

BIOFARM
Jurnal Ilmiah Pertanian
ISSN Print: 0216-5430; ISSN Online: 2301-6442
Vol. 19, No. 2, Oktober 2023

Soil Erodibility Prediction On Oil Palm Land In Ujung Bandar Village, South Rantau District, Labuhanbatu Regency

Prediksi Erodibilitas Tanah Pada Lahan Kelapa Sawit Di Kelurahan Ujung Bandar Kecamatan Rantau Selatan Kabupaten Labuhanbatu

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ABSTRACT.
There will be widespread damage to the land as a result of land degradation, particularly to forest land. Changes in land use from extremely durable vegetation to escalated agrarian land make the dirt all the more handily disintegrated. One of the deciding variables of disintegration is soil disintegration and soil cover vegetation. Soil erodiability is the typical measure of soil lost every year per unit of the file, while the land cover is helpful for safeguarding the dirt from the danger of harm by disintegration and further developing soil conditions. The exploration was done from October 2022 to June 2023. In January 2013, field sampling was carried out. The technique utilized in this study was the review strategy and the purposive examining technique. Choose three points of observation. Then, in the laboratory, data analysis and field observation. Assessment of soil erodibility is completed by taking soil tests, deciding soil structure, soil porousness in the field, and deciding soil surface and natural matter for examination in the research center. Distinguishing proof of disintegration by taking documentation of kinds of disintegration that alludes to references and realities tracked down in the field. To decide the worth of erodibility (soil aversion to disintegration) utilizing a nomograph (soil erosibility). Results of the Study Soil erodibility on oil palm land in the Urung Kompas Village was low to medium, ranging from 0.17 to 0.26. The research site on oil palm land in the Urung Kompas subdistrict has five types of erosion: trench erosion, splash erosion, sheet erosion, furrow erosion, and landslides.

Keywords: Land Degradation, Soil Erodiability, Soil Cover Vegetation, Types Of Erosion

ABSTRAK
Kerusakan lahan akan terjadi secara luas akibat degradasi lahan, khususnya lahan hutan. Perubahan penggunaan lahan dari vegetasi yang sangat tahan lama menjadi lahan pertanian yang semakin luas membuat tanah semakin mudah terurai. Salah satu variabel penentu disintegrasi adalah disintegrasi tanah dan vegetasi penutup tanah. Erodiabilitas tanah adalah ukuran umum hilangnya tanah setiap tahun per unit arsip, sedangkan tutupan lahan berguna

untuk melindungi kotoran dari bahaya kerusakan akibat disintegrasi dan perkembangan kondisi tanah lebih lanjut. Eksplorasi dilakukan pada bulan Oktober 2022 hingga Juni 2023. Pada bulan Januari 2013 dilakukan pengambilan sampel di lapangan. Teknik yang digunakan dalam penelitian ini adalah strategi review dan teknik pengujian purposive. Pilih tiga titik pengamatan. Kemudian di laboratorium, analisis data dan observasi lapangan. Penilaian erodibilitas tanah dilakukan dengan melakukan uji tanah, menentukan struktur tanah, keroposan tanah di lapangan, serta menentukan permukaan tanah dan bahan alam untuk diperiksa di pusat penelitian. Membedakan bukti disintegrasi dengan mengambil dokumentasi jenis-jenis disintegrasi yang mengacu pada referensi dan realita yang ditelusuri di lapangan. Untuk menentukan nilai erodibilitas (keengganan tanah terhadap disintegrasi) menggunakan nomograf (erosibilitas tanah). Hasil Kajian Erodibilitas tanah pada lahan kelapa sawit di Desa Urung Kompas tergolong rendah hingga sedang, berkisar antara 0,17 hingga 0,26. Lokasi penelitian pada lahan kelapa sawit di Kecamatan Urung Kompas mempunyai lima jenis erosi yaitu erosi parit, erosi percikan, erosi lembaran, erosi alur, dan longsor.

Kata Kunci : Degradasi Lahan, Erodiabilitas Tanah, Vegetasi Penutup Tanah, Jenis Erosi

1. INTRODUCTION

The oil palm plant (*Elaeis guineensis* Jacq) is an oil-creating ranch crop which is a significant figure the Indonesian economy, so it has supported the public authority, the confidential area and the local area to endeavor to keep on creating it (Sandi *et al.,* 2020). Right now, oil palm advancement is for the most part done on dry land with level to soak geology. This is due to the fact that 77.4% of Indonesia's dry land is composed of wavy, undulating, hilly, and mountainous regions with slopes greater than 3% [Yulia *et al.,* 2015]. However, environmental considerations must be taken into account when growing oil palm on sloping dry land, particularly those pertaining to soil/land characteristics and climate. it is vital to know land/land for thought in picking an area for oil palm development [Ayuningtyas *et al.,* 2018].

Disintegration is a cycle where soil is segregated and afterward moved to somewhere else by the power of water, wind, streams or gravity. Soil properties, climate, topography, and land cover vegetation are the four main factors influencing erosion [Arifin, 2010]. The Universal Soil Loss Equation (USLE) is the general equation that is used to calculate the amount of soil erosion by using these four factors by [Sulistyaningrum *et al.,*2014]. [Ashari,, 2013] The productivity and potential of the land will be impacted by continuous use without effective management. Accelerated land degradation is the most common factor that affects how land is used [Wang *et al.,*2017].

The issue of soil loss as a result of water or wind erosion is one of the considerations in land use. Although soil loss is inevitable, it must remain below the rate of soil formation in order to be considered acceptable [Sahat *et al.,* 2016]. [Zhang *et al.,* 2019] Soil erodibility (K) is the soil's sensitivity to erosion or ease of erodibility.(Dini *et al.,*19]

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The potential disintegration risk in oil palm lands should be tended to, particularly on slanting terrains. [Satriawan *et al.,* 2021] As a result, it is necessary to measure and estimate erosion in order to determine the extent of erosion on oil palm-planted sloping land in order to establish policies and soil conservation measures that prevent soil damage and permit erodible use. A property of soil demonstrates the soil's susceptibility to erode when raindrops strike it. [Ziadat *et al.,*2013] The properties of a soil, such as its structure, permeability, organic matter content, and texture, all have an impact on its erodibility.

In order to prevent significant erosion, erosion control is required [Ayuningtyas *et al.,*2018]. It is possible to lower the value of erosion that has already occurred or will occur by employing water and soil conservation strategies. The first step in conserving soil and water is figuring out what the predicted effects of erosion will be. [Ayuningtyas *et al.,* 2018]

II. METHODS

The research was carried out from October 2022 to June 2023. Field sampling was carried out in January 2013. Initial and advanced data management was carried out at the Faculty of Science and Technology and Agricultural Soil Clinic Deli Serdang while for direct sampling it was carried out in Urung Kompas Village, Kecamatan Kecamatan South Rantau Labuhanbatu Regency at an elevation of 28 meters above sea level with coordinates E.98^{0}45'23" N. 02^{0}43'21" which are presented in Figure 1.

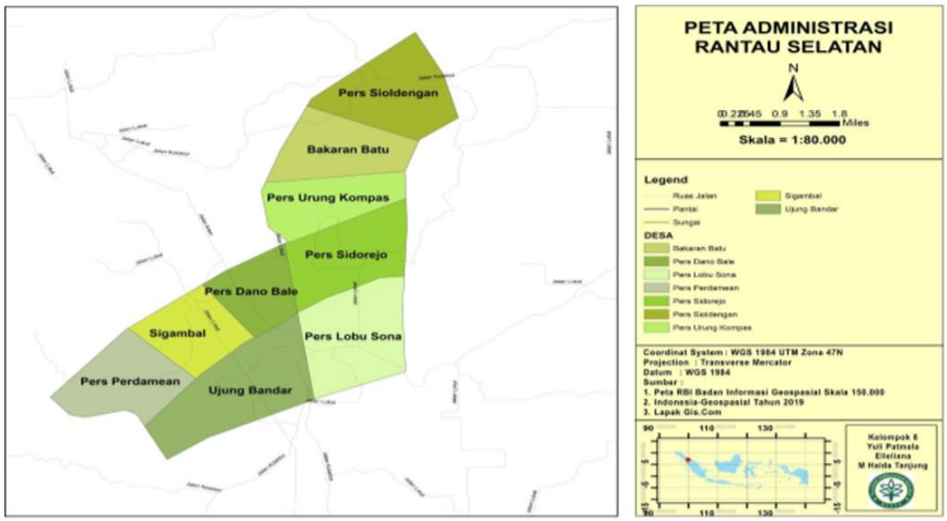


Figure 1. Administrative map of Rantau Selatan District and research locations

Research methods

This study used survey methods and laboratory analysis. The data used in this study are primary data and secondary data. Primary data is data obtained directly from the field and results of laboratory analysis, while secondary data is obtained from literature, map analysis and data from related agencies. The sampling method uses stratified sampling with land unit strata.

Research procedure

The implementation of the research was carried out in four (4) working stages, namely: the preparation stage, data collection, data processing and data analysis. The preparatory stage is carried out before starting research activities. This stage starts with a literature study and prepares the tools and materials used in research activities. After the materials needed in the research activities are met, the next thing to do is data collection carried out in this study, consisting of collecting primary data and secondary data. The primary data collected includes soil elements, the required soil elements are soil structure, soil texture, organic matter, and soil permeability. The secondary data collected in this study included a general description of the location and land use data in the Urung Kompas Village, South Rantau District, Labuhanbatu Regency.

Soil erodibility values are calculated using the [6] formula:

100K = 2.1 M1.14 (10-4)(12 – a) + 3.25 (b –2) +2.5 (c – 3)

Information :

K = soil erodibility

M = particle size (% fine sand + % silt) X (100 - % clay) / (Table 3)

a = organic matter content

b = soil structure class (Table 1)

c = soil permeability classes (Table 2)

NB: The value of M can also be roughly estimated from table 1 if only the soil texture class is known. Using the M value for the K formula in this table is an inaccurate method that is only used when the grain size distribution is unknown. To find out the texture class, you can use the texture triangle (figure 1). Soil elements needed in calculating soil erodibility are soil structure, soil texture, organic matter, and soil permeability. Soil sampling at each LMU samples were taken based on disturbed and undisturbed soil samples. Disturbed soil samples are used in the analysis of soil structure, soil texture, and soil organic matter while undisturbed soil samples are used to calculate soil permeability. Sampling of disturbed and undisturbed soil was carried out at the same location at each LMU sample. For undisturbed soil samples, a sample ring is used by cleaning the sampling location from litter, then inserting the sample ring into the soil until the ring is completely filled with soil and taking the ring by digging into the soil, then the sample ring is coded according to the sample LMU. For disturbed soil samples, only take the soil resulting from the excavation of the sample ring and then immediately put it into the sample plastic and then code it according to the sample LMU.

Assessment of the structure and permeability of each soil using the following table:

Tabel 1. *The M Value Of The Soil Texture Class Used For The Formula K*

No.	*Texture class* (USDA)	M Value
1	*Sandy clay*	1215
2	*Light clay*	1685
3	*Sandy clay loam*	2160
4	*Silty clay*	2510
5	*Clay loam*	2830
6	*Sand*	3035
7	*Loamy sand*	3245
8	*Silty clay loam*	3770
9	*Sandy loam*	4005
10	*Loam*	4390
11	*Silt loam*	6330
12	*Silt*	8245

Sumber:P.32/MENHUT-II/2009

Tabel 2. *Soil K Value Classification*

Class	Value K	Dignity
2	0.11-0.21	Low
3	0.22-0.32	Medium
4	0.33-0.44	Somewhat High
5	0.45-0.55	High
6	0.56-0.64	Very High

III. RESULT AND DISCUSSION

Physical properties of soil

The results of the analysis of soil physical properties and their classes: soil texture, soil structure, organic matter, and permeability of oil palm land are presented in Table 1 below:

Table 3 Soil texture, soil structure, organic matter and permeability at the study site.

Location	Texture Soil	Structure Land/ Class	Organic matter (%)/ Class	Permeability/ Class
1	Clay Clay	Granular Medium/ 3	2,26/ 3	16,40/ 2
2	Clay Sandy	Granular Medium/ 3	2,09/ 3	1,53/ 5

Source : Agricultural Land Clinical Laboratory of Deli Serdang Regency (2023).

Soil Erodibility

Estimation of soil erodibility value is obtained by means of analysis of physical and chemical properties of soil, based on the results of laboratory testing. The value of soil erodibility on oil palm land in Urung Kompas Village (locations 1 and 2 and 3) is as follows:

Soil Edivity Location 1 The value of soil erodibility (K) is obtained using a soil erodibility estimator (nomograph). The results of the quantative analysis of soil erodibility factors were land value 1 (I), sand 20%, dust 40%, clay 40%, angular lump structure, C – organic 1.05%, organic matter 1.81% (class 3), permeability 0.54 cm / h (class 2). For land (II), sand 25%, dust 35%, clay 40%, lump structure, C- organic 0.96%, organic matter 1.65%, permeability 1.24 cm / hour and (III), sand 26%, dust 36%, clay 38%, angular lump structure C-organic 1.02%, organic matter 1.75%, permeability 1.54 cm / hour.

These data are entered into the nomograph estimating soil erodibility, so that a soil erodibility value of 0.17 (low erodibility class) is obtained. Soil Erodiibility at location 2 The value of soil erodibility (K) is obtained using a

soil erodibility estimator (nomograph). The results of quantitative analysis of soil erodibility factors are Land value 2 (I), Sand 23%, dust 35%, lumpy soil structure, C- organic 1.25%, organic matter 2.15%, permeability 2.54 cm / hour. (II), Sand 25%, dust 35%, blocky structure, C- organic 0.96%, organic matter 1.65%, permeability 1.24 cm/h. (III). Sand 26%, dust 36%, clay 38%, blocky structure, C- organic 1.12%, organic matter 1.75%, permeability 1.93 cm/h.

These data are entered into the nomograph estimating soil erodibility, so that a soil erodibility value of 0.19 (low erodibility class) is obtained. Soil Erodiibility at location 3 The value of soil erodibility (K) is obtained using soil erodibility estimation (nomograph). The result of quantitative analysis of soil erodibility factors is Land value 3 (I). Sand 22%, dust 36%, clay 42%, blocky structure, C- organic 1.35%, organic matter 2.15%, permeability 2.32 cm/h. (II). Sand 22%, dust 28%, clay 40%, blocky structure, C- organic, 0.98%, organic matter 1.68%, permeability 2.25 cm/h. (III). Sand 22%, dust 36%, blocky structure, C-organic 1.33%, organic matter 2.29%, permeability 2.34 cm/h.

These data are entered into the nomograph estimating soil erodibility, so that a soil erodibility value of 0.26 (medium erodibility class) is obtained.

Recapitulation of the calculation of soil erodibility value (K) on oil palm land in undone kompas village in Table 2 below.

Table 2. Calculation of soil erodibility (K) on revegetation land in Urung Kompas Village

Research Location	Soil Texture	Organic Matter	Permeability Class	Erodibility (K)	Erodibility Class (K)
I	Clay	2	3	0.18	Low
II	Clay	2	4	0.20	Low
III	Clay Sandy	3	4	0.36	Keep

Source : Primary Data (2023)

Description: Organic matter class: 3 = medium, soil structure class: 3 = coarse granular, Permeability class: 5 = slow.

From the calculation that the class or level of soil erodibility on oil palm land in the village of urung kompas erodibility value ranges from 0.17 - 0.26 classified as class (low-medium). The soil structure at the study site was medium granular. The content of organic matter ranges from 2.09% - 2.26%. Organic matter has an important role to play in the ability of the soil to resist erosion.

The presence of vegetation can help maintain and improve soil structure through organic matter around it and roots that grow in the soil.

The organic matter produced on the land is included in the medium criteria because it is land that has been added soil to help the initial

growth of plants in the process of land reclamation and revegetation until the growth of plants to adulthood. Mature vegetation is able to produce organic matter through branches and leaves that fall to the ground and then undergo a decomposition process.

This is because organic matter has the ability to absorb and hold high water, helps the development of soil structure, and adds fertility so that it affects the existence of vegetation that grows on it [Sulistyaningrum *et al.,* 2017),]The sensitivity of the soil to the occurrence of erosion depends on the stability and resistance of the soil structure to pressure. [17], High soil permeability will be able to destroy weak aggregates or soil structures, potentially causing soil sensitivity to erosion. The soil texture is dominated by clay clay and the least content of fine sand and dust, resulting in soil not susceptible to erosion. This can be seen from the conditions around the land that changes shape above the soil surface, where uniformly the soil looks eroded from top to bottom so that the thickness of the soil decreases, the soil gathers in the lowest area. Water flowing on the surface of the soil is turbid (yellow-brownish), there are spots on the surface of the soil. The area has slopes of 12% belonging to the class of gentle slopes.[Megawati*, et al.,* 2020]

The fertility of the soil is reduced because many nutrients are lost due to erosion. The condition of vegetation around the land looks less which is not able to cover the entire soil surface, making it easier for water to directly hit the ground as a result of the sloping condition of the land and the amount of rainfall can cause sheet erosion. The handling that can be done is by mechanical (making trenches and guludan parallel to the contours) and vegetative such as planting *cover crops*, covering with litter, and other vegetation that can grow on the land.

Actions that can be taken in the event to pay attention to the conditions around the landslide whether it is still feasible or not to be backfilled properly, and pay attention to the causes of landslides such as repairing slopes during post-mining landfill activities, paying attention to the basic condition of the land whether it contains water or not. So that when stockpiling is carried out, there is no watery land to avoid these landslide events. The KTA technique formulated for landslide handling is a combination of vegetative and mechanical methods, such as slopes and dikes planted with *cover crops*, making gulud terraces, repairing drainage channels, making retaining walls.[Djufri, *et al.,* 2021]

IV. CONCLUSION

The erodibility of the soil in the study area on oil palm land in the Urung Kompas Village ranged from 0.17-0.26 into the low to medium class. There are 5 types of erosion found at the research location of oil palm land in the Urung Kompas sub-district, namely trench erosion, splash erosion, sheet erosion, furrow erosion, and landslides.

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