

Advanced Wetland Soils

CSES 5854

I. Catalog Description

Hydric soil identification and delineation, wetland water budgets, restoration of damaged wetlands, and creation of compensation wetlands. Utilization of advanced soil information systems and GIS/GPS in wetlands study. Constructed wetlands for water treatment. Mandatory 3-day field trip. May not be taken after CSES/ENSC 4854. Pre: 4124 or 4134 or FOR 4374. (3H, 3L, 4C) I, Odd.

Course Number: 5854

ADP Title: Advanced Wetland Soils

II. LEARNING OBJECTIVES

Upon completion of this course, the students will be able to:

1. Discuss and apply legal and scientific wetland terms, concepts, and regulations.
2. Relate the chemical, physical, biogeochemical, and morphological characteristics of wetland soils to their location, role, and function in the landscape.
3. Identify individual wetland soils based upon use of Hydric Soil Indicators, *Soil Taxonomy*, and other appropriate techniques to currently accepted federal/state regulatory standards.
4. Map and delineate hydric soil boundaries in the field and correctly relate their occurrence to hydro-geomorphic classification, specific site hydrology and water budgets, and vegetation patterns.
5. Apply essential principles of wetland restoration and creation to develop a proposed mitigation site design and develop site-specific success criteria.
6. Design appropriate soil and hydrologic monitoring and study procedures for natural and created wetlands, including appropriate GIS/GPS technologies.

III. JUSTIFICATION

The ability to accurately delineate natural wetland soils and to plan for the appropriate restoration or creation of new wetlands are critical emerging skills for graduate students in the biological and earth sciences. Both private and public sector employers of M.S. and Ph.D. students commonly require a detailed knowledge of wetland soils, functions, and values. This course will offer advanced material on a range of wetland topical areas along with an intensive

field research project assignment and a mandatory statewide field trip with associated report.

There are currently no graduate-level courses offered in this specific area (wetland soils/hydrogeology/mitigation) at Virginia Tech. However, two related undergraduate courses (FIW 4534 – Ecology and Management of Wetland Systems; FOR 4374 – Forested Wetlands) are offered in the College of Natural Resources with approximately 15% mutual overlap, primarily in the area of wetland regulation and basic delineation. With approval of this course, graduate students would have a significant and fully complementary cluster of coursework available to them in support of their future employment needs. A parallel undergraduate offering (CSES/ENSC 4854) provides approximately 50% overlap in basic topical content with this course, without the detailed literature readings, field trips, and detailed field research project required by this course. However, due to that topical overlap, students electing to take CSES/ENSC 4854 may not take this course for graduate credit.

This course should be offered at the 5000 level due to the fact that it will require advanced knowledge of soils, geology, geomorphology, and soil-plant relationships. The required reading materials will come primarily from the published literature and agency reports in addition to the textbook. The assigned field project will require students to synthesize existing literature, design an appropriate field study and sampling protocol, gather required data, and produce a scientifically sound and fully referenced research study report. The mandatory three-day field trip will similarly require students to synthesize insights from published studies with their field observations to produce a detailed analytical report of the wetland soils and landscapes observed across Virginia.

IV. Prerequisites and Corequisites

Students must have a solid background in soil morphology, landscape relations, regional parent materials, and soil/plant relations. Therefore, enrolling students must have successfully completed CSES/ENSC 4124 – Soil Survey & Taxonomy or CSES/ENSC - 4134 Soil Genesis & Classification or FOR 4374 – Forested Wetlands.

V. Texts and Special Teaching Aids

Required Text:

Richardson, J.L. and M.J. Vepraskas (eds.) 2001. Wetland soils: Genesis, hydrology, landscapes and classification. Lewis Publ., Boca Raton, FL. 417 p.

Approximately 20 journal articles and agency reports will be used as required readings and supplied to students. Examples:

1. Vepraskas, M. J. 1995. Redoximorphic Features for Identifying Aquic Conditions. NC Agric. Research Serv., Tech. Bull. 301, Raleigh. 33 p.

2. Patrick, W.H., R.P. Gambrell and S.P. Faulkner. 1996. Redox measurements in soils. P. 1255-1274 *In*: Methods of Soil Analysis, Part 3, Chemical Methods, SSSA Book Series no. 5, ASA-

SSSA, Madison WI.

3. He, X, M.J. Vepraskas, D.L. Lindbo and R.W. Skaggs. 2003. A method to predict soil saturation and frequency and duration from soil color. *Soil Sci. Soc. J.* 67:961-969.
4. Vepraskas, M.J. and S.W. Sprecher. 1997. Overview of aquic conditions and hydric soils. P. 1-28 *In: Aquic Conditions and Hydric Soils: The Problem Soils.* SSSA Special Pub. 50, ASA-SSSA, Madison WI.
5. Whittecar, G.R. and W. L. Daniels. 1999. Use of hydrogeomorphic concepts to design created wetlands in southeastern Virginia. *Geomorphology* 31: 355-371.
6. Stolt, M.H., M.H. Genthner, W.L. Daniels, V.A. Groover, S.M. Nagle, and K.C. Haering. 2000. Comparison of soil and other environmental conditions in constructed and adjacent palustrine reference wetlands. *Wetlands* 20(4): 671-683.

VI . Syllabus

Lectures:

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| Introduction and overview | 7% |
| Wetland definitions and regulatory framework | 7% |
| Wetland soil biogeochemistry | 7% |
| Physical properties of wetlands soils | 7% |
| Wetland soil hydrology and water budgets | 7% |
| Wetland soil morphology | 7% |
| Redoximorphic features and hydric soil indicators | 7% |
| Wetland soil landscape relationships | 7% |
| Delineation of hydric soil in agricultural landscapes | 7% |
| Hydrogeomorphology and other geomorphic classification systems | 7% |
| Hydric soils and <i>Soil Taxonomy</i> | 6% |
| Mid-Atlantic and Southeastern wetlands and associated soils | 6% |
| Constructed wetlands for water treatment | 6% |

Wetland mitigation principles 6%

Restored and constructed mitigation wetlands 6%

Laboratory/Field Sessions:

Hydric soil landscape relationship 10%

Wetland soil hydrology and HGM 10%

Delineation of jurisdictional boundaries 10%

Occurrence and location of wetland and hydric soil indicators 15%

Agricultural wetlands 10%

Constructed wetlands and monitoring 20%

Location and design an appropriate created wetland site project 25%

VII. Old Syllabus - NA