Soil Genesis and Geomorphology <u>12(44):136, Syllabus, Fall, 2012</u>

Instructor: Dr. Art Bettis, Rm 209 TH; Phone: 335-1831; art-bettis@uiowa.edu. Office hours: Tuesday 2:30-4:30 PM, Thursday 10-12 AM or by appointment

<u>**Text:</u>** Soils:Genesis and Geomorphology by Schaetzl and Anderson, 2005. Cambridge Univ. Press (ISBN 0-521-81201-1). Available at the IMU Bookstore (Old Capitol Center)</u>

Lecture: 8:30-9:20 TTH, Rm 231 TH. Lab: Tuesday 11:30-1:20, Rm B18 TH.

Goals and Objectives: This course is designed for intermediate and advanced undergraduates and graduate students. It provides an introduction to soil geomorphology, soil genesis, and classification, including the basics of soil profile description, field textural classification, recognition of master horizons, and essential soil-landscape, soil-vegetation, and soil-climate relationships. Lab often involves short field excursions to describe soils and examine field soil landscape relationships. A required weekend field trip permits examination of soil landscapes outside the Iowa City area.

Expectations: Students are expected to attend all classes and labs. If absence is required you should obtain notes from a classmate and make arrangements with Dr. Bettis to get any handouts. Active participation as part of a team in labs and projects is essential. After completing this course you should be able to make accurate and complete soil descriptions, have a basic understanding of soil-geomorphic relationships, be able to effectively use published soil surveys, know where to find on-line soils data and have a basic understanding of soils' role in the Earth System.

<u>Grading:</u> exam 1 (15%); exam 2 (20%); comprehensive final exam (30%); annotated bibliography (10%); lab and project participation and assignments (25%). Graduate students will also be required to give a 15-minute class presentation. A plus/minus grading system is used.

Labs: We will examine and describe soils during many lab periods. Most labs during the first two months of the semester will be outdoors so you should dress appropriately (field clothes, footwear, and rain gear if necessary) and bring along water, sunscreen, and insect repellent. During the last three labs you will work in groups to apply your knowledge of soils to a field and lab project.

<u>Field Trip:</u> We will take one **mandatory field trip Saturday, October 27** to examine soils and landscapes outside the Iowa City area. We will leave at 7AM Saturday and return at about 5PM. If you have conflicts with this schedule contact me during the first week of class.

On Reserve in Science Library

Bigham and Ciolkoz (editors), 1993, Soil Color. Gerrard, 1992, Soil Geomorphology. Mack and James, 1992, Paleosols for Sedimentologists. Retallack, 2001, Soils of the Past (2nd edition). Richardson and Vepraskas (editors), 2001, Wetland Soils.

<u>On-Line</u>

Soil Taxonomy -- <u>ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil Taxonomy/tax.pdf</u> Keys to Soil Taxonomy -- <u>http://soils.usda.gov/technical/classification/tax_keys</u> Glossary of Soil Science Terms – <u>https://www.soils.org/publications/soils-glossary/</u> The Soil Orders – <u>http://soils.ag.uidaho.edu/soilorders/</u> Soil Survey Manual - <u>http://soils.usda.gov/technical/manual/</u> Field Book for Describing and Sampling Soils - <u>http://soils.usda.gov/technical/fieldbook/</u> National Soil Survey Handbook – <u>http://soils.usda.gov/technical/handbook/</u> U.S. Department of Agriculture Soil Survey Division – <u>http://soils.usda.gov/</u> National Soil Survey Geographic Data Access (SURSGO) – <u>http://soils.usda.gov/survey/geography/ssurgo/</u> J. Aguilar, C. Dorronsoro-Fdez, J. Fernández, C. Dorronsoro Diaz, F. Martin and B. Dorronsoro. Soil Microscopy: Soil Micromorphography. Interactive multimedia programme for self-studying soil thin section description <u>http://edafologia.ugr.es/micgraf/indexw.htm</u> Bettis, 2006, Encyclopedia of Quaternary Science. S. Elias (Ed.). Amsterdam, Elsevier. V. 3, p. 2119-2129. <u>http://www.sciencedirect.com/science? ob=ArticleURL& udi=B8F8W-4MWJ3HV-</u> <u>4W&_rdoc=7&_hierId=6412000023&_refWorkId=389&_explode=6412000022,6412000023&_fmt=high</u> <u>&_orig=na&_docanchor=&_idxType=SC&view=c&_ct=7&_acct=C000020939&_version=1&_urlVersion</u> <u>=0&_userid=440026&md5=1a77809714f93eef596a82665cad12ed</u>

Class and Lab Schedule

Aug 21	Class schedule, course objectives, grading, introduction to soils *[no lab meeting]
Aug 23	Major soil horizons; texture
Aug 28	Other descriptive characteristics: color, structure, consistence, etc; Soil horizon modifiers *[lab: field identification of major textural groups, soil color]
Aug 30	Soil mineralogy and soil physics
Sept 4	Soil organic matter and organisms *[lab: description of soils formed in loess]
Sept 6	Introduction to soil-forming processes
Sept 11	Soils and their relationship to the geomorphic system *[lab: description of soils formed in alluvium]
Sept 13	Reasons for soil profile differences – Jenny's 5 factors of soil formation: (1) Landscape (topographic) relations – the catena concept and erosion surfaces
Sept 18	Catena relationships and erosion surface examples *[lab: examination of landscapes and soils on the Iowan Erosion Surface]
Sept 20	Soil-forming factors continued (2) Climate and (2) biologic relationships
Sept 25	Soil-forming factors continued (4) Parent material and (5) time *[lab: description of soils formed in sand and gravel]
Sept 27	EXAM 1
Oct 2	Subsolum processes and weathering zones *[lab: weathering zones]
Oct 4	Soil classification I: reasons for classification, brief history of soil classification emphasizing US classification schemes
Oct 9	Soil classification II: Soil Taxonomy (US); orders *[lab: describe soils formed under prairie and under forest]
Oct 11	Soil classification III: Soil Taxonomy; suborders, and lower categories of classification
Oct 16	Soil micromorphology take home exercise – classify 5 soil profiles: DUE Thursday, Oct 25 *[lab: understanding and using soil survey reports]
Oct 18	Soils and surface exposure dating
Oct. 23	Quaternary buried soils *[lab: Web Soil Survey exercise]
Oct 25	Pre-Quaternary buried soils **take-home exercise due**

Oct 27 (Saturday) **** field trip****

Oct 30	Wetland soils
	*[lab: project]

Nov 1 Alluvial soils

Nov 6	Exam 2	
	*[lab:project]	

- Nov 13 Soils of arid regions
- Nov 15 Soils of cold regions *[lab: project]

*** BIBLIOGRAPHIES DUE AT BEGINNING OF CLASS****

Nov 20 and 22 no class Thanksgiving break

Nov 27Soils of the tropics
*[lab: project reports due]Nov 29Soil development modelsDec 4Grad Student PresentationsDec 6Graduate Student Presentations

FINAL EXAMTBA****

Reading Assignments

Aug 21	Introduction to soils Schaetzl and Anderson 2005 (text) p. 3-8
Aug 23	Major soil horizons; texture Text p. 9-14; 32-53. Soil Survey Staff, 1993. <u>Soil Survey Manual</u> , p. 117-122; 136- 141; <u>http://soils.usda.gov/technical/manual/</u> Cptr. 3 Designations for horizons and other layers (master horizons and layers and transitional and combination horizons sections only); particle size distribution
Aug 28	Other descriptive characteristics; Soil horizon modifiers Text 37-50 Soil Survey Staff, 1993, p. 122-130; 133-134; 146-191; <u>http://soils.usda.gov/technical/manual/</u> Cptr. 3 subordinate distinctions within master horizons and layers, sample horizon sequences, cyclic and intermittent horizons and layers; boundaries of horizons and layers, topography; soil color, soil structure, concentrations, consistence, roots, pores, animals
Aug 30	Soil mineralogy and soil physics Text p. 54-81; 82-92
Sept 4	Organic matter and organisms Text p. 93-105
Sept 6	Introduction to soil-forming processes Text p. 347- 353; 295-323
Sept 11	Soils and their relationship to the geomorphic system Text p. 167-225
Sept 13	Reasons for soil profile differences – Jenny's 5 factors of soil formation; landscape relations – the catena concept and erosion surfaces Text p.465-506
Sept 18	Catena relationships and erosion surface examples Text p. 506-546
Sept 20	Soil-forming factors; climate and biotic relationships Text p.302-317
Sept 25	Soil-forming factors; parent material and time Text p.300-302
Sept 27	EXAM 1
Oct 2	 Subsolum processes and weathering zones Text p. 226-238; 32-33 Bigham and Ciolkoz (editors), 1993, <u>Soil Color</u>, p. 109-123 (Richardson and Daniels – Stratigraphic and hydraulic influences on soil color development) Bettis. 2006. <u>Weathering Profiles</u>. Encyclopedia of Quaternary Science. S. Elias (Ed.). Amsterdam, Elsevier. V. 3, pp. 2119-2129
Oct 4	Soil classification I Text. p. 106-115
Oct 9	Soil classification II Text. p. 115-122

Oct 11	Soil Classification III Text. p. 122-146
	Soil Survey Staff, 1999, <u>Soil Taxonomy</u> , <u>ftp://ftp-</u>
	<u>fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/tax.pdf</u> cptrs. 6&7
Oct 16	Soil micromorphology Text. p. 22-31
	J. Aguilar, C. Dorronsoro-Fdez, J. Fernández, C. Dorronsoro Diaz, F. Martin and B. Dorronsoro. Soil Microscopy: Soil Micromorphography. Interactive multimedia programme for self-studying soil thin section description <u>http://edafologia.ugr.es/micgraf/indexw.htm</u> (browse)
Oct 18	Soils and surface exposure dating Text. p. 547-618
Oct 23	Quaternary buried soils Text p. 619-632 Grimley et al., 2003. Modern, Sangamon and Yarmouth soil development in loess of unglaciated
	southwestern Illinois. <u>Quaternary Science Reviews</u> 22: 225-244. On-line journal Bettis, 1998, Subsolum weathering profile characteristics as indicators of the relative rank of stratigraphic breaks in till sequences. <u>Quaternary International</u> 51/52: 72-73. On-line journal Lab : Text. p. 146-163
Oct 25	Pre-Quaternary buried soils Retallack, 2001. Soils of the Past, p. 7-36; 87-101. Nordt, L.C., Dworkin, S.I. and Atchley, S.C. 2012. Ecosystem response to biochemical behavior during the Late Cretaceous and early Paleocene within the western interior of North America. <u>Geological Society of America Bulletin</u> 123: 1745-1762. On-line journal . Lab: Mack and James 1992. Short Course Manual on Paleosols for Sedimentologists. p. 57-86
Oct 30	Wetland soils Vepraskas, 1992, Redoximorphic Features for Identifying Aquic Conditions, p. 1-31 Richardson and Vepraskas (editors), 2001, <u>Wetland Soils</u> , p. 163-182 (Vepraskas Morphological features of seasonally reduced soils) Text p. 486-501
Nov 1	Alluvial soils Gerrard, 1992, p. 90-124 Richardson and Vepraskas (editors), 2001, <u>Wetland Soils</u> , p. 283-299 (Lindbo and Richardson – Hydric soils and wetlands in riverine systems)
Nov 6	Exam 2
Nov 13	Soils of arid regions Text p. 402-440
Nov 15	Soils of cold regions Text p. 263-277 Gerrard, 1992, p. 180-199
Nov 20 and 22	NO CLASS THANKSGIVING BREAK
Nov 27	Soils of the tropics Text. p. 385-402

Nov 29 Soil development models Text. p. 295-342 Dec 4 no readings

Dec 6 no readings

Department of Geoscience Syllabus Information:

Department Office: 121 Trowbridge Hall **Department Chair** (DEO): Prof. M.K. Reagan DEO Telephone: 319-335-1820 Telephone: 319-335-1818 DEO Office: 121C TH

Administrative Home

DEO Email: geology-deo@uiowa.edu

The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS <u>Student Academic Handbook</u>.

Electronic Communication

University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (*Operations Manual*, <u>III.15.2</u>. Scroll down to k.11.)

Accommodations for Disabilities

A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See <u>www.uiowa.edu/~sds/</u> for more information.

Academic Honesty

The College of Liberal Arts and Sciences expects all students to do their own work, as stated in the <u>CLAS Code of</u> <u>Academic Honesty</u>. Instructors fail any assignment that shows evidence of plagiarism or other forms of cheating, also reporting the student's name to the College. A student reported to the College for cheating is placed on disciplinary probation; a student reported twice is suspended or expelled.

CLAS Final Examination Policies

Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

Making a Suggestion or a Complaint

Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS <u>Student Academic Handbook</u>.

Understanding Sexual Harassment

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI <u>Comprehensive</u> <u>Guide on Sexual Harassment</u> for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather

In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety <u>web site</u>.

Rights and responsibilities in the classroom. See: <u>Current policies and regulations affecting students</u> for Universitywide policies. The College's statement on student rights and responsibilities can be found at: <u>http://www.clas.uiowa.edu/students/handbook/x/</u>.

The CLAS policy and procedural statements have been summarized from the web pages of the <u>College of Liberal Arts</u> and <u>Sciences</u> and The University of Iowa <u>Operations Manual</u>.