**Introduction**

Ants are prolific soil-dwelling organisms in terms of their overall biomass, global distribution, and species diversity. Although the breadth of ant activity within soils is tremendous, little work has been done to quantify their impact on pedology—especially in Iowa.

**Objective**

Quantify the impact of ant activities on pedology at Doolittle Prairie State Preserve, Iowa.

**Doolittle Prairie State Preserve**

- 10.5 ha prairie remnant
- Location—Central Iowa (42.15° N, Lat. 93.59° W, Long.)
- Formed in Lacustine
- Sediments over glacial till
- ~7,000 years old

**SMU Series Soil Taxonomy**

- 288 Ottosen Aquic Hapludoll
- 388 Ottosen Aquic Hapludoll
- Okoboji Cumulic Endoaquoll
- Harps Typic Endoaquoll
- 388 Kossuth Typic Endoaquoll
- Harps Typic Calciaquoll
- Haplic Vermudoll
- Typic Endoaquoll
- Typic Hapludoll
- Aquic Hapludoll
- Cumulic Endoaquoll
- Typic Vermudoll
- Haplic Vermudoll
- Typic Endoaquoll

**Methods**

- Doolittle Prairie was reconnoitered to identify mound number, distribution and external morphology.
- A subset of 11 mounds were selected for detailed examination.
- Cores were taken as follows:
  - Profiles were described and analyzed per horizon for selected chemical and physical properties.

**Hypotheses**

- **H0:** Pedological properties on and off mounds (after bulk density corrections) are identical.
- **H1:** Many pedological properties vary on and off of mounds, but properties are identical around the radius of the mounds.
- **H2:** Differences in pedological properties can be observed on and off of the mounds, as well as along the radius of the mounds.

**Fornica Montana Wheeler at Doolittle Prairie**

<table>
<thead>
<tr>
<th>Ant Mound Data</th>
<th>Min</th>
<th>Max</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (m)</td>
<td>0.4</td>
<td>2.0</td>
<td>0.9 +/- 0.5</td>
</tr>
<tr>
<td>BT Depth (m)</td>
<td>-</td>
<td>1.8</td>
<td>0.9 +/- 0.3</td>
</tr>
<tr>
<td>Area (m²)</td>
<td>0.1</td>
<td>3.2</td>
<td>0.6</td>
</tr>
<tr>
<td>Vol. (m³)</td>
<td>-</td>
<td>5.7</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- ~100 mound/ha
- Surface area of mounds range 600-3,000 m² of 10.5 ha
- 0.6-2.8% of surface of prairie covered by mounds.
- Total prairie turnover by ants est. 1,000 years.

**Taxonomy**

**Taxonomic Change in Relation to Adjacent Soil**

<table>
<thead>
<tr>
<th>Order</th>
<th>Suborder</th>
<th>G. Group</th>
<th>Subgroup</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>31%</td>
<td>88%</td>
<td>100%</td>
<td>16</td>
</tr>
<tr>
<td>Periphery 0%</td>
<td>12%</td>
<td>90%</td>
<td>96%</td>
<td>42</td>
</tr>
</tbody>
</table>

- Typic Endoaquoll classification due to bias of US Soil Taxonomy
- Redox materials brought upward by ants
- Otherwise, are Vermudolls
- As result, the numbers above are conservative

**Chemical Properties**

<table>
<thead>
<tr>
<th>pH with Depth</th>
<th>Carbon with Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH = 0.00 cm + 6.9, r² = 0.42</td>
<td>OC% = 0.00 cm/0.0 - 0.8 cm + 4.1, r² = 0.89</td>
</tr>
<tr>
<td>pH = 0.00 cm + 6.0, r² = 0.34</td>
<td>Inorganic C% = 0.00 cm/0.0 - 0.1 cm + 4.9, r² = 0.89</td>
</tr>
</tbody>
</table>

**Acknowledgments**

- Iowa Lakeside Lab-Iowa Regents’ University
- Iowa Department of Natural Resources
- The Story County Conservation Board
- Stephen Cover and E.O. Wilson

**Interpretations**

- Ant bioturbation is a critical state factor of soil formation at Doolittle Prairie.
  - Estimated total ant turnover ~1000 years
  - Does not include other prairie organisms
- Taxonomy under ant bioturbation changes rapidly.
  - Haploids to Vermudolls
  - Udaloids to “Aquolls”
- Recycling of bases, enrichment of carbonate minerals, cycling organic material, resetting structure, and porosity are major contributions of ants at Doolittle Prairie.
- Soils now devoid of ants (cultivated, urban) exhibit better horizonation at the expense of crucial ecosystem services.

**Soils Role in Restoring Ecosystem Services**

- Sacramento, California
- Biodiversity and Ecological Sustainability
- March 8th, 2014