The Effect of Social Forestry on the Existence of Sustainable Forest Management in Indonesia (Case Study: Bialo Forest Management Unit)

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Abstract. Social forestry is a sustainable forest management system in Indonesia that is implemented in forest areas managed by the community to improve their welfare and maintain environmental balance. In Indonesia, especially South Sulawesi Province, there is a unit of the Bialo Forest Management Unit, which is the first Forest Management Unit to have a special license for Social Forestry licenses for Village Forest Schemes, and Customary Forests, and to date there have been 26 total Social Forestry licenses. The fundamental thing related to the success of social forestry management is the existence of sustainable forest conditions in the area. The research method was conducted by interpreting the land cover at each location of the social forestry approval permit in 2000, the year of the Social Forestry License, and in 2023, using Landsat 7 imagery and Landsat 8 imagery. The results of this study found that from 2000 to the year of the Social Forestry License, the land cover that experienced the greatest change was an increase in mixed dryland agriculture by 7% and low-density forest by 5%, followed by a decrease in the area of high-density forest by 5%. When social forestry licenses are granted until 2023, there was an increase in mixed dryland agriculture by 3.5% and high-density forest by 2%. Changes in forest area in the Village Forest and Indigenous Forest schemes are better applied in Bialo Forest Management Unit than the Community Forest scheme in maintaining sustainable forests. Several factors influence land change in each social forestry license location, namely because the level of community dependence on cultivated land is quite high to meet economic needs and they consider the land they have been cultivating so far belongs to their ancestors who have been cultivated for generations.

Keywords: Forest, social forestry, land cover change, Bialo Forest Management Unit

1 Introduction

The condition of forests in Indonesia is currently experiencing changes marked by uncontrollable deforestation, and forest degradation within forest areas and outside forest areas. Data released by the Ministry of Environment and Forestry (2022) explains

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that land cover change from forest to non-forest from 2000 to 2020 amounted to ± 15.46 million ha [1]. Changes that occurred within the forest area amounted to approximately 11 million ha and in other use areas amounted to approximately ± 4 million ha. This can be caused by several factors, namely natural factors such as forest fires and human factors such as illegal logging, or conversion of forest areas into plantations and transmigration. In addition, higher population growth requires land for settlements and additional land for food needs. According to reference [2], the conversion of forests into fields and plantations is a separate threat to forest areas which is inseparable from the presence of people living around the forest. In addition, the ongoing development marked by the expansion of settlements, roads, and urban activities has changed the use of forest land into community activities [3].

Data released by the Ministry of Environment and Forestry (2022) states that around 25,800 villages in and around forest areas with 9.2 million households have the potential to cause land tenure problems in forest areas [1].

Addressing the issue of community land tenure in forest areas, the government then issued a policy through the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 9 of 2021 concerning Social Forestry Management which is also related to forest area management. Under the regulation, communities within forest areas can gain legal access to manage forests by applying for social forestry. With this social forestry program, communities are expected to improve their livelihood economy while still harmonizing environmental and socio-cultural conditions through five schemes, namely village forests, community forests, community plantation forests, indigenous forests, and forestry partnerships [4].

Information related to problems and conflicts in forest communities at the site level can be found in each Forest Management Unit. The existence of Forest Management Units at the site level has a role in verifying applications for Social Forestry Forest Management Permits. Thus, Forest Management Units have an important role in supporting social forestry programs [5]. In South Sulawesi Province, are 737 permits spread across 24 Forest Management Units. Based on data from the GoKups website, social forestry in South Sulawesi has 1,087 business groups with the second highest platinum class after Kalimantan, which makes South Sulawesi one of the provinces with good social forestry achievements.

Bialo Forest Management Unit is one of the Forest Management Units located in South Sulawesi Province whose administrative area covers Bantaeng Regency and Bulukumba Regency with an area of 395.83 km² and 1,154.58 km² respectively. From 2010 to 2019, Bialo Forest Management Unit has obtained 26 social forestry licenses, including 19 Community Forest schemes, 3 Village Forest schemes, 3 Forestry Partnership schemes, and 1 Indigenous Forest scheme. The selection of the Bialo Forest Management Unit location is based on the fact that the Ammatoa Kajang Indigenous Forest is the first region in Indonesia to have a regional regulation on the protection of indigenous peoples and is a pioneer in the establishment and legal recognition of community customary forests in Indonesia. In addition, the Village Forest program in Bantaeng Regency was also one of the first areas in Indonesia to receive approval from the central government [6].

The granting of forest management licenses to communities in all social forestry areas certainly influences the dynamics of land cover change, which can occur in the form of an increase in forest area or vice versa. Changes in conditions at the permit location can be analyzed using land cover data over time. Land cover changes can be identified by utilizing satellite imagery, so that monitoring of land cover and its changes can be detected easily and quickly [7]. Thus, to determine the effect of permits and social forestry schemes on land cover change, a study was conducted on the Effect of Social Forestry on Land Cover Change in the Bialo Forest Management Unit.

2 Literature Review

Conflicts over tenure of forest or forest areas with several parties, especially local communities, and up to Indigenous communities make their management less sustainable [8]. Simply put, communities need access to land as a very important component of people's livelihoods to ensure their food security and income. In addition, issues between customary land and forest areas are an important part of forest management [9]. The interests of local communities also conflict with the state in forest areas, causing instability, insecurity, and improper land use outcomes [8, 10]. Forest tenure conflicts will also stimulate the emergence of prolonged conflicts that lead to the formation of political and social movements throughout the region [11].

Through the Ministry of Environment and Forestry, the Indonesian government has formulated a policy based on the problem of forest area conflicts in the form of community-based forest management, better known as Social Forestry (Purnomo and Anand, 2014). Social Forestry policy has three pillars: livelihoods, access rights and conservation [12]. Social forestry allows the opening of access provided by the government for communities located around forest areas to obtain economic benefits. People can access the forest by taking non-timber forest products such as honey, rattan, palm water and so on. The reciprocal is that the community protects the forest by not destroying the forest and planting certain types of trees that have grown around the forest area. In the 1990s, communities were only involved in project-based forest and land rehabilitation [8, 13]. However, entering the reform era in the 2000s, communities were given access to forest areas for 35 years to utilize the land and vegetation [8]. The condition of social forestry in the era of Joko Widodo's leadership, which began in 2014 until now, is the issuance of licenses very quickly, the development of new schemes and regulatory structures. Even in 2015, the area of social forestry has more than doubled to 2 million hectares and continues to grow to reach the target of 12.7 million hectares for community access [13]. However, reference [13] argues that social forestry licenses focus on permit issuance rather than actual implementation. Thus, an assessment is needed to assess the success of a Social Forestry program to run as expected.

It is fundamental to see the success of social forestry by looking at the existence of forests from each period until the achievement of sustainable forest ideals.

3 Method

3.1 Research Location and Time

This research was conducted in the working area of the Bialo Forest Management Unit, which consists of two districts in South Sulawesi Province, namely Bantaeng Regency and Bulukumba Regency. In addition, the area borders the waters of the Flores Sea, and the Gulf of Bone. The research location can be seen in Figure 1.

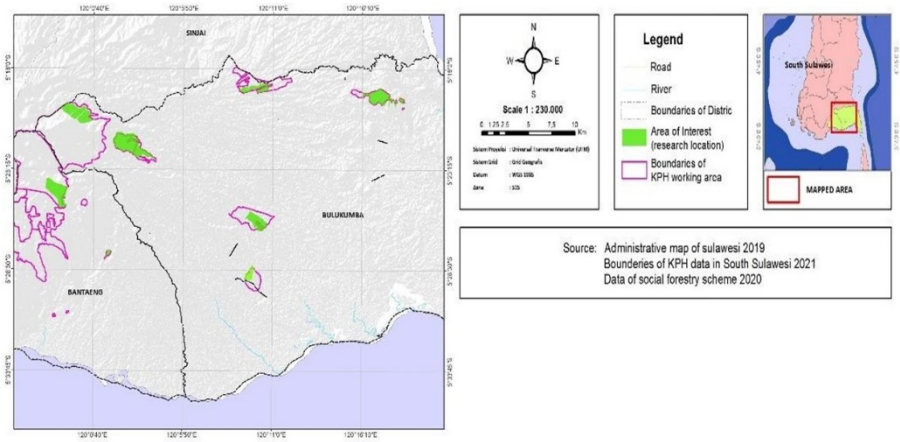


Fig. 1. Research Location Map

3.2 Research Tools and Materials

The tools used were laptop, GPS receiver, stationery, and camera. Materials used were boundary data from the Bialo Forest Management Unit, data on social forestry license boundaries in the Bialo Forest Management Unit working area in the form of spatial data (shapefile) and Decree Letter related to the license of each Social Forestry Group; Landsat 7 image recording years 2000, 2010 - 2012 and Landsat 8 image recording years 2013 - 2023.

3.3 Research Procedure

Determination of location boundary. The research location boundary is the boundary of the social forestry scheme area located in the Bialo Forest Management Unit area.

Data collection. The research began by collecting the necessary data, namely the Bialo Forest Management Unit boundary obtained from the Forest Area Consolidation Center in Region VII, Makassar and social forestry permit data obtained from the Social Forestry and Environmental Partnership Center in the Sulawesi Region and the Social

Forestry Acceleration Working Group in South Sulawesi Province. Landsat 7 imagery of recording years 2000, 2010-2012 and Landsat 8 imagery of recording years 2013-2023.

Gap and Fill Landsat 7. This study uses data from Landsat 7 from 2000 to 2015. However, since 2003, the sensor system on Landsat 7 has been damaged in the form of a failure of the scan line corrector (SLC), so that the resulting recording data could be better. To fix this problem, the gap fill command can be used to correct the black lines by taking the closest information or by using image information from a different recording time.

Radiometric correction. Radiometric correction is intended to improve the pixel values of Landsat 7 and 8 images due to atmospheric disturbances as the main source of error. The correction process is carried out in the Semi-automatic Classification Plugin menu in QGIS Software and at the same time performs atmospheric correction by checking the Apply DOS 1 atmospheric correction option.

Image cropping. Image cropping is done to cut the image and select certain parts to be used, by cutting the image with the area that is the research object.

Land cover classification. Land cover classification using Landsat 7 and Landsat 8 imagery was conducted using the on-screen digitization method that refers to the Land Cover Monitoring Guidelines issued by the Director General of Forestry Planning in 2015. This classification was done by delineating each land cover class on a computer screen using ArcGIS software at a scale of 1:50,000 with a combination of band 5-4-3 on Landsat 7 imagery and a combination of band 6-5-4 on Landsat 8 imagery.

Ground check and field data collection. Field checking begins with determining the representative coordinate points in each land cover class. Sampling techniques using purposive sampling were taken based on trends in land cover changes such as forests that experienced an increase in area, besides that samples were also taken with consideration of accessibility in each land cover class.

Accuracy test. The accuracy test used on the land cover classification results is the confusion matrix method using the Kappa accuracy test. The Kappa coefficient value has a range of 0 to 1, where the acceptable accuracy value is 85% or 0.85. The Kappa accuracy test formula is presented as follows:

$$\boldsymbol{Kappa}\ (\boldsymbol{k}) = \frac{\mathrm{N}\ \sum_{i=1}^{r} \mathrm{X}_{ii} - \sum_{i=1}^{r} \mathrm{X}_{i} + \mathrm{X}_{+i}}{\mathrm{N}^2 - \sum \mathrm{X}_1 + \mathrm{X}_{+1}} \times 100\% \quad (1)$$

Information
K = Kappa value
r = number of rows in the confusion matrix
x_{ii} = Diagonal value of contingency matrix of i-th row and i-th column
x_{+i} = Number of pixels in the i-th column
x_{i+} = Number of pixels in the i-th row
N = Number of pixels in the sample

Analysis of land cover change. Land cover change analysis was conducted on three classification maps with three different times, namely 2000, the year of the social forestry license, and 2023, by overlaying using ArcGis software which will result in changes in the area and shape of the land cover class.

Comparative analysis of Social Forestry schemes on land cover change. Comparative analysis of Social Forestry schemes was conducted by comparing the area of each land cover class in 2000, the year of the social forestry license, and 2020 based on the existing social forestry schemes in Bialo Forest Management Unit. This analysis was conducted to see what Social Forestry scheme is suitable for the Bialo Forest Management Unit in conserving the forest.

Analysis of causes of land cover change. Analysis of the causes of land cover change from discussions with the community, who is the head of the social forestry group in accordance with the field ground check point. In addition, a review of the work plan of each social forestry group, both the business work plan and annual work plan, which is the main basis for managing the area, was also conducted.

4 Findings and Discussions

4.1 Land cover change

The results of image interpretation using the on-screen digitization method in 2000, in the year of the social forestry license, and 2023, show that there are nine land cover classes in 15 Social Forestry Groups in the Bialo Forest Management Unit, namely high-density forest (Hp), low-density forest (Hs), dryland agriculture (Pt), mixed dryland agriculture (Pc), settlements (Pm), rice fields (Sw), water bodies (A), shrubs (B), and open land (T). The percentage of land cover change can be seen in Figure 2.

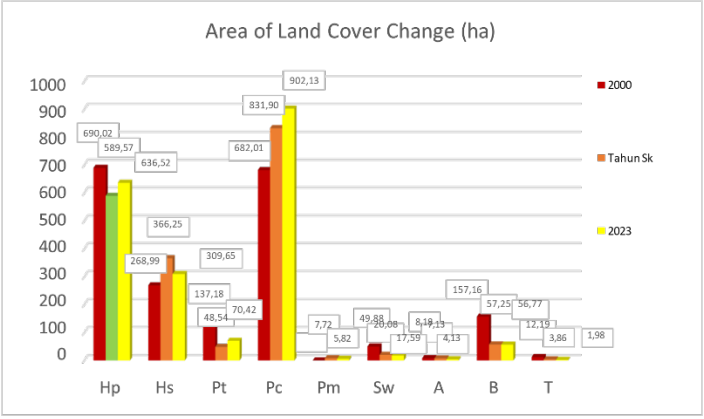


Fig. 2. Percentage of Land Cover in 2000, the year of the Social Forestry License, and 2023

Figure 2 shows that in 2000 the most dominating land cover was high-density forest with an area of 690 ha. This was followed by mixed dryland farming at 682 ha, low-density forest at 269 ha, shrubs at 157 ha, dryland farming at 137 ha, rice paddies at 50 ha, open land at 12 ha and the lowest area on water bodies at 8 ha. In the year of the social forestry license, mixed dryland agriculture increased to 832 ha and dominated the land cover, low-density forest to 366 ha, settlements 7.7 ha, followed by a decrease in high-density forest to 589 ha, dryland agriculture 48 ha, rice fields 20 ha, shrubs 57 ha, open land 3.86 ha and water bodies to 7.13 ha. Overall, the average land cover has been dominated by mixed dryland agriculture since 2000. In the year of the social forestry license, settlements were identified. This was influenced by the high rate of population growth and the temporary huts made by the community as a place to rest. In 2023, mixed dryland agriculture increased again to 902 ha, dryland farming to 70.4 ha, and high-density forest to 636.5 ha. The opposite happened to low-density forest, which experienced a reduction in area to 309.6 ha. In addition, settlements, rice fields, open land, shrubs and water bodies only experienced slight and insignificant changes.

The data illustrates the disturbance that occurred in the social forestry license site in the Bialo Forest Management Unit. It can be seen from the increase in mixed dryland agriculture and the significant decrease in high-density forest from 2000 to the year of the social forestry license. Changes in land cover to shrubs and mixed agriculture indicate that disturbances in the area tend to be high. After the community received a social forestry management license, it was seen that activities in the area became more prevalent, marked by the increase in mixed dryland agriculture and dryland agriculture as well as high-density forest. The location's high level of agricultural activities is due to the high level of community dependence on the forest for their needs. Based on several work plan documents of social forestry groups, it was found that the factors causing the increase of high-density forest cover are the rampant planting of timber crops such as sengon and teak as well as multipurpose trees such as coffee, candlenut, mangosteen, durian and nutmeg.

4.2 Accuracy test results of 2023 image interpretation

Ground check is carried out by visiting the coordinate points determined through sampling. The confusion matrix data can be seen in Table 1.

Table 1. Confusion matrix of accuracy test results in 2023

Land Cover Class		Ground check data in 2023									Total
		Hp	Hs	Pt	Pc	Sw	B	A	Pm	T	
Interpretation results of 2023 Imagery	Hp	7									7
	Hs	1	6								7
	Pt			1							1
	Pc				3						3
	Sw					1					1
	B				1		3				4
	A							1			1
	Pm								1		1
	T									1	1
Total		8	6	1	4	1	3	1	1	1	26

The results of the confusion matrix of ground checkpoints in 2023 for each land cover class, obtained 24 points that match image interpretation and field conditions. The data was then calculated using the Kappa formula to see the accuracy percentage and obtained an accuracy percentage of 90.56%. According to reference [14], the acceptable level of accuracy of image interpretation is 85%. This shows that the results of image interpretation are acceptable.

4.3 Comparison of land cover for each Social Forestry scheme

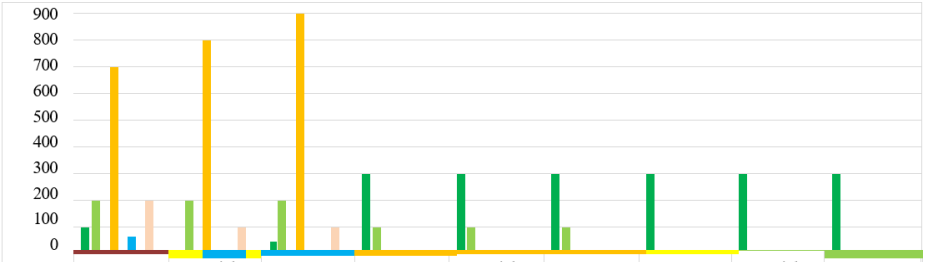
In this research, three schemes can be compared, namely Community Forest, Village Forest, and Indigenous Forest. Land cover comparison of these schemes was conducted in 2000, in the year of the social forestry license, and in 2023 to see which social forestry scheme is suitable for conserving forests in the Bialo Forest Management Unit. The land cover changes for each scheme are presented in Figure 3.

Based on the results of the comparative analysis among the three schemes, the Village Forest scheme has the largest change in the area of high-density forest class among the other schemes since the social forestry license was issued. Village Forest experienced a slight decrease from 271.4 ha in 2000 to 266.76 ha in the year of the social forestry license but increased in area to 293.56 ha in 2023. This is followed by the Indigenous Forest scheme, which in 2000 was 300 ha and decreased to 278 ha in the year of the social forestry license and increased to 294.7 in 2023. The opposite happens to the Community Forest scheme, where from 2000 to the year of the social forestry license, it decreased from 118 ha to 44 ha and increased slightly in 2023 to 48 ha and mixed dryland farming dominates.

The Village Forest Scheme is considered the most influential in increasing land cover in the form of high-density forest. Since the social forestry license was issued in the Village Forest, agroforestry-based planting activities have been increasingly carried

out by planting coffee, cloves and passion fruit understands and tree stands to shade the coffee plants. This has caused forest closure in the location to increase in area. In addition, the utilization of the Village Forest is only oriented towards the village community so that no outsiders can take forest products to the location.

The head of the Campaga Village Forest institution provided information that the local wisdom believed by residents in Campaga village is to honor the forest through unwritten traditional rules, including conveying prohibitions in the forest area considered to have a positive impact on maintaining forest sustainability. A long time ago, they also did not dare to do logging because it was sacred and the community believed that if they took wood, bad things would happen to them. Forest security patrols or field supervision activities are also increasingly carried out after receiving Social Forestry licenses.



	2000	social forestry license	2023	2000	social forestry license	2023	2000	social forestry license	2023
	Community Forest			Village Forest			Indigenous Forest		
Hp	118,19	44,82	48,19	271,38	266,76	293,56	300,44	277,99	294,77
Hs	190,58	245,94	232,96	78,41	86,37	58,14	0,00	33,94	18,55
Pt	123,63	45,12	68,39	0,00	1,36	1,36	13,56	2,06	0,67
Pc	667,02	820,25	891,01	14,99	11,65	11,12	0,00	0,00	0,00
Pm	0,00	7,72	5,82	0,00	0,00	0,00	0,00	0,00	0,00
Sw	49,88	20,08	17,59	0,00	0,00	0,00	0,00	0,00	0,00
A	8,18	7,13	4,13	0,00	0,00	0,00	0,00	0,00	0,00
B	157,16	57,25	56,77	0,00	0,00	0,00	0,00	0,00	0,00
T	12,19	3,86	1,98	0,00	0,00	0,00	0,00	0,00	0,00

Fig. 3. Land cover change in each scheme in 2000, the year of the Social Forestry License, *and 2023*

This is inversely proportional to the Community Forest scheme, considered less suitable for implementation in the Bialo Forest Management Unit. It can be seen from the increasing area of mixed dryland farming since the issuance of the social forestry license, so it is not in accordance with the purpose of social forestry, which is to conserve forests. One contributing factor is the community's need for cultivated land, where they consider the land, they have been cultivating so far belongs to their ancestors who have been cultivated for generations. Research by reference [15] states that several forest management models in which the community is the main actor have a real impact on forest destruction, such as the Community Forest program in Lombok, causing ecological damage to forest resources. In addition, the very small increase in forest area

in Community Forest sites may be due to the year of the social forestry permit issuance, namely in 2015 and 2019, so that the planting activities carried out have not shown significant results. In the Indigenous Forest scheme, there was an increase in the area of high-density forest from the year the social forestry license was issued until 2023, but it has not yet reached the area of high-density forest in 2000. This is because from 1990 to 2000 there was massive forest encroachment, including in indigenous forest sites.

5 Conclusion & Recommendations

5.1 Conclusion

The most significant land cover change in social forestry licenses in the Bialo Forest Management Unit was the increase in mixed dryland agriculture from 2000 to 2023. In addition, the SF scheme that has the most influence on increasing forest cover in the Bialo Forest Management Unit is the Village Forest scheme, characterized by a more significant increase in high-density forest area compared to the Indigenous Forest and the Village Forest schemes. The factors causing the change of forest cover to non-forest are years of encroachment into agricultural or plantation land and the condition of the land is not assisted by rehabilitation activities. In addition, the level of community dependence on cultivated land is quite high in order to meet economic needs and they consider the land they have been cultivating so far belongs to their ancestors who have been cultivated for generations.

5.2 Recommendations

The results showed that land cover in the social forestry license in the Bialo Forest Management Unit is currently dominated by mixed dryland farming, so a follow-up is needed by conducting Forest and Land Rehabilitation activities, to restore degraded forest conditions. In addition, discussions through regular Forum Group Discussions with various parties related to forest protection and security also needed to be carried out so that evaluation and monitoring activities can continue. Institutional strengthening of social forestry permit holder groups also needs to be completed as it is a guideline for the community in land utilization. Forest management efforts involving the community need to be reviewed in terms of assistance so that the planning not only impacts on welfare but also preserves the forest by preventing forest degradation.

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