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Identification Of Damage To The Sirimau Protected Forest On Ambon Island

Fransina Sarah Latumahina[1], Gun Mardiatmoko[2], Susilawati[3]

[1,2.] Department of Forestry, Agriculture Faculty Pattimura University, Ambon, Maluku, Indonesia
[3.] Department of Forestry, Lambung Mangkurat University, Banjarmasin, South Kalimantan, Indonesia
**Corresponding Author: fransina.latumahina@yahoo.com*

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ABSTRACT

The research was carried out in the Sirimau Protected Forest area of Ambon Island in June – October 2024, several forms of damage in the protected forest are Konk, Cancer, Damage to leaf shoots or shoots, Broken or dead branches, Open Wounds, Termite Attacks, Liana, Brum, Moss, Broken Rod, Leaves Discoloration. The damage to the Sirimau Protected Forest has caused serious ecological impacts, especially the decline in the forest's ability as a primary water catchment and absorption area for Ambon City. This has implications for increasing the risk of hydrometeorological disasters, such as flash floods and landslides in downstream areas, and threatens the sustainability of clean water supplies for residents.

INTRODUCTION

The condition of Protected Forests on small islands in Maluku in the last ten years has experienced a worrying condition, where Landsat-6 image data shows that there has been a change in protected forest cover in Maluku covering an area of 34,776 ha/year due to forest fires, pest and disease attacks, clearing of forest areas, livestock grazing, illegal logging, low monitoring and evaluation measures, and forest utilization based on individual interests. This condition results in disturbances to biodiversity and the health of protected forests, as a result of which

protected forests are unable to function as a life support system to regulate water systems, prevent floods, control erosion, prevent seawater intrusion, maintain soil fertility and fail to prevent global warming on small islands in Maluku. This condition is in contrast to the role of protected forests whose existence must be protected because it is useful as an ecosystem guardian, whose determination is based on the function of forests according to Law Number 41 of 1999 concerning Forestry. Therefore, it is considered necessary and very important to know the level of vegetation biodiversity and the health status of protected forests from an early stage (*Early warning*) as a preventive measure for regional protection in the face of the impact of climate change and the provision of food sources from forest areas on small islands. Healthy Protected Forests are formed when biotic and abiotic factors in the forest are not limiting factors in achieving the functions and benefits of forests in this and future periods. Healthy forest conditions are characterized by stable vegetation biodiversity, biomass accumulation and rapid nutrient cycles, and no damage by pest organisms. Biodiversity is one of the measurement indices in forest health assessments, which can also affect carbon stores in a forest community. Biodiversity is used as one of the indicators of forest health assessment because almost 99.9% of biodiversity and productivity of protected forests have a great influence on ecosystem stability and regional health. *Forest Health Monitoring Field Methods Guide* It is known that assessments with biodiversity parameters are based on the health of the constituent trees, while the health of trees is affected by the damage to trees in the forest that occurs due to the attack of pathogens, pests and human activities. Healthy Protected Forests must be able to carry out physiological functions with ecological resilience from various disturbances. In the last decade, the level of biodiversity and the health of protected forest ecosystems have become the main focus in the management of the area in the Small Island. This is due to the increasing cases related to Protected Forests in Maluku where there is a decrease in protected forest cover by 30-35%/year which is characterized by the loss of vegetation biodiversity and other ecosystem disturbances. Starting from the above background, the formulation of the problem presented is how to measure the level of protected forest biodiversity and the assessment of the health of protected forest ecosystems on small islands in Maluku in facing the impact of climate change so that forest health status information can be used as a basis for decision-making and policies in managing Protected Forests for the realization of the concept *green economy,* Where protected forests must be maintained so that people living around protected forests do not experience the impact of damage that can affect the welfare of the community through community economic activities by restricting the use of natural resources in protected forests.

The existence of protected forests on small islands in Maluku in the last ten years has experienced crown damage, biodiversity disturbances, productivity disturbances, decreased site quality and the emergence of damage as a result of the deterioration of the health of protected forests and not functioning optimally. This condition needs serious attention because if the health of the protected forest is disturbed, it will have an impact on water systems, flooding and erosion, seawater intrusion, decreased soil fertility and hydrometric disasters on small islands. Information on the health status of protected forests in Maluku has never been known definitively and comprehensively, so through this study accurate information will be obtained about the health status of protected forests that will be used to maintain the health quality of protected forests in a parmanent manner so that protected forest conservation efforts can be carried out from an early age within the framework of *the green economy* concept especially in efforts to restrict public

access to protected forests Information on the health status of protected forests in Maluku has never been known definitively and comprehensively, so that through this research accurate information will be obtained about the health status of protected forests that will be used to maintain the health quality of protected forests in a parmanent manner so that protected forest conservation efforts can be carried out from an early age within the framework of *the green economy* concept especially in an effort to restrict community access to protected forests so that protected forests are maintained and controlled to be used appropriately for the welfare of the community around the area. The approach to solve the research problem is with a *Forest Health Monitoring Field* system using the parameters of crown health, biodiversity level, site quality, damage rate, and productivity assessment which will determine the level of health of the protected forest ecosystem on small islands in Maluku so that the existence of protected forests is maintained. The problem found in a decade in protected forest areas on small islands in Maluku is the decline in the function and potential of protected forests as a result of flooding, erosion, seawater intrusion, decreased soil fertility and hydrometric disasters due to climate change on small islands. Therefore, strong efforts are needed to ensure the preservation of protected forest ecosystems to ensure their functions and benefits. One of the criteria for achieving sustainable forests is the value of biodiversity and the health of its forest ecosystems. Therefore, this research is new, especially for the protected forest ecosystem in Maluku, so it is expected to be the policy basis for the conservation movement in the framework of *the green economy* in dealing with the impact of climate change on small islands in Maluku. The protection and health aspects of forests as a chain of forest maintenance or development must be an integral part of a forest management unit in order to protect forests and their components from various factors that cause damage. In the past decade, research to assess the health of protected forest ecosystems has never been carried out in Maluku, and even in other areas it is also very limited to monoculture forest areas such as Teak Forest and Meranti Forest. This research will be different from previous research based on the parameters used, namely the health of the crown, the level of biodiversity, the quality of the site, the level of damage, and the assessment of productivity in protected forests that are different ecologically and geophysically with varied habitat conditions, as well as the concept of *green economy* Limiting the exploitation of protected forests is also used in this study by looking at community activities around the forest with the final result will produce a healthy protected forest model and will be the basis for the implementation of the sustainable protected forest protection and conservation movement in the face of the impact of climate change on small islands. The purpose of the research is to identify the form of damage in the Sirimau protected forest area in dealing with the impact of climate change on small islands in Maluku.

RESEARCH METHODS

The research was carried out in the Sirimau Protected Forest area of Ambon Island with plot points in the forest area in Rutong Country in June – October 2024 as seen in the map below.

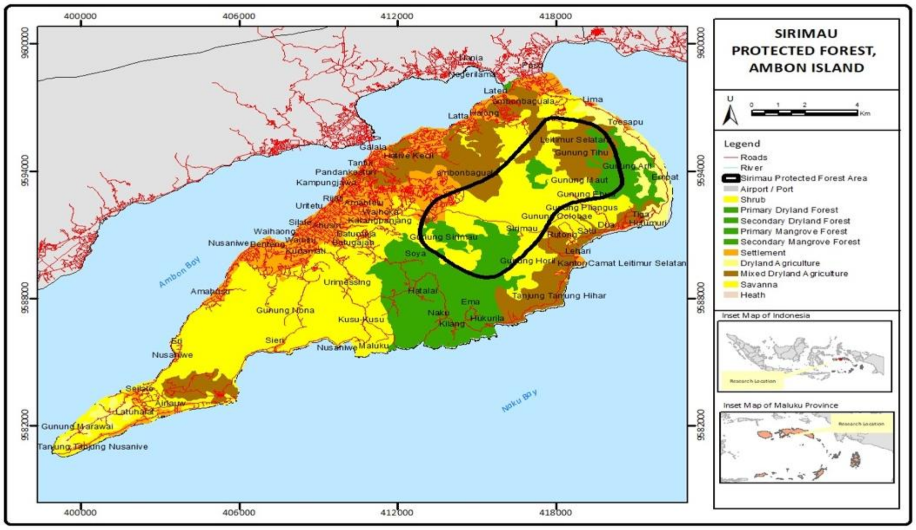


Figure 1. Map of Sirimau Ambon Protected Forest

The research was carried out in the Sirimau Protected Forest area of Ambon Island with plot points in the forest area in Rutong Land and on Haruku Island with plot points in Haruku Land

RESULTS AND DISCUSSION

Forms of Damage to the Sirimau Protected Forest area
The results of the analysis of the forms of damage in the Sirimau protected forest area can be seen in the table below

Table 1. Forms of Damage in the Sirimau Protected Forest area

Forms of Tree Damage							
Claster	**Plot**	**Damage Type**	**Damage Code**	**Number of Trees**	**Damage Location**	**Damage Pictures**	**Information**
I	**1**	Moss	31	76	Roots and lower stems	**=**  Location of moss on the roots and stems of the lower algae	1 tree 5 forms of damage
		Broken Rod	5	28	Upper trunk		

						 Broken Rod	
		Liana	20	31	Trunk	 Liana	
		Conk, fruit body and other indicators	2	1	Top of the stem		

						 Conk damage to the top of the stem	
		Brum on the roots or stems	12	1	Roots and lower stems	 Brum on the roots and lower trunk	
	2	Moss	31	40	Roots and lower stems		1 tree 5 forms of damage

						 Moss on the roots and lower stems	
		Brum on the roots or stems	12	2	Lower trunk and upper trunk	 Brum on the rootstock and upper trunk	
		Termite	6	2	Roots and lower stems		

						 Termites on the roots and lower trunks	
		Broken/dead branches	22	4	Branch	 Broken/dead branches	
		Broken Rod	5	31	Top of the stem		

						 Broken stem top of the stem	
	3	Broken Rod	5	43	Top of the stem	 Broken stem at the top of the stem	1 tree 7 forms of damage
		Moss	31	62	Bottom of the stem		

						 Moss on the trunk of the trunk	
		Moss	20	23		 Liana on the upper stem	
		Termite	6	13	Roots and lower stems	 Termites on the roots and lower trunks	

		wounds	3	4	Bottom of the stem	 Open wound on the bottom of the trunk	
		Broken branches	22	5	Branches	 Broken Branches on the branch section	
		Brum on the roots or stems	12	2	Bottom of the stem		

						 Brum on the bottom of the stem	
	4	Moss	31	45	Bottom of the stem	 Moss on the bottom of the stem	1 tree 4 forms of damage
		Termite	6	4	Roots and lower stems		

						 Termites on the roots and lower trunks	
		Liana	20	21	Top stem	 Liana on the upper stem	

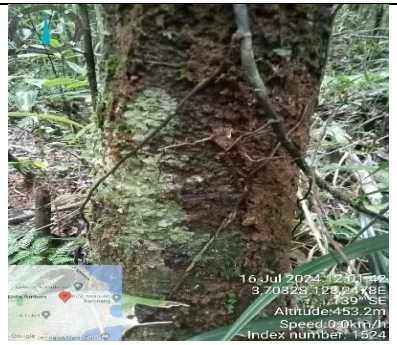
		Broken/dead branches	22	1	Branch	 Broken/dead branches	
II	**1**	Moss	31	38	Bottom of the stem	 Moss on the bottom of the stem	1 tree 5 forms of damage
		Broken Rod	5	18	Top of the stem		

						 Broken stem at the top of the stem	
		Liana	**20**	**13**	**Top of the stem**	 **Liana on the top of the stem**	
		Open wounds	3	1	Bottom of the stem		

						Open wounds on the bottom of the trunk	
		Brum on the roots or stems	12	4	Bottom of the stem	 Brum on the lower trunk	
	2	Termite	6	5	Root and lower stem	 Termites on the trunk and lower roots	1 tree 4 forms of poverty
		Liana	20	24	Top of the stem		

						 Liana on the top of the stem	
		Broken Rod	5	11	Top of the stem	 Broken stem at the top of the stem	
		Cancer	1	2	the top of the stem		

						 Cancer of the upper part of the trunk	
	3	Moss	6	14	Lower trunk	 Moss on the lower trunk	1 tree 4 forms of poverty
		Termite	6	11	Roots and lower stems		

						 Termites on the roots and lower trunks	
		Broken Rod	5	8	Top of the stem	 Broken rod at the top of the rod	
		Liana	20	15	Top of the stem		

						 Liana on the top of the stem	
	4	Moss	31	25	Bottom of the stem	 Moss on the bottom of the stem	1 tree 5 forms of keruasakan
		Konk, fruit body and other indicators	2	3	crown		

						 Kong on the title bar	
		Liana	20	7	Top of the stem	 Liana on the top of the stem	

		Termite	6	13	Root and lower stem		
		Broken Rod	5	20	Top of the stem	 Broken stem at the top of the stem	

Source : Primary data, 2024

The results of the recapitulation of the forms of damage in the Sirimau protected forest area can be seen in table 2 below

Table 2 Recapitulation of the form of damage in the Sirimau Protected Forest area

Number	Damage Type	Damage Code	Sum	Location
1	Broken Rod	5	102	Cluster 1
2	Moss	31	216	
3	Liana	20	75	
4	Termite	6	19	
5	Mist	12	5	
6	Broken/dead branches	22	10	
7	Konk, fruit body and other indicators	2	1	
8	Open wounds	3	4	
9	Damaged leaves, shoots or shoots	24	73	
10	Leaves change color	25	60	
1	Broken Rod	5	57	Cluster II
2	Moss	31	77	
3	Liana	20	59	
4	Termite	6	29	
5	Mist	12	4	
6	Cancer	1	2	
7	Konk, fruit body and other indicators	2	3	
8	Open wounds	3	1	
9	Damaged	24	89	

	leaves, shoots or shoots			
10	Leaves change color	25	73	
1	Broken Rod	5	15	Cluster III
2	Moss	31	212	
3	Liana	20	175	
4	Termite	6	8	
5	Mist	12	2	
6	Broken/dead branches	22	2	
7	Konk, fruit body and other indicators	2	12	
8	Open wounds	3	1	
9	Damaged leaves, shoots or shoots	24	86	
10	Leaves change color	22	131	

Source : Primary data, 2024

The forms of damage found in forest areas can be explained as follows:
Konk is characterized by the presence of decay in the infected part of the wood, which can lead to weakening of the plant structure and even death. The characteristics of konk include:

- Discoloration of wood: The part affected by the konk will usually change color to darker or even blacker.
- Soft wood texture: Wood rotten from konk will feel softer when compared to healthy wood.
- The presence of fungal mycelium: Often, we can see fungal mycelium (fine threads) growing in or on rotten wood surfaces.
- Unpleasant odor: Wood that rots due to konk usually emits a characteristic odor, such as a musty or foul odor.

The main cause of the occurrence of konk is fungal infestation. The fungus that causes konk usually gets into plant tissues through wounds on the skin or branches, or through injured roots. Factors that can accelerate the development of konk include:

- High humidity: Humid environmental conditions strongly favor the growth of conk-causing fungi.

- Warm temperatures**:** Warm temperatures are also ideal conditions for fungal growth.
- Plant age: Plants that are old or under stress are more susceptible to conk-causing fungal attacks.

Konk is caused by the infestation of fungi and pests that attack the bark. Phytophtora palmivora fungus is a type of fungus that often damages trees.

Pest attacks can also cause damage to the bottom of the tree trunk. (Arwanda et al. 2021 & Siregar et al. 2023). Symptoms of konk are usually seen as open boils or bark damage. In the early stages, the damage to the snail is in the form of small spots on the bark, which then develop into large wounds. Untreated damage to the snail can lead to the death of the tree. (Arwanda et al. 2021 & Siregar et al. 2023). The impact of konk on plants varies greatly, depending on the severity of the damage. Some of the possible impacts. Damage to conk on trees can affect tree health, inhibit growth and reduce biomass. Other impacts are the loss of the canopy, the death of trees, and changes in the structure of the forest. This has an impact on the overall destruction of the forest. (Arwanda et al. 2021 & Siregar et al. 2023). Based on Pertiwi, at.al (2019) explained that the type of damage to *konk* (fruit body) is damage characterized by the presence of mushroom/fungal fruit bodies which are a sign of further weathering on the tree trunk.

1. Cancer

Cancer in plants is one of the most serious diseases and can cause great losses in agriculture. Although the name is the same as cancer in humans, the mechanism and causes are different. In plants, cancer is generally caused by pathogenic infections such as fungi, bacteria, or viruses. (Surachman, N, A. 2023.)

2. Damage to leaf shoots or shoots

Damage to leaf shoots is characterized by a change in the color of the leaves, yellow spots appear on the leaves, which is caused by the disease of chlorosis of plants attacked by chlorosis. Symptoms and signs that are seen are yellowing leaves with mosaic patterns, spots, rings, or haris patterns. The density of the soil is also included in the factors that affect root development which causes a lack of nutrient supply so that it has an impact on the yellowing of the leaves. Damage due to chlorosis shows that mangroves are deficient in nutrients. (Sodikin, 2019).

3. Broken or dead branches

The breakage of the branches is caused by strong winds and continuous rain so that the branches are weathered and easily broken. Broken/dead branches occur due to weak branching conditions or the presence of seasonal/weathered branches (Haikal *et al.,* 2020).

4. Open Wounds

Open wounds are a type of damage that occurs due to biotic factors or abiotic factors. Open wounds are the main factor in the occurrence of weathering in wood. The weathering of the wood can increase the potential for tree fall or collapse. Wounds on the tree provide access to destructive organisms such as bacteria, viruses, pests and other organisms. Wood destructive fungi found in trees will develop through wounds in trees (Rikto, 2010).

5. Termite Attacks

Termite attacks are characterized by the presence of soil crusts on the trunk that threaten the survival of the tree. The affected parts of the tree are found at the base and trunk of mangrove trees because the base and trunk contain a lot of cellulose substances that are preferred by termites. Termite spread through branches, stems, twigs or through liana plants found in

mangroves (Pertiwi *et al.,* 2019). Termites feed on cellulose in the wood where a severe attack will leave cavities or holes in the tree trunk, making the tree porous and fragile. This can cause the tree to break easily, especially when there are strong winds, wood powder (termite droppings) is found around the base of the tree at the roots, especially the respiratory roots (pneumatophore), where termite attacks can cause structural damage that weakens the tree's ability to breathe and absorb nutrients.

6. Moss

Moss or climbing plant is a type of plant that is a characteristic of the tropical rainforest ecosystem and its existence adds to the diversity of plant types in the forest ecosystem. The most obvious sign of liana infestation is the trunk and branches of mangrove trees entangled by liana tendrils where these twists can be very strong and pressing, potentially injuring the bark of the tree trunk and disrupting the flow of nutrients. Liana is a formidable competitor, although it does not get food from the host tree because it is not parasitic), it competes fiercely in absorbing water and nutrients from the soil, which can be detrimental to the growth of mangrove trees. As the moss grows and wraps, they can cover the tree's crown (canopy), blocking the sunlight that the tree needs to photosynthesize. This can significantly inhibit tree growth. In the case of severe liana infestation, the coiled weight of the liana can add to the heavy load on the mangrove tree, especially when wet. Tight windings can also stifle stem growth, causing the tree to become weak, porous, and eventually die and fall. The presence of the dominant liana can change the composition of mangrove forest vegetation. Fast-growing lianas can reduce tree biomass and carbon sequestration by the forest as a whole, which disrupts the balance of the ecosystem, so to control these attacks, regular cleaning of lianas is highly recommended. (Apriani, H., Kiswanto., and Marjenah. 2022)

7. Brum

Brum is the growth of new shoots that occur on roots, stems or branches. The growth of these shoots is an abnormal event due to overgrown shoots. reveals that abnormal growth in plants, such as excessive stem growth based on experience, is caused by genetic abnormalities inherited by the parent and also due to environmental factors in the location where the tree grows, where this growth has a great effect on the reproduction of a tree, because the growth of these shoots causes a lack of optimal distribution of the results of the tree's metabolism (Rikto 2010).

8. Moss

Moss is a type of plant that does not seem to attract attention and often causes a dirty environment. Damage due to moss growth can cause disruption of metabolic processes in trees, moss that accumulates on the trunk can also clog air circulation so as to interfere with the process of photosynthesis and plant respiration so that it can worsen the health condition of the tree. According to Sri Winarsih (2008), crustal mosses are formed from a symbiosis of mutualism between fungi and algae that live attached to various substrates epiphytely. (Abimanyu, B,. Safe'i, R., Hidayat, W. 2018)

9. Broken Rod

Damage to broken trunks is one type of rust observed in mangrove trees, which is characterized by the breaking of the trunk to the inside of the wood that is visible through the gaps between the broken mangrove trunks. This type of damage is caused by various factors, including attacks of pests that destroy plants that cause holes to form in the plant (Pertiwi, et al. 2019).

10. Leaves Discoloration

Leaves experience discoloration due to chlorosis which is characterized by yellowing leaves with mosaic patterns, spots, rings, or haris patterns. The density of the soil also affects the development of mangrove roots which causes a lack of nutrient supply so that it has an impact on the yellowing of the leaves. Chlorosis shows that trees lack nutrients, where nutrients are one of the factors needed in the process of growth and development of mangroves, because if there is a lack of nutrients, it causes disorders and symptoms in various forms so that it can cause death.

CONCLUSION

Based on the analysis and discussion of the damage identified in the Sirimau Protected Forest on Ambon Island, the following conclusions can be drawn. Significant damage has occurred in the Sirimau Protected Forest area, characterized by changes in land cover, primarily due to attacks by pests, diseases, weeds, and lianas. This is compounded by socio-economic pressures on communities living near the forest, coupled with weak monitoring and law enforcement systems. The community's dependence on forest resources for their livelihoods has encouraged encroachment, which has not been accompanied by effective prevention and enforcement efforts. The destruction of the Sirimau Protected Forest has had serious ecological impacts, particularly the reduction in the forest's capacity as a primary water catchment area for Ambon City. This has led to an increased risk of hydrometeorological disasters, such as flash floods and landslides in downstream areas, and threatens the sustainability of clean water supplies for residents.

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