SENJOp
http://senjop.ppj.unp.ac.id/index.php/senjop/
Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

MODIFICATION OF LAND CONSERVATION ON AGRICULTURE BASED ON ENVIRONMENTAL MITIGATION IN BIOSEQUENT MARAPI

*Dedi Hermon

[1]Department of Geography - Universitas Negeri Padang
Email: dihermon006@gmail.com

*Corresponding Author, Received: Agust 13, 2020, Revised: Nov, 18, 2020, Accepted: Dec, 01, 2020

ABSTRACT

Intention of this research is to study distribution of erodibilitas for the instruction of conservation agriculture which have base development of have continuation to pursuant to biosequent in Marapi West Sumatra and give solution about ideal and compatible conservation technique type used by farmer society to increase and maintain erodibilitas in managing farm for the agriculture. Method the used i] method of survey with technique intake of sampel by stratified random sampling. Result of research obtained by ideal conservation at permanent plant cover, sequental cropping+mulsa, and bench terrace+mulsa+waterway. While conservation which is not ideal to be applied is contur strip cropping, maximum tillage+intercropping, and bench terrace. Other pertained at conservation rather ideal.

Keywords: *biosequent, erodibilitas, stratified random sampling*

INTRODUCTION

Soil is part of the ecosystem, where humans, animals, and plants carry out their activities, so that soil properties are always heterogeneous, dynamic, and different from one place to another (Birkeland, 1974; Buol *et* al., 1980; Arsyad, 1989). Hermon (2001), explained that the role of humans has a very large effect on changes in soil properties. According to Arsyad (1989) and Darmawijaya (1980), The large role of humans in influencing the properties of the land is caused by a large enough population increase, so that the need for food will also increase, supported by increased development development and poverty which causes competition in land use and new land clearing in the upper watershed areas by logging forest in primary forests, which should have + 40% forest to be used as a buffer area.

Rusman (1998) and Hermon (2009), added that this farming system quickly reduces the biological potential of the land, due to the high intensity of surface soil erosion by runoff, so that the carrying capacity of the land decreases. On the lands on the lower slopes of Marapi, which is the upper watershed area of Batang Anai, it has been optimally utilized for agricultural land, this has resulted in the land carrying capacity as a buffer zone will decrease if it is not immediately addressed by implementing an ideal soil conservation agricultural system which can restore soil resistance to crushing and sweeping processes. The ideal conservation agriculture here is defined as an agricultural system implemented by the community (farmers) who apply conservation techniques in managing land in accordance with the carrying capacity of the land in a sustainable manner (Hermon, 2014; Hermon, 2015).

SENJOp
http://senjop.ppj.unp.ac.id/index.php/senjop/
Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

This depends on the stability of soil aggregates against the energy destruction of rainwater and runoff. Soil resistance to destruction and washing by rainwater and runoff is known as soil erodibility (Seta, 1991; Hermon, 2010; Hermon, 2012). The land use pattern in Marapi is generally used as agricultural land, either as mixed gardens, horticulture, or as rice fields. In addition, land use is also for forests, both primary and production forests. In a biosequent forest, which generally contains a variety of vegetation and activities in it and must be 40% of the total area, it has been intensively disturbed by human intervention. This forest land should have been cleared and used as agricultural areas. So directly, changing the land use pattern itself will cause the carrying capacity of the land to decrease (Deptan Sumbar, 2004). So in Marapi there are two dominant biosequent, namely forest biosequent and agricultural plant biosequent.

The conservation farming techniques applied by farmers in Marapi are currently very diverse, such as making terraces, crop rotation, using mulch, and so on. Conservation agriculture that has been implemented without going through solid planning, in other words the applied land use pattern is not in accordance with the land use plan recommended by the government (Hermon, 2016; Hermon, 2017; Hermon, 2018; Hermon, 2019). The mistakes in conservation patterns and techniques applied by farmers are caused by the low level of education of farmers in absorbing the information provided by the government, so that the conservation agricultural techniques applied to agricultural activities are not yet based on science and technology, in other words, only done in accordance the wishes of the farmer himself. With low knowledge of land management, the process of erosion and washing of the soil by run-off is quite intensive, this can be seen from the large number of landslides in agricultural areas, the formation of erosion trails, and the flooding of Batang Anai when it rains. The Batang Anai flood had washed away the railway bridge in Malibou Anai, this happened in 1980. This incident was enough to inform the government that the land in the upper watershed area (Marapi-Singgalang physiography) is already vulnerable to erosion and washing away, so it is no longer function as a buffer zone optimally (Darmawijaya, 1990; Hermon, 2001; Hermon, 2019; Hermon, 2020).

This is very dangerous if it is not immediately addressed, because the physical damage to soil in land use for agriculture that has used soil conservation techniques is generally unknown, due to the assumption that land that has been managed with conservation techniques and strategies will not be damaged. Therefore, it is necessary to analyze soil erodibility to determine the degradation of soil properties. Soil erodibility test using the Bouyoucos method is a simple method developed in 1935 to analyze soil erodibility. This method is suitable for use in heterogeneous relief lands with heterogeneous land use patterns on soils formed from volcanic tuff (Seta, 1991). By analyzing soil erodibility, it will be known the level of soil resistance to destruction by raindrops and washing away by surface runoff, so that suitable and ideal land use patterns based on soil conservation management can be applied.

SENJOp
http://senjop.ppj.unp.ac.id/index.php/senjop/
Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

METHOD

This research was conducted using a descriptive survey method. Determination and sampling was carried out by stratified random sampling and biosequent was considered a stratum, and the vegetation sequence from the conservation farming system found on the lower slopes of Mount Marapi to an altitude of 1500 meters above sea level (conservation agriculture used as research area is conservation agriculture area that has been managed within the 3-5 years). At each sample point, land data and soil data that determine soil erodibility were identified. Types of soil analysis (observed parameters) and the methods used were: (1) soil texture analysis (3 fractions) with the texture sieve method, (2) soil organic matter analysis using the dry burning method (Poerwowidodo, 1990), (3) Soil permeability analysis using the De Boot method (1967).

RESULT AND DISCUSSION

Analysis of the soil erodibility value of each conservation farming technique found in the research location is to analyze the ideal conservation farming technique to be applied at the research location. This is to avoid soil damage due to the process of crushing by raindrops and eroding and washing away by runoff. The distribution of erodibility values for each conservation farming technique that is applied varies, with the range of criteria for erodibility values according to unsuitable for conservation agriculture, ranging from 1.4 to 5.7 Conservation farming techniques with appropriate and ideal criteria erodibility values to always be applied in the research area are Sequental Cropping + Mulch and Bench Terrace + Waterway + Mulch. Sequental Cropping + Mulch (K 1,4), characterizes that the soil aggregate is resistant to crushing by impact of raindrops and erosion and washing away by run off. The stability of soil aggregates is caused by the agricultural system which always covers the land throughout the year, both by cultivated agricultural vegetation and by the inorganic mulch used. With a pattern of planting land with two or more types of crops, where the second or third crop is planted after the first crop is harvested, without conducting soil cultivation, organic matter sources are very potential to form stable soil aggregates that are resistant to rain grain destruction. In addition, the role of mulch here is very large, namely to protect the soil from the impact of raindrops and more importantly regulate and stabilize the soil temperature, so that it affects the weathering of soil organic matter sources by soil microorganisms and at the same time accelerates the chemical weathering process in the soil. The fast chemical weathering process in the soil will directly accelerate the clay formation process. According toAccording to Shoji dan Ono (1978), clay is very potential to form stable soil aggregates.

The conservation farming system with Bench Terrace + Waterway + Mulch (K 1.5) also features a stable soil aggregate. Agriculture using a bench terrace is very suitable for use on land that has a slope of> 30%, this is done to shorten the length of the slope and reduce the strength of the run off rate. The stability of the soil aggregate, which is

Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

characterized by a low K value, is due to the construction of a waterway on the sides of the bench terraces and the use of mulch. The drainage channel functions as a channel for run off, so that the run off becomes a harmless flow. Agricultural techniques with appropriate criteria and somewhat ideal to be applied in the research area are Contour Strip Cropping + Intercropping, Intercropping, Intercropping + Mulch, Sequental Cropping, Minimum Tillage + Intercropping, Ridge Terrace + Intercropping, and Bench Terrace + Waterway. The conservation farming system with a cropping pattern with a stripe pattern in line with the contour lines and cutting the sulfur applied with an intercropping pattern (Contour Strip Cropping + Intercropping K 2.1) is rather ideal to be applied in the study area. The erodibility value in this conservation farming system is generally influenced by the low activity of microorganisms at the beginning of the planting process so that the danger of raindrops and run-off is a bit intensive at the beginning of the planting. Likewise with the intercropping agricultural system (intercropping, K 2,3).

Intercropping + Mulch (K 1,7) and Sequental Cropping (K1,8), characterize that the soil aggregate is somewhat resistant to the crushing and washing process by run off. Intercropping (intercropping) is a conservation agriculture system where land is planted with more than one type of food crop (horticulture) simultaneously. The existence of soil erodibility values with moderate criteria is caused by the application of mulch after soil cultivation and before the planting process. Meanwhile, Sequental Cropping is a technique derived from Multiple Cropping, which is a conservation farming system, where land is planted with more than two types of crops where the second crop is planted after the first crop is harvested. Soil erodibility values with moderate criteria are caused by not applying mulch in the land management process.

Minimum Tillage + Intercropping, Ridge Terrace + Intercropping, and Bench Terrace + Waterway conservation farming techniques are mechanical conservation techniques (physics). Minimum Tillage + Intercropping (K 2,1), is an agricultural system with minimum tillage and an intercropping pattern is applied to the land. With a non-intensive tillage pattern, the soil temperature and humidity are always suitable to support the activity of soil microorganisms in decomposing soil organic matter sources, so that the contribution of organic matter to stabilize soil aggregates is always there.

The Ridge Terrace + Intercropping (K 2,3) technique is a conservation farming system by creating a ridge terrace with the ridge part of the credit terrace planted with support plants. The reality in the field is that the mounds of the credit terrace are planted with food crops (sweet potato and cassava), so that the mounds do not function according to their function. Meanwhile, the Bench Terrace + Waterway technique (bench terrace and drainage channel, K 2.5) has been implemented but part of the sewerage is not planted with support plants (grass).

Conservation farming systems with techniques, Maximum Tillage + Intercropping, and Bench Terrace are not ideal to be applied in the research area. The Contour Strip Cropping (K 2,9) technique is an agricultural technique by making crop lines in the same direction as the contour lines. It is not ideal that this technique be applied in the study area due to the long exposure to open land even though it has been planted with similar plants, this clearly affects the activity of microorganisms, hit raindrops and run off in increasing

Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

erosion activity. Likewise with the Maximum Tillage + Intercropping technique (K 5,7), which is a very intensive tillage technique. Based on the soil erodibility value, this very intensive tillage technique (maximum tillage) is not suitable even though it is applied with other conservation techniques.

Bench Terrace conservation farming techniques (bench terrace, K 2,8) are also not suitable to be applied in the research area. Bench terraces that are made without making a waterway are clearly very dangerous for soil sustainability, because rainwater will flow into a dangerous flow and landslides on agricultural lands can occur.

CONCLUSION

Sequental Cropping + Mulch, is a conservation farming technique that is classified as a vegetative conservation technique. Sequental Cropping is planting food crops (horticulture) of more than one type of crop where the second crop is planted immediately after the first crop is harvested without any soil processing. By applying the use of mulch, soil sustainability is maintained and the soil's ability to support plant growth is also optimal. This conservation farming technique is ideally applied in research areas belonging to the upper watershed area of the Batang Anai watershed, which are vulnerable to being critical if there is an error in land management for agricultural business.This technique characterizes that the soil is always covered by vegetation, so that the soil has a fairly good source of organic matter (C-organic 4.32%). With high levels of soil organic matter, the soil has the capacity to absorb water and store water in a balanced manner (permeability 12.48 cm / hour). This also affects the texture and structure of the soil, so that the soil erodibility value is also low (K 1.4) and the soil is resistant to destruction by raindrops and erosion and washing away by run off.

REFERENCES

Arsyad, S, (1989), Pengawetan Tanah, IPB, Bogor

Birkeland, P.W, (1974), Pedology, Weathering, and Geomorphological Research, New York Oxford University Press, London-Toronto

Buol, S.W., F.D. Hole., and R.J. Mc. Cracken, (1980), Soil Genesis and Classification, Second Edition, The Iowa State University Press,Amess

Darmawijaya, M.I, (1990), Klasifikasi Tanah, Gajah Mada University Press, Yogyakarta

Hermon, D. 2001. Studi Kontribusi Penggunaan Lahan dan Vegetasi Terhadap Karakteristik Epipedon. Tesis Magister. Program Pascasarjana Universitas Andalas Padang

Hermon, D. 2009. Dinamika Permukiman dan Arahan Kebijakan Pengembangan Permukiman pada Kawasan Rawan Longsor di Kota Padang. Disertasi. IPB Bogor

Hermon, D. 2010. Geografi Lingkungan: Perubahan Lingkungan Global. UNP Press

Hermon, D. Mitigasi Bencana Hidrometeorlogi: Banjir, Longsor, Degradasi Lahan, Ekologi, Kekeringan, dan Puting Beliung. UNP Press. Padang. 2012.

Hermon, D. Impacts of Land Cover Change on Climate Trend in Padang Indonesia. Indonesian Journal of Geography. Volume 46. Issue 2. p: 138-142. Fakultas Geografi Universitas Gajah Mada. 2014.

Science and Environmental Journals for Postgraduate (SENJOp)
Vol.3 No.1 (pp. 8-13) December 2020
p_ISSN 2655-5085
e_ISSN 2655-5239

Hermon, D. Geografi Bencana Alam. Jakarta: PT RajaGrafindo Persada. 2015.
Hermon, D. Mitigasi Perubahan Iklim. Rajawali Pers (Radjagrafindo). 2016.
Hermon, D. Estimate of Changes in Carbon Stocks Based on Land Cover Changes in the Leuser Ecosystem Area (LEA) Indonesia. Forum Geografi. Volume 29. Issue 2. p: 188-196. 2016.
Hermon, D. Climate Change Mitigation. Rajawali Pers (Radjagrafindo). 2017.
Hermon, D. 2019. Land Stability Model for Sustainable Spatial Planning in Padang City-Indonesia based on Landslide Disaster. Journal of Geography and Earth Sciences. Vol. 7. Issue 1. 19-26
Hermon, D. 2019. Characteristics of Melanic Epipedon Based on Biosequence in The Physiography of Marapi-Singgalang, West Sumatra. IOP Conference Series: Earth and Environmental Science. Vol. 314. Issue 1. 012010
Hermon, D., Ikhwan, A. Putra, O. Oktorie. 2020. Spatial Analysis of Tsunami Vulnerability Zones as a Basic Concept of Coastal Disaster Mitigation in Development Planning of Pariaman City. Journal of Advanced Research in Dynamical and Control Systems – JARDCS. Vol. 12. 07-Special Issue. 681-690
Hermon, D., Ganefri., Erianjoni, I. Dewata, P. Iskarni., A. Syam. 2019. A Policy Model of Adaptation Mitigation and Social Risks The Volcano Eruption Disaster of Sinabung in Karo Regency-Indonesia. International Journal of GEOMATE. Vol. 17. Issue 60. 190-196
Hermon, D. Erianjoni., I. Dewata, A. Putra., O. Oktorie. 2019. Liquefaction Vulnerability Analysis as a Coastal Spatial Planning Concept in Pariaman City–Indonesia. International Journal of Recent Technology and Engineering (IJRTE). Vol. 8. Issue 2. 4181-4186
Hermon, D. 2019. Evaluation of Physical Development of The Coastal Tourism Regions on Tsunami Potentially Zones in Pariaman City-Indonesia. International Journal of GEOMATE. Vol. 17. Issue 59. 189-196
Mulyanto, B, (1990), Some genetic Characteristics of Soils on Volcanic Ash from West Java Indonesia, Thesis, University of Ghent, Belgia
Oktorie, O. A Study of Landslide Areas Mitigation and Adaptation in Palupuah Subdistrict, Agam Regency, West Sumatra Province, Indonesia. Sumatra Journal of Disaster, Geography and Geography Education. Volume 1. Issue. 1. p: 43-49. Master Program of Geography Education. 2017.
Oktorie, O., D. Hermon, Erianjoni, A. Syarief, A. Putra. 2019. A Calculation and Compiling Models of Land Cover Quality Index 2019 uses the Geographic Information System in Pariaman City, West Sumatra Province, Indonesia. International Journal of Recent Technology and Engineering (IJRTE). Vol. 8. Issue 3. 6406-6411
Rusman, B, (1998), Konservasi Tanah dan Air, PPS Universitas Andalas, Padang
Seta, A.K, (1991), Konservasi Sumberdaya Tanah dan Air, Kalam Mulia. Jakarta
Wisaksono, W, (1954), Ilmu Tubuh Tanah, Jakarta
Wischmeier, W.H., C.B. Johnson, and B.V. Cross, (1971), A Soil Erodibility Nomograph for Farmland and Construction Sites, J, Soil and Water Cons, 26. 5