**Introduction**

Soil is an important natural resource yet for many countries including Haiti the only soil inventory is a general soil map at 1:250,000 scale which is not suitable for management planning at the farm level (Figure 1).

![Image of soil map](image1)

The objectives of the Pilot Study Project were to:

(a) Generate a detailed soil map (1:24,000) for a 3000 ha Pilot Study Area;
(b) Combine Traditional Soil Survey and Digital Soil Mapping approaches;
(a) Develop capacities in Haiti for conducting future soil surveys at national scale.

**Materials and Methods**

**Study Area General Characteristics**

Pilot Study Area in located in Cul de Sac valley which is situated between topographically uplifted mountain ranges. The valley has been filled with marine and erosional deposits. The southern part of the study site is located at the foothills of mountains and expands north toward the central Cul de Sac valley (Figure 2).

Pilot Study Area is characterized by high relief with elevations ranging from 130 to 330 meters above sea level.

The climate for the Cul de Sac is tropical but varies with elevation. The Cul de Sac area is relatively warmer and dryer with mean annual temperature of 26.2°C and the mean annual precipitation was 740 mm. The annual rainfall distribution shows two distinct rainy seasons April–June and October–November.

**Soil Survey**

The soil survey was conducted based on a combination of traditional and digital soil mapping approaches accompanied by field observation, data collection, soil sampling, and laboratory analysis of physical and chemical properties.

![Elevation Map](image2)

**Soil Physical and Chemical Properties**

The presence of Ca enriched materials and salts especially sodium was reflected by the measured soil chemical properties (Table 2). Overall, the total clay for all soils combined was 40%, however, CaCO₃ clay accounted for four fourth of the total amount. Generally clay decreased with depth while CaCO₃ clay did not always follow the same trend.

![Soil Percentages](image3)

**Results and Discussion**

**Soil Types**

Based on the observed and measured field site and soil characteristics, 11 soil types were identified (Table 1).

![Soil Map](image4)

**Soil Behavior - Interpretation**

The urban expansion in the agricultural prime farm land in the Cul de Sac valley has increased rapidly, especially after the 2010 earthquake in Port au Prince. Based on soil properties mainly depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility the soils in the study area were rated for suitability to support small houses without basement (Figure 7). Three categorical ratings were developed “Not limited,” “Somewhat limited” and “Very limited” The rating of the soils for construction suitability based on the soil properties and landscape setting confirmed the existing land uses (Figure 7 a, b) and highlighted also the potential problems with the most recent construction of houses (Figure 7c).

![Soil Behavior Map](image5)

**Conclusions**

The detailed soil map of the Pilot Study Area highlighted several unique features of the Cul de Sac valley. The Cul de Sac originated from the collision of Caribbean Plate and North America Plate approximately 10 million years ago. Cul de Sac valley was initially submerged under sea water separating the two island north and south but rose steadily as the tectonic plates moved toward each other. The uplift of the limestone sedimentary rocks on both sides of the valley was followed by erosion and deposition process the resulted in the Cul de Sac valley filling with Ca rich materials coating and cementing the gravel deposits. The concentration of water movement toward the valley combined with dryer and warmer climate conditions in Cul de Sac lead to further enrichment of fine sediments with CaCO₃, as shown by the chemical soil properties.

The use of CLHC allowed for unbiased and efficient representation of the soil variability in the study area and served as the base for selecting representative sites for soil characterization and understanding of soil landscape relationships and soil geomorphology based on transects from the selected sites. The soil variability could have been represented by a smaller number of points selected from the CLHC, however this was necessitated due to the need to provide training for 25-30 Haiti soil scientists in order to build capacity in the country for expanding the survey beyond the study area.

**Acknowledgements**

The completion of this project would have not been possible without the support of the Government of Haiti, United States International Development Agency (USAID), United States Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS), Soil Science Division (SSD), World Soil Resources and National Soil Survey Center (NSSC) as well as the participation of many individuals and non governmental organization such as FONHDAD whose contribution has been crucial for the success of this project.

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**Table 1. Taxonomic Classification of soils in the study area.**

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Taxonomic Group</th>
<th>Subgroup</th>
<th>Series</th>
<th>Implantation</th>
<th>Parent Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mollisols</td>
<td>Mollisols</td>
<td>Mollisols</td>
<td>Mollisols</td>
<td>Mollisols</td>
<td>Mollisols</td>
</tr>
<tr>
<td>Inceptisols</td>
<td>Inceptisols</td>
<td>Inceptisols</td>
<td>Inceptisols</td>
<td>Inceptisols</td>
<td>Inceptisols</td>
</tr>
<tr>
<td>Vertisols</td>
<td>Vertisols</td>
<td>Vertisols</td>
<td>Vertisols</td>
<td>Vertisols</td>
<td>Vertisols</td>
</tr>
</tbody>
</table>

**Table 2. Summary of Chemical-Physical properties for selected soils.**

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Texture</th>
<th>pH</th>
<th>Organic Matter</th>
<th>CEC</th>
<th>CaCO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mollisols</td>
<td>Clay</td>
<td>6.5</td>
<td>2%</td>
<td>30</td>
<td>2%</td>
</tr>
<tr>
<td>Inceptisols</td>
<td>Clay</td>
<td>7.0</td>
<td>5%</td>
<td>45</td>
<td>5%</td>
</tr>
<tr>
<td>Vertisols</td>
<td>Clay</td>
<td>8.0</td>
<td>8%</td>
<td>50</td>
<td>8%</td>
</tr>
</tbody>
</table>

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**Figure 2. Elevation of Pilot Study Area and the location of field sample sites and transect sites.**

**Figure 3. Detailed Soil Map and the distribution of soil types.**

**Figure 4. Soil-Landscape relationships in the study area and the underlying parent materials.**

**Figure 5. Soil Profiles, their associated landscapes and a conceptual general stratigraphy and water movement following a transect from southeast to northwest direction (see Figure 3 for transect sites).**

**Figure 6. General Soil Map area.**

**Figure 7. Ratings of map units for construction of dwellings (houses) without basements.**

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**Figure 8. General Soil Map area.**

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**Figure 9. General Soil Map area.**