

ENVIRONMENTAL GEOMORPHOLOGY

Geography 306

Fall 2012

Instructor: Randall Schaetzl

Office: 128 Geography Building

Office Hours: M, W 1:00 - 2:30 and most other times that I am in my office

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TEXT: Strahler, A.H. and A.N. Strahler. 1992. Modern Physical Geography. 4th ed. Wiley and Sons Publishers. 638 pp.

LECTURES: Tu, Th 3:00-4:20 in Room 214 Berkey Hall

COURSE GOALS: This course is intended for students who have a basic background in physical geography, biology, geology, soils and/or earth science. The major goal of GEO 306 is to provide students with an understanding of the evolution of Earth's physical landscape, so that they can later utilize this knowledge in making sound and intelligent environmental decisions. At many universities, a course like this would simply be called "Landforms", and that title would be appropriate here too.

Emphasis in the course will be on process vs form, with the premise that a knowledge of one may allow for accurate estimation of the other. That is, in order to understand what you see (the landforms that are there) in the natural world, you must also know how those landforms could have formed - the processes that have shaped them. Knowledge of process and form may allow one to make inferences about the two in a spatial sense: this is the essence of geographical geomorphology. The dating and composition of landforms and sediments will be stressed in this class. I will attempt to help everyone understand why knowledge of landform and surface ages is important to land management. Examples of environmental management and mismanagement of the physical landscape will permeate but not dominate the course lectures and readings.

REQUIREMENTS:

General: Regular attendance is assumed, though not taken or checked. Expectations (and the final course curve) for graduate students will be the same as for undergraduates, except that any graduate students will be expected to participate in **all** field trips.

Readings: Most readings will come from the text, which I expect you to have read *before* class!

Exams and Assignments: GEO 306 has three 30-minute exams and a final exam, all of which will be of essay/short answer/definition format, along with some (few) objective questions. The exams will be given during the last half of class, except Exam #1, which you can take all hour to do. **The final exam is cumulative.**

OTHER

Every attempt will be made to use the metric/Celsius systems in GEO 306. Students should familiarize themselves with these systems of measurement.

The use of cell PHONES and COMPUTERS is **not allowed** in the classroom. Students who use these devices will be asked to leave and return to the classroom without them. There are no exceptions to this policy.

Research Paper: Michigan has 91 physiographic regions, all of which can be examined on the physiomap web site: <http://www.physiomap.msu.edu/> All GEO 306 students will write a 100-point research paper on one of these physiographic (landform) regions. The paper constitutes 1/3 of your grade. This is to be a scientific paper written in traditional, scientific paper format. Students are encouraged to visit the site/region and take photographs, explore spatial relationships, etc. **The paper must include more than simple literature review and compilation, and qualitative description.** All papers **must** present, discuss and quantitatively analyze some original data that you have collected from the GIS data layers or from visiting the site. Expectations for graduate students are considerably higher - see me for details.

The paper must be 3-5 pages long, exclusive of references, figures, and tables, with 1-inch margins and 1.5 line-spacing, written in Times New Roman 11-pt font. Number all pages. Citations to literature are encouraged. Choosing a more challenging or large region will be viewed favorably. Deviation from these explicit instructions will result in a loss of points.

The general purpose of this paper is to familiarize you with the potentials of GIS in the field of geomorphology, to get you thinking about landforms on a regional scale, and to apply principles that we have learned in class to the Michigan landscape. The specific goals of the paper are as follows: 1. Use GIS data (and perhaps observations made during a visit) to **describe** the geomorphology, topography, soils, hydrology and sediments of your region. 2. Then, use your knowledge of geomorphology to **interpret** how this landscape evolved, what its major landforms are, and how they formed and interrelate.

Key components of a successful paper include but are not limited to: (a) images captured from the GIS screen, showing some aspect of the region. All images **MUST** be numbered and have a caption. (b) data gathered from the GIS (or on the ground) about the distribution of, or connections between, landforms and sediments in the region. (c) discussions of how and why the region is different from its neighboring regions. The physiomap web page will be helpful, but you **MUST** go beyond what is presented there.

Tasks and due dates:

1. *Selection of research area* (a physiographic region). Students who choose a region (and stick with it, for the final paper) *and* send that information to Dr. Schaeztl by October 1 will receive 3 pts extra credit. Nonetheless, all regions **MUST** be approved, so that no two people are working on the same region this semester.

2. *GIS work.* The GIS work is best done in Room 201 of the Geography Building, where we have ample computing power. Each machine there is equipped with GIS software and the data layers you will need to do your project. In week four, I will hand out a detailed GIS “cheat sheet” and password information that can be used to get you started on the computers, and to help you get used to the software. I will also go over how to use the data and software, in class during that week. I will also make myself available intermittently, in the evenings, during October and November, to help you work on this project.

3. *Draft paper for review.* I will be happy to examine and comment on ONE proofed draft of your paper, or parts of it, provided that it is emailed to me in MS-Word. Because of time constraints, I cannot examine any drafts emailed to me after noon on Nov 30.

Evaluation criteria:

Your finished paper will be graded on several components (approximately as follows):

Writing, grammar and organization.....	40%
Quality of original data and graphics.....	20%
Geomorphology interpretations.....	40%

Papers must be handed in by email in MS-Word format. **The due date for this paper is NOON on December 6th.** Papers handed in after that date will lose 20 points per day. Obviously, this means that papers handed in five days (or more) late will receive a grade of zero, regardless of their content or quality. Exceptions are granted **only** in cases of extreme illness or extenuating circumstances.

Long list of do’s and don’ts – read this again and again!

Quality matters more than quantity. Spelling and grammar **COUNT!** Use of metric and Celsius units will be viewed favorably. All figures and tables should be consecutively numbered and have a title/caption. All

information that is not “common knowledge” must be referenced appropriately - right where the statement is made. References to at least some scholarly works will be viewed most favorably; use of your textbook as a reference is acceptable but additional citations would be better. You may use any reference style that you wish, as long as you are *consistent*. Please **limit** the use of web pages as references to no more than one in four; URLs are generally not acceptable as citations in scientific papers, and thus are only barely acceptable in yours. If you do use web sites, provide the URLs of all the sites from which you may have gathered data or other information.

Each paper must have a clearly written statement of purpose - what are you studying, why are you studying it, and what questions do you hope to answer? Make sure that, at the end of your paper, you actually answer the question and clearly state the results of your study, even if it is a repeat of earlier statements.

I have found that the most common sources of "point loss" for the papers in GEO 306 are (1) lack of appropriate subheadings (*e.g.*, Introduction, Methods, Study Area, Results, etc.), (2) improper referencing or lack thereof, and (3) no maps or figures are included for studies that would have benefitted from them.

I will be checking for plagiarism. If I find evidence of blatant plagiarism this will result in an automatic failing grade in the class and, potentially, dismissal from the University.

Field Trips: Field trips are a very important part of this course; do not count yourself out of them, for anything less than a very important conflict. There will be three field trips in GEO 306; because of the size of the vans we use, each trip can accommodate only 9 students. Bonus points are awarded for students that go on these trips (see below). In all cases, if more than 9 students want to go, the ones with the highest grade going into the trip will be included - sorry. The trips are not required but strongly recommended. Trips are required for graduate students.

Northern Lower Michigan landforms, soils and glacial geomorphology - *worth 15 bonus pts*

The Thumb and landscapes of Glacial Lake Saginaw - *worth 5 bonus pts*

The SW Michigan interlobate region, and the Lake Michigan shoreline and dunes - *worth 5 bonus pts*

To go on a trip, just email me and tell me which trip you are interested in attending. I will compile a list. If you later withdraw from the list it will cost you 5 points, so be sure you are really “in” before you sign up. The Geography Department will cover the cost of transportation. Lunches will be usually be eaten “on the run” from coolers; you will be expected to bring your own food. For the third trip, a 3-day, 2-night trip to the northern lower peninsula of Michigan, lodging and food costs will be covered by the students. We will cook dinners and breakfasts at a house where we will be staying (a beautiful place, on a small lake), to save money. This trip is open to the **first nine students who sign up and pay Dr. Schaetzl a non-refundable, partial payment of \$50 to cover lodging (a balance of something like \$45 will be due after the trip is over).**

GRADING:

A maximum of 300 points can be earned in this course. Grades are based on a curve of the student's *overall point total*. Points are assigned as follows:

First exam.....	40 points
Second exam.....	40 points
Third exam.....	40 points
Final exam.....	80 points
Paper.....	<u>100 points</u>
Total:	300 points

As stated above, BONUS POINTS (Extra Credit) are available for students that participate in field trips and for those who get their region approved before October 1. Students with less than 150 total points will receive a grade of 0.0 - **no exceptions.**

RELATED COURSES

Several other, graduate and advanced undergraduate level, courses are offered at MSU; these courses are related in content to GEO 306. (Courses at the 100-300 level in many other disciplines may be helpful as well, but have been omitted for space purposes.) The courses below may be taken to advance your knowledge of a certain subject area(s) in physical geography and geomorphology. I would be happy to talk to you about these courses, if you have questions.

GEO 401: Geography of Plants of North America

GEO 407: Regional Geomorphology of the United States (offered next spring semester, by Dr Arbogast)

GEO 408: Soil Geomorphology Field Study (offered next fall, by me)

GEO 871: Seminar in Physical Geography (yes, undergrads can and do take 800-level courses)

FOR 409: Forest Hydrology

GLG 412: Glacial Geology and the Record of Climate Change (offered each spring by Dr Larson)

GLG 423: Survey of Environmental Geosciences

GLG 431: Sedimentology/Stratigraphy

GLG 863: Mineral-Water Interactions

RD 201: Issues and Applications in Resource Development

CSS 210: Fundamentals of Soil and Landscape Science

CSS 470: Soil Resources

LECTURE OUTLINE

DATE	TOPICS	READINGS
Aug 30	Introduction, geomorphology and geomorphic surfaces, slopes, soils	
Sep 4	Geomorphic concepts and models: Davis, Penck	330-333; 352-354
Sep 6	Relative dating techniques: weathering and soil formation	
Sep 11	Numerical dating techniques: tephrochronology, ^{10}Be , ^{14}C and OSL	433
Sep 13	Numerical dating techniques, continued	
Sep 18	Rocks vs minerals, bedrock-controlled landforms	214-227; 355-358; 366-377
Sep 20	GIS project; Bedrock-controlled landforms: I. Flat-lying and sedimentary folded rocks	
Sep 25	Bedrock-controlled landforms II. Faulted rocks, basin-and-range topography	348-351
Sep 27	QUIZ 1	
Oct 2	Alluvial fans and bajadas	
Oct 4	Vulcanism and volcanic landforms	246-280
Oct 9	Weathering and geomorphology	281-287
Oct 11	Soil horizons and formation, relative dating using soils	445-450; 455-457
Oct 16	Soil geomorphology, stone lines, pedimentation	
Oct 18	Paleopedology; catch up QUIZ 2	
	Fri-Sun, Oct 19-21 - Field Trip 1 - Northern lower Michigan landforms, soils and glacial geomorphology	
Oct 23	Mass movement	287-297
Oct 25	Fluvial geomorphology: channel initiation and the drainage basin	298-300
Oct 30	Fluvial geomorphology: flow of water in the stream channel	300-304
Nov 1	Fluvial geomorphology: landforms and flooding	322-328; 334-342; 304-308; 328-329
	Friday, Nov 2 - Field Trip 2 - The Thumb and the landscapes and landforms of Glacial Lake Saginaw	
Nov 6	Glaciation: introduction and landforms formed via glacial erosion; QUIZ 3	425-426; 433-434; 441-444
Nov 8	Glaciation: sediments and glacial deposits	427-432
	Saturday, Nov 10 - Field Trip 3 – The SW Michigan interlobate region; the Lake Michigan shoreline and dunes	
Nov 13	Glaciation: depositional landforms	432; 434-436; 409-411
Nov 15	Glaciation: landforms and catch up	
Nov 20	Shorezones, shorelines and coastal processes	378-384
Nov 22	Thanksgiving break	
Nov 27	Coastal geomorphology and coastal systems	385-400
Nov 29	Coastal geomorphology: issues on the Great Lakes	
Dec 4	Karst and solutional landforms; caves	359-361
Dec 6	Eolian systems and the Great Lakes' dunefields	403-409

IMPORTANT DATES

- Oct 1 Last chance to get extra credit for having your paper's "physiographic region" approved
- Dec 6 Papers due at noon
- Dec 10 FINAL EXAM (3:00-5:00)