - *Muscicapa dauurica*
- Ferruginous Flycatcher - *Muscicapa ferruginea*
- Mugimaki Flycatcher - *Ficedula mugimaki*

- Snowy-browed Flycatcher - *Ficedula hyperythra*
- Little Pied Flycatcher - *Ficedula westermanni*
- Indigo Flycatcher - *Eumyias indigo*
- Hill Blue-Flycatcher - *Cyornis banyumas*
- Grey-headed Canary-Flycatcher - *Culicicapa ceylonensis*
- Oriental Magpie-Robin - *Copsychus saularis*
- Sunda Robin - *Cinclidium diana*
- Sunda Forktail - *Enicurus velatus*
- White-crowned Forktail - *Enicurus leschenaulti*
- Javan Cochoa - *Cochoa azurea*
- Pied Bushchat - *Saxicola caprata*
- Short-tailed Starling - *Aplonis minor*
- Asian Glossy Starling - *Aplonis panayensis*
- Asian Pied Starling - *Sturnus contra*
- Pale-bellied Myna - *Acridotheres cinereus*
- Velvet-fronted Nuthatch - *Sitta frontalis*
- Blue Nuthatch - *Sitta azurea*
- Great Tit - *Parus major*
- Pigmy Tit - *Psaltria exilis*
- Barn Swallow - *Hirundo rustica*
- Pacific Swallow - *Pacific Swallow*
- Striated Swallow - *Hirundo striolata*
- Asian House-Martin - *Delichon dasypus*
- Straw-headed Bulbul - *Pycnonotus zeylanicus*
- Black-headed Bulbul - *Pycnonotus atriceps*
- Black-crested Bulbul - *Pycnonotus melanicterus*
- Sooty-headed Bulbul - *Pycnonotus aurigaster*
- Orange-spotted Bulbul - *Pycnonotus bimaculatus*
- Yellow-vented Bulbul - *Pycnonotus goiavier*
- Olive-winged Bulbul - *Pycnonotus plumosus*
- Grey-cheeked Bulbul - *Alophoixus bres*
- Sunda Bulbul - *Hypsipetes virescens*
- Zitting Cisticola - *Cisticola juncidis*
- Golden-headed Cisticola - *Cisticola exilis*
- Brown Prinia - *Prinia polychroa*
- Bar-winged Prinia - *Prinia familiaris*
- Yellow-bellied Prinia - *Prinia flaviventris*
- Plain Prinia - *Prinia inornata*
- Oriental White-eye - *Zosterops palpebrosus*
- Mountain White-eye - *Zosterops montanus*
- Javan Grey - throated White - eye - *Lophozosterops javanicus*
- Javan Tesia - *Tesia superciliaris*
- Sunda Bush-Warbler - *Cettia vulcania*
- Lanceolated Warbler - *Locustella lanceolata*
- Pallas's Grasshopper-Warbler - *Locustella certhiola*
- Mountain Tailorbird - *Orthotomus cuculatus*
- Common Tailorbird - *Orthotomus*
- Olive-backed Tailorbird - *Orthotomus sepium*
- Arctic Warbler - *Phylloscopus borealis*
- Eastern Crowned- Warbler - *Phylloscopus coronatus*
- Mountain Leaf-Warbler - *Phylloscopus trivirgatus*
- Sunda Warbler - *Seicercus grammiceps*
- Yellow-bellied Warbler - *Abroscopus superciliaris*
- Striated Grassbird - *Megalurus palustris*
- Rufous-fronted Laughingthrush - *Garrulax rufifrons*
- Horsfield's Babbler - *Malacocincla sepiarium*
- Temminck's Babbler - *Pellorneum pyrrogenys*
- Black-capped Babbler - *Pellorneum capistratum*
- Scaly - crowned Babbler - *Malacopteron cinereum*
- Chestnut-backed Scimitar-Babbler - *Pomatorhinus montanus*

- Large Wren - Babbler - *Napothera macrodactyla*
- Eyebrowed Wren - Babbler - *Napothera epilepidota*
- Pygmy Wren-Babbler - *Pnoepyga pusilla*
- White-breasted Babbler - *Stachyris grammiceps*
- White-bibbed Babbler - *Stachyris thoracica*
- Crescent-chested Babbler - *Stachyris melanothorax*
- Striped Tit-Babbler - *Macronous gularis*
- Chestnut-capped Babbler - *Timalia pileata*
- White-browed Shrike -Babbler - *Pteruthius flaviscapis*
- Chestnut -fronted Shrike -Babbler- *Pteruthius aenobarbus*
- Javan Fulvetta - *Alcippe pyrrhoptera*
- Spotted Crocias - *Crocias albonotatus*
- Australasian Lark - *Mirafra javanica*
- Orange -bellied Flowerpecker- *Dicaeum trigonostigma*
- Plain Flowerpecker - *Dicaeum concolor*
- Blood -breasted Flowerpecker- *Dicaeum sanguinolentum*
- Scarlet - headed Flowerpecker- *Dicaeum trochileum*
- Plain-throated Sunbird - *Anthreptes malacensis*
- Ruby-cheeked Sunbird - *Anthreptes singalensis*
- Olive-backed Sunbird - *Nectarinia jugularis*
- White-flanked Sunbird - *Aethopyga eximia*
- Scarlet Sunbird - *Aethopyga mystacalis*
- Little Spiderhunter - *Arachnothera longirostra*
- Long - billed Spiderhunter- *Arachnothera robusta*
- Yellow - eared Spiderhunter - *Arachnothera chrysogenys*
- Eurasian Tree Sparrow - *Passer montanus*
- Forest Wagtail - *Dendronanthus indicus*
- Yellow Wagtail - *Motacilla flava*
- Grey Wagtail - *Motacilla cinerea*
- Red Avadavat - *Amandava amandava*
- Tawny-breasted Parrotfinch - *Erythrura hyperythra*
- Pin-tailed Parrotfinch - *Erythrura prasina*
- Javan Munia - *Lonchura leucogastroides*
- Scaly-breasted Munia - *Lonchura punctulata*
- White-headed Munia - *Lonchura maja*
- Java Sparrow - *Lonchura oryzivora*
- Mountain Serin - *Serinus estherae*

Reptiles

- Crested Lizard - *Bronchocela cristatella*
- Bunglon - *Gonocephalus chamaeleontinus*
- False Calotes Lizard - *Pseudocalotes tympanistriga*
- Common Sun Skink - *Mabuya multifasciata*
- Green Whip Snake - *Ahaetulla prasina*
- Javanese Reed Snake - *Calamaria linnaei*
- Yellow - striped Racer - *Elaphe flavolineata*
- Malayan Pit - Viper - *Calloselasma rhodostoma*
- Flat-nosed Pit - Viper - *Trimeresurus puniceus*
- Banded Krait - *Bungarus fasciatus*
- Reticulated Python - *Python reticulatus*

Amphibians

- *Philautus aurifasciatus*
- *Microhyla palmipes*
- *Megophyrs montana*
- *Bufo melanostictus*
- *Leptophryne cruentata*
- *Rhacophorus reinwardti*
- *Rhacophorus javanus*
- *Polypedates leucomystax*
- *Rana chalconota*
- *Amolops masoni*

- Large Wren - Babbler - *Napothera macrodactyla*
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- *Microhyla palmipes*
- *Megophyrs montana*
- *Bufo melanostictus*
- *Leptophryne cruentata*
- *Rhacophorus reinwardti*
- *Rhacophorus javanus*
- *Polypedates leucomystax*
- *Rana chalconota*
- *Amolops masoni*

ABOUT AUTHOR

Wiratno

He graduated from Gadjah Mada University, Faculty of Forestry in 1988 and finish his master degree in Survey Integration for Natural Resource Management in ITC, The Netherlands in 1993. Working in Conservation Planning Section, DG.of Forest Protection and Nature Conservation in 1994-1998. Promotion to became Head of Unit KSDA in Yogyakarta happened in the period of 1999-2000. Position as policy analyst in Conservation International Indonesia brought him to conduct policy assessment in Papua (2001-2002) and Siberut Program (2003-2004). Recently, he was appointed as manager in Mt. Leuser National Park. Beside, he is very active writing many articles in news paper, he is a lead author of the book entitled 'Looking Into A Cracked Mirror: Reflection of Conservation and Implication for National Park Management (2001) supported by Gibbon Foundation and FoRest Press.

Saut M Lubis

He finish his master degree and PhD candidate in Meteorology and Ocean Engineering from University of Hawaii. In 1991 - 1993 taken hold Director Ocean and Air Pollution-BAPEDAL. Than, as consultant for Project of 21 Agenda and in 1999 - 2000 became National Project Coordinator for Sectoral Project of 21st Agenda-UNDP. Now he is working as Advisor on Sustainable Development-UNDP.

Hari Kushardanto

After got Coastal Management Continuation Training in Germany, 1997-1998. He got MSc in Environment and Development from University of East Anglia, England, in 2000. He ever been involved in some UNDP Project activities. Now become Program Manager for Rare-inspiring Conservation Indonesia.

Virza S. Sastawidjaja

Got MSc in Business Strategy and Environmental Management from University of Bradford, England 1998. Work at Environmental Ministry and BAPEDAL in 1990 - 1998, than become Environmental Economist in Nature Resources Management (NRM) - USAID