**Syllabus: Landscape Pedology**

Environmental Science 454 – Fall 2012

MWF 9-9:50 Traphagan 225

Instructor: Dr. Stephanie A. Ewing

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Teaching Assistants:

Christine R. Miller, <[cmiller96@hotmail.com](cmiller96%40hotmail.com)>

Carmel E. Johnston <carmel.johnston@msu.montana.edu>

**Office Hours**

Dr. Ewing: MW 10-11, 817 LJH (inside 818) or by appointment

TAs: MW 10-11 (Carmel, 8th floor LJH); 11-12 (Christine, 8th floor LJH) or by appointment

Class goal: Develop tools for quantifying processes of soil development, taking advantage of local examples through field trips and hands-on evaluation of local soils.

Learning outcomes:

Describe and interpret soils in terms of key processes

Quantify mass fluxes within and through soils

Understand Montana soils in global context and in terms of local land use/management

Philosophy:

Active learning requires independent thinking and curiosity. Why are you here? I strongly encourage you to ask questions, propose answers, contribute your unique perspective and experience, critique in a constructive way, and be respectful. If you have concerns or curiosities, please take them up with me in office hours.

**Texts**

Schaetzl, R. and S. Anderson (2005). *Soils: Genesis and Geomorphology*. Cambridge University Press. *[available at the MSU bookstore; electronic version available from Renne Library]*

Birkeland, P. W. (1999) *Soils and Geomorphology* (3rd ed.). Oxford University Press. *[two library copies placed on reserve; selections will be posted on D2L]*

Soil Survey Staff (2010). *Keys to Soil Taxonomy* 11th ed. NRCS.*[electronic version available on D2L; 20 copies available soon at MSU bookstore; also available for purchase from GPO website]*

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. (eds) (2002), *Field book for describing and sampling soils*, Version 2.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE. *[excerpts being printed at University Printing Service, electronic version available on D2L]*

\*\*\*READINGS WILL BE ASSIGNED WEEKLY & POSTED ON D2L

**Evaluation**

Daily quizzes (~20): 10%

Lab writeups (First soil description, Hyalite, Red Bluff, Fort Ellis, Judith Basin, Lutz/other): 40%

 \*\*\*lab scores can be improved by re-submitting within one week of graded return

Problem sets (two): 10%

Class participation: 10% (questions/discussion in lecture & field, office hours)

Class presentation: 10%

Exams (2): 20%

Grades will be assigned on the following scale (after final curve):

90-100% A; 80-89% B, 70-79% C, 60-69% D, <60% F

+ = top 3% (except A; e.g., 87-89% B+), - = bottom 3% (e.g., 90-92% A-)

**Week 1: Soil description and interpretation**

*Reading:*

*S&A Ch. 1, Introduction, pp 3-8*

*S&A Ch. 2, Basic concepts: soil morphology, pp 9-21*

*S&A Ch 3, Basic concepts: soil horizons, pp 33-53*

*Lectures:*

 August 27: Introduction; class organization

 August 29: What do soils tell us? Reference frames and residence times

 August 31: Soil description and interpretation – soil horizons and soil process

***Field trip Aug 31: Lutz farm***

Theme: Soil description & interpretation

**Week 2: Soil classification & parent material**

***Soil description lab due Wednes. Sept 5, 9 am***

*Reading:*

*S&A Ch 7, Soil classification, mapping & maps*

*Lectures:*

 September 3: LABOR DAY HOLIDAY

 September 5: Soil classification and soil development – is taxonomy useful?

 September 7: Regional parent materials, geologic time scale

***Field trip Sept 7: Hyalite Canyon***

 Theme: Parent materials, young alpine soils on old rocks

**Week 3: Weathering processes**

***Hyalite lab report due Wednesday Sept. 12, 9 am***

*Reading:*

*S&A Chapter 5, Soil physics*

*S&A Ch 9, Weathering*

*Birkeland Ch 3-5, Weathering processes, The products of weathering,*

*Processes responsible for the development of soil profiles*

*Lectures:*

 September 10: Weathering and soil mass balance

 September 12: Water movement through soils

 September 14: Weathering and the chemistry of natural waters

***Lab sections Sept 14: Soil texturing & bulk density; mass balance problem set***

 Theme: Quantifying soil mass balance and fluxes

**Week 4: Soil biogeochemistry**

***Problem set I due Wednesday, Sept 19, 9 am***

*Reading:*

 *Amundson 2001, The Carbon Budget in Soils*

*Birkeland Ch 8, Weathering and soil development with time*

*Lectures:*

 September 17: Soils & the carbon cycle

 September 19: (Brookshire) Soils and global N+P (or plant communities)

 September 21: Quantifying soil carbon

***Lab Sept 21: Quantifying soil carbon***

 Theme: Soil biogeochemistry

**Week 5: Weathering – a closer look**

***Problem set II due Wednesday, Sept 26, 9 am***

*Reading:*

*S&A Chs 13, Soil geomorphology & hydrology*

*Birkeland Ch 9, Topography-soil relations/catenas*

*Chadwick & Chorover, 2001*

*Lectures:*

 September 24: Climate and time sequences: Hawaii

 September 26: Clay minerals (climate, time, parent material)

 September 28: Solute accumulation in soils; atmospheric deposition

***Field trip Sept 28: Red Bluff Ranch***

 Theme: soil development on crystalline rocks, catena, erosional/depositional

**Week 6: Weathering/Exam I**

***Individual project proposal due MONDAY Oct. 1***

***Red Bluff report due Wednesday Oct. 3, 9 am***

***Reading: review***

*Lectures:*

 October 1: Weathering and residence time

 October 3: Exam review

 October 5: **Exam I**

***Friday Oct 5: no lab***

**Week 7: Land Use I**

***Reading: TBA***

*Lectures:*

 October 8: Biogeochemistry of agriculture

 October 10: Judith Basin case study (TA Miller/guest lecture)

 October 12: Soil management and water quality

***Weather dependent SATURDAY field trip Oct 13: Judith Basin***

 Themes: contemporary food production, land use history

**Week 8: Land Use II & Soil Degradation**

***Judith Basin lab report due Oct 17, 9 am***

***Reading: TBA***

*Lectures:*

 October 15: Soil degradation

 October 17: Soil restoration – what is background?

 October 19 Soil carbon analysis

***Friday Oct 19: Ft. Ellis***

 Theme: quantifying soil process

**Week 9: Weathering & Climate**

***Ft. Ellis lab report due Oct. 24, 9 am***

***Reading: Birkeland Ch 10, Climate-soil relations***

*Lectures:*

 October 22: Global soil variation with climate

 October 24: Arid soil variation with climate

 October 26: Weathering finale

***Field trip Friday Oct 26: Lutz Farm/restoration site***

**Week 10: Student presentations**

 October 29: four presentations

 October 31: four presentations

 November 2: four presentations

***Lutz lab report due Oct 31, 9 am***

**Week 11: Student presentations**

 November 5: four presentations

 November 7: four presentations

 November 9: Take-home themes/discussion

Veteran’s Day holiday Monday 11/12.

**Final Exam: Dec 12 8:00-9:50 am**

**Absence policy:** Three unexpected absences allowed per semester (including sickness). If you know ahead of time that you are going to miss class, and your reason is compelling, please let me know, and I will excuse the absence if appropriate.

**Late work policy:** I expect you to turn in work on time, and I will make every effort to return graded work within one week. Grades will reflect a lateness deduction of 5%/day.

**D2L:** Class materials including this syllabus, supplemental reading, lecture outlines, and homework assignments will be placed on the D2L site for this course.