PAPER • OPEN ACCESS

Evaluation of non forest area land characteristic for citrus plant (*Citrus* sp)

To cite this article: F S Harahap *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **454** 012139

View the article online for updates and enhancements.

Evaluation of non forest area land characteristic for citrus plant (*Citrus* sp)

F S Harahap[1]*, H Walida[1], N E Mustamu[1], K Rizal[1], B A Dalimunthe[1], M Wicaksono[2] and A Rauf[3]

[1]Program Study of Agrotechnology, Faculty of Science and Technology, Universitas Labuhanbatu, Sumatera Utara, Indonesia.
[2]Politeknik Pembangunan Pertanian, Medan, Sumatera Utara, Indonesia.
[3]Faculty of Agriculture, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia.

E-mail: *fitrasyawalharahap@gmail.com

Abstract. An approach to assess the potential of land resources is an evaluation of the land. The results of the land evaluation will provide information and direction of land use needed, and finally the expected production value was known. The improvement efforts aimed at increasing productivity, for the suitability of actual land to be suitability of potential commodity land in the District of Pakpak Bharat so needs to be supported by information regarding land suitability. Data collection for the results of land evaluation is used by a survey method, analysis with comparing and matching for citrus plants (Citrus sp.). The land units are based on a land map, slope map, height map, land cover map, consisting of 6 land units and 18 points. The result showed that the citrus plant is quite appropriate (S2) covering an area of 1,984.60 ha and not appropriate (N) as 1,318.82 ha.

1. Introduction

The land survey which is carried out can be aimed at increasing area opening, new planting, rationalizing land use, solving problems of land damage and so on which will produce a recommendation for the implementation of these objectives [1]. Land suitability for agricultural crops is basically a reflection of the suitability of the physical conditions of the land to the intended designation. Knowing the land suitability and production data also agricultural productivity of the research area will be able to identify the alignment between the conditions of the land and the ability to produce them, so that the regions that contribute positively to the cultivation of agricultural crops and those who have problems are known [2].

Land characteristics are land characteristics that can be assessed or planned. The nature of the land that we can estimate for agricultural purposes, among others; land, climate, topography and geological, vegetation and socioeconomic formations Each unit of land map that results from the survey and mapping of land resources, its characteristics are detailed and described which includes the state of the physical environment and soil. This data is used for land evaluation and evaluation. From complete data obtained through land survey or research in the field, land suitability classes can be made [13]. Land evaluation is an effort for a specific use with the valuation of a land. Land suitability is a certain level

of use with the suitability of land for certain uses. After repairing land suitability can be assessed in the present and future conditions.

The process of assessing the potential of a land is a must to do [3]. Land evaluation is useful as a basis for the development of agriculture, especially for the use of other areas. The area is outside the forest that can be used for the activities of all development sectors, one of which is the agricultural sector [5].

Administratively, Pakpak Bharat Regency has 8 sub-districts, one of them is Sitellu Tali Urang Julu Subdistrict, divided from Salak Subdistrict. Based on Regional Regulation No. 08/2006, the natural and topographic condition of Pakpak Bharat Regency is one of the agricultural sectors which constitutes a large potential community income to support the community's economy. The total area is 1,218.30 km2 (121,830 ha). Of the total area, amounting to 25,640.99 ha, is land for other use areas (APL) or areas outside the forest area, which can be used for the other, like for agricultural cultivation, village, offices and other supporting facilities. Sitellu Tali Urang Julu sub-district has land area of 3,303.42 ha, or 12.86% of the 25,640.99 ha total area in Pakpak Bharat [9].

Land evaluation in the context of rearranging existing land use is useful in an area, sand helps in land use planning decisions, in overcoming competition between various land use possibilities, so land can be used more efficiently [6]. The results of the assessment in the form of classes and subclass suitability of plant land are determined by the heaviest limiting factors. [4] The use of mapping of the suitability of actual and potential land for oil palm plants with geographic information systems. Limiting factors can consist of one or more depending on the characteristics of the soil [12]

Planted Citrus plants can be in areas between 40^0 N- 40^0 S. In the tropics, it can be planted in the lowlands to above sea level altitude of 650 m. In the equatorial area can be planted up to a height of 2000 m above sea level. Optimal temperature 25-30^{0}C. Sunlight is very necessary for the growth of the citrus. Therefore, sweet citrus grown in a protected place are less well developed and susceptible to disease. Citrus plants are grown in various types of mulch from sandy soils to heavy clay soils. It is best for river deposits. Citrus plants need enough water, especially if they start flowering, but cannot stand inundation, therefore drainage must be good with a soil pH of 5-6 [10]. Land that contains a lot of sand and deep water is more than 1.50 m, very good for citrus plantations. The good thing is, if the water in the soil during the rainy season is 50 cm and in the dry season 150 cm deep from the ground [11].

Land suitability information is expected to provide input and information to carry out appropriate management for sustainable development and community welfare. Based on this, it is necessary to conduct research in an effort to evaluate the level of land suitability for Citrus (*Citrus, SP*) commodity crops whether suitable for cultivation in the area and what efforts are needed to improve the cultivation of plants. Therefore, it is important to evaluate land suitability for superior commodities in the Other Purposes Area in Pakpak Bharat Regency to find out the potential of the land.

2. Materials and methods

This research was conducted using a survey method consisting of 5 activities namely preparation, pre-survey, main survey, soil analysis in the Laboratory and data processing. Soil sampling is done by drilling in the area of land units where land units are selected based on the map of land use units. The research data obtained are used in the level of soil fertility criteria according to [15]. The land evaluation process is determined by matching the characteristics of the land with the requirements for the growth of citrus plants, which are matched with the technical evaluation of land evaluation for agricultural commodities [3]-[13]. In the matching process Leibig's minimum law is used to determine the limiting factors that will affect the land suitability class and subclass. The results of land suitability on plant commodities are produced in the form of actual and potential land suitability Tables using geographic information system software and then mapped the actual land suitability and potential land suitability, the value of land characteristics for soil samples is carried out using a soil drill at a depth of 0-30 cm. Determination of soil chemical properties was carried out by soil analysis in the Laboratory of the Faculty of Agriculture, Universitas Sumatra Utara.

3. Result and discussions

3.1. Non-forest area land characteristics

Table 1. Land characteristics in unit land one to six at a depth of 0-30 cm in other area use in the sub-district Sitellu Tali Urang Julu in Pakpak Barat District for evaluation of the suitability of citrus plants (*Citrus* sp.)

Land Characteristics	Land Unit					
	1	**2**	**3**	**4**	**5**	**6**
Temperature /tc						
Temperature Average (^{0}C)	19.62	19.88	19.32	20.09	20.09	18.83
Height Place (masl)	1114	1070	1164	1036	1035	1246
water availability / wa						
Rainfall (mm)	2920	2920	2920	2920	2920	2920
Moon Dry Duration	1	1	1	1	1	1
Agro-climate Zone	83.28	83.28	83.28	83.28	83.28	83.28
Moisture (%)						
Oxygen of Availability / oa	Good	Good	Good	Good	Good	Good
Drainage						
Rooting Condition /rc	Sandy Clay Loam	Sandy Loam	Loamy Sand	Loamy Sand	Sandy Loam	Loamy Sand
Texture	7.08(M)	8.86(M)	11.34(M)	7.85(M)	6.17(M)	6.42(M)
Coarse Material (%)	>100	>100	>100	>100	>100	>100
Depth of Soil (cm)						
Nutrient Retention /nr	17.64(M)	33.48(H)	31.68(H)	48.60(H)	25.20(H)	25.80(H)
CEC of clay (cmol)	27.16 (L)	19.93 (VL)	15.62 (L)	12.72(L)	14.87 (VL)	23.69(L)
Base saturation (%)	5.66(MA)	5.61(MA)	5.73(MA)	6.50(N)	5.44(MA)	6.50(N)
pH H_2O	1.61(L)	3.72(H)	7.61(VH)	7.61(VH)	7.60(VH)	2.76(M)
C-organic (%)						
Nutrient Availability /na	0.15(L)	0.37(M)	0.44(M)	0.46(M)	0.56(H)	0.24(M)
N-total (%)	6.40(VL)	9.77(VL)	13.60(L)	6.63(VL)	11.05(L)	6.16(VL)
P2O5 Bray II (ppm)	0.87(H)	1.20(VH)	1.54(VH)	1.20(VH)	0.54 (M)	0.88(H)
K-exchange (mg/100g)						
Sodicity /xn	2.68(L)	1.77(VL)	1.62(VL)	0.93(VL)	1.25(VL)	2.04(L)
Alkalinity/ESP (%)						
Erosion hazard/eh	18.4	7.6	8.1	5.1	6.2	15.5
Slope (%)	M	VL	VL	VL	VL	M
Erosion hazard						
Flood hazard/fh	F0	F0	F0	F0	F0	F0
Puddle						

Land preparation /lp	0	0	0	0	0	0
Rocks on the surface	0	0	0	0	0	0
Rock outcrop						

Land in non-forest area also known the characteristics of the non-forest area. Other purposes land in Sitellu Tali Urang Julu Subdistrict, Pakpak Bharat District, which was previously an area of various types of forests and agricultural land, the most widespread area dry land others, such as secondary dryland forests, bushes, production forests, and rice fields.

The results of the field survey and analysis of soil samples in the laboratory can be seen, that the location of the observation and sampling of land can be grouped into six units of land (land units), with land characteristics for depths of 0-30 cm (Table 1) respectively. Other areas of use there are types of soil dominated by Andisol and there are also types of soil inseptisol. Andisol soil types with great group Hapludands dominant in dryland agriculture. Hapludands are soil formed from the parent material of volcanic ash. Based on the Oldeman climate classification [8] this area belongs to the D1 climate zone, which is a climate zone that has the characteristics of 3-4 wet months and <2 dry months in a row. The agroecosystem zone which is dominated by dry land agriculture and forest areas with the shape of hilly areas, has a slope of 7-25%. Physical characteristics of the soil that affect plant roots such as drainage and depth of roots, texture of soil and effective depth of > 100 cm. The pH value of soil in this APL land varies from 5.4 (slightly acidic) to 6.50 (neutral), the total N-value of land on APL land varies from low to high, P_2O_5 values are very low to low, while K_2O land on the land has a high average. For C-Organic in the other use of land area is relatively high, so that the land unit are largely not need the addition of organic substation. Soil organic substation contains many nutrients, including humus indispensable for growing.

The role of organic substation to the availability of nutrients in the soil cannot be separated by the mineralization, which is the end of the decomposition process organic materials. Organic substation has a chemical role in providing N, P, and K for plants. The CEC value in APL land is high. With a high CEC value, the soil is able to absorb and provide more nutrients than the soil with a lower CEC. The CEC value of a soil is influenced by the nature and amount of clay fraction and organic matter besides the pH of the extracting solution. Base saturation on APL land is included in very low to low class. Alkaline saturation is one indicator of soil chemical fertility. Fertile soil is a land with high base saturation, because there is no serious soil washing Conversely, soils with low base saturation will inhibit nutrient absorption by plant roots [7].

3.2. Land suitability for citrus crops (Citrus sp.)

Results from the use of other areas of the characteristics of the suitability of land in Citrus (*Citrus* sp.) base saturation nutrient retention and availability of soil nutrients P_2O_5 on the use of other areas in plants Orange (*Citrus* sp.). Factor nutrient availability is not a major limiting factor in assessing the suitability of the land, because the management with the addition of nutrients to the soil can do by themselves. other uses Sitellu Tali Urang Julu, to plant oranges (*Citrus* sp.) (Table 2).

The main limiting factor for the assessment of land suitability on citrus plants in districts of Sitellu Tali Urang Julu Pakpak Bharat Regency namely soil texture is due to the soil texture will not change in a short time, for example the dust texture is hard to be into the texture of sand soil or soil that are difficult to change clay. so that in the evaluation of soil with roots media in the form of texture, improvement cannot be done (Table 2).

Table 2. Summary of citrus (*Citrus* sp.) for suitability

Land Unit	Suitability Actual Land	Estimated Repair Effort	Potential Land Suitability	hectare	%
Land Unit 1	**S$_3$-na**	• Calcification of 1.37 tons of CaCO3 / ha • Fertilizing 49 kg P2O5 / ha or 10.09 kg SP36 / ha	**S$_2$-rc, na**	939.11	28.4
Land Unit 2	**S$_3$-na, eh**	- Liming 1.02 tons CaCO$_3$ / ha - Fertilizing 1.29 tons N / ha or 2.81 tons Urea Fertilizer / ha - Fertilization 219 kg P2O5 / ha or 59.70 kg Fertilizer SP36 / ha - planted parallel to contour or Manufacture terrace	**S$_2$-rc, na, eh**	258.38	7.8
Land Unit 3	**N-rc**	- Liming 476 kg agricultural lime CaCO3 / ha - Fertilization containing 16.42 kg P2O5 / ha or Fertilizer SP36 / ha 45.62 kg	**N- rc**	327.84	9.9
Land Unit 4	**N-rc**	- Fertilization containing 15.00 kg P2O5 / ha or 41.68 kg Fertilizer SP36 / ha - Terracing or planting parallel to contour	**N-rc**	567.80	17.2
Land Unit 5	**N-rc**	- Liming 552.83 kg of agricultural lime CaCO3 / ha - Fertilization of 9.02 kg P$_2$O$_5$ / ha or Fertilizer SP36 / ha 25.04 kg - Terracing or planting parallel to contour	**N-rc**	423.17	12.8
Land Unit 6	**S$_3$-na**	- Liming 1.17 tons of agricultural lime / ha - Fertilizing 12.92 kg P$_2$O$_5$ / ha or SP36 fertilizer 35.88 kg / ha	**S$_2$-rc, na**	787.11	23.8
TOTAL				**3303.42**	**100**

Source: Results of Geographic Information System Analysis

4. Conclusions

Characteristics of land suitability in citrus plants (*Citrus* sp.). that is, nutrient saturation retention and availability of P$_2$O$_5$ soil nutrients in the use of other areas in the District so that limiting factors for nutrient availability can still be managed by adding nutrients to the soil for citrus (*Citrus* sp.) area values are quite appropriate (S2) and N, covering an area of 1,984.60 ha and 1,318.82 ha.

References

[1] Anggoro A 2006 Analisis Keselarasan Antara Kondisi Lahan dan Produktivitas Tanaman Pangan dengan Teknologi SIG Di Kabupaten Klaten Jawa Tengah [Alignment Analysis Between Land Condition and Food Plant Productivity with GIS Technology in Klaten Regency, Central Java] Jurnal Penelitian Sains dan Teknologi **7** 2 pp 150-69

[2]   Cibro G F 2012 Kesesuaian Lahan Untuk Tanaman Jeruk (*Citrus Sp.*) dan Kopi Arabika (*Coffea Arabica*) di Kecamatan Siempat Rube Kabupaten Pakpak Bharat [Land Suitability for Citrus (*Citrus Sp.*) And Arabica Coffee (*Coffea Arabica*) in Siempat Rube District, Pakpak Bharat Regency] *Undergraduate Thesis* Universitas Sumatera Utara Medan

[3]   Hardjowigeno S, Widiamaka 2007 *Evaluasi Kesesuaian Lahan dan Perencanaan Tataguna Lahan [Evaluation of Land Suitability and Land Use Planning]* Yogyakarta: Universitas Gadjah Mada Press

[4]   Harahap F S, Sitompul R, Rauf A, Rahmawaty, Harahap D E, Walida H 2019 Land suitability evaluation for oil palm plantations (*Elaeis guineensis Jacq.*) on Sitellu Tali Urang Julu, Pakpak Bharat District *IOP Conf Ser: Earth Environ Sci* 260: 012116 DOI: 10.1088/1755-1315/260/1/012116

[5]   Kementerian Kehutanan [Ministry of Environment and Forestry] 2009 Peraturan Menteri Kehutanan Nomor P-50/Menhut-II/2009 tentang Penegasan Status dan Fungsi Kawasan Hutan [Minister of Forestry Regulation Number P-50/Menhut-II/2009 concerning Affirmation of the Status and Function of Forest Areas] Jakarta: Kementerian Kehutanan [Ministry of Environment and Forestry]

[6]   Mega I M, Dibia I N, Ratna I G P, Kusmiyarti T B 2010 *Klasifikasi Tanah dan Kesesuaian Lahan [Land Classification and Land Suitability]* Denpasar: Universitas Udayana 145 p

[7]   Indranada H K 1986 *Pengelolaan kesuburan tanah [Management of soil fertility]* Jakarta: Bina Aksara 90 p ISBN 979-511-672-2

[8]   Oldeman L R 1975 *Contribution: An Agroclimatic map of Java and Madura* Bogor: Central Research Institute for Agriculture

[9]   Pemerintah Kabupaten Pakpak Bharat [Pakpak Bharat Regency Govenrment] 2014 www.sumutprov.go.id.

[10] Purnomosidhi P 2007 *Perbanyakan dan Budidaya Tanaman Buah-buahan [Propagation and cultivation of fruit trees]* Bogor: World Agroforestry Centre dan Winrock Internastional

[11] Ritung S, Nugroho K, Mulyani A, Suryani E 2011 *Petunjuk Teknis Evaluasi Lahan Untuk Komoditas Pertanian [Land Evaluation Technical Guidelines for Agricultural Commodities]* Bogor: Badan Penelitian dan Pengembangan Pertanian [Agricultural Research and Development Agency 159 p

[12] Ritung S, Wahyunto, Fahmuddin A, Hidayat H 2007 *Panduan Kesesuaian Lahan dengan Contoh Peta Arahan Penggunaan Lahan Kabupaten Aceh Barat [Guide to Land Suitability with Sample Directions for Land Use in West Aceh District]* Bogor: Balai Penelitian Tanah [Soil Research Institute] and World Agroforestry Centre

[13] Sastrohartono M 2011 *Evaluasi Kesesuaian Lahan Untuk Perkebunan Dengan Aplikasi Extensi Artificil Neural Network (Ann.Avx) Dalam Acrview-Gis [Evaluation of Land Suitability for Plantations with the Application of Artificil Neural Network (Ann.Avx) Extensions in Acrview-Gis]* Yogyakarta: Institut Pertanian Stiper Yogyakarta

[14] Saputri D E 2010 Analisis Kemampuan Lahan Dengan Menggunakan Penginderaan Jauh dan Sistem Informasi Geografi di DAS Grindulu Pacitan Propinsi Jawa Timur [Land Capability Analysis Using Remote Sensing and Geographic Information Systems in Grindulu Pacitan Watershed, East Java Province] *Thesis* Universitas Sebelas Maret Surakarta

[15] Sys C, van Ranst E, Debaveye J, Beernaert F 1993 *Land Evaluation Part III: Crop Requirements Agricultural Publication No 7* Brussels- Belgium: General Administration for Development Corp. 191 p