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Tesis

Evaluation of the capacity of greater use in burned soils and its proposal in conservation

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EVALUATION OF THE CAPACITY OF GREATER USE IN BURNED SOILS AND ITS PROPOSAL IN CONSERVATION

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Abstract. This article presents and proposes the study of soil conservation according to the results of the capacity of greater use in burned soils from the town of Incho, in the vicinity of the province of Huancayo. In addition, measurements of physical and chemical parameters were made that followed the guidelines of Decree D.S.N°0062/75/AG and updated by D.S.N°017- 2009-AG, which establishes the regulation of classification of lands by their capacity of greater use which allowed us the corresponding determination of a Class A2 medium level soil, which is called Land Suitable for Cultivation in Clean, so it is a type of soil suitable for agriculture. In this way it is concluded to opt for moderate management practices such as technified irrigation since the research allows an adequate study for the conservation of a burned soil.

1. Introduction

At present it is known that the soil is a very important factor since it houses life and can provide nutrients, minerals, water, etc. Which help the growth of sustainable plant life on earth. However, over the years the capacity and amount of fertile soil on the planet has been reduced in an alarming way, which generates concern in agriculture since farmers are increasingly committed to growing their food for a growing population. [1]

The main objective of soil science research is to carry out an analysis that allows us to understand the dynamic properties, physical and chemical characteristics, soil functions that allow us to delimit the interpretation on the origin, environmental functions, and presence of pollutants. The analysis of the existing problems in a soil allows us to develop an adequate diagnosis of classification of capacity for greater use and to match a conservation alternative that allows the optimal development of sustainable agriculture. [2]

The arson and natural fires lead to a degradation of soil, so it is defined as a burned soil to the modification of microbial composition, soil, and dynamic organic matter in which there is a reorganization of the forms of carbon as a mineral, originating new forms of organic carbon resistant to oxidation and with a time of permanence in it. [3]

According to the Ministry of Agriculture and Irrigation, it defines as the capacity of greater use of soils the technical-interpretative system whose objectives to assign the maximum natural aptitude of a geographical area to produce constantly with an adequate management. [4]. There are not many local studies that use this interpretive system in burned soils, since various investigations of this typeare usually carried out, but at the national level.

The optimal composition for a fertile soil must contain in proportion amounts of organic material,water, air, mineral and microbial composition that allows the unbeatable development of agriculture according to the FAO, added to this a burned soil does not have the same composition since when subjected to certain temperature factors these lead to degradation, thus modifying itscomposition and losing its ability to host life. [3]

As already mentioned above, the physical, chemical, biological and physicochemical properties of the soil control the various cycles of buffer function that the soil fulfils in its capacity as a scrubber; for which a study was developed that gives us important information on those characteristics that help us develop a diagnosis of greater use capacity in this case of burned soils and their treatment in a conservation process according to both data obtained such as their texture, structure, porosity, cation exchange capacity, pH and organic composition.[5]

2. Methodology

The research was developed according to the obtaining of the parameters given by the multiparameter equipment that helped determine the data for the evaluation of the greater use capacity of the land, such as the analysis of density, field capacity, pH, capacity and cationic exchange of soil and organic carbon in accordance with everything established with the FAO land evaluation (8 categories) and the soil conservation manual proposed by the Integrated Pest Management Program in Central America "PROMIPAC".

2.1. Munsell and soil sample table method

They are methods that allow the surface identification of the [6] terrain, these allowed us the direct recognition to a certain depth of the soil in this case 6 meters and the determination of the soil profile, given by a capital letter. Samples are never taken at the edges of horizons. The weight of each sample is usually 1 kg. The determination of the nuances of the visible range of the electromagnetic spectrum is a very important parameter. The study was carried out according to the Munsell table since it is composed of leaves, each of them representing a hue(hue), clarity (value)and purity (Chroma). [7] According to the FAO, this technique is very important since its use determines the presence of certain compounds in the soil.

2.2. Hydrometer Method

It was applied under Stokes' law applied to a dispersed soil mass, with particles of various shapes and sizes being used to determine the percentage of dispersed soil particles, which remain in suspension at a certain time. For routine testing for sorting purposes, hydrometer analysis is applied to soil particles passing the 2.00mm sieve. [8]

2.3. Walkley Black Method

This method was used to determine the percentage of organic matter present according to the sample obtained, in turn obtaining the amount of organic carbon since this allows the sustainability of agricultural systems related to soil properties and their sustained yield of the crops present. [9] The evaluation of the capacity of greater use of the land was applied according to the D.S. N° 0062/75/AG, updated and approved by Supreme Decree N° 006-2017-JUS that establishes the regulation of classification of lands by their capacity of greater use in the chapters established by the Peruvian system of legal information according to the five (05) groups of established by the regulation. [10]

3. Presentation and analysis of results

In principle the sampling study is located at the UTM coordinates 18L 477872, 8668619 in the annex of Incho, district of Huancayo,province of Huancayo with dimensions of 20x30 meters and 12 sample points were taken with adepth of approximately 20cm.

Regarding the results of the qualification of the external morphology constituent to the third category of CTCUM, established according to those risk factors, limitations and special conditions that define the use of greater land, it recognizes six (6) types of fundamental limitation that make it present in the *table 1*.

Table 1. Results of the qualification of external morphology.

Characteristics	Rating
Short Slope Long Slope	0-4
	0-2
Micro topography or Microrelief	Smooth Wavy (with widely spaced microwaves)
Stone surface	Moderately stony
Sewer system	Moderate
Hydric erosion	Moderate
Presence of Carbonates	Null

According to FAO, the sampling code and depth must be given and recorded. It is recommended that the number of the soil profile or soil sample be followed by a capital letter and the depth range at which each sample has been taken starting from the bottom to the upper wing, regardless of the horizon from which it has been taken the samples are never taken at the limits of the horizons, according to this we obtained that at 51 cm deep the roots of the plants were observed, which indicates that there is no presence of carbonates and this is a dark brown color; at 36 cm from the excavation stones of 2.5 cmin diameter are observed which indicates that there is no presence of carbonates and this is of a light brown color; at 25 cm stones of 8 cm in diameter are observed without the presence of carbonates andthis of gray color and finally at 13.5 cm of depth stones of 8 cm to more diameter are observed nor is there the presence of carbonates and this is usually of a gray color, these samples served us for the implementation of a mechanical method to separate two solids formed by particles of different sizes according to the Peruvian Technical Standard(NTP 350.001) that establishes the requirements that must be met by the test sieves that are used to classify different materials according to the size of their particles or fragments.

We used the formula of gravel weight between weight of the sample brought from the field by 100 obtaining the percentage of thick elements see in *table 2*.

Table 2. Soil sample results

	Soil Sample (gr)	Soil Sample (%)
Earth Fine Dry Air	75.3	69.27
Gravel	22.8	28.51
Lost	1.9	2.22

One of the most important parameters that influence the determination of the concentration of hydrogen ions in solution represents the pH of the soil which with the measurement of the potentiometer gave us that it has a neutral pH with 7.3.

According to the soil samples of the horizons of the soil profile, the Munsell table was used to obtain results such as that we have a dry soil (7.5YR 4/6) with strong brown delimitation, this indicates the presence of goethite, decomposed organic materials influenced by the moisture content present; likewise, the moist soil (5YR 4/3) of reddish brown color indicates the presence of iron hydroxide (limonite) which limits poor drainage with the presence of Mn and low fertility which is the ability of a land to give the growth and development of plants and optimize the yield of their crops. [11]

It was determined that the textual class of the soil is 30.14% silt, 18.99% clay and 50.86% sand which indicates that we have a loamy loam soil, for the determination of the field capacity the test tube method was implemented, which uses the dry soil to the air for the determination of the field capacity inthis case of 21.08% [12] of the study sample and 12.08% sand, which generated that our density see *table 3* that shows us the bulk density 1.266 (gr / ml) and the density of the particle 2.5 for soil sampleand 2.27 for sand (gr / ml).

Table 3. Density results obtained by the soil sample

	Sample under study	Sand
Apparent density (gr/ml)	1.266	1.266
Particle density (gr/ml)	2.5	2.27

The percentage of porosity of the study sample tells us that our soil indicates a 49.37 percent porosity compared to the sand that shows 44.3%.

The cation exchange capacity for a soil is fundamental since it indicates the potential that it has for the retention and exchange of nutrients since it has a direct relationship to the amount and frequency of application of fertilizers, the results evaluated are according to *table 4* [13] which indicates a CIC of 9.76(cmol/ kg) which indicates a low rating level within the ranges established by FAO <8-12>.

Table 4. Cation exchange results

Description	Results
Sample weight in grams	5 gr
Milliliters of Versanate	6.1 ml
Milliliters of Aliquot	5 ml
CEC (cmol/kg)	9.76 cmol/ kg

Source: Own elaboration with information provided by FAO

According to *table 5* the electrical conductivity according to the soil classification is <2-4> with 0.46 dS/ m indicating that the soil is slightly saline, which refers to the number of ions dissolved in a solution and this in turn the presence of impurities or dissolved substances present in a solution. [14]

Table 5. EC results according to soil classification

Description	Results
Weight of the soil	20 gr
Volume of water	20 ml
EC (dS/m)	0.46 dS/m

The percentage obtained of organic matter in the sample is a high percentage 5.6 this is due to the influence on the determination of organic carbon of 32.76, the use of organic matter in agriculture is decisive since it is due to this the development of an agriculture free of synthetic products that eventually lead to the deterioration and loss of soil. [15]

The determination of the major use of land includes the assessment of all the physical and chemical parameters that we obtained as results in accordance with the provisions of Supreme Decree No. 006-2017-JUS in the Single Ordered Text of Law No. 27444, Law of General Administrative Procedure, the CTCUM allows predicting the behavior and conservation of soil applied in accordance with the provisions of FAO under climatological conditions, texture, etc. That allow to know what the proper use and handling will be.

According to data provided by the SENAHMI Peru the location of our sample is in Subhumid or dry according to the rainy, cold, humid climate; which indicates that our sample belongs to (9) Tropical Low Montane Dry Forest (bs-MBT) this Tropical Latitudinal region was obtained according to the annual precipitation and the potential evapotranspiration ratio, data obtained by the Ministry of the Environment and the National Service of Meteorology and Hydrology of Peru according to Technical Note No. 003 in 2017. [16] Key 9 delimits us to group A Cultivation in Clean Irrigation.

Having as a final result the physical characteristics and chemical parameters studied and analyzed in *table 6* these allow us to establish that our sample obtained as a result (a) Clean Land for Clean Cultivation (Symbol A), which indicates the periodic and continuous removals or pairing of the soil, taking into account ecological characteristics that allow obtaining alternatives of Permanent, pastures,

forest production and protection according to the policies established by the Peruvian State; a.2 Medium Agrological Quality (Symbol A2) lands of production of crops in clean that require moderate management practices and soil conservation in order to avoid deterioration and maintain sustainable production.

Table 6. Physical and chemical characteristics of the soil

Characteristics	Rating	Range
Short slope	0-4	1
Long slope	0-2	1
Microtopography	Soft Wavy	2
Surface Stoniness	Moderately stony	1
Drainage	Moderate	D
Erosion	Moderate	-
Presence of carbonates	None	0
Texture	MG	2
pH	7.06	-
Salinity	Slightly Saline	1

It was determined that the sample of burned soil of the Incho annex has the highest use capacity of Class A2 medium level, which is called for lands Suitable for Clean Cultivation, require moderate management practices and soil conservation, to avoid its deterioration and maintain an available productivity. The sample of burned soil of the Annex of Incho has the greater capacity of use of Sub Class of Limitation by Salts (Symbol "I") and by the Limitation by Soils (Symbol "S") see *table 7*, the excess of salts is harmful to the growth of plants is a component of the edaphic factor. The soil factor represents one of the fundamental components of the earth that fulfills main functions both of sustainability of plants and of source of nutrients.

Table 7. Salt and soil limitation table

Symbol	Key	Characteristics	Agricultural Quality
w	Drainage	Somewhat excessive	2
l	Salinity	Slightly	3
i	Flooding		-
e	Erosion	Moderate	2
e	Microrelief	Gently undulating	2
S	Effective depth	Shallow	3
e	Long slope	0-2	1
E	Short Slope	0-4	1
S	Stoniness	Moderately stony	2
S	Graveness	-	-
S	Texture	Moderately coarse	2
C	Climate	Temperate sub-humid	2

4. Discussion

The results obtained indicate that our soil requires moderate management practices and in turn soil conservation practices which they digest in order to avoid its deterioration and maintain an available productivity unlike a research carried out in the Lambayeque region in which 7.21% of the total area of the study scope determined that the lands obtained are Lands Suitable for Permanent Crops (C) which means that economically profitable permanent crops must be prioritized for intensive

production, which also requires soil management and conservation measures, according to the proper use of fertilizers. [17]

It also proposes the use of a Technified irrigation system so that there can be an efficient use of water,good irrigation and drainage will allow the periodic washing of soils with good quality water.

According to a 14.31% of Land with potential for Clean Crops throughout the territory of the department of Piura as well as our data obtained, these refer to a greater profitability with any type of crop implemented in the area and the implementation of adequate management techniques that facilitateand optimize the application of irrigation water at the level of each plant is suggested. They themselves suggest the implementation of organic matter management so that it can improve the physical and chemical conditions that allow the proper management of the soil. [18]

At the same time, it proposes the technical irrigation system for the conduction of irrigation water in crop fields and thus ensure the efficiency of use of the hydrological resource.

In other studies carried out for the determination of greater land use it was determined that compared to the result obtained it is said that the Tacna Region presents classes A (Land for Cultivation in Clean) as well as our sample this type of land presents low agrological quality where the main limitations are considered with the soil resource and its physical and chemical conditions the which one causes irrigation for poor drainage, these limitations relate the effective depth in a dictated topography of extreme slopes, poor drainage and absence of the soil resource. [19]

In turn, in a study carried out in the Arequipa Region, it was determined that the capacity of land use was described as Land suitable for Clean Crops (A) since these soils meet the basic delimiting conditions that allow the periodic and continuous removal of the soil for the use of this in different applications such as the sowing of herbaceous and semi-shrub plants of a short vegetative period, it is said that these lands can be used and dedicated to various activities such as permanent crops, forest production, grazing protection, which in summary requires various soil conservation management techniques since this requires limiting factors such as techniques of good use and use in its development to achieve the reduction of its annual loss. [20]

5. Conclusions

According to the statement established by the Ministry of Agriculture and Irrigation from the determination of the capacity for greater use of the land, it is of the utmost importance to carry outthis type of research due to the contribution it makes, in accordance with the utility that is provided.To the application of the lands in different areas and activities, be it agricultural, livestock, in regionalor local systems, our study determined the greater capacity of use of the Class A2 of medium level, which is called the lands suitable for cultivation in clean, suggesting not only moderate management practices such as technical irrigation, but also the application of different soil conservation techniques such as: Green fertilizers since they are a conservation proposal that allows the protection of the soil against the direct action of the rain that can cause loss and erosion problems.

The characteristics present in the soil study present relief and edaphic characteristics for the production of clean crops which specify a demand for removal or periodic and continuous plowing of the soil, due to this and the demand for its ecological characteristics. You use alternatives for use whether they are pastures, agroforestry production, permanent and protection crops in specific agreement with current policies and regulations and social interest in a private or state way, without contradicting or wasting the principles of sustainable use.

This technique allows the improvement of the physical conditions of the soil as well as the increase of the capacity of organic matter for the use of crops, with the use of incorporating cut and cultivated vegetation into the soil when it is still green. [21]

The Peruvian State must opt for measures and alternatives that preserve and give usefulness to all types of soil according to their classification, because in the last few soils burned due to fires causedor generated naturally are abandoned without establishing a measure. be it recovery or use, we have a soil rich in microbiota that can be used by our farmers and ranchers.

The incorporation of permanent crops allows the production of a great variety of crops because once planted they must remain for an average of less than five years, it is necessary to choose to implement this technique because the valley area would allow the production of various varieties of products that conform to the conditions of use and the capacity established in the soil study.

Opting to produce pastures in the area can help a lot in the use of livestock since the Mantaro Valley is considered as a cattle and farmer Valley, the first potato producer in Peru and exporter of its varieties in the world.

Likewise, it is also suggested to carry out more studies that can determine the inclusion of more soil conservation techniques for class A2 of medium level, available for lands suitable for clean cultivation.

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