



BIODIVERSITY CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS IN INDONESIA

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Source: <https://travel.kompas.com/read/2021/09/20/092629927/desa-wisata-ranu-pani-tawarkan-wisata-alam-dan-fasilitas-lengkap?page=all>

ABSTRACT

In 2015, the world leaders agreed to the 17 Sustainable Development Goals (SDGs)- a shared blueprint for peace, prosperity for people, and the planet, now and into the future. These SDGs are 1. No poverty, 2. Zero hunger, 3. Good Health and Well-being, 4. Quality Education, 5. Gender Equality, 6. Clean Water and Sanitation, 7. Affordable and Clean Energy, 8. Decent work and Economic Growth, 9. Industry, Innovation and Infrastructure, 10. Reduced inequalities, 11. Sustainable cities and communities, 12. Responsible consumption and production, 13. Climate Action, 14. Life below Water, 15. Life on Land, 16. Peace, Justice, and Strong Institutions, 17. Partnership for the Goals, 17. Sustainable Development Goals Integration. In this article, we propose and highlight the rapid loss of biodiversity and dangerously changing climate are some indicators of this crisis.

INTRODUCTION

Life on Land Concerns with Biodiversity

Our world is in a crisis. Rapid loss of biodiversity and dangerously changing climate are indicators of this crisis. Conserving nature is fundamental to achieving a more prosperous, healthy, and equitable world, with this importance underscored and exacerbated by the COVID-19 pandemic. We need to reverse the loss of nature, recover our natural ecosystems, and do it now if we want to achieve the vision of “living in harmony with nature by 2050,” as indicated in the emerging post-2020 global biodiversity framework. While one in ten people still suffers from extreme poverty, more than one billion people have lifted themselves out of poverty during the last 25 years. However, humanity’s collective economic prosperity has come at a high cost for nature. Multiple drivers and pressures (Figure 1) negatively impact biodiversity and ecosystem services: never have human impacts on nature

been greater. Environmental assessments reveal two headlines. First, trends are overwhelmingly negative for all life on Earth and the benefits that nature provides to people. However, second, urgent transformative change can still turn these trends around.

Some assessments are based on IUCN’s global standards. The IUCN Red List of Threatened Species TM assesses 112,432 species and finds that extinction risk is high (~25%) and worsening. The Red List of Ecosystems will soon complement this in assessing the risk of ecosystem collapse. Comparing the 238,563 sites documented in the World Database on Protected Areas with the 16,366 sites documented in the World Database of Key Biodiversity Areas finds that the average protected area coverage of sites contributing significantly to the global persistence of biodiversity is only 43%.

The science and evidence on which IUCN’s work is based show that many of the planetary systems that

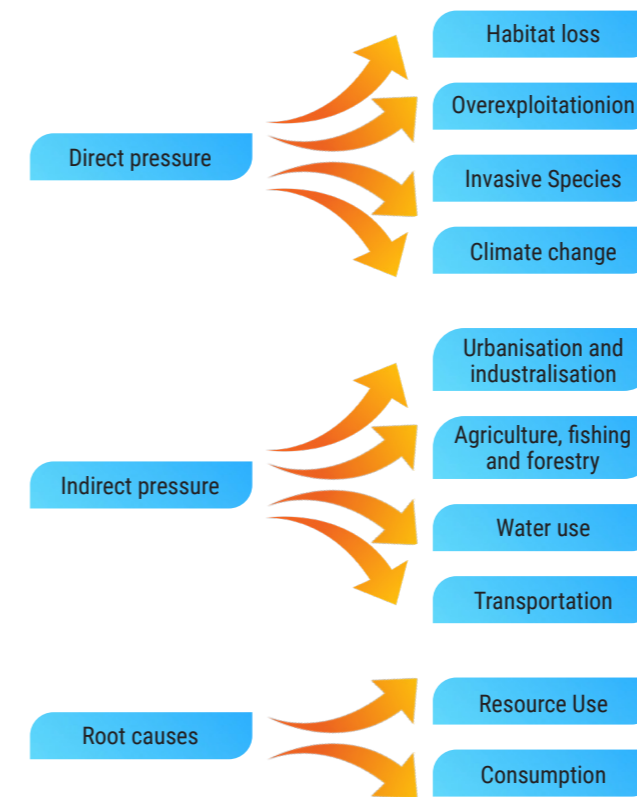


Figure 1. Multiple drivers and pressures negatively impact biodiversity and ecosystem services.

regulate climate and support life on Earth suffer major impacts from human activities. IUCN’s reports on ocean warming, acidification, and deoxygenation, for example, demonstrate the tremendous pressures that our marine systems and the biodiversity they support are undergoing. Similarly, our land, freshwater, and climatic systems are undergoing dramatic changes and their capacity to support life is rapidly decreasing. While not yet published, preliminary results from IUCN studies suggest substantial environmental linkages of the COVID-19 pandemic and human health in general (IUCN, 2021).

The 2019 Global Assessment Report of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) and the Global Biodiversity Outlook found that the world’s governments are not on track to deliver the 2011–2020 Strategic Plan for Biodiversity. Negative trends are also revealed in biome-specific assessments, e.g., the Global Land Outlook shows productivity declines from 20% of vegetated land from 1998–2013; the Global Wetlands Outlook shows a 35% decrease in the extent of wetlands since 1970; the World Ocean Assessment indicates severe and increasing human impacts through climate change, fisheries, ocean use, and pollution; and the Intergovernmental Panel on Climate Change reports on global warming and oceans show that anthropogenic greenhouse gas emissions have caused 1 °C global warming above pre-industrial levels with widespread negative impacts and that net CO₂ emissions will need to reach zero by 2050 and stay negative after that to limit global warming to 1.5 °C. The

Global Environmental Outlook and the Global Sustainable Development Report also highlight that transformative change is essential if these trends are to be reversed (IPBES, 2019).

Five Pathways to Transformative Change

Referring to The Nature 2030 IUCN Program, which provides an overview and targets that unite various indicators in saving the earth, with the main elements with transformative change for people, land, water, oceans and climate (Figure 2).

Recognize

Recognise that people and planet face unprecedented challenges, the urgency with which we must act, what we must do, and the role everyone can play. We also recognise that conservation works, that nature is wonderful, and that many are already working to protect and restore it.

Retain

Retain the world’s biodiversity, and natural and cultural heritage, in key biodiversity areas and other places where diversity and traditional knowledge flourish.

Restore

Restore species populations, ecosystems and the benefits that nature provides to people, capitalising on the UN Decade of Ecosystem Restoration.

Resource

Resource the movement by mobilizing investment in nature and the people working to conserve it through finance, capacity development and generating knowledge.

Reconnect

Reconnect people, societies and economies to nature, and rebuild connections between fragmented habitats.



Figure 2. IUCN’s Nature 2030 Programme Framework

Invasive Alien Plant Species Management in the Frame Work of Ranu Pani Ecosystems Rehabilitation

Ranu Pani is the origin of Bromo Tengger Semeru National Park (BTSNP). The protection status of Ranu Pani was awarded by the Dutch colonial government by declaring it as a Nature Reserve of Ranu Pane- Ranu Regulo in

1922. In 1981 the Nature Reserve of Ranu Pani and Ranu Regulo was changed to the Tourist Park and in 1985 was declared as part of the area of BTSNP together with the Nature Reserve of Sand Sea and the Nature Reserve of Ranu Gumbolo. For these reasons, the conservation effort of these lakes is very important to be implemented continuously since, historically, the existence of BTSNP must be distinct from that of Ranu Pani. Besides that Ranu Pani has a significant cultural value as one of the holy water resources and in one of the lakeside stands Rondo Kuning shrine, where ritual of Tengger people were held. The management of Ranu Pani is under the working section of the National Park management in the third area of BTSNP. Administratively Ranu Pani village is located in the district of Senduro, regency of Lumajang, East Java province. Geographical position is in between 08° 00' 20.4583" South Lat. and 112° 55' 51.6481" East Long. The naming of Ranu Pani refers to the existence of a mountainous lake in the village area, i.e. Ranu Pani. Beside that there are other nearby lakes, i.e. Ranu Regulo, as well as Ranu Kumbolo (the last lake is before the summit of Semeru mountain).

The village of Ranu Pani is located at an elevation of 2.200 m asl called as "enclaved village" another village Ngadas at an elevation of 1.900 m asl is also called an "enclaved village". Historically the two villages were formed since the 18th century based upon village community legend originated from the direct descendent of Mojopahit kingdoms. The name Tengger is originated from the names of village cofounders, i.e. Joko Seger and Roro Anteng. "Teng" is descended from 'An-teng' while "ger" is descended from 'Seger'. Literally translated, Tengger in Java dialect was assumed to originate from "ancient java Kawi". Based on this historical culture, therefore, people community in these villages, cannot be moved by the Government at will, although there are regulations in the BTSNP Law. The local community existed long before the BTSNP regulation was declared; where they are native people who, as individual or social entities, are termed by the Government as indigenous people.

PROBLEMS THREATENING THE ECOSYSTEMS INTEGRITY

Fire Wood and Dry Land Annual Cropping Systems

Ranu Pani lake is located in fragile ecosystems, surrounded by an extensive forest in a very steep slope, which is prone to erosion. The forest has been cleared for agriculture and cattle farming in the last century prevailing up to now for almost 100 years. The location of Ranu Pani Village is shown in Figure 3. The figure is too small to identify Ranu Pani and Ranu Regulo, but in Figure 4 is more conspicuous.

Ranu Pani suffered from sedimentation through both landslides from the hilly forest and erosion from agricultural areas. The erosion is caused by the agricultural field with a steep slope, as shown in Figure 5.



Figure 3. The village of Ranu Pani is shown as areas of the forest that has been cleared for human settlement and the accompanying agricultural lands.

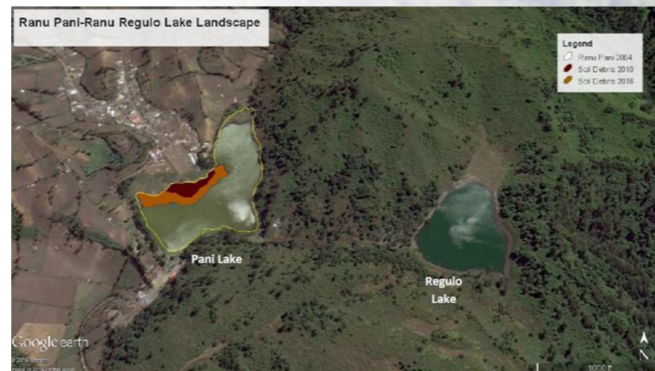


Figure 4. The picture is showing the Ranu Pani with grey water color, yellow and brown sedimentation, while Ranu Regulo, exhibits blue water color indicating a better water quality.



Figure 5. The erosion is caused by the agricultural field with a steep slope in Ranu Pani

The cultivation of potatoes in Ranu Pane village is indeed very profitable. It would be difficult to convince farmers not to grow potatoes.

The continuing human pressure in Ranu Pani as shown in Figure 5 to fulfill their need must be addressed wisely. This condition is critical, the impacted forest has been suffering from the invasion of invasive alien plant species threatening further degradation.



<https://jadesta.kememparekraf.go.id/desa/ranupani>

REPORTED FOREST TREES AROUND RANU PANI VILLAGE

Floristic data are not found, but several reports provide useful information the existence of some invasive alien plant species, indicating the alteration of vegetation composition (Table 1)

Table 1. The reported vegetations around Ranu Pani forest

No	Local Names	Scientific Names	Refernces	Comments
1	Kirinyu	<i>Chromolaena odorata</i>	S. Budiyantri	Invasive alien
2	Akasia gunung	<i>Acacia deccurens</i>	(2015)	Invasive alien
3	kiambang	<i>Salvinia molesta</i>		Invasive alien
4		<i>Eupatorium riparium</i>		Invasive alien
5		<i>Clibadium surinamensis</i>		Invasive alien
6	Adas	<i>Foeniculum vulgare</i>	Sawitri dkk.	
7	Bunga paitan	<i>Titonia diversifolia</i>	(2019)	Invasive alien
8	kecubung	<i>Datura fastuosa</i>		
9	Anggrek tanah	<i>Herbania sp.</i>		
10	Kipres	<i>Casuarina semiperens</i>		
11	Cemara gunung	<i>Casuarina junhuniana</i>		
12	Persilon	<i>Acacia auriculiformis</i>		Invasive alien
13	Bunga ungu	<i>Verbena braziliensis</i>		Invasive alien
14		<i>Paraserianthes lapantha</i>		
15		<i>Fuchsia megallamania</i>		
16		<i>Acer laurinum</i>	Hariyati (2013)	Local species
17		<i>Acmena accuminatisima</i>		Local species
18		<i>Lithocarpus sundaicus</i>		Local species
19		<i>Vernonia arborea</i>		Local species
20		<i>Aglaiia odoratissima</i>		Local species
21		<i>Dodonaea viscosa,</i>		Local species
22		<i>Ficus sp.,</i>		Local species
24		<i>Homalanthus giganteus</i>		Local species
25		<i>Macropanax dispernum</i>		Local species
26		<i>Pittosporum moluccanum</i>		Local species
27		<i>Engelhardia spicata</i>		Local species

Those invasive alien plant species have proved themselves to possess a great capacity to invade the habitat they are living in, capable of competing out the local species reducing biodiversity considerably. It is recommended, therefore to reduce the population of those invasive alien plant species and to replace with local species. When the local species is established it will reduce the soil erosion as well. This is in line with the recommendation of expert from the Faculty of Agriculture University of Brawijaya.

Ranu Pani lake was formed from caldera following ancient eruptions of Semeru mountain, and with time was filled

up with rainwater from surface flow and soil infiltration (Fitri, 2015; Kenedie, 2016). This lake function (and other similar lakes) is to balance or as an indicator of ecosystem health. Healthy lakes from healthy ecosystems may be developed for the benefit of human beings, such as for tourism of the natural environment, agricultural sources of water, and other anthropogenic activities such as fisheries and water sources for households (Widyastuti, Sukanto & Setyaningrum, 2015). The current water quality of Ranu Pani and Ranu Regulo lake is presented in Table 2.

Table 2. Water quality of Ranu Pani and Ranu Regulo recorded up to 2016 Sawitri & Takandjandji (2018).

No	Analysis Parameter	Unit	2002 ¹		2008 ²		2011 ³		2016 ⁴	
			RPane	RRglo	RPane	RRglo	RPane	RRglo	RPane	RRglo
Physics										
1	TDS	mg/l	-	-	-	-	180	53.75	40.66	1.96
2	TSS	NTU	-	-	-	-	57.50	22.50	7.50	7.80
Chemistry										
3	pH	mg/l	8.61	7.29	5.38	6.83	6.56	6.38	6.87	6.58
4	BOD	mg/l	-	-	-	5.27	2.55	2.16	23.70	28.00
5	COD	mg/l	-	-	-	-	10.56	7.16	48.60	58.30
6	DO	mg/l	13.65	13.30	8.67	-	5.24	5.50	3.40	3.30
7	PO ₄	mg/l	-	-	0.25	0.25	0.75	0.39	0.68	0.43
8	NO ₃ N	mg/l	0.01	0.01	0.12	0.05	1.13	0.53	0.04	0.07
9	Cl	mg/l	-	-	-	-	-	-	4.90	0.05
10	SO ₄	mg/l	-	-	-	-	-	-	3.40	5.10
11	Detrjent	mg/l	-	-	-	-	-	-	0.54	0.30
Microbiology										
12	Fecal	MPN/							1100	140
13	Caliform	100								
	Chlorophyla	mg/m ³							128	24

The water quality of Ranu Pani recorded from 2002-2016 has been deteriorating, values of BOD and COD increased considerably in 2016 while DO has been decreasing to a very low value. This condition indicated substantial organic pollution that must be addressed accordingly to find out the process that facilitated the deterioration and soon must be overcome to remedy the condition.

The concentration of [PO4-] and [NO3-] ions are very high brought by soil eroded from an excess of fertilizer applied by farmers in their agricultural fields. Adding massive fertilizer ions to Ranu Pani water stimulated the excessive growth of *Salvinia molesta* an invasive aquatic weed from South America. BIOTROP has been working on *Salvinia molesta* since 1970s' The biological control of *Salvinia molesta* using its natural enemy, *Cyrtobagous salviniae* was studied in 1995. The study of its host specificity was completed in 1997. The colony was released in the field where this *Salvinia molesta* was a problem, such as in Danau Ranau in Banten, or in various lebung inside Sugarcane Gunung Madu Plantation in South Sumatera. BIOTROP is ready to send the colony of *Cyrtobagous salviniae* to Ranu Pane any time. It is important to be aware that the biocontrol agent must be observed and evaluated regularly to ensure its population is sufficiently high.

The recommendation of semiloka "Kegiatan Updating data Fasilitasi Pemulihan Ekosistem Ranu Pane 2019" (Kenedie, 2019), was very supportive to the management of Ranu Pani village in the framework of developing Ranu Pani as a hub of the tourism in BTSNP.

1. The Regent of Lumajang regency promoted historical tourism capitalizing on the history of the Tengger people, with their legends. The Regent, through the Tourism Service, targeted 600 visitors daily. At any moment, there will be 600 visitors climbing BTSTN. It is estimated that there will be 1500 visitors queueing to climb up the mountain, waiting for 4 days intervals at Ranu Pani. Therefore, it is important to redesign Ranu Pani village to enable them to honor the visitors by providing comfortable lodges, inns, or hotels and modern culinary capable of satisfying the visitors. The lodges or hotels shall be constructed well, preventing the managers from using firewood energy to warm the rooms.

2. The management of refuse has been mentioned on several occasions. It is important to have this particular commitment because it is an indication that we care to the environment, care to the visitors, care to conservation, care to biodiversity, in fact these are what we are advocating to sell. The deterioration of Ranu Pane water quality is 2 sides, one is an excessive ionic nutrient from the practice of dry land annual cropping systems in a very steep slope, supporting the excessive growth of the invasive alien aquatic plant *Salvinia molesta*. Two is the pollution of domestic refuse that is thrown away in the ditch and brought to Ranu Pani lake. A great number of visitors were camping around the lake, it was comfortable for them and practical too just to throw the rubbish they had after their delicious dinner. It must not happen again.

Biodiversity Contribution to SDG in Indonesia

- BIOTROP is currently studying the service of "Black Soldier's Fly" or BSF (*Hermetia illuciens*), which has been known to digest organic refuse to become compost and the maggot or larvae of this fly is so useful that it may be used for chicken feeding or even fish which will constitute of integrated management of Ranu Pani lake. The pollution of organic refuse will be prevented from flowing into the lake; one problem of degrading the Ranu Pane water is solved, and when the sedimentation can be prevented by reforestation of degraded forest and the establishment of agroforestry the Ranu Pani lake will become a healthy lake again, when this recovered lake is utilized for fisheries.
- Currently *Salvinia molesta* can easily be removed from the lake easily. BIOTROP in line with this activity is ready for developing fisheries methods in Ranu Pani lake that suitable to the existing condition. This will open up jobs to produce fish enriching raw material for unique different culinary in Ranu Pane village hotels or inns.
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- Recommendations from the faculty of Agriculture to introduce agroforestry systems may be good. BIOTROP has a program of Vocational School on Agriculture specializing in the introduction of tropical fruits. This program is indeed suitable to support the restoration of degraded ecosystems of Rani Pani by introducing say "coffee plantation" owned by individual farmers, which is suitable to be planted in the agroforestry system beside the annual crops for their livings. It is also an opportunity for creative persons to produce beautiful things that may be taken by visitors for their love one back home.
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CONCLUSION

- Ranu Pani Village is located in fragile ecosystems. It is surrounded by forest in very steep slope, and prone to erosion. It was declared as a new village with its government power to administer and provide services to the population of Ranu Pani. Electricity line was installed in its early establishment of village apparatus
- While the population was only 20 families in 1950's it reached 395 families in 2014.
- The population livelihood is mainly dry land annual cropping systems, planting potato, cabbage, and spring. Onion. The planting of potatoes is very profitable. However, the practice of this kind of agriculture is facilitating a considerable pollution to Ranu Pani lake.
- Adopting a soil conservation technology such as terracing or adoption of agroforestry at the same time also reforestation of degraded forest due to previous clearing, may halt the sedimentation and organic pollution due to the growth of *Salvinia*.

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ACKNOWLEDGEMENT

We thank to SEAMEO BIOTROP for providing the trip to Ranu Pani, Bromo Tengger Semeru National Park.

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Agro-Eco-Edu-Tourism Program in Supporting Biodiversity Conservation

SEAMEO BIOTROP'S Program to enhance the continuation of tropical biodiversity conservation program in Southeast Asia through agricultural and ecosystem based education and tourism activities

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