# The Effectiveness of the Community Forestry Program on Geophysical Conditions and Socio-Economic Aspects; Case Study in Sesaot Protection Forest

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## ABSTRACT

The HKm program in West Nusa Tenggara (NTB), has been tested since 1995, in the Sesaot protected forest area of 25 hectares, with 58 cultivators by stipulating a pattern*agroforestry.* In 1998, an evaluation was carried out by the Ministry of Forestry. As a result, the success rate reaches 93%. Due to this success, expansion was then carried out to reach 211 Ha, bringing the total area to 236 Ha, with a total of 1,224 cultivators. In the development of the implementation of the HKm program which has been running for almost two decades, research results have been obtained which show that the community forestry program in Sesaot is running effectively as indicated by the positive changes in the slope, erosion and vegetation conditions.At the slope level, the most dominant changes occur at the slope level of 0-8% with an additional area reaching 50% of the initial area189.83 Ha to 303.69 Ha . In the vegetation changes that occur lead to positive changes, where the very dense vegetation density experienced by the Sesaot protected forest has increased in the 1994 – 2004 range reaching 50% and the 2004 – 2014 range reaching 33.94%. An increase in the level of slope that becomes flat and a high level of vegetation density affects the ability of the land to increase erosion, so that the percentage of erosion in the Sesaot protected forest area is at a low level of erosion. Changes in protected forest conditions that are getting better have a positive impact on social and environmental aspects the economy of the community around the Sesaot protected forest. the impact that is directly felt by the community around the forest can be proven by the improvement in the economic condition of the community. So it can be concluded that the HKm program in the Sesaot protected forest area has brought positive changes to changes in its geophysical conditions as well as the impact on the socio-economic aspects of the people around the forest which continue to improve.

***Keywords***:

community forests, protected forests, geophysical conditions

## INTRODUCTION

Forests in Indonesia have long been managed with a paradigm*scientific forestry* (Kartodihardjo, 2012; Safitri, 2015). Forests are classified through political and administrative considerations which tend to benefit the economic interests of the elite only. Policies based on the law do not provide benefits for the common people, even exclude the people living in and around the forest, and at the same time threaten their lives and livelihoods (Fay, 2005).

Population growth which continues to grow every year and the gripping poverty of the community around the forest area has forced the community to carry out encroachment on the forest. Such actions cause a fairly high rate of deforestation due to changes in the conversion of forest areas into agricultural and plantation lands (Senoaji, 2009).

One of the efforts to improve the welfare of the people living around the forest is to increase people's access to the forest by utilizing its potential without changing the function of the forest area. In this case, the effort is (executed) through the community forestry program (HKm), as a manifestation of the implementation of the concept*forest for people*. The development of HKm has started since 1995, then in terms of regulations it has undergone several changes, namely from the Decree of the Minister of Forestry No. 622/Kpts-ll/1995, Decree of the Minister of Forestry No. 677/Kpts-ll/1998, Decree of the Minister of Forestry No.31/Kpts-ll/2001 and Regulation of the Minister of Forestry No. P.35/Menhut-ll/2007 (Dipokusumo et al., 2011). The HKm is intended so that forest resources really function to provide economic interests for the community while maintaining the sustainability of forest ecosystems (Awang, 2003).

The forest areas allocated for the HKm program are protection forests and production forests. For the Sesaot forest area itself, the area allocated for the HKm Program is only in the Protected Forest area. Communities are not burdened with rights or permits in the utilization of forest products where the area is a source of livelihood for the local community. The Business License for the Utilization of HKm Management (IUPHKm) is granted for a period of 35 years and is extended according to the evaluation results every 5 years.

Communities who are already involved in forest management will influence changes in the function of forest areas to other land uses. Changes in land use in the Sesaot protected forest area have an impact on changes in the geophysical conditions of the land. Changes in geophysical conditions in the Sesaot protected forest due to community forestry (HKm) can be seen directly from several aspects, including the level of slope and vegetation that can changed due to community intervention in forest management. From changes in the level of slope and vegetation density, it can affect changes in other geophysical conditions such as erosion in the Sesaot protected forest. Changes in the geophysical conditions that occur in the Sesaot protected forest can have positive and negative impacts on different aspects. These changes certainly cannot be separated from the role of the community and the government in carrying out this HKm program. Based on the description above, the purpose of this

study was to determine changes in slope, vegetation and erosion conditions as a result of the implementation of the Mitra Sesaot community forestry (HKm) program and community perceptions from socio-economic aspects.

## Research methods

***Research sites***

This research was conducted at HKm Mitra Sesaot, Sesaot Village, Narmada District, West Lombok Regency. The research was conducted from March 2023. A map of the research locations can be seen in Figure 1.

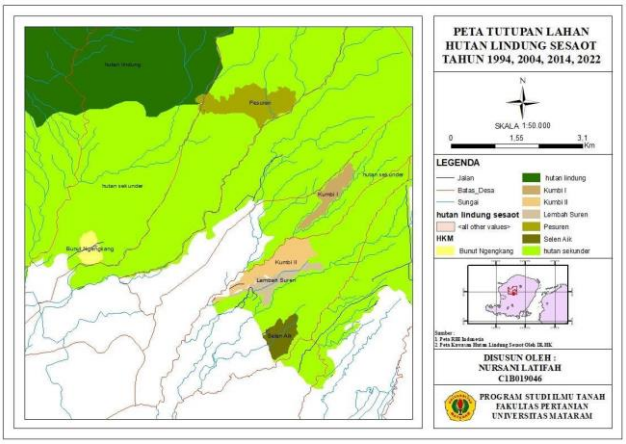


**Figure 1. Location of HKm Mitra Sesaot, West Lombok**

***Data Collection Techniques***

This research method uses a spatial analysis method and a qualitative descriptive method using a case study approach. Process landsat image data and DEM data using*software*ArcGIS 10.8. Supporting data was obtained from several related agencies and other data collected through site surveys and in-depth interviews with HKm Mitra Sesaot farmer groups. Respondents in this study were determined based on HKm landowners in the Sesaot protected forest. Information obtained from in-depth interviews includes land management techniques, land geophysical conditions, farmers' income, and community behavior in the utilization of forest resources. Determination of sample points and informants using purposive sampling technique.

***Data analysis***

Analysis of changes in geophysical conditions is carried out by:

1. Analysis of the slope level of HKm Mitra Sesaot
For analysis of changes in the slope of the HKm Mitra Sesaot slope, DEMNAS data for 1994 and 2022 is needed to be used as a comparison which will be converted. The slope was created using the ArcGIS 10.8 application with Spatial Analysis Tools. Then done*reclass* slope class based on land rehabilitation pattern and soil conservation.

Table 1. Classification of Slope Levels

| Class | Slope (%) | Classification |
|---|---|---|
| I | 0 – 8 | Flat |
| II | 8 – 15 | Sloping |
| III | 15 – 25 | Quite steep |
| IV | 25 – 45 | Care |
| IN | >45 | Sangat Kuram |

2. The vegetation density analysis of HKm Mitra Sesaot

The method used in analyzing the density of vegetation in the Sesaot protection forest is the integration between land cover classification using the maximum likelihood method and the vegetation index, namely the Normalized Difference Vegetation Index (NDVI). The final result in determining the vegetation index class uses the greenness level index class proposed by Marwoto and Genting, (2009).

Table 2. Vegetation density index values

| No. | Nilai Indeks Vegetasi | Tingkat Kehijauan |
|---|---|---|
| 1. | 0.40 – 1 | Tinggi |
| 2. | 0.25 - < .40 | Sedang |
| 3. | 0.03 – 0.25 | Rendah |
| 4. | -1 – 0.03 | Non Vegetasi |

## Results and Discussion

***Changes in Slope Degree***

Changes in the slope level of the Mitra Sesaot HKm from 1994 to 2022 can be seen from DEM data processing that has experienced a change in the slope level which can be seen from changes in the colors that indicate differences in the slope levels in the Mitra Sesaot HKm area, as seen in the picture 1.

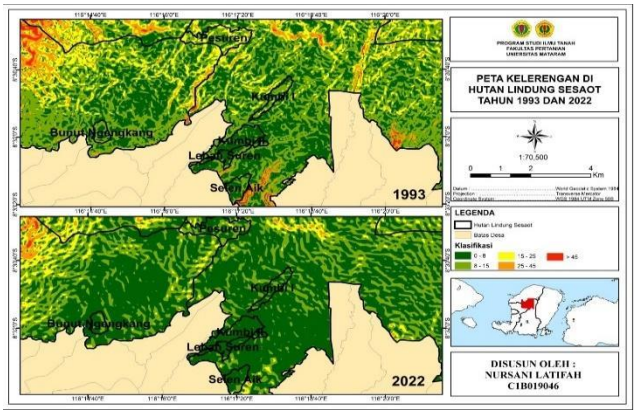


Figure 2. Map of Changes in the Slope of Hkm Mitra Sesaot in 1994 – 2022

Tebel 3. Level of Slope of Hkm Mitra Sesaot 1994 – 2022

| Kemiringan Lereng (%) | Klasifikasi | Tahun 1994 (Ha) | Tahun 2022 (Ha) | Perubahan (Ha) | Persentase Perubahan (%) |
|---|---|---|---|---|---|
| 0 - 8 | Datar | 189.83 | 303.70 | 113.87 | 50.00 |
| 8 - 15 | Landai | 150.87 | 91.77 | -59.10 | 25.95 |
| 15 - 25 | Agak Curam | 54.95 | 7.99 | -46.96 | 20.62 |
| 25 - 45 | Curam | 6.72 | 0.00 | -6.72 | 2.95 |
| >45 | Sangat Curam | 1.09 | 0.00 | -1.09 | 0.48 |
| Total | | 403.46 | 403.46 | 227.74 | 100 |

Image analysis of DEM data in 1994 shows the slope level in 1994 and 2022 is dominated by the slope of 0% - 8% (flat) with an area of 189.83 Ha and 303.70 Ha with an additional change of area reaching 50%, while the slope level flat to slightly steep, experiencing a decrease in area in the range of 1994 to 2022 with a percentage change of 20.62%, 2.95% and 0.48%. Changes in the level of slope from 1994 to 2022 may occur due to changes in the use of protected forest land to mixed forest which causes human activities to clear land by intervening in land by making mounds on the ground perpendicularly or cutting slope direction. By changing the slope level of Mitra Sesaot HKm which is dominated by the gentle slope level, it has a positive influence on the erosion rate of the land, where the gentle slope can inhibit surface runoff and can reduce the level of erosion hazard in the Mitra Sesaot HKm area.

***Changes in Vegetation Density Levels***

The level of vegetation density in Mitra Sesaot HKm through the interpretation of landsat imagery from 1994 to 2022 shows that there has been a change in the level of vegetation density seen from the colors that show different levels of vegetation density in each landsat image. Can be seen in figure 3.

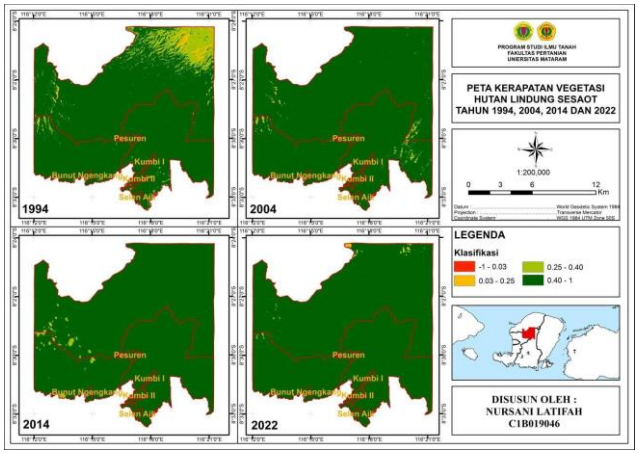


Figure 3. Map of Changes in the Level of Vegetation Density in Mitra Sesaot HKm in 1994, 2004, 2014 and 2022

Table 4. Vegetation Density Index of the Sesaot Protected Forest for the Period 1994 – 2004

| No. | Kerapatan Vegetasi | Luas Kerapatan Vegetasi | | | | | |
|---|---|---|---|---|---|---|---|
| | | Tahun 1994 | | Tahun 2004 | | Perubahan | Perubahan |
| | | (Ha) | (%) | (Ha) | (%) | (Ha) | (%) |
| 1 | Tidak Bervegetasi | 2 | 0.01 | 0.56 | 0.003 | -1.44 | 0.04 |
| 2 | Cukup Rapat | 242 | 1.14 | 34 | 0.16 | -208 | 5.65 |
| 3 | Rapat | 1815.04 | 8.55 | 183 | 0.86 | -1632.038 | 44.31 |
| 4 | Sangat Rapat | 19176.19 | 90.30 | 21017.67 | 98.98 | 1841.48 | 50.00 |
| Total | | 21235.23 | 100.00 | 21235.23 | 100.00 | 3682.96 | 100.00 |

From the results of calculating the difference between the level of vegetation density between 1994 and 2014 there was an increase in area only occurring at very dense vegetation levels which reached 50% from the initial area of 19,176.19 Ha to 21,017.67 Ha, while the other vegetation density levels decreased wide. The largest area decrease occurred at the level of dense vegetation density which decreased by 44.31% from an initial area of 1,815.04 Ha to 183 Ha.

Table 5. Vegetation Density Index for the Sesaot Protected Forest for the 2014 – 2022 period

| No. | Kerapatan Vegetasi | Luas Kerapatan Vegetasi | | | | | |
|---|---|---|---|---|---|---|---|
| | | Tahun 2014 | | Tahun 2022 | | Perubahan | Perubahan |
| | | (Ha) | (%) | (Ha) | (%) | (Ha) | (%) |
| 1 | Tidak Bervegetasi | 0.27 | 0.00 | 27 | 0.13 | 26.73 | 13.12 |
| 2 | Cukup Rapat | 20 | 0.09 | 26 | 0.12 | 6 | 2.94 |
| 3 | Rapat | 167.9 | 0.79 | 66 | 0.31 | -101.9 | 50.00 |
| 4 | Sangat Rapat | 21047.06 | 99.11 | 21116.23 | 99.44 | 69.17 | 33.94 |
| Total | | 21235.23 | 100.00 | 21235.23 | 100.00 | 203.80 | 100.00 |

In the range of 2014 to 2022 almost all levels of vegetation density have increased in area, for non-vegetated density there has been a percentage change of 13.12%, quite dense vegetation density of 2.94% and very dense vegetation density of 33.94%, whereas in dense vegetation has decreased by 50%. All changes in the level of vegetation density that occurred from 1994-2022 were caused by the intervention of the community who had managed protected forest areas into forest areas.*agroforestry* which they do themselves. This had a positive impact on the condition of the land at HKm Mitra Sesaot. It can be seen from the changes in the area of very dense vegetation density which continues to increase in area in the 1994 – 2022 range. The positive impacts that occurred in the 1994 – 2022 range did not occur solely because of the forest rehabilitation program, but these changes were also supported by activities increasing farmer knowledge through counseling has played a role in changing the level of vegetation in the Sesaot protected forest area.

All HKm locations in the Sesaot protected forest area show good vegetation conditions, having a high level of vegetation density will certainly affect soil and water conservation. With forest vegetation, it certainly maintains soil fertility and the size of the soil pores, due to the activity of microorganisms and the roots of

the vegetation. The looser the soil, the faster the infiltration rate and the rainwater that falls to the ground will be absorbed properly by plant roots, this of course has a positive impact on minimal erosion and flooding hazards. This is in line with Utomo's statement (1994) which states, the presence of vegetation can reduce the rate of surface runoff and erosion, besides that vegetation can also reduce soil erodibility where vegetation itself affects organic matter content, permeability, aggregation and infiltration. Vegetation will provide protection to the soil from the process of destroying aggregates by rainwater and surface runoff, thereby limiting the damaging power of rain and surface runoff (Asdak 2010).

***Changes in Erosion Hazard Levels***

To determine the level of erosion there are several factors that influence it, namely, rainfall, soil type, morphology and slope. As for the supporting data, hydrology and climatology data and land use data are needed (Wirawan, 2019). The Mitra Sesaot HKm area has a rainfall of 2500 – 3000 mm/year which is classified as a wet climate, with a slope that is more dominated by a slope of 0 – 15%. With a flat and gentle slope, it will be able to control the flow of surface water so as to prevent erosion. In addition to rainfall and slope, soil type also affects the resistance of the soil structure to the dispersion and erosion of incoming raindrops and surface water. The type of soil found in the Sesaot protected forest is Mediterranean brown forest soil type, brown forest soil type is forest soil type. Soils that were previously classified as brown forest can be included in the Inceptisol soil type (USDA, 2014). Inceptisol soil type is a young soil type that belongs to the mineral soil type that has an organic matter content of less than 20% or has a layer of organic matter that is less than 30 cm thick so it has a light texture. Inceptisol soils located in protected forest areas have a higher organic matter content than inceptisol soils outside forest areas. This can happen because of the large amount of leaf litter which is the main component in the forest ecosystem because it is a source of soil organic matter. Inceptisol soil has a crumbly soil structure and loose consistency and a neutral pH makes it easy to absorb nutrients so it has a fairly high organic matter content. Soil that has the ability to absorb and has a fairly high organic matter tends to be more resistant to erosion.

The change in the geophysical condition of the Sesaot protected forest against erosion is a positive change, where before the HKm program was implemented by the government, the community encroached on the forest by cutting down trees because of their deplorable economic conditions in the 1993 era. After the HKm trial program was in In 1995, the people who had been given forest land for planting began to plant various kinds of plants with patterns*agroforestry*. Widiyanto (2016) says that function*agroforestry* as a soil erosion preventer through land cover and title strata, storage of groundwater reserves, and carbon sequestration. By doing the pattern*agroforestry* can increase the land's ability to resist erosion, so that the erosion hazard is low in the Sesaot protected forest area.

***Society's Perception from the Economic Aspect***

Community perception is one of the key factors that will determine the behavior of forest farmers in managing their land. There are several aspects that can be analyzed regarding community perceptions, namely, community knowledge about HKm and how much people understand about HKm land management. Knowledge of members of the Mitra Sesaot HKm group on Community Forests. Knowing about community forestry means understanding what is meant by community forestry itself. Based on the results of interviews with HKm farmers, all respondents knew about the HKm program, because on average Sesaot's partner HKm farmers have managed HKm land from the start of the formation of HKm which has been passed down from generation to generation. Community understanding related to the HKm program is interpreted more as an opportunity to obtain land tenure rights in forest areas as a family economic resource. From this understanding, people tend to behave exploitatively to maximize the economic benefits of the land. The results of in-depth interviews with forest farmers obtained three categories of community understanding regarding the existence of HKm land, namely:

1. Hkm land is understood as a source for meeting basic needs in the short and long term.
2. HKm land that they have obtained can be inherited and even bought and sold.
3. HKm land tenure as a demand for the government to obtain welfare through the right to manage the surrounding natural resources.

The community's perception that tends towards improving their economy makes them manage HKm land through cropping patterns by selecting types of plants that produce in the short term and continuously (seasonally and annually). Even though from the initial requirements for managing HKm it was explained that the percentage of plants they planted was 70% for tree/timber plants and 30% for MPTS (fruit) plants, but the facts on the ground show that almost all of the HKm land in Mitra Sesaot has almost been planted. 100% fruit.

Several reasons are considered by the community in deciding to plant trees, namely:

1. Timber plants cannot be cut down because they are located in a protected forest area so they cannot provide economic benefits to the community, even if they plant tree/timber plants they are vulnerable to theft. So that people are traumatized to plant tree crops because they are always the target of theft. So they think that instead of cutting down trees and damaging the surrounding MPTS plants, they prefer to plant MPTS plants only because they provide more economic benefits and prevent illegal cutting of trees.
2. Narrow area with land ownership of 0.20 – 0.50 Ha. When compared with the output received, it turns out that it is not able to support the needs of those who have an average number of members of 3-5 people. The impact is that people's attention to managing their land is less serious, so that the land is not taken care of. This causes people to look for alternatives and tend to think narrowly. Under certain conditions, people can climb forests for land expansion, sell land or known as land compensation to other parties and steal wood to get additional income. The community seeks to maximize the utilization of the management space to obtain maximum economic benefits so that the community acts exploitatively. Interest in planting wood is lacking and is considered to interfere with productive plants.
3. Profits earned. if these types of plants are considered profitable and provide benefits, the community will plant the recommended plants even though they are not in accordance

with the 30% composition in accordance with the agreement, but if they are considered capable of harming MPTS plants and seasonal crops, the community will not plant them.

From the above understanding, it can be concluded that people's perceptions of the HKm program are more oriented towards fulfilling their wishes. Individual or group actions will always prioritize the desires and needs of these individuals or groups. Thus efforts to better maintain environmental balance are not the first priority, but the second or next priority. However, there are still many local people who manage forests according to the system*agroforestry* in various ways, characterized by variations in vegetation type, plant structure, recognized vegetation species, and plant density.. This effort is proven to be able to maintain soil conservation value, where the condition of the land in the Sesaot protected forest area has experienced positive changes to its geophysical conditions. Their efforts to reduce the use of chemical fertilizers also make the land in good condition and can continue to be planted with various kinds of plants.

***Public Perceptions from the Economic Aspect***

The existence of the HKm program provides a source of income for the surrounding community. The economic impact of the HKm program increases production value for the community. This increase in production comes from the granting of HKm permits, so that farmers get a guarantee of certainty to manage the forest and make the best use of it. The granting of HKm permits also gives the community freedom to manage HKm land by planting various types of fruit trees to improve their economy. Based on the results of the research, donations from HKm land contributed significantly to farmers' income. Farmers' income from HKm land varies greatly because the commodities planted in the HKm managed area are also very diverse. Plant commodities that are considered important include durian, rambutan, candlenut, palm, banana, cocoa and from empon-empon in the form of sweet potato, taro, turmeric and ginger.

Bananas are the first crop that can be relied upon as a source of income from HKm land. At the beginning of HKm management, in one banana harvest season, it can produce around IDR 2,400,000.00 in one week. The longer the land is managed, the contribution of banana plants decreases because the quality of banana plants continues to decline as other crops grow. Then durian becomes the source of income that has the most high economic value. The heyday of the durian harvest occurred around 2014-2015, where farmers at that time could get a crop of up to IDR 130,000,000.00 more. However, in recent years, farmers have not been able to get good production from durian plants, because the weather is now erratic, resulting in many damaged fruits and small yields obtained. Another big yield is from the palm tree, a more profitable result where the palm sap that can be made into brown sugar can reach a price of IDR 30,000/kg. One tapper can tap up to 10 trees per day.

One palm tree can produce 20-30 liters of sap. If it is sold in the form of palm wine, the price per liter is Rp. 50,000.00. If in a day to tap 100 liters of sap, the farmers get an income of Rp. 500,000.00/day. Meanwhile, if the sap water is processed into crystal sugar, the price can reach Rp. 75,000.00/kg. One kilogram of crystal sugar is obtained from 4 -5 liters of sap. Seeing the enormous economic potential of sugar palm, it is not surprising that the income obtained from the sugar palm harvest can reach IDR 10,000,000.00/month.

Research results published by*World Agroforesty Centre* – ICRAF 2010 in Markum*et al*(2014) stated that the average income per day per capita of HKm Mitra Sesaot farmers was IDR 12,654 (1.3 UUS). By using the 2008 international poverty line standard of 1.25 UUS per capita per day (World Bank), it can be said that HKm Mitra Sesaot farmers are among the people living above the poverty line. From HKm management activities, it can be seen from the sale of NTFP commodities and other by-products on HKm Mitra Sesaot's land that has had a real positive impact in driving the economy of the Village on the outskirts of the Sesaot protected forest. So this HKm program is one of the strategies that is quite effective in alleviating the poverty line for communities around the forest.

## CONCLUSION

The community forestry program in the Sesaot protected forest has had a positive impact on the geophysical conditions of the land in terms of changes in slope, vegetation and erosion conditions. At the slope level, the Mitra Sesaot HKm area experienced a change in the slope level, the dominant slope changed to a slope of 0 – 8% with a flat topography reaching50%, In the vegetation changes that occur lead to positive changes, where the very dense vegetation density experienced by the Sesaot protected forest has increased in the 1994 – 2004 range reaching 50% and the 2004 – 2014 range reaching 33.94%. The increase in the level of vegetation and the level of flat slopes has an effect on the low level of erosion hazard in the Sesaot protected forest area. While the community's perception of the HKm program from a socio-economic perspective shows the many benefits they get from the HKm program, the existence of the HKm program that has been implemented has had a good impact on the social and economic conditions of the community around the Sesaot protected forest. Communities who are allowed to manage forest areas certainly improve the economy of the surrounding community. The improving economic conditions of the surrounding community certainly affect the security level of the Sesaot protected forest, as well as the community's efforts to continue to maintain good land conditions, and have a good impact on soil and water conservation in the Sesaot protected forest area.

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