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The Carbon Stock Environment of Mapping Vegetation in UMMAT Education Forest West Rinjani

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Abstract: Indonesia is a country that has a role as carbon sink which is very influential on climate change in the Southeast Asian region, on the island of Lombok there are clusters that stretch forest hills from West Rinjani to East Rinjani. This Forest Protected or Educational Forest which has been controlled has an area of more than 90 hectares with based on Minister Environment and forest Republic Indonesia SK 405/MENLHK/Setjen/PLA.0/6/2016 in couple years ago are diversity of flora and several types of plants and trees. Land fires or forest areas in Mount Rinjani National Park on the eve of the 78th Indonesian independence along the Aik Berik hiking trail were caused by humans or due to negligence. The community thinks about the condition, the destruction as well as the benefits of Protected Forest/Edu Forest, residents have perceptions about carbon storage and the benefits of Protected forest as a carbon store as well as people's perceptions about climate change that is happening. The Data was obtained systematically have marked 9 plots divers growth stage 20x20 m for tree shape, 10x10m for poles, 5x5m for saplings, 2x2m for seedlings, 1x1m for wet grass. The form of balance and harmony that is still protected by Muslims the bond between human and Allah, and their environment. The Universe of God's gave gift to manage and maintain it, so that it remains sustainable and good. In the Al-Qur'an it is explicitly stated that all forms of damage that exist on this earth are the result of human activities in interacting with their environment. That the universe was created by Allah as a form of His love for humans. Allah created and this nature for the benefit of humans. Nature is made a verse or a sign of the existence and omnipotence of Allah. Realizing that the universe is God's creation, then taking care of the earth and preserving it is part of the consequences of this monotheistic belief. The primary data used is hill mapping, settlements and watershed observations of perceptions about carbon storage to vegetation, while the purpose of the activity or research is to carry out an analysis of identifying community perceptions of carbon storage and forest vegetation in Batu Bolong Village.

Keywords: Carbon; Environment; Forest; Vegetation

Introduction

The Communities in the archipelago of Indonesia have wealth of flora and fauna as a National Park Area or Protected Forest, it is undeniable that environmental protection which is always a trending topic in electronic media and a hot issue in discussions and debates about nature and the environment, the State of Indonesia as a contributor to GHG / Greenhouse Gases were caused decrease in the amount of land in Lombok or forest area as carbon saving and absorption (Dauvergne, 2010) when there is an imbalance between the release and absorption of carbon into the atmosphere there will be an increase in the global warming potential. The occurrence of GWP on the earth's surface results in climate change which is often the subject of discussion.

Rinjani National Park Mount The existence of communities that inhabit or live on the edge of and around protected forest ecosystems or forest areas with a special purpose requires that the community be able to utilize and manage it for survival. Forms of agricultural activities include plantations, livestock which are used as agro-forests, mahogany, jackfruit, mango, sugar palm and white teak plants which have been managed since

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2003 in Protected Forest (KHDTK UMMAT) in the development of reforestation KPH West Rinjani has an important value in meeting the needs economy. The evaluation of divers cultivation in Batu Bolong Agroforest system most important for biodiversity, sustainable ecology, economy, sosial and advantage even local wisdom (Gamfeldt et al., 2013; Marini et al., 2010; Santoro et al., 2023).

The community is active in forming knowledge from what is witnessed or observed daily. A positive perception among farmer groups is a positive thing as an indicator that efforts to prevent floods, fires and support from elements around the forest, the environment we live in is an important thing, the environment is not only a place for human activities, but the environment also plays a very important role in supporting various human activity or endeavor. With this interaction, it is certain that the shape of the environment will also be influenced by human attitudes or characters. The attitude of individual or group behavior determines whether the condition of an environment is good or bad.

Conversely, how humans treat the environment will affect the quality of human life itself. It is apply in water, agricultural feedstock, medical fields and other. Activated carbon used to varoius fields, it is highly demanded material (Esquivel-Marín et al., 2023). The multifunctional nature of agriculture allows links to be made between society, the economy, and the environment. As such, it is intrinsically linked to sustainability. Although some argue that agriculture has always been multifunctional, it was not until the 1970s that it was recognized in the literature that agriculture plays multiple roles, where, in addition to producing food and fibre, it contributes to the development of multifunctional landscapes.

These concepts are key in the current debate on agricultural policy reform and rural development in many countries and international platforms. Several authors suggest that sustainable development is a global goal that includes multifunctional agriculture A crucial to make inexpensive activated carbon that is mesoporous in nature as compare to commercial as available Carbon in market at higher price. In view of that activated carbon has prepared from rice husk (Chowdhury et al., 2012) coconut coir (Ghosh et al., 2021) coffee husk (Murthy et al., 2019), ginger waste (Ahmad & Kumar, 2010), leaves of prunus dulcis (Jain & Gogate, 2019), moringa oleifera seed husk (dos Santos Escobar et al., 2021). The perception are processes organizing and interpretation stimulus were accepted by organism or individu during becomes meaning, activity integrated itself individu. Stimulus get impact respons from individu depend on attention having feel.

According, feel, think, ability and experience has for individu not same, though result perseption when thing stimulus differs for everyone. Perseption are someone ability for compare, clasify, and fokus on process sensoric in the past experience relevant. Therefore someone, has perseption even different same object. Brown (1997) put forward that almost 50% of forest biomass is composed of carbon. Forests are increasingly damaged due to incidents nature and illegal logging will increase the amount of GHG. In terms of the function of forests as a barrier to climate change, they can absorb CO2 emitted into the atmosphere, which has decreased. Thus, increasing the rate of forest destruction will at least reduce the capacity of the forest in storing one type of GHG, namely carbon.

Situmorang et al. (2016) stated that Estimating carbon stocks through the use of land cover data is very helpful in estimating carbon reserves in the forest considering the vast forest area, especially in Lombok (Ramadhan et al., 2014) stated that the amount of carbon reserves in a vegetation type is influenced by the high number of trees that have a large diameter (trunk circumference), so that cutting down trees to extract their potential wood will reduce the amount of carbon stored in a vegetation type (Hartono, 2016). Satellite image interpretation is one of the technologies used in geographic studies. Satellite imagery on Google Earth is a mosaic of images from remote sensing obtained using satellites orbiting outer space, for applications in the fields of weather, agriculture, forestry, natural resource mapping, natural disaster studies, the environment and marine affairs. From the use of Google Earth imagery, the forms of sheet erosion, groove erosion and gully erosion can be interpreted.

The develop procedure in this research consists of four step. The first is Measure plot, which involves formulating requirements for field to observe. In this step, the researcher will gather various information about map that used to challenges, determine the necessary avenza map development. The second step is Signed and DBH, where the focus is on signed the plant to the analysis, including the selection of media, tools, and color paint based on the field needs. The third step is validated by experts on a limited scale. Added, this stage includes revisions from various or diversity in the field based on their suggestions and input. The fourth stage is Noted differs, which aims to activity every plot and ecology its ecosystem by the researcher.

Method

This type of research category of Research and Education, benefit carbon, forest protect. More methods have used to calculate data for Important Value indices

every species that stages was calculated which plantation are ecology saving carbon or tree forest used to match they are ecosystem providing excellent (Reshad et al., 2020). The index calculated by integrating Relative Frequency (RF), Relative Density (RD), and relative Dominance (RB)Of every wood species (Mueller-Dombois & Ellenberg, 1974) as follows.

$$\text{Density (D)} = \frac{Total\ number\ of\ individuals}{size\ of\ plots} = \frac{23\ tree}{20} = 1{,}15 \quad (1)$$

Relative Density (RD)

$$RD = \frac{Number\ of\ individuals\ of\ the\ species}{Number\ of\ individuals\ of\ all\ species}\ x\ 100 \quad (2)$$

Frequency (F)

$$F = \frac{Number\ of\ quadrats\ which\ species\ occured}{Total\ size\ of\ plots} \quad (3)$$

Relative Frequency (RF)

$$RF = \frac{Number\ of\ ocurence\ of\ the\ species}{Number\ of\ occcurence\ of\ all\ species} x100 \quad (4)$$

Dominance (Dm)

$$Dm = \frac{Total\ basal\ area\ of\ the\ species}{Total\ size\ of\ plots} \quad (5)$$

Relative Dominance (RDm)

$$= \frac{Total\ basal\ area\ of\ the\ species}{Total\ basal\ area\ of\ all\ species} x100$$

To increase the community participation to support the tree or plants rehabilitation program, Indonesia's government has issued a social forestry scheme that allows the community to develop ecotourism in rehabilitated edu forest areas (Nurbaya et al., 2022). Community forestry has been an essential strategy for promoting mangrove rehabilitation (Hagger et al., 2022). In general, Indonesia's community empowerment strategy surrounding forests is collaborative forest management, such as ecotourism activity.

Figure 1. Make plot

Figure 2. Measure and Signed

Figure 3. Noted Vegetation

Based on the physical condition of the land is done by overlaying the map then importing it into the Avenza Map Application to become the criteria for the physical potential of the land (Hills, Rivers and Settlements). In this case Land or Land Boundary Maps, maps of soil types that describe sensitivity to erosion, rainfall maps, slope maps, soil carrying capacity maps, and maps that are entry points in Google Map. Hardware: Laptop Lenovo – AMD A8 spesific ; AMD-Core ™ i5 – 4010U CPU @ 1.70 GHz 1.70 GHz Memori 4.00 GB; Software: a. ArcGis 10.2 b. Microsoft Office Word 2013 Microsoft Excel 2013; GPS Handphone Galaxy A03; Avenza Map.

Materials The following data is used in this study, data obtained from the Map of the Muhammadiyah University of Mataram Protected Forest located in West Lombok Regency in 2023.

Result and Discussion

This research is located in a Protection Forest Universitas Muhammadiah Mataram NTB conducted by Harry (2023) while the motivation for ecosystem preservation is the perception of ecological functions because they have an influence on ecosystem sustainability and economic value. Receiving support or support that the people in Batu Bolong. Hamlet have an indirect perception of the benefits of carbon. The

community is very committed to protecting so that things such as burning forests do not happen, forests that are relevant for storing carbon and other things related to forests. There is a positive relationship between community perceptions of environmental knowledge about carbon and environmental vegetation in protected forests or UMMAT educational forests (Agustin & Maisyaroh, 2020).

Several planting activities were carried out for rehabilitation in stages and adjusted to the availability of the available budget. The planting of mahogany, white teak and jackfruit trees is carried out in stages from year to year until the planting, significant in growth but negligence always occurs which causes fires to return. This means that there are still very large buffer areas that continue to receive rehabilitation or are planted with plants, have and contain very high organic matter and the ability of the land to absorb water is 13 times its weight (Riono & Apriyanto, 2020). The high organic content makes protected forests a different energy source than usual. The land is a unique ecosystem that always stores water and have many functions including economic, cultural, biological functions (Saragih et al., 2022), hydrological, and ecological functions which play an important role in life in these ecosystem (Huwoyon & Gustiano, 2013).

The forest is useful for environmental services, namely as a carbon store, biomass production, climate control, and biodiversity (Handayani & Winara, 2020). Protected land or forest is one of the largest sources of carbon stored beneath the surface of the soil. This carbon is formed on the soil surface in the form of biomass, litter and dead wood (necromass), while below the soil surface it is in the form of soil organic matter. Considerable carbon stocks are found in peat soils of the intertidal and lowland (inland) types which include various physiographical units such as peat domes, lake basins, swamps behind rivers, and coastal plains which affect the amount of carbon stores. (Jermias & Supit, 2016) Cultivation and treatment role for animal the number with goals common nursery generally grazing livestock during the dry season and impounding/tying them under the shade of trees during the rainy season (planting season) whereas for ownership in small numbers or rearing for the purpose of fattening (feedloting) is carried out by impounding them all day long and the farmer provides all the needs of the cattle (system intensive). Differences in environmental conditions for the formation of peat affect the dominant biomass or plant species in that location (Zakiah et al., 2018). Total Carbon reserve maked by formula 6 (Tosiani, 2015).

Total carbon reserves per year=A(ton/ha)×B(ha) (6)
Note: A = carbon stocks per land cover (tons/ha), B = annual activity data/cover area land (ha).

Changes in carbon stocks based on land cover class are simply obtained through repeated inventory of carbon stocks or what is termed "stock difference method" (Ipcc, 2006) is done by calculating the area of land cover for each land cover class, calculate the average carbon stock in each land cover and calculate the total stock carbon at time 1, time 2 and so on, then calculate the difference between stocks carbon at time 1 and time 2 to get the value of changes in carbon stocks. Calculation of changes carbon reserves using the equation. Ogrodnik (2020) smart environment (share of parks, lawns and green areas in the total area; share of legally protected areas in the total area; particulate matter retained or neutralized in pollution abatement equipment in % of pollution generated, noteworthy are the potential benefits related to environmen- tal protection, such as minimization of gas and dust emissions and reduction of traffic noise.

$$\Delta C = (Ct2-Ct1)/(t2-t1) \quad (7)$$

Note: ΔC = annual change in carbon stocks for each carbon storage (tonnes C/year), Ct1 = carbon reserves in carbon storage in year t-1 (tons C), Ct2 = carbon reserves in carbon storage in year t-2 (tons C), t1 = initial observation year, t2 = final observation year.

Research by Tosiani (2015) it was states that the conversion from carbon to CO2 is by using multiplication results carbon reserves (C) by a factor of 3.67 (44/12). Based on Data in 2018 there have been good changes in land cover increase or decrease in area. The highest change in area was in 2018 with an area of 93 ha and keep depence the growth was in 2009 covering an area of 93 ha. To realize of the target, the government needs tremendous efforts, include support from the community around the protect forest.

The research uses mapping, exploring, and collecting or arranging tree/plant species on line transects/plots when exploring/mapping each area including; settlements, rivers to hills that can represent ecosystem types or vegetation types along the hills in the search that was carried out in July 2023.

Table 1. Method DBH and Structure Vegetation (Agro Forest Plotting Sample)

Structure Vegetation	Local Names	Diameter (cm)	High (Meter)
Plot 20x20 M, DBH >20 Cm			
	Mahoni	69	16

Structure Vegetation	Local Names	Diameter (cm)	High (Meter)
-Swietena Mahogani	Mahoni	77	17
-Swietena Mahogani	Jambu	43	15
-Anacardium occidentale	Mente Juwet	128	19
-Syzygium cumini	Mangga	72	13
- Mangifera Odorata	Nangka	100	18
- Artocarpus heterophylus	Mangga	61	12
- Mangifera Odorata			
Poles Plot 10x10 M, DBH >19.9 Cm	Mahoni	88	17
-Swietena Mahogani	Mangga	99	19
- Mangifera Odorata	Ginong	165	21
-Fabaceae	Nangka	67	15
- Artocarpus heterophylus	Mangga	90	13
Stake/Sapling Plot 5x5 M, DBH 2.5-9.9 Cm			
-Mangifera Odorata			
Seedling Level Plot 2x2 M, DBH <2.5 Cm	Dry Leaf		
Under Story Plant Plot 1x1 M	Dry Leaf 0.055 Kg		
Wet Grass (Kg) Seedling (gram)	0.070 Kg		

Based on Table 1, the density of vegetation, as assessed from the students' responses, were 9 plot with a " number " every criteria seeding, poles, sapling and shape of tree.

Table 2. Method DBH and Structure Vegetation Density Plot

Structure Vegetation	Local Names	Diameter (cm)	High (Meter)
Plot 20x20 M, DBH >20Cm			
-Dimocarpus Longan	Kelengkeng	68	15
-Swietena Mahogani	Mahoni	101	23
-Swietena Mahogani	Mahoni	67	20
	Juwet	128	26
-Anacardium occidentale	Nangka	72	13
- Artocarpus heterophylus	Jamplung	100	24
- Calophylum inophylum	Mahoni	61	19
-Swietena Mahogani	Mahoni	102	24
-Swietena Mahogani	Simpur	68	16
-Dillenea Suffruticosa	Alpukat	100	19
Poles Plot 10x10 M, DBH >19.9Cm			
-Persea Americana			
- Theobroma Cacao	Kakao	40	13
-Erythrina variegate	Dadap	131	27
-Citrus xamblycarpa	Jeruk Limau	55	16
-Aquilaria malaccensis	Gaharu	68	20
- Mangifera Odorata	Mangga	84	18
-Aquilaria malaccensis	Gaharu Mangga	40 61	17 18
Stake/Sapling Plot 5x5 M, DBH 2.5-9.9 Cm			
-Mangifera Odorata			
Seedling Level Plot 2x2 M, DBH <2.5 Cm	Dry heavy		
Under Story Plant Plot 1x1 M	0,060 Kg 0,085		
Wet Grass (Kg) 0.120 Seedling (gram)	Kg		

Based on Table 2, the density of vegetation, as assessed from the agro forest, were ninth plot with a " number " every criteria seeding, poles, sapling and shape of tree.

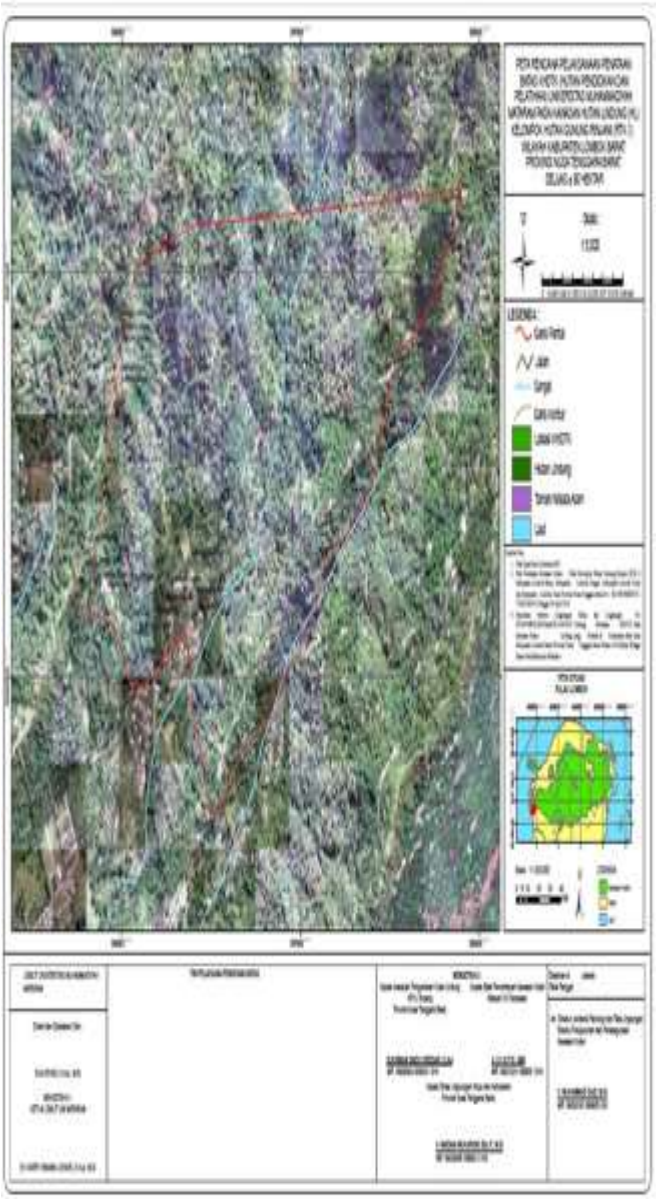

Figure 1. Primary Picture 1 with Boundaries Mapping Distribution

Collect data about carbon do it Interview has been done helped Avenza software which given some question direction region, villages and river, divides 2 variable perseption. Variable community perception about saving benefit carbon, forest protect, benefit for feed animal, the way for rearrange cultivation and plant get be better.

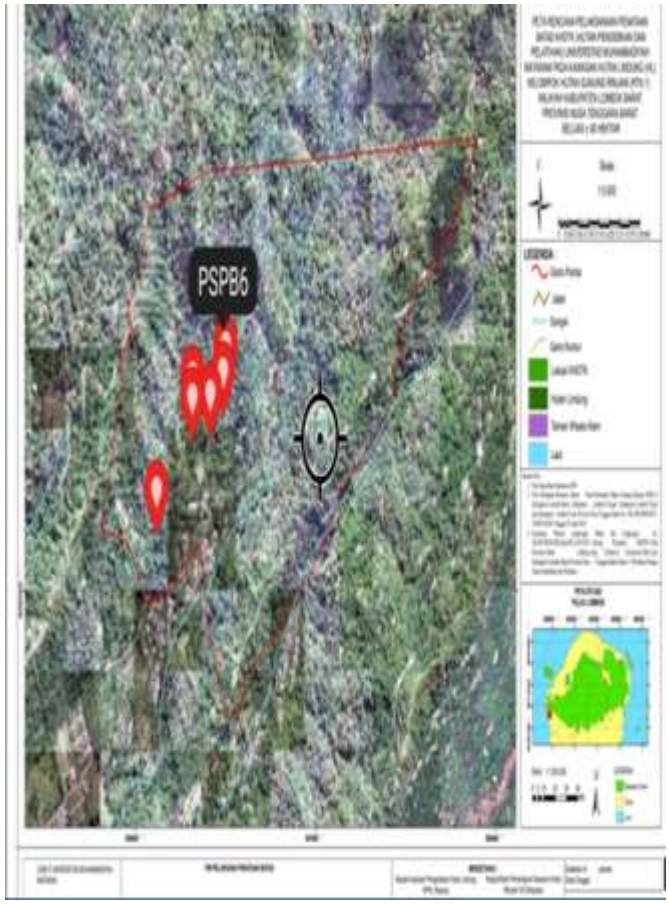

Figure 2. Education Forest University Muhammadiah Mataram 2023, Mapped existed KHDTK Lombok Barat

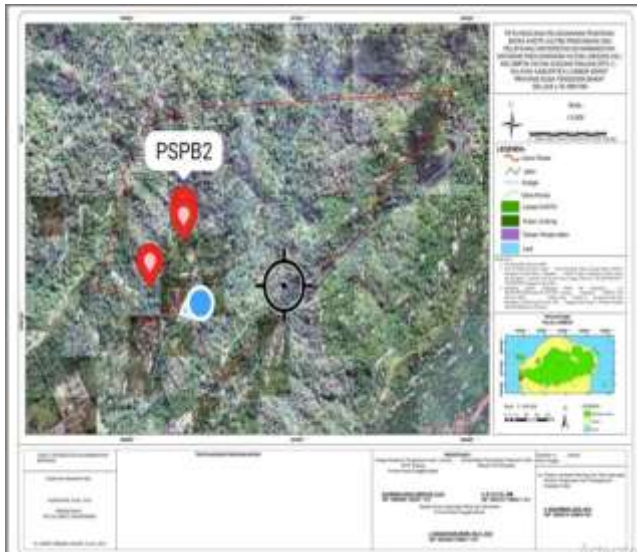

Figure 3. Education Forest University Muhammadiah Mataram

Purposive sampling used for choose respondent more imposible exactly and informasion result in research effective and comprehensive (Campbell et al.,

2020). For quantitative analyze, which give score on question and answer.

Table 3. Hill Plant observe Results

Species of Plant Exist plot	H1	H2	H3	H4	H5	H6	H7	H8	H9
Swietena Mahagoni;	v	v	v	v	v	v	v	v	v
Mangifera odorata;	v	v	v	-	v	v	v	v	v
Artocarpus hetero pylus	v	v	v	-	v	v	v	v	v
Anacardium occiden; tale	v	v	v	v	v	v	v	v	v
Fabaceae	v	v	v	v	v	v	v	v	v
Dimocarpus Longan;	v	v	v	v	v	v	v	v	v
Calophylum ; Inophylum	v	v	v	v	v	v	v	v	v
Dillenea ; Suffruticosa	v	v	v	v	v	v	v	v	v
Persea Americana ;	-	v	-	v	v	v	v	v	v
Percentage of plant each; 91.63%									

Data Collection Stage

The Data have been collected occure Date 9,15 August and 2 September 2023, the primary plot has taken by Students University Muhammadiah Mataram, were made plot and measure every plot 20x20 meter each hill distance and prepare south to northern Batu Bolong to the hill carried out in Protection Forest map data obtained from Muhammadiyah University of Mataram. Meanwhile, the percentage value was obtained from the results of interviews with residents/communities living around the Batulayar Protection Forest, West Lombok Regency.

Data Processing Stage - Making a Land Based Potential Map.

The Mountain Tropical Region (MTR) is the main source of water and plays an important role in food security in the tropics. MTR forests have very good benefits, including significance in the process of the hydrological cycle; regulating air humidity; reducing erosion and sedimentation; and providing important resources, both timber and non-timber. Multiple threats against MTR include land clearing, excessive exploitation of natural resources, increasing population, and natural events such as earthquakes and volcanic eruptions. MTR management must pay attention to the highest-priority strategy, and effective communication between stakeholders must be urgently improved. Damage to natural forests is characterized by degradation and deforestation. Degradation can be seen from the reduced crown cover to the changes in forest structure from shrubs to tall trees. Forest damage can be caused by natural factors such as forest fires, climate change, pests, and diseases. It is estimated that 30% (or around 34 million hectares) of Indonesia's natural forests have been degraded.

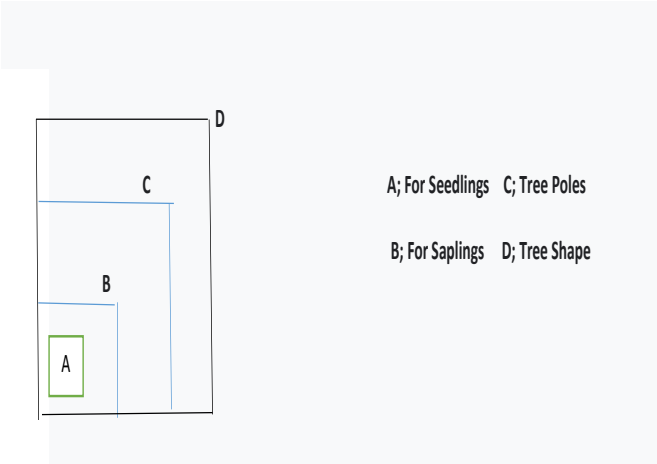

Figure 4. Noted A; 2X2 Meter B;5x5 Meter C;10X10 Meter D;20X20 Meter (Matatula et al., 2019).

This study elaborated on the relationship between total carbon with tree density and basal area (Fig. 3). The relationship between total carbon stock and tree density showed an irregular pattern. In contrast, the relationship between the total carbon basal area and the number of species showed a better shape. The predictor of the basal area was better than tree density in estimating the total carbon. The linear regression equation to estimate total aboveground carbon stock using predictor tree density (X1) and basal area (X2), and the number of species (X3) were Y = 0.1415X1 + 201.99 (R2 = 0.131), Y = 61.283X2 – 35.934 (R2 = 0.550), Y = 243.03 X3 – 29.577 (R2 = 0.689), respectively. A positive correlation between biomass or carbon with IVI has also been shown in mangrove forests (R et al., 2022), community forests (Wirabuana et al., 2021), dry forests (Dimobe et al., 2019; Yasin & Mulyana, 2022), forest plantation (Behera et al., 2017), and tropical forest. However, the predictor of tree density (X1).

Table 1. Interval Saving Carbon

Interval	Class
1.00 – 1.33	low
1.34 - 1.67	Low
1.68 - 2.00	Moderately high

Tools and equipment

Tools and equipment are Source Indonesia Landscape Map Path 131 Row 56 Region map, administrasi used to during data collect Information land. Used software ArcGis 10.1, MS Office, computer, Global Positioning System (GPS) for analisis spasial and

the data. The Observed maped, have make on the morphology and agronomy traits in both grow up environment. Observed were included Carbon stock of seedlings, shape, saplings, poles, leaves, stems, and fruit. Additionally, observed were also made on the plant resistance characteristics, namely the identify, maped rate, and severity. Plants were observed in the begin up to 30 days after all coordinate have done. Visual symptoms were observed in the tissues of inoculated plant, Leaf features, such as epidermal cells, oil cells, oleoresin cells, vascular bundles, stomatal index, and the presence or absence of calcium oxalate crystals or trichomes are key anatomical features that are useful in helping to distinguish medicinal species accurately (Osman et al., 2019; Zhao et al., 2005). For example, turmeric (Curcuma longa L.) can easily be mixed with sawdust and cornflour to counterfeit this product in the food market. The detection of such ingredients in turmeric products suggests adulteration with non-Curcuma species (Osman et al., 2019).

Conclusion

The Mapping and Perception about Forest Vegetation were material prepared control and of ecosistem forest carbon in Edu forest Muhammadiah University of Mataram. Due to intrinsic properties has been widely use an environment service and keeping waters also affecting factors and application in funtional Avenza map from Government of West Nusa Tenggara (NTB). While planting on land occurred in 2022 (2.82%), it was dry land farming with a slope and there were settlements, in general the area experienced a decrease due to increased land use for settlements and land expansion for dry land farming mixed with bushes. Potential carbon reserves based on land cover classes over a period of 15 years from 2003-2018 experienced a downward trend, where the highest potential carbon reserves.

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Author Contributions
Conceptualization; methodology, spatial, validation, mapping distribution. and data analysis, investigation, resources, supervisor in research activities to article writing, reviewed and edited

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Conflicts of Interest
The authors declare that there is no conflict of interest regarding the publication of this paper.

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