



Pedological Processes in Wetlands and Subaqueous Soils

For over 35 years, Dr. Rabenhorst has been focused on the pedogenesis and hypopedology of wetland soils, including non-tidal wetlands, coastal marshes and subaqueous soils (permanently submerged under water). Over the last 15 years he has also worked on technology for documenting reducing soil conditions.

Wetland Soils

- Wetlands provide valuable ecosystem services, including recreation and aesthetics, fish and wildlife habitat, water quality security and improvement, and protection from flooding and shoreline erosion.
- Hydric soils are one of the three required parameters (with hydrology and vegetation) used to identify and delineate wetland to ensure their protection.
- Saturated and reducing soil conditions enable wetlands to function properly and also cause the development of soil features (known as field indicators) that can be used to recognize hydric soils and wetlands (even at times when they are not wet).
- For a variety of complex (geological, hydrological and pedological) reasons, some wetland soils lack features typically used for identification. Failure to recognize certain wetlands, makes them vulnerable to exploitation and destruction.

Pedologists at UMD have studied these problem hydric soils in order to better understand their biogeochemical processes, attempting to observe features that can be used to identify the hydric soils in these vulnerable wetlands.

- New field indicators have been developed to help protect wetlands in the Piedmont section of Central Maryland, in the near coastal portions of the Delmarva Peninsula as well as along the barrier islands of the Mid-Atlantic region.
- Graduate student Sara Mack has been focused on problematic hydric soils formed from red parent materials that do not show typical colors of wetland soils. Using a lab test and digital instrumentation that accurately records small changes in color, soils from across the US were evaluated to create guidance maps for use by soil and wetland scientists. Her work also answered questions about the cause of this phenomenon.

Important Developments in IRIS Technology

Indicator of reduction in soils (IRIS) technology utilizes an Fe oxide coating (patented by Dr. Rabenhorst) applied to a PVC device that is inserted into a soil to evaluate/demonstrate wetland soil function. The value and appeal of IRIS are its conceptual simplicity and its ease of use. Over the last couple of years Dr. Rabenhorst has made significant advances in IRIS technology providing important improvements (patents pending):

- Development of a system for deploying flat PVC films rather than the traditional ½ inch schedule 40 PVC tubes. This approach greatly facilitates acquisition of digital images for quantitative analysis, protects IRIS devices during transport and deployment, requires a small fraction of the storage volume for IRIS devices, and is far more sustainable – generating much less plastic for disposal.
- The formulation of a Mn oxide (birnessite) coating that can be easily applied to PVC to make Mn-coated IRIS. These Mn-oxide coatings become solubilized under moderately reducing conditions less extreme than those required for Fe oxide dissolution, and that may more closely reflect environmentally important functions like denitrification.

Subaqueous Soils of Chesapeake Bay – Even Wetter!

As a result of award winning work by Dr. Rabenhorst's former student George Demas, soil processes were documented in subaqueous (under shallow water) environments in Maryland's Coastal Bays leading to a change in the USDA-NRCS definition of soil, and recognition of soils beneath these shallow water bodies.

- Doctoral student Barret Wessel and MS student Evan Park are now exploring the applications in the Chesapeake Bay estuary. This provides a robust strategy for mapping the sediments in the estuaries that captures three-dimensional information facilitating science-based management. High quality underwater soil surveys are produced.
- Historical bathymetry and newly collected data permit visualization of the underwater landscapes.
- Coring devices and augers are used for sampling and classification of soil profiles, and models can be developed linking particular soils to portions of the underwater landscape.
- Subaqueous soil surveys can be used to assess potential for submerged aquatic vegetation (SAV), for crab habitat, for shellfish stocking and production, suitability for moorings and docks, facilitating strategies for nutrient reduction, assessing potential effects of dredging, materials for dune and beach replenishment, C accounting, and more!

