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Physical Properties of Soils in Selected Subdivisions in Tacloban City and Palo, Leyte

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Abstract:- The study was conducted to analyzed and to determine the physical properties of soil such as texture, bulk density, water holding capacity, soil moisture content, pH, and organic matter content in selected subdivisions in Tacloban City and Palo, Leyte. Analysis of pH, texture, water holding capacity, and organic matter was at the Soil Research Testing and Plant Analysis Laboratory (SRTPAL) Department of Agronomy and Soil Science (DASS) VSU Baybay, Leyte. While the bulk density, soil moisture content was computed using the standard formula. To analyzed the result Analysis of Variance (ANOVA) using the SPSS Program to determine whether soils from subdivisions categorized as waterlogged and mountainous, developed and developing subdivisions derived from their filling and parent materials were significant different. The results showed that soils from various categories from subdivisions had no significant effect on bulk density, water holding capacity, & soil moisture content. However, some properties such as soil pH were significant in the waterlogged and mountainous area. It is recommended that a further study be conducted to include all appropriate soil parameters and procedures such as liming for acid soils, cause of erosion, flooding, water drainage capacity, depth to water table and other significant soil quality parameters. Also recommend for in-depth study by the developers and engineers to ensure that the soil quality be suitable for housing and for the safety of the homeowners.

***Keywords*:-** *Bulk Density, Water Holding Capacity, Soil PH, Organic Matter, Waterlogged, Mountainous.*

I. INTRODUCTION

Soil plays a significant role in the Earth's ecosystem, especially in managing water and maintaining environmental sustainability. Soil's texture, structure, bulk density, and moisture retention play a significant role in determining their suitability for various land uses. Understanding these characteristics is vital for successful land management and planning in urban subdivisions with high development pressures.

Additionally, Brown, L. R., & Green, T. W. (2021) emphasize that the connection between soil characteristics and urbanization is crucial, since inadequate land use can result in soil depletion, higher erosion rates, and diminished water quality. Hence, studying the physical characteristics of soils in these situations helps to comprehend the present soil state and also guides in implementing sustainable strategies to improve soil health and resistance to climate change effects.

Urbanization frequently changes the original soil conditions, affecting its physical properties and, as a result, its ability to sustain plant life and regulate water. Soil compaction caused by construction work can decrease porosity and affect drainage, leading to increased flooding and hindering plant growth, as discussed by Lal (2015). On the other hand, it is important to keep soil properties healthy in order to support green spaces and promote successful stormwater management in urban areas.

Different factors such as geological history, land use practices, and human influences can contribute to the variation in soil properties across different subdivisions. Jones et al. (2019) emphasized the importance of conducting specific studies on soil characteristics in order to customize land management practices according to the individual environmental conditions of each area. This study seeks to examine the characteristics of soils in specific areas, offering a thorough analysis to guide urban development, farming techniques, and conservation efforts.

This research will offer important information on sustainable land use methods and homeowner safety by enhancing our understanding of soil physical characteristics, guaranteeing that urban growth doesn't negatively impact soil health and ecosystem integrity, and informing their housing project development strategy.

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➢ *Objectives*

The study generally aims to analyze suitability of soils within selected subdivision in Tacloban City and Palo, Leyte. The specific objectives were:

- To determine the soil physical characteristics in terms of;
  - ✓ texture
  - ✓ bulk density
  - ✓ soil moisture content
  - ✓ water holding capacity
- To analyze the soil pH
- To analyze the organic matter content, and
- To compare the physical characteristics of soil in developed and developing subdivisions in:
  - ✓ waterlogged area
  - ✓ mountainous area.

II. METHODOLOGY

This study was conducted in four selected subdivisions in Tacloban City and Palo Leyte two from waterlogged (developed and developing), and two from mountainous area (developed and developing). Soil samples were collected per instruction of the management of the subdivisions to analyze its physical characteristics (texture, bulk density, soil moisture content, and water holding capacity), soil pH, and organic matter content of soil. Soil sample was taken using a soil auger from depth of (0-20cm), (21-40cm), (40-60cm), (60-80cm), (80-100cm) from filling materials and parent materials each sample represent an area of approximately one hectare, and place separately in a clean and labeled bag for storing and soil testing.

The researcher was collected analyzed for physical properties such as soil texture, bulk density, soil moisture content, water holding capacity, pH, and soil organic matter. The bulk density was measured by core method (Brady, (1999): Db = Ms/Vt) where; Db = bulk density, Ms = Mass of soil, Vt = total soil volume. The available water capacity was computed from the product of mass water content on the basis of dry weight and bulk density of each sample. The soil pH is usually determined potentiometrically measured in the supernatant suspension of 1:2.5 soil: liquid mixture in a slurry system using an electronic pH meter (McLean, 1982). While, the organic matter content of the soil is an important parameter in relation to soil fertility management. Determination of the absolute content organic matter is calculated from the measured reducing power using appropriate factors.

The Physical properties performed in comparing the result of analysis of the parameters identify with the Analysis of Variance to test the hypotheses:

- There is no significant difference in four subdivisions on soil physical properties within two (2) waterlogged and two (2) mountainous area.
- There is no significant difference in four subdivisions on soil physical properties within two (2) developed and two (2) developing area.
- There is no significant difference between soils from filling materials and parent materials in selected subdivision in Tacloban City and palo, Leyte.

III. RESULTS AND DISCUSSIONS

This section aims to expound the comparison in the physical properties of soil from filling and parent materials from developed and developing subdivisions in mountainous and waterlogged area in Tacloban City and Palo, Leyte.

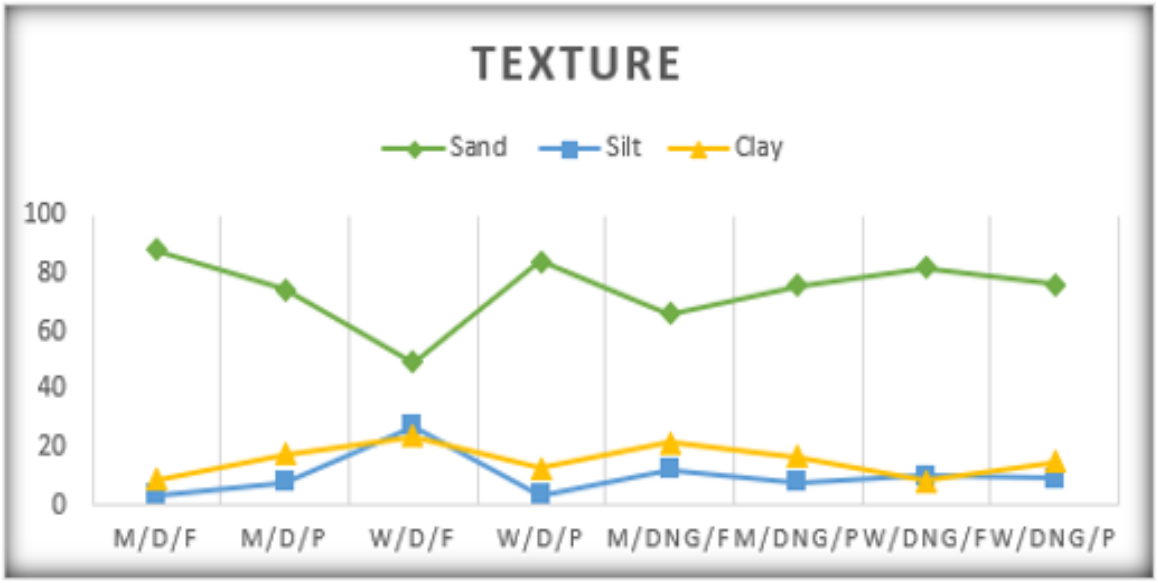

Fig 1. Soil Physical Properties (Texture)
Legend: M = mountainous, W = waterlogged, D = developed, Dng = developing, F = filling materials, P = parent materials

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Figure 1 shows the soil texture of soil samples taken from the waterlogged and mountainous subdivisions in Tacloban City and Palo, Leyte. The ideal soil contains 15-20% clay, 25-40% silt and 40-70% sand (Karlen et al., 2009). The results are closest to the approximation, the ideal proportion was found in the developed in waterlogged area and in the mountainous developing subdivisions.

Table 1. Bulk Density of Soil Samples

Source of Variation	F-Value	P-Value	Verbal Interpretation
Waterlogged and Mountainous	5.883	.052	Not Significant
Developed and developing	0. 371	.565	Not Significant
Filling and Parent materials	0.173	.692	Not Significant

Table 1, present the ANOVA for bulk density of soils samples in four (4) subdivisions indicates that there was no significant difference in bulk density. This parameter is useful both in soil management and in the quantification of soil forming process. High bulk density values imply that the soil is less porous or compact (Brady, 1999). The bulk density was comparable between the different categories and location of the subdivisions.

Table 2. Soil Moisture Content of Soil Samples

Source of Variation	F-Value	P-Value	Verbal Interpretation
Waterlogged and Mountainous	1.128	.312	Not Significant
Developed and Developing	0. 015	.906	Not Significant
Filling and Parent materials	0.368	.566	Not Significant

The results of the ANOVA for the soil moisture content (Table 2) of the soil samples indicate that there was no significant difference between the four (4) subdivisions. According to Brady (1999) soil water is greatly affected by site factors such as landscape position, climate, ground water as well as by nature of solid components of the soil. Soil water plays a major role in soil formations of the soil particularly as an ecological regulator. However, the results shows that there is no significant effect on the housing development.

Table 3. Water Holding Capacity of Soil Sample

Source of Variation	F-Value	P-Value	Verbal Interpretation
Waterlogged and Mountainous	0.010	.925	Not Significant
Developed and Developing	0. 899	.380	Not Significant
Filling and Parent materials	0.449	.528	Not Significant

The results indicate on water holding capacity (Table 3) that there was no significant difference between the selected subdivisions. According to Curell (2011) the relative increase in water holding capacity became smaller as the amount of organic matter from amendments increased. Kladivco (2004) state that the soil texture is the major determiner of water holding capacity of the soil. The large pores in sandy soils allow water to both infiltrate and drain quickly, leaving smaller amount stored within the profile.

Table 4. Soil pH of the Soil Sample

Source of Variation	F-Value	P-Value	Verbal Interpretation
Waterlogged and Mountainous	6.144	.048	Significant
Developed and Developing	0. 001	.981	Not Significant
Filling and Parent materials	0.075	.794	Not Significant

Table 4 present the results for the pH of the soil samples in the different subdivisions showed that there was significant difference in both waterlogged and mountainous subdivisions while the other has no significant it is revealed that the materials was acidic and the other value of pH are acceptable according to normal pH (Mc Lean, 1982). This characteristic has implication to landscaping of housing projects.

Table 5. Organic Matter of Soil Samples

Source of Variation	F-Value	P-Value	Verbal Interpretation
Waterlogged and Mountainous	4.373	.081	Not Significant
Developed and Developing	0. 957	.366	Not Significant
Filling and Parent materials	1.091	.337	Not Significant

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The table shows organic matter content taken from four (4) subdivisions revealed that there was no significant difference. This can be reckons with the fact that organic matter took several years or decade to transform these into new compound to be compacted with the parent materials (Soc.Sci.Society of America, 2004). In addition, (Odesanwo, 2009), inorganic soil samples are more compacted than the soils with high organic matter content. Brady (1999) also stated that the inorganic materials from sand and silt derived from clay materials are suited or ideal soil for housing development.

IV. CONCLUSION

Based on the findings of the study the physical characteristics of soils in specific areas, emphasizing aspects like texture, bulk density, water holding capacity, moisture content, organic matter, and pH. The results showed that although several physical properties were no significant in all locations, pH levels varied significantly between waterlogged and mountainous areas.

The lower pH levels in waterlogged soils suggest increased acidity due to the presence of organic matter and anaerobic conditions common in these environments. On the other hand, the pH levels of the soil in the mountains were more neutral to alkaline, probably due to the geological makeup and drainage patterns in these areas. The noticeable variance in pH levels has significant consequences for land management and agricultural practices, as it impacts nutrient availability and plant growth in the soil.

V. RECOMMENDATIONS

In general, although many physical properties showed little variation, the notable pH discrepancies emphasize the necessity of customized soil management approaches in both urban planning and agriculture. Future research should investigate how changes in soil pH affect plants, and overall ecosystem wellbeing in these areas, with the goal of promoting sustainable land use and better soil control.

It is also recommended to conduct a more comprehensive study that encompasses all relevant soil factors and techniques, including liming for acidic soils, erosion and flooding causes, as well as creating and executing water management plans to mitigate waterlogging, like enhancing drainage or utilizing raised beds. This may assist in regulating acidity levels and improving soil condition.

Develop extended monitoring schemes to monitor soil characteristics, especially pH, over time in response to land use practices and climate conditions. This information can be used to develop adaptive management strategies that are appropriate for housing and the protection of homeowners.

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