Landscape-based multifunctional plant forest management

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Abstract. This study aims to analyze the characteristics of land use, land tenure, and the role of stakeholders in each landuse unit and to formulate a multifunctional landscape setting model for the PT Inhutani I Plantation Forest Management Unit Gowa Industrial Forest, which is adaptive to physical conditions, land tenure, and stakeholder interests. Landscape-based multifunctional plantation forest management analyzes in terms of land use, land tenure and stakeholders. Landuse is in the form of physical conditions such as land cover, altitude, soil type, geology, slope and climate, then land tenure is in the form of land ownership rights, namely on the part of the industrial plantation forest manager and the community around the industrial plantation forest area who have interests or activities in the area and stakeholders in the form of institutions or related stakeholders. The results of the study show that the characteristics of landuse in the last 5 years have changed in several places from forested to rice fields or open area, this is also evidenced by the results of land tenure where people have a high dependence on land around the area to meet their daily needs. Based on this, a multifunctional landscape setting model was created that leads to the use of NTFPs that will involve more communities in management.

1. Introduction

Forests are ecosystems that are still a topic of much attention and study by researchers. This cannot be separated from the role of the forest which is very important for human life as well as being very vulnerable to damage both naturally and due to human activities. The existence and existence of forests until now continues to experience shrinkage. During 2018-2019, there has been 462,458 ha of deforestation in Indonesia (Directorate General of Forest Planology and Forest Governance 2020) while according to FAO (2020) it is stated that in the 2010 and 2020 periods there has been a deforestation of 4.7 million ha/year throughout world [1].

Not all forest areas in Indonesia are forested, as stated by the Ministry of Environment and Forestry in the 2019 Land Cover Recalculation Book, only 46.3% of forest area is forest and the rest is non-forest with a total of 43% conservation and protected forest areas, 22% fixed production forest, 24% limited production forest, and 11% convertible production forest. Meanwhile, the ratio of primary natural forest, secondary forest and plantation forest is 48.1%, 39.7%, and 4.6%, respectively. The presentation of plantation forests is still very small, even though plantation forests have a more flexible and wider designation than natural forests, especially plantation forests that have good potential to be used together with communities around the forest.

The physical condition of the land is the condition or condition of the land which includes soil type, pH, and temperature. Topography itself means the shape or condition of the earth which is usually marked by differences in altitude. The physical condition and topography of the land have an important
influence on the distribution and growth of a plant species. In the development of plantation forests, physical and topographical conditions have an important influence on the selection of types and planting patterns [2].

Land tenure or land ownership is one of the important aspects in the management of a plantation forest, the analysis of this land tenure aspect can reduce conflicts over land in the future. As is known, currently there are many land conflicts between the community and the company. This can happen because the mapping system for land ownership is still poor. Land tenure is a legal term for land tenure rights, and not just a fact of land tenure, because someone may own the land, but does not always have the right to control [3]. According to Kamilah and Yuliana (2016), for example, on customary land, although individual rights are known, the individual does not have the right to transfer the land to someone else freely without interference from the family and community where the land is located [4].

Stakeholders are attachments based on certain interests. Thus, talking about stakeholder theory means discussing matters relating to the interests of various parties [5]. Mardikanto (2014) mentions that the basic premise of stakeholder theory is that the stronger the corporate relationship, the better the corporate business will be [6]. On the other hand, the worse the corporate relationship, the more difficult it will be. Fauziyah (2014) states that in general, stakeholders can be divided into three groups, namely main stakeholders, supporting stakeholders, and key stakeholders [7].

The term landscape is generally understood as a landscape that has a unique character as a result of the action and interaction of various factors, both natural and the influence of human activities, so that this uniqueness needs to be preserved (European convention). Citing from various sources, Arifin et al (2009) put forward the notion of landscape which comes from the words 'land' and 'scape' referring to an area with the totality of its characters [8].

The goal of integrated landscape management is to go beyond this narrow focus and lead to a more holistic way of managing natural resources at the landscape scale to offset competing land uses and manage ecosystems sustainably. The interrelated elements of a landscape can be managed to provide all the goods and services needed. Where the elements of a forest landscape show the relationship between various land uses, and the importance of developing sustainable natural resource management approaches, especially in multifunctional-based plantation forests [3].

2. Research methods
2.1. Research implementation method
This research was conducted in the HTI area of PT Inhutani I Gowa Plantation Forest Management Unit, in Block IV in Belapungranga Village, Belabori, Borisallo and Lanna Village, Parangloe District, Gowa Regency, South Sulawesi Province. The research method used is a combination or mixed methodology, which is a combination of qualitative and quantitative approaches. The qualitative approach is carried out by exploring data and information on social aspects related to HTI landscape management, including aspects of land tenure and the role of stakeholders in each landuse unit in the management of HTI areas. A qualitative approach is used to complement the data from the quantitative approach.

2.2. Data analysis
2.2.1. Landuse and landtenure analysis

| Table 1. Key information in analyzing landscapes is presented in Table 1 |
| --- |
| **Type of Data/Information** | **Use of Data/Information** | **Source of Data/Information** |
| Landuse | analysis of existing landuse | Thematic maps, field observations |
| Landuse patterns (rice fields, gardens, forest plantations, etc.). | Formulate a multifunctional landscape setting model for PT Inhutani's HTI I Plantation Forest Management Unit in Gowa, Makassar that is adaptive to physical conditions | Interviews and FGDs with PT Inhutani, local government, farmers managing landuse, and local communities |
| Landuse change trend (at least the last 5 years) | | |
2.2.2. Stakeholder analysis

Stakeholder analysis aims to identify stakeholders who are directly or indirectly involved in the management of the landuse and landscape of the selected HTI block. The analysis includes: land users, land management institutions, and local community institutions in forest management. The results of the stakeholder analysis will be used in formulating a multifunctional landscape setting model for the HTI area of PT Inhutani I Plantation Forest Management Unit Gowa, Makassar which is adaptive to the social conditions of the local community.

3. Results

3.1. Landuse

| Year | River (ha) | Scrub (ha) | Plantation Forest (ha) | Estate (ha) | Settlement (ha) | Ricefield (ha) | Open Area (ha) | Total (ha) |
|------|------------|------------|------------------------|-------------|----------------|----------------|----------------|------------|
| 2016 | 5.77       | 18.08      | 2,347.31               | 4.50        | 38.86          | 123.57         | 10.27          | 2,548.36   |
| 2017 | 5.77       | 19.56      | 2,344.50               | 4.50        | 40.19          | 124.89         | 8.96           | 2,548.36   |
| 2018 | 5.77       | 18.36      | 2,336.14               | 7.33        | 40.68          | 127.63         | 12.45          | 2,548.36   |
| 2019 | 5.77       | 50.22      | 2,229.69               | 14.64       | 40.82          | 134.97         | 72.25          | 2,548.36   |
| 2020 | 5.77       | 50.22      | 2,227.36               | 14.64       | 40.82          | 136.92         | 72.62          | 2,548.36   |
Based on land change data for the last 5 years, it can be seen that the condition of the Plantation Forest in Block IV PT. Inhutani I UMHT Gowa continues to experience changes in area from 2,347.31 Ha in 2016 to 2,227.36 Ha in 2020 where the area is reduced by 119.96 Ha. This significant decrease in area occurred between 2018 and 2019. This reduction in area can be caused by several factors, one of which is the activities of PT. Inhutani I UMHT Gowa which carries out harvesting activities in Block IV in accordance with the 2016 RKT and 2017 RKT. However, based on the graph, between 2016, 2017 and 2018 did not experience very significant changes, due to the harvesting carried out by PT. Inhutani I UMHT Gowa only took certain types, namely the Acacia and Eucalyptus species.

Figure 1. Land use map in 2020 for each unit in block iv
The condition of areas other than plantation forests, which continues to experience a decline in area and stagnant water bodies, is inversely proportional to the condition of land cover of shrubs, gardens, rice fields, open area and settlements whose area has increased significantly from year to year. As in the area of rice fields and gardens, which significantly increased between 2018 and 2019. Rice fields from 127.63 Ha to 134.97 Ha and gardens from 7.33 Ha to 14.64 Ha, this proves that in the span of that year the community entered into the area to work the land (Okuvasi) into rice fields and gardens. In terms of residential land cover, the condition increased but not as significantly as changes in the cover of paddy fields and gardens, a significant increase occurred in 2017 from 38.86 Ha to 40.19 Ha, while the rest of the conditions the increase was not too significant. For open area cover at the time of harvesting by PT. Inhutani I UMHT Gowa in RKT 2016 and RKT 2017, where the range from 2016 to 2018 did not experience significant changes because Inhutani I UMHT Gowa only cut certain types with a selective logging system. Meanwhile, from 2019 to 2020, the land cover of open area experienced a very significant increase to 72.25 Ha. The condition of the open area is likely due to the clearing of land that will be converted into rice fields or gardens to meet the needs of the people living around the area.

3.2. Physical condition of land cover each unit

a. Conditions in unit 1 are relatively the same for each land cover, such as the altitude ranging from 25 – 200 masl with slopes from slightly flat (1-3%) to wavy (8 – 5%). Geological/rock types in the form of AHK (Mixture of Tufit, mudstone, sandstone) and WTE (Mixture of Tufit, fine-grained tephra, sandstone and mudstone), the geological conditions are evenly distributed over each land cover in unit 1. Fluvaquentic Endoaquepts, Typic Eutrudepts, Aquic Haplustepts, Aquic Eutrudepts, and Typic Haplustepts were almost evenly distributed in each land cover. If viewed based on the physical category with a climate of C (Medium Rainy Climate), it can be seen that the area in unit 1 is indeed suitable for residential areas, rice fields and gardens, but if viewed based on the function of the area based on the decree, Minister of Environment and Forestry No. SK. 362 on 28 May 2019 which is still in the form of a Forest Area and in accordance with the Decree of the Minister of Forestry No. SK. 607 dated 31 October 2012 in

![Figure 2. Conditions of land cover change from 2016 to 2020](image-url)
the form of PT. Inhutani I UMHT Gowa, so the best condition is suggested in the form of an agroforestry pattern.

b. Conditions in unit 2, such as the altitude of the plantation forest land cover ranges from 50-200 masl, while in addition to plantation forests it ranges from 50-150 masl. Slopes range from slightly flat (1 – 3%) to bumpy (8 – 15%). In unit 2 there is a water body at an altitude of 100 – 125 masl in the area of the Bantimurung Parangloe waterfall which has the potential to be used as a tourist destination, but due to uncontrolled water discharge, a controlling DAM is still needed. Land cover Gardens, Settlements, Rice Fields and open area have soil types Typic Eutrudepts, Aquic Haplustepts, and Typic Haplustepts. Based on the existing physical conditions in unit 2, it is advisable to use an agroforestry pattern for areas that have been occupied.

c. Physical condition in unit 3, has an altitude of 150-250 masl with slopes from slightly flat (1-3%) to steep hills (25-40%) with complete geology and soil types. From the physical conditions obtained, unit 3 is very suitable for agroforestry patterns, sylvopastura to planting staple crops such as eucalyptus and acacia, agathis, eucalyptus and other types that are suitable at altitudes in this unit.

d. Unit 4 has a slightly different physical condition from the previous 3 units where the altitude in unit 4 ranges from 200-450 meters above sea level with slopes that are almost dominated by steep hills (25-40%) and bumpy (8-15%) with geology BYN is a soil type including Typic Eutrudepts, Typic Hapludalfs, and Aquic Haplustepts. Based on these conditions, there are not too many agroforestry patterns in this unit, especially on land cover in the form of rice fields located at an unsuitable height, it should be moved or converted to land cover that is more suitable in terms of conservation.

e. The physical condition in unit 5 is almost the same as in unit 4 but the altitude is starting to increase, namely the altitude from 225 - 550 masl, the slopes are almost dominated by steep hills (25-40%) and bumpy (8-15%) with BYN geology, namely Soil types include Typic Eutrudepts, Typic Hapludalfs, and Aquic Haplustepts. Based on these conditions, this unit is advised to focus more on the pattern of planting forestry plants in the form of staple and living plants as well as the utilization of NTFPs.

f. Physical conditions in unit 6, the altitude ranges from 325 – 725 masl with undulating slopes (8-15%) to very steep mountains (>40%) with BYN geology, namely soil types including the Typic Eutrudepts, Typic Hapludalfs, and Aquic Haplustepts groups. This condition will be more suitable for the management of living plants in the form of pine for NTFPs and other plants that have a water and soil conservation function.

3.3. Land tenure

3.3.1. PT. Inhutani I UMHT Gowa

a. Pre-construction Stage

PT Inhutani I received an assignment from the Ministry of Forestry according to a decree. Assignment of the Minister of Forestry No. 266/KPTS/II/1986 dated August 28, 1986 and SK. No. 087/KPTS-V/1990 covering an area. 31,960 Ha. In its development, after several technical feasibility studies, financial feasibility, social feasibility studies were carried out by involving several consultants, PT Inhutani I Gowa-Maros only managed about 6,788.89 Ha.

b. Construction Stage

From the area of 6,788.89 Ha, PT Inhutani I UMHT Gowa then changed the area to 6,500 Ha to carry out PWH activities, land clearing, nursery and planting with 5 Annual Work Plans (RKT), namely:
  - RKT 1987/88 area = 1,115.34 Ha,
  - RKT 1988/89 area = 2,114.94 Ha,
  - RKT 1990/91 area = 1,044.94 Ha,
  - RKT 1991/92 area = 1,246.72 Ha,
- RKT 1992/93 area = 1,267.29 Ha.

Since RKT 1992/93 PT Inhutani I no longer carries out forest planning activities, forest area clearing, nursery activities, planting, except plant maintenance activities, maintenance of function boundaries and forest supervision and security and implements Forest Village Development (CSR) programs in the form of agro-forestry. After the issuance of IUPHHK-HTI Decree No. SK 607/Menhut-II/2012 which was stipulated on October 31, 2012 covering an area of ± 18,350 Ha, then a Business Work Plan was prepared in 2016 (in 2018 Revision), then the Annual Work Plan for the Utilization of Industrial Timber Forest Products (RKTUPHHK – HTI) In 2016 to 2021.

3.4. Communities around the industrial forest Area

The community participates in using and managing the land even though they already know that the land is an HTI area of PT Inhutani I Gowa Plantation Forest Management Unit due to economic factors. They only work the land into gardens, rice fields or shop buildings to fulfil their daily lives and earn a living. Besides that, the lack of other business alternatives makes it difficult for the community to improve their welfare.

The results of interviews with 55 respondents from the community in Belapunggranga, Belabori, Borisallo, Bontokassi and Lanna Villages, Parangloe District, Gowa Regency, South Sulawesi Province, found that 52 respondents participated in using and managing the land in the concession area. If divided for each unit, there are 12 respondents in unit 1, 13 respondents in unit 2, 9 respondents in unit 3, 8 respondents in unit 4, each 5 respondents in units 5 and 6, manage land at all in the concession area.

![Figure 3. Evidence of community land ownership using and managing land in the HTI area of PT Inhutani I Gowa Plantation Forest Management Unit.](image)

Based on the diagram above, it can be seen that the people who use and manage the land in the concession area do not have a certificate, but only proof of payment of land tax (PBB). There are even people who have absolutely no proof of land ownership. A total of 21 respondents claimed to regularly pay PBB for the land they cultivate every year, while 31 respondents admitted that they did not have any proof of land ownership in any form.

The people who use and manage the land in unit 1 have started working on it since the 1980s, starting from land that was initially intercropped with PT. Inhutani I UMHT Gowa, some are inherited from parents and then continue to this day. It is also known that as many as 12 respondents in unit 1 who participate in utilizing and managing land in the concession area all have proof of ownership in the form of PBB. The communities in units 2 to 6 only started to use and manage land in the 2000s, especially those in units 3 and 4, some of which have only started to use and manage land around 2019 to January 2021. In addition, most communities in units 2 to 6 do not have proof of land ownership. As in unit 2, out of 13 respondents, only 3 respondents had proof of PBB, while in unit 6 out of 5 respondents, none of them had proof of ownership even though it was only proof of PBB.

Figure 2 also shows that the lower the number of people who participate in using and managing land in the concession area, the lower the number of people participating in the use and management of the concession area. Generally, these communities already know that the land they manage is an area that
Based on the existing respondent's data, it is known that the people who work in the unit 1 area all manage the land into gardens and there is one respondent who manages it at the same time as gardens and rice fields. As for the community in the unit 2 area, there are only three respondents who manage land into gardens, while ten other respondents use land on the side of the main road to construct buildings. This building is used to open a shop or a selling kiosk. Meanwhile, people in units 3 and 4 generally manage land into gardens and rice fields and some build buildings as houses on the same land they manage their gardens. In the unit 5 area, it was found that people were working on rice fields and gardens and there was one respondent who managed the land into gardens and at the same time used the land as a place for grazing livestock. Herding of livestock is also carried out by the community in the unit 6 area, but there are no more plantations there, but only the management of land into rice fields. The lack of employment opportunities that match the level of education and skills is also the cause of the low welfare of the community. Meanwhile, due to ignorance about the boundaries of the concession area, different perceptions or unclear boundaries are also factors that cause people to work on the land.

3.5. Stakeholders

Stakeholders are groups that have a concern and interest in an issue that is determined by considering their important position and influence. A total of eleven stakeholders were identified, involved and played a role in the management of PT. Inhutani I UMHT Gowa as listed in Table 3.

| Stakeholders | Role | Policy Base |
|--------------|------|-------------|
| Ministry of Environment and Forestry (KLHK), namely, BPTH, BPDas, and Manggala Agni DAOPS Gowa | Control and supervision; forest rehabilitation & reclamation; forest protection and nature conservation; and facilitate partnerships between plantations and communities. | Regulation of the Minister of Forestry of the Republic of Indonesia Number: P.16/Menhut-II/2014 concerning Guidelines for Borrowing and Using Forest Areas. |
| South Sulawesi Provincial Forestry Service, especially KPH Jeneberang I | Play a role in providing guidance and supervision of forest area management | - Law No. 41 of 1999 on Forestry |
| | | - Regulation of the Minister of Forestry of the Republic of Indonesia No. P.43/Menhut-II/2013 concerning Structuring of Work Area Boundaries for Forest Utilization Permits, Principle Approval of Forest Area Use, Principle Approval of Forest Area Release and Forest Area Management in |
### 3.6. Multifunctional plantation forest management

![Figure 5. Landscape-based multifunctional plantation forest management map](image)

Based on the division of units on the map, before setting the landscape, the land cover in the form of rice fields was almost evenly distributed in each unit, but in the landscape setting it was more focused on areas that were slightly flat to wavy with an altitude below 400 meters above sea level which was very suitable for units 1, 2 and 3 as well as some in units 4 and 5. As for unit 6 because it is an upstream area and has an altitude of up to 700 meters above sea level with a slope dominated by >40%, the suitable
arrangement is planting of staple crops in Production Forests in the form of Acacia, Eucalyptus and Agathis as well as in the form of life-producing plants. Sap (NTFP) is Pine. For more complete can be seen in table 4.

Table 4. The extent of the landscape arrangement of Block IV

| No | Landscape Settings       | Area per Unit (Ha) | Total Area (Ha) |
|----|--------------------------|--------------------|-----------------|
|    |                          | 1                  | 2               | 3               | 4               | 5               | 6               |      |
| 1  | Agroforestry             | 8.56               | 3.37            | 7.26            | 19.19           |
| 2  | Acacia, Eucalyptus, Agathis | 136.50          | 360.61          | 125.87          | 326.69          | 949.67          |
| 3  | Grazing Area             | 10.49              | 9.03            | 23.63           | 43.15           |
| 4  | NTFPs Bees               |                    | 28.70           | 28.70           |
| 5  | NTFP Pine                |                    | 136.38          | 34.57           | 154.49          | 325.44          |
| 6  | Nature Tourism Area      | 29.96              |                |                |                | 29.96           |
| 7  | Estate                   | 9.79               | 1.94            |                |                | 11.73           |
| 8  | Settlement               | 19.11              | 2.58            | 6.50            | 12.63           | 40.82           |
| 9  | Melaleuca cajuputi       | 187.96             | 91.95           | 218.22          | 282.85          | 203.55          | 984.54          |
| 10 | Ricefield                | 48.51              | 7.63            | 24.92           | 25.85           | 8.25            | 115.15          |
|    | Total                    | 284.41             | 281.02          | 280.53          | 820.26          | 400.95          | 481.19          | 2548.36 |

In unit 2, which was previously a body of water in the form of a waterfall, arrangements were made in the form of a waterfall natural tourist area due to adequate location conditions with maintained standing conditions in the area. In units 1, 2 and 3 there are grazing areas and agroforestry areas, this is because in these areas previously there was illegal grazing in the forest which could interfere with the eucalyptus planting activities carried out by PT. Inhutani I UMHT Gowa, so it is necessary to arrange grazing locations in these three units. The agroforestry area itself is deemed necessary to reduce the impacts arising from land management in the form of converting forestry land to agricultural land, so that the community can also intercrop while maintaining forestry plants. In unit 5, there is an arrangement of honey bee collection areas that must be preserved to support the community in Borisallo and Bontokassi Villages who often use honey bees to take their honey and sell it.

In units 1 – 5, the arrangement of eucalyptus is carried out according to the management plan of PT. Inhutani I UMHT Gowa, where the area is very suitable for developing eucalyptus plants, and it is hoped that the ongoing planting activities involving the community who live around the area can help meet the economic needs of the community. In addition, eucalyptus plants can also provide another alternative for the community to switch to forestry plants that can be harvested regularly and become additional income for the community.

With this arrangement, which emphasizes the planting of forestry plants that produce NTFPs in the form of eucalyptus, pine and NTFPs from honey bees, which are supported by production forest plants and nature tourism areas, can maintain forest functions in accordance with their designation and can support the community around the forest in general, and PT. Inhutani I UMHT Gowa in particular as a provider of jobs later. The six structuring units can support the success of future plantation forest management.

4. Conclusion
The conclusion of this research:
1. Landuse characteristics in 2020 in units 1-6 there are areas in the form of rice fields which are not suitable for several locations in units 4-6 because the altitude and slope are increasing up to unit 6 (altitude up to 725 masl and slopes up to >40%). Then other areas are not well managed, especially in logged over areas.
2. Land tenure in the HTI area is managed by PT. Inhutani I UMHT Gowa, but over time, some people who live around the HTI area have started occupancy to meet their daily needs. Of the several lands that were occupied, none had proof of ownership of the certificate and was only limited to PBB and the rest did not have documents.

3. The roles of each stakeholder are interrelated, especially in the management of plantation forests where PT. Inhutani I UMH Gowa as manager, forestry agency as controller, rehabilitation/protection as well as guidance and supervision, Village/Sub-district apparatus as supervision and guidance to the community, and the community as service providers.

4. The multifunctional landscape setting model for the PT. Inhutani I UMHT Gowa is more towards the use of NTFPs in the form of eucalyptus, pine and honey bees and is supported by HTI plants in the form of acacia, eucalyptus and agathis. Where from this model will involve more communities around the forest and minimize land conversion or land occupations whose designation is not suitable.

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