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AGROTECHNOLOGY APPROACH OF LABORATORIUM LAPANG TERPADU FACULTY OF AGRICULTURE UNIVERSITY OF LAMPUNG BY LAND UNITS

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ABSTRACT

Laboratorium Lapang Terpadu Faculty of Agriculture, University of Lampung is required to support Lampung University Vision, Mission and Vision of the Faculty of Agriculture Lampung University. Aside from being a supporter of the the learning process and research, can also be used as a showcase (show window). This study aims to studying alternative approach to land management with land units. The method used is a survey method that consists of the preparation phase, a preliminary survey, primary survey, soil analysis in the laboratory, and data analysis. Evaluation of erosion using the Universal Soil Loss Equation (USLE). The results showed that the erosion of the land unit no.2 is still well below the Tolerable Erosion. Erosion on the land units No.3 with 8-15% slope by using a mixture of garden soil and pasture that is 100.29 t / ha / yr. Erosion on land units no.4 and no.5 respectively of 831.74 t / ha / yr and 381.81 t / ha / yr. Erosion on land units 3,4, and 5 have exceeded the value of erosion that can still be tolerated and require agrotechnology. Agrotechnology approach for land units no.3 is P0 (patio bench without plants) or a combination of bench terraces and swidden (P1C6). Land units 4 with the perfect combination of bench terraces and not in the specified moor (P1C2), or patio bench is perfect and good pasture (P1C1). 5 land units with a combination of bench terraces and a high density of annual plants (P1C3) or with an annual plant density is (P1C4).

Keywords : land unit, agrotechnology approach, erosion, C-organic, land use

I. INTRODUCTION

Laboratorium Lapang Terpadu of the Faculty of Agriculture , University of Lampung is needed to support the vision of the University of Lampung and Vision and Mission of the Faculty of Agriculture , University of Lampung. According Banuwa , Syam and Wiharso (2011), an integrated field laboratory of the Faculty of Agriculture, University of Lampung in addition to support teaching, learning and research, can also be used as a showcase (show window). The existence of a unified field laboratory of the Faculty of Agriculture, University of Lampung is expected to build a new image in the field of agriculture , especially for the younger generation , that agriculture is not inferior to other fields, can be an attractive profession, prospectively, and honorable.

From the results of previous studies, this laboratory has a very diverse class slopes. In general the dominant slope is slightly slanted / wavy with slopes of 8-15 % (65 % of the total area), followed by a gentle slope / choppy (20% of the total area), flat (8% of the total area), rather steep (6% of the total area), and the remaining one percent steep slope (Banuwa, *et al*., 2011) .

Laboratorium Lapang Terpadu of the Faculty of Agriculture , University of Lampung , with an area of approximately 6.784 hectares located in the complex of Lampung University campus. This laboratory, as intended, is used to perform a variety of research related to agricultural science. With dominant ramps to undulating contour, as well as high rainfall, the estimated erosion potential is also large enough so that it is feared will be a decline in soil fertility and loss of topsoil (top soil), if not managed properly.

The erosion problem will lead to land degradation, which will affect the sustainability of integrated field laboratory of the Faculty of Agriculture, University of Lampung, so that the necessary soil and water conservation efforts in accordance with the rules of science. Soil conservation is defined as the placement of each field on how to use the land in accordance with the ability of the soil and treat it in accordance with the requirements necessary to avoid damage to the land. While water conservation principle is the use of water that falls to the ground as efficiently as possible, and the timing of the flow so that no destructive floods and there is enough water during the dry season (Arsyad, 2010).

Soil conservation does not mean suspension or ban the use of land, but with the ability to customize the type of land use and provide treatment in accordance with the conditions required in order to work the land sustainably. Each treatment was given on a piece of land will affect the water system, so efforts to conserve land is also a water conservation (Priyono and Cahyono, 2004).

Main goal of this research is to get each management alternative land units in the integrated field laboratory of the Faculty of Agriculture, University of Lampung.

II. MATERIALS AND METHODS

A. Place and Time Research

This study was conducted in Laboratorium Lapang Terpadu of the Faculty of Agriculture, University of Lampung, Jl. Sumantri Brojonegoro No. 1 Gedung Meneng Bandar Lampung.

Study determined the location intentionally (purposive), given the Laboratorium Lapang Terpadu of the Faculty of Agriculture, University of Lampung is home Unila academics doing research, experiment, practice and other activities related to the development of education and community service.

B. Determination of Land Unit

Land units is determined based on the results of the class map overlaying slope, soil type maps and land use maps. Acquired land units used as the object of observation. After conducting a preliminary survey (field assessment), carried out observations of the existing land units.

C. Data Collections

1. Soil

Soil data obtained from field observations and laboratory analysis of soil samples in soil and in Lampung State Polytechnic Laboratory of Soil Science, Faculty of Agriculture, University of Lampung. Soil sample taken consisted of intact and composite soil samples. Intact soil samples taken by 5 (five) points, each taken at a depth of 0-20 cm and 20-40 cm with two replicates representing each land unit. Intact soil samples used for the analysis of soil physical properties such as bulk density and soil texture. While the composite soil samples used for the analysis of soil properties.

2. Vegetation

Vegetation data required include: type of vegetation, the estimated amount, approximate cover has, and spread in the research area visually.

3. Rainfall

Rainfall data obtained from rain Kemiling graduated station. Data from this station is obtained through the Meteorology and Geophysics Agency (BMKG) Masgar, Tegineneng, Pesawaran District.

D. Data Analisys

1. Erosion

Erosion is calculated using the USLE (Wischmeier and Smith, 1978):

$$A = R \times K \times L \times S \times C \times P \qquad (1)$$

where:
A = number of eroded soil (t / ha / yr)
R = rainfall erosivity factor index
K = soil erodibility
L = slope length factor
S = slope steepness factor
C = factor of vegetation ground cover and crop management
P = factor specific measures of soil conservation

2. Rainfall erosivity factor (R)

Determination of rainfall erosivity factor (R) is the sum of the values of monthly rainfall erosion index and is calculated by the equation:

$$R = \sum_{i=1}^{12} (EI30)i \qquad (2)$$

EI30 determination, prediction equation uses Bols (1978, in Arsyad, 2010), as follows :

$$EI30 = 6{,}119\ (Rain)^{1{,}21}(Days)^{-0{,}47}(Maxp)^{0{,}53} \qquad (3)$$

Where :
EI30 = monthly rainfall erosion index
Rain = precipitation monthly averages (cm)
Days = number of rainy days per month on average
Maxp = maximum rainfall during 24 hours in the month (cm)
Annual EI_{30} is the sum of monthly EI_{30}

3. *Soil Erodibility Factor (K)*
Soil erodibility value was calculated by using the formula Wischmeier and Smith (1978) :

$$100K = \{1,292\ (2,1\ M^{1,14}\ (10^{-4})(12 - a) + 3,25\ (b - 2) + 2,5\ (c - 3)\} \quad (4)$$

Where :
K = soil erodibility
M = grade soil texture (% silt +% dust) (100 -% clay)
a =% organic matter
b = the soil structure code
c = code permeability of the soil profile

4. *Length and slope factor (LS)*
Length and slope factor is calculated according to the formula (Wischmeier and Smith 1978) remedy the slope is less than 12 percent:

$$LS = \sqrt{X(0,0138 + 0,00965S + 0,00138S^2)} \quad (5)$$

For slopes over 12 percent using the formula according to Eppink (1985) as follows:

$$LS = (X/22)^{0.50}\ (S/9)^{1,35} \quad (6)$$

Where :
X = length of slope (m)
S = slope steepness (%)

5. *Plants and Land Management Factor(C)*
Determination of factors Plants and Land Management (C) based on various studies that have been done before.

6. *Conservation factor (P)*
Factors conservation measures are also determined based on the various studies that have been done before.

7. *Erosion can be tolerated (Etol)*
Tollerable soil loss (Etol) is calculated based on the equation proposed by Wood and Dent (1983, in Banuwa, 2008) which takes into account the minimum depth of the soil, the rate of soil formation, a depth equivalent (equivalent depth), and age in order to land (resources life). The rate of soil formation used was 2 mm / yr with age to use (UGT) for 400 years (Arsyad, 2010), a factor of 0.8 with a soil depth of effective soil depth varies between 720 mm to 1200 mm. The equation is as follows :

$$E_{tol} = \frac{D_e - D_{\min}}{UGT} + LPT \quad (7)$$

Where :
De = depth of equivalent
= Effective soil depth (mm) x depth of soil factors
Dmin = minimum depth of soil (mm)
UGT = Land use age (years)
LPT = rate of formation of soil (mm / yr)

8. *Agrotechnology*
Selection of Agrotechnology set based on the criteria used to determine the maximum value of CP. Alternative agro technology is resulting in erosion of the value of CP is less than or equal to the erosion that can be tolerated.

Selection of Agrotechnology set based on the criteria used to define the maximum CP value is used as an alternative agro technology is resulting in erosion of the value of CP is less than or equal to the erosion that can be tolerated. These criteria can be written as follows (Banuwa, 2008) :

$$A \leq E_{tol} \text{ atau } RKLSCP \leq E_{tol} \quad (8)$$

$$CP \le \frac{E_{tol}}{RKLS} \text{ atau } CP \le CP_{max} \qquad (9)$$

III. RESULTS AND DISCUSSION

A. General Situation Research Sites

1. Geography condition

Geographically, the study site is located between 526,650 mT and 9,406,450 mU to 527,200 mT and 9,406,850 mU (UTM coordinates) or 5^{o} 22 '11.38 "latitude and 105^{o} 14' 25.96" E to 5^{o} 21 '58.35 "latitude and 105^{o}14 '43.83 "East. Altitude between 110 -130 m above sea level. (The Worldwide Coordinate Converter, 2012). Administratively, the study site is located in the Village gedong Meneng, Rajabasa District, the city of Bandar Lampung. The lowest part is located in the middle of the location, and the flow of water from the west toward the east. At the time of the study, in the east there are several ponds / lebung, which serves as a reservoir and storage of runoff water and used as a place of pisciculture.

2. Slope Class

FP unified field laboratory Unila dominated by undulating slopes (8-15%) and only a small part rather steep slope (30-45%). It is also in accordance with results of previous studies, that the slopes 8-15% reaching 65 percent and the total area is rather steep slope is only about six percent.

3. Rainfall

Based on data from Masgar Climatology Station, Tegineneng, annual rainfall average of the last six years at the study site is at 2,156 mm, with the highest annual rainfall in the year 2010 amounted to 3,297 mm. While the monthly rainfall average ranges between 78 mm (August) to 297 mm (February). Wet month in December to May (6 months), and the dry months (<100 mm) occurred in August and September. The average monthly number of rainy days was 8 days, with the highest number of rainy days is 13 days which occurred in January, and the lowest was 4 days in August and September. The maximum amount of daily rainfall average is 49 mm, with the highest daily maximum rainfall occurs in December in the amount of 82 mm and the lowest occurred in August which is 28 mm.

Rainfall annual average over the last six years to reach 2,156 mm with 13 rainy days the number of days in a month. The maximum amount of daily rainfall averaged over the last six years to reach 82 mm which occurred in December. These three components are crucial rainfall erosivity rainfall (rainfall ability to cause erosion).

4. Soil

a. Soil Fertility

The results Banuwa, Sham and Wiharso (2011), soil fertility status FP Unila unified field laboratory is low, with a pH of 5.12 to 5.63, the total nitrogen content of between 0.310 to 0.469% (classified as moderate), Phosphate content of between 5.301 - 8.573 ppm (classified as very low), the content of exchangeable potassium (K-dd) ranged from 0.165 to 0.760 g me/100, content of calcium (Ca-dd) can be exchanged relatively low (2.298 to 3.612 g me/100), Magnesium content exchangeable (Mg-dd) is low (.374 to .553 me/100 g), the value of Cation Exchange Capacity (CEC) ranged from 8.740 to 13.821 g me/100 (relatively low). Laboratory analysis showed that the levels of Carbon (C) organic soil ranged from 1.51 to 1.96%.

b. Physical properties of soil

From the survey and laboratory analysis, field laboratory Unila integrated FP can be classified in the group with the Ultisol soil parent material igneous / volcanic. Effective soil depth ranged from 72 cm - 136 cm. Water table is more than 72 cm. In general, the study site has good drainage. Of all land units, soil structure type is type 4 (blocky, plates, and solid: blocky, platy, and massive). Permeability class (moderate) and moderate to slow (moderate to slow). C-organic content of the soil at the study site ranged from 1.51 to 1.96 percent. Bulk density ranged from 1.13 to 1.21 g / cc.

In general, the soil in the study area is classified as a fine-textured clay, with a structure belonging to already developed. Soil structure cuboid angle with medium to coarse. On the top layer in a particular place is rounded cube, this is because they are influenced by the organic matter content.

Land in locations such studies are closely related to plasticity plastic classified according to soil texture that contains clay . Soils containing clay soil is a little bit dense , but the ability of soil to hold water is still quite high .

In the valley areas in the central part of the study area there is still a pool of water which resulted in somewhat poor drainage . Soil inundation of land in this area are generally gray , while the other part was relatively good drainage , marked with bright colors and a homogeneous soil.

Land belonging to the depth (more than 72 cm) , so that roots can still plant roots develop properly .

Soil bulk density in the study area that is not too varied between 1.13 to 1.21 g / cc with a total pore space analysis is ranged between 54.34 to 57.36 %.

Topsoil permeability between 4.10 to 11.53 cm per hour , which is slow to moderate and moderate . As for the bottom layer ranged from 0.77 to 6.73 cm / hour , which is slow to moderate.

5. Land Use

Land use at the time of this study there are several types . In the middle section extends from west to east, there are some lebung / ponds are partially flooded . in the northern and central parts , used as a student / researcher doing research and prakrik various types of crops such as corn , peanuts , beans, forestry plants , spinach , kale land , and others . In the western part of the garden is a mix that is not too tight and there are a variety of crops such as bananas , cocoa , Tangkil , coconut , palm , bamboo , rosewood , papaya , and others . In the southeast there are some palm trees and there are mounds and traditional terraces .

In the southern part which is the main entrance , there are several permanent and semi- permanent buildings, livestock barns , greenhouses , office , residential guard , tower , and others . Along the boundary fence of integrated FP Unila field laboratory equipped with the inspection using the paving block with a width of approximately 150 cm . Around the yard office is also covered by paving block.

6. Land Unit

Based on the results of field survey and analysis of soil samples and the slope class map, then the set 5 land units in integrated FP Unila field laboratory. Land units determined by the properties or characteristics of a homogeneous land. As the differentiating factor is (1) the type of soil, (2) land cover, (3) climate rainfall in this case, and (4) slope. Relatively homogeneous soil types for the entire study area, as well as land cover and rainfall. Therefore the slope factor is the only differentiating factor in the determination of land units.

Land unified field laboratory FP Unila dominated by land unit 3 with an area 3.417 ha (50.37%) and 4 units of land with an area of 2.034 ha (29.98%).

Unit 1 is a unit of area of land with a slope of 0-3 percent that at the time the study was conducted in the form of ponds and rice fields are not processed. This vast land unit 1 approximately 0.737 ha. The most extensive land unit is a unit of area 3 (3.417 ha), with a variety of land uses such as garden mix, reeds and cassava. Land unit 5 is the smallest area (0.351 ha). This land has a rather steep slope, overgrown shrubs.

7. Erosion

a. Rainfall erosivity factor (R)

Rainfall erosivity value (R) of 2236, where the highest value of EI30 in December in the amount of 350 and the lowest in August at 71.

b. Soil Erodibility Factor (K)

K value is calculated based on a variety of factors: texture, structure, organic C content, and permeability. K values varied between 0.159 to 0.193.

c. The slope and slope length factor (LS)

LS factor is determined by the slope and slope length. Because of the slope varies from 1-45% and slope length also varies from 1 m to 120 m, then the LS values obtained varied depending on the class of the slope and slope length. LS values ranged from 0.077 to 4.717.

d. Vegetation management factor (CP)

Vegetation management factor (CP) ranged from 0.200 to 0.500. Assignment is consistent with the observations (survey) field, where conditions are very diverse vegetation cover.

The amount of soil erosion in the entire laboratory, field lerpadu FP Lampung University amounted to 330.67 tons / ha / yr . Highest erosion on land units with an area of 2,034 ha 4 , erosion of 831.67 tonnes / ha / yr . Next is a unit of land with an area of 0.351 ha 5 , the erosion is 381.84 tonnes / ha / yr . At least 2 units of land erosion , followed by a land unit 3 , respectively 8.88 and 100.30 tons / ha / yr .

Erosion increases with increasing slope gradient and slope length . Erosion for land unit 2 with slope between 3-8 % is equal to 8.88 ton / ha / yr . Erosion is still below the tolerable erosion to the land unit that is equal to 35.09 tons / ha / yr . This means that the land unit 2 does not require soil and water conservation measures to reduce erosion , requiring only maintenance actions so that erosion can always be maintained under Etol .

Soil erosion prediction for unit 3 on average amounted to 100.30 tons / ha / yr or 2.8 times greater than Etol is equal to 35.83 tons / ha / yr . 4 land units have an average value of erosion of 831.67 tons / ha / yr or 23 times greater than the value that is equal Etol 36.05 tons / ha / yr . While the average erosion on land unit 5 is equal to 381.84 tonnes / ha / yr or 10 times greater than the value of Etol is equal to 37.99 tons / ha / yr .

Three land units with slope 8-15 % , has a value greater erosion of value erosion in laboratory and requires soil and water conservation measures (Agro) to suppress the erosion to be below or equal to the value erosion that can be tolerated .

Unit 4 has a slope of land between 15-30 % and have a greater erosion of value erosion that can still be tolerated. Erosion is very high value is due to land units 4 , in addition to having a hilly slope also has a long slope. Long slope resulting in runoff that has the potential to cause greater erosion along the slope . Land units require soil and water conservation measures are more intensive than the land unit 3 to be able to suppress the erosion that is under or equal to the erosion in laboratory.

Five units of land with a slope of 30-45% with erosion four times greater than the erosion that can still be tolerated. Although the land unit 5 is steeper, but because the slope was relatively short (maximum 23 m), the erosion is lower than 4 land units. However, the land unit 5 also requires soil and water conservation measures that erosion can be reduced. Erosion average for the whole area of integrated FP Unila field laboratory is at 330.67 tonnes / ha / yr with Etol value of 35.89 tonnes / ha / yr.

8. *Erosion in laboratory*

E_{tol} values ranged from 33.67 tonnes / ha / yr (land units 2) up to 37.99 tonnes / ha / yr (land units 5). Assuming that during the 400 years of the functioning of the laboratory field lerpadu FP Unila still works fine. Because of the erosion rate is well above the value erosion that can be tolerated then need a serious effort to reduce the rate of erosion on each land unit, especially with conservative management efforts so that the value of CP can be reduced to a minimum. Other efforts that can be done is to shorten the length of the slope values (X) by means of terracing and mounds at certain locations.

9. *Organic carbon content of soil*

Soil organic carbon content reflects the amount of carbon captured by plants through photosynthesis and then go into the soil through the weathering process , and stored in the soil . Organic carbon content also reflects the condition of plants that cover the land in question . On open lands , the ability of plants to capture carbon through the process of photosynthesis is much lower when compared to the sealed area . The greater the organic carbon found in the soil means that the higher the amount of photosynthesis that occurs on the surface of the land where carbon is found.

The amount of organic carbon in the soil on land units 2 , 3 , 4 , and 5 each in succession by 1.96 % , 1.75 % , 1.79 % and 1 , 70 % . Highest organic carbon stocks in land units 2.

Carbon stored , either in the ground or above the ground surface from CO2 (carbon dioxide) in the atmosphere, which is absorbed by plants through photosynthesis . Carbon dioxide is a greenhouse gas (GHG) and was among the major greenhouse gases (CO2 , CH4 , N2O5) . According Hairiah (2007 in Banuwa and Henrie , 2010) , the concentration of the three types of gas late in the atmosphere continue to rise until doubled . Furthermore Banuwa and Henrie (2010) , reported that the amount of carbon stored in each land use varies , depending on the variety , plant density , soil type , management practices , and others.

Carbon stored in the soil is the sum of the percent of soil organic carbon multiplied by the weight of the soil , coupled with soil microorganisms biomass carbon (Banuwa and Henrie , 2010) . In this study the carbon biomass of soil microorganisms are not in the analysis . The amount of carbon stored in the soil at the field laboratory integrated FP Unila soil at a depth of 20 cm is equal to 252.00 tons , or an average of 41.97 tonnes / ha .

Loss of organic carbon in the soil due to erosion is estimated at 38.60 tons / yr (15.32 % of the total organic carbon in the soil) if there is no agro technology is applied to the field laboratory lerpadu Unila FP , or in less than 7 years old then carbon stocks will be depleted by erosion . By applying Agro- suit that has been described above , then the loss of organic carbon from the soil due to erosion can be reduced by 0.851 tons / yr (0.34 %) . Thus, agro technology applied to reduce the loss of soil organic carbon in integrated FP Unila field laboratory at 37.75 tons / year , or are able to maintain the organic carbon stored in the soil by 97.80 %.

10. *Analysis of Agrotechnology*

Agrotechnology or conservation measures that must be done is in accordance with the characteristics of each land unit. Land unit 2 do not require conservation action because of erosion predictions are still far below the erosion that can be tolerated . Land units 3 , 4 and 5 land units require proper agro technology to reduce erosion is predicted to occur in order to be below the value erosion that can still be tolerated.

Attempts to do is to conduct management activities (P) and planting appropriate vegetation and crop management (C) corresponding to each land unit . By doing the proper management and the selection of appropriate plant species , then the value of C and P factors can be reduced and further value erosion can also be suppressed.

For conservation measures (factor P), there are 5 actions that can be selected and combined with 6 types of vegetation and crop management factor (factor C). Of these two factors is then carried out so that the combination of CP values obtained for each of the land units that meet the criteria of value erosion is lower or equal to the erosion that can still be in tolerance.

The most effective conservation action is to create the perfect bench terraces (P1), with a P value of 0.04 . While the factors that best plants for conservation and grazing is good (C1) or used as a high-density mixed farms (C3). The combination of conservation measures with the choice of plants will give you the best value of CP for each land unit.

a. *Land unit 2*

Land unit 2 with CP actual value of 0.300 with erosion of 8.88 t / ha / yr only require maintenance actions that do not increase erosion.

b. *Land unit 3*

Three land units with a value of 0.200 has CP actual erosion of 100.30 tonnes / ha / yr . CP value target should be equal to or less than 0.071 so that erosion can be reduced to less than or equal to the erosion that is still tolerable (Etol = 35.83 tonnes / ha / yr) . Conservation actions that can be performed on land unit 3 is P1 (perfect bench terraces) . Combinations that can be done is with the crop factor C1 (good pasture) , C2 (moor is not specified) , C4 (mixed farms with medium density) , and C6 (shifting cultivation) . Traditional terracing (P2) can also be applied to the land unit 3 , which combined with good pasture (C1) . Most land unit 3 can be used as a useful good pasture for livestock feed ingredients . Erosion that occurs after conservation measures on land unit 3 are presented in Table 4.

c. *Land Unit 4*

Land unit 4 with a value of 0.500 CP actual erosion yield of 831.67 t / ha / yr. CP value target should be equal to or less than 0,022 so that erosion can be reduced to less than or equal to the erosion that is still tolerable (E_{tol} = 36.05 tonnes / ha / yr). Conservation actions that can be performed on land unit 4 is P1 (perfect bench terraces) and P2 (traditional patio) . Can be combined with crop factor C1 (good pasture) , C2 (moor is not specified) , C5 (low density mixed farms) . For land units 4 , good grass planting can be applied in relation to the location of the cattle pens that require grass as feed . Erosion that occurs after conservation measures on land units 4 are presented in Table 5.

d. *Land Unit 5*

Five land units with a value of 0.200 with CP actual erosion of 381.84 tonnes / ha / yr . CP value target should be equal to or less than 0,020 so that erosion can be reduced to less than or equal to the erosion that is still tolerable (Etol = 37.99 tonnes / ha / yr) . Conservation actions that can be performed on land unit 5 is the perfect bench terracing (P1) , with a combination of factors C3 plants (garden mixed with high density) and C4 (mixed farms with medium density) . 5 spacious land units less than 0.5 ha and slopes 30-45 % . By making the perfect patio , it can be combined with land 5 mixed garden which contains a variety of forest plants and can be used as an arboretum as a place of study and practice of forestry students . Erosion that occurs after conservation measures on land units 5 are presented in Table 6.

Table 1. Erosion on land unit 3 by a combination of conservation measures

No	Alternatif Tindakan	Nilai P	Nilai C	R	K	LS *)	CP	Erosi (t/ha/th)	Etol (t/ha/th)
1				2.236	0,181	1,239	0,200	100,29	35,83
2	P1C2	0,04	0,700	2.236	0,181	1,239	0,028	14,04	35,83
3	P1C4	0,04	0,200	2.236	0,181	1,239	0,008	4,01	35,83
4	P1C6	0,04	0,400	2.236	0,181	1,239	0,016	8,02	35,83
5	P2C1	0,40	0,040	2.236	0,181	1,239	0,016	8,02	35,83

Table 2. Erosion on land unit 4 by a combination of conservation measures

No	Alternatif tindakan	Nilai P	Nilai C	R	K	LS *)	CP	Erosi (t/ha/th)	Etol (t/ha/th)
1				2.236	0,176	4,227	0,5000	831,74	36,05
2	P1C1	0,04	0,040	2.236	0,176	4,227	0,0016	2,66	36,05
3	P1C2	0,04	0,100	2.236	0,176	4,227	0,0040	6,65	36,05
4	P1C5	0,04	0,200	2.236	0,176	4,227	0,0080	13,31	36,05
5	P2C1	0,04	0,040	2.236	0,176	4,227	0,0016	2,66	36,05

Table 3. Erosion on land unit 5 by a combination of conservation measures

No	Alternatif tindakan	Nilai P	Nilai C	R	K	LS *)	CP	Erosi (t/ha/th)	Etol (t/ha/th)
1				2.236	0,181	4,717	0,200	381,81	37,99
2	P1C3	0,04	0,100	2.236	0,181	4,717	0,004	7,64	37,99
3	P1C4	0,04	0,200	2.236	0,181	4,717	0,008	15,27	37,99

Where: R= rain erosivity, K= soil erodibility, LS = length and slope factor, CP = agrotechnology factor, E_{tol} =erosion can be tolerated.

IV. CONCLUSION

A. Conclusion

From these results it can be concluded:

1. Actual erosion without soil and water conservation measures: 2 land unit is 8.88 tonnes / ha / yr, 3 land units is 100.30 tonnes / ha / yr, 4 land units of 831.67 tons / ha / yr, and the unit 5 land of 381.84 tonnes / ha / yr.
2. With Agro, erosion of land units 3 to 14.04 tonnes / ha / yr (P1C2), 4.01 tonnes / ha / yr (P1C4), 8.02 tonnes / ha / yr (P1C6), and 8.02 tons / ha / yr (P2C1), on land units 4 to 2.66 tonnes / ha / yr (P1C1), 6.65 tonnes / ha / yr (P1C2), 13.31 tons / ha / yr (P1C5), and 2.66 tonnes / ha / yr (P2C1);, and land units 5 to 7.64 tonnes / ha / yr (P1C3), and 15.27 tonnes / ha / yr (P1C4).

B. Suggestion

1. Soil and water conservation measures that need to be done is the perfect bench terracing for land units 4 and 5, whereas for the 3 land units with combined traditional patio with a mix of high density orchard can reduce erosion to be under erosion can be tolerated.
2. Perfect combination of bench terraces with good pasture can be applied to land units 3 and 4, especially those located near the corral.

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Attachment

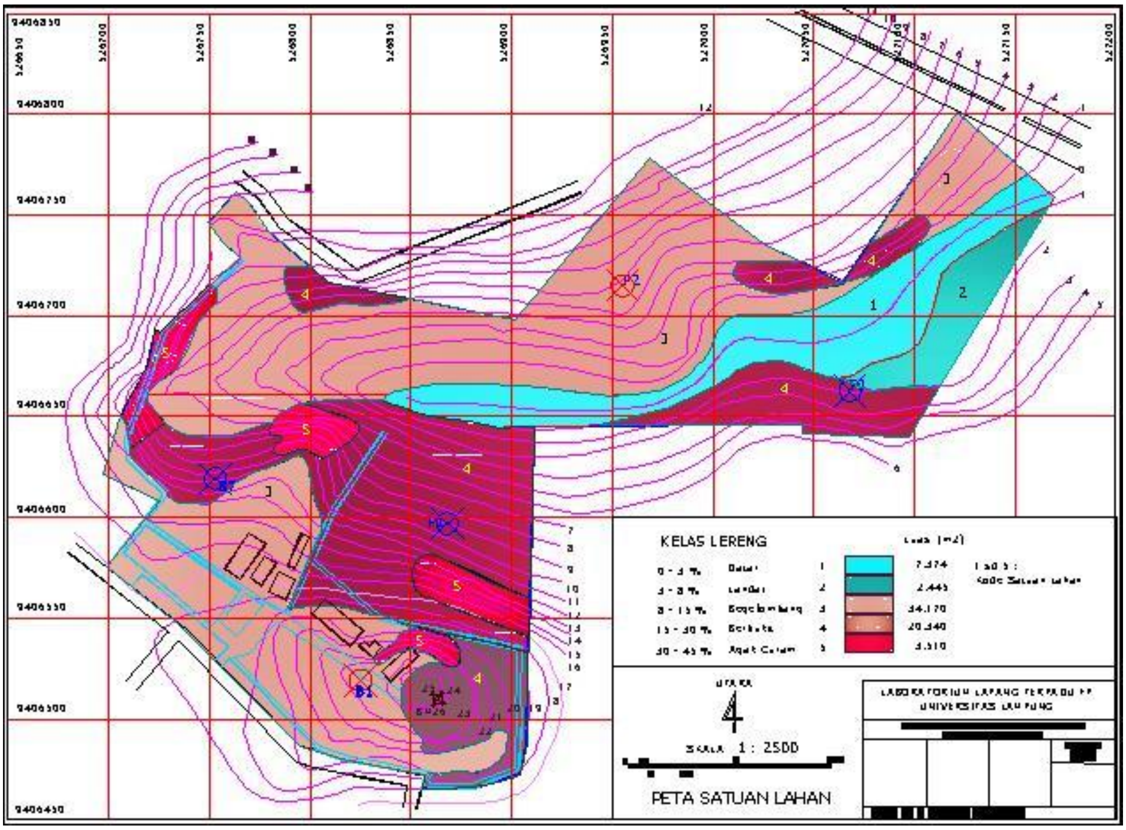

Fig. 1. Map land unit (land units) Integrated Field Laboratory FP Unila

Tabel 1. Land units integrated field laboratory of the Faculty of Agriculture, University of Lampung.

Serial No.	Land Unit	Slope	Land Use / Vegetation	Area		Soil
				Ha	%	Type
1	1	0 - 3 %	Taro and grass, a pool / pond	0,737	10,87%	Ultisol
2	2	3 - 8 %	Imperata grass and shrubs	0,245	3,60%	Ultisol
3	3	8 - 15 %	Grassland and mixed farms, jengkol, etc.	3,417	50,37%	Ultisol
4	4	15 -30 %	Mixed farms, corn, beans	2,034	29,98%	Ultisol
5	5	30 - 45 %	Mixed farms, bamboo, cocoa, bananas, etc.	0,351	5,17%	Ultisol
	Total			6,784	100,00%	

Source: Measurement results topographic maps and field observations.

Table 2. Alternative conservation actions for integrated field laboratory FP Unila.

Code	Value	Alternative conservation actions
P1	0,04	Perfect Bench terraces
P2	0,40	traditional terraces
P3	0,40	*Hill side ditch atau sil pits* (rorak)
P4	0,75	Contour cropping slope of 9-20%
P5	0,90	Contour cropping slope> 20%

Source: Arsyad (2010) and Abdurahman *et al.* (1984) in Banuwa (2008).
Bench terraces perfect
traditional patio
Hill side ditch or seals pits (rorak)
Contour cropping slope of 9-20%
Contour cropping slope> 20%

Table 3. Alternative crop factor used to reduce erosion.

Kode	Value	Crops
C1	0,040	meadows good
C2	0,700	Tegalan not specified
C3	0,100	high density mixed Gardens
C4	0,200	medium density mixed Gardens
C5	0,500	low density mixture Gardens
C6	0,400	Shifting
C7	0,357	Mulch sequential cropping pattern of crop residues

Source: Banuwa (2008).

Table 4. Erosion on land unit 3 by a combination of conservation measures

No	Alternative actions	Nilai P	Nilai C	R	K	LS *)	CP	Erosi (t/ha/th)	Etol (t/ha/th)
1				**2.236**	**0,181**	**1,239**	**0,200**	**100,29**	**35,83**
2	P1C2	0,04	0,700	2.236	0,181	1,239	0,028	14,04	35,83
3	P1C4	0,04	0,200	2.236	0,181	1,239	0,008	4,01	35,83
4	P1C6	0,04	0,400	2.236	0,181	1,239	0,016	8,02	35,83
5	P2C1	0,40	0,040	2.236	0,181	1,239	0,016	8,02	35,83

Source : calculation results

Table 5. Erosion of on land unit 4 with a combination of conservation measures

No	Alternative actions	Nilai P	Nilai C	R	K	LS *)	CP	Erosi (t/ha/th)	Etol (t/ha/th)
1				**2.236**	**0,176**	**4,227**	**0,5000**	**831,74**	**36,05**
2	P1C1	0,04	0,040	2.236	0,176	4,227	0,0016	2,66	36,05
3	P1C2	0,04	0,100	2.236	0,176	4,227	0,0040	6,65	36,05
4	P1C5	0,04	0,200	2.236	0,176	4,227	0,0080	13,31	36,05
5	P2C1	0,04	0,040	2.236	0,176	4,227	0,0016	2,66	36,05

Table 6. Erosion of on land unit 5 with a combination of conservation actions

Serial No.	Alternative actions	P Value	C Value	R	K	LS *)	CP	Erosion (t/ha/th)	Etol (t/ha/th)
1				**2.236**	**0,181**	**4,717**	**0,200**	**381,81**	**37,99**
2	P1C3	0,04	0,100	2.236	0,181	4,717	0,004	7,64	37,99
3	P1C4	0,04	0,200	2.236	0,181	4,717	0,008	15,27	37,99

Description: R = rainfall erosivity, K = soil erodibility, LS = length and slope factor, CP Agrotechnology factor, Etol = erosion that can still be tolerated.