

# ENVIRONMENTAL GEOMORPHOLOGY

Geography 306

Fall 2006

Instructor: Randall Schaetzl

Office: 128 Geography Building

Office Hours: M-W 9:00 - 12:00 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:** M, W 3:00-4:20 in Rm. 304 Natural Science Building

**COURSE GOALS:** Although this course has no specific prerequisites, it is intended for those 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. Emphasis will be on process *vs* form, with the premise that a knowledge of one may allow for accurate estimation of the other. 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 of landforms and sediments will be stressed. I will attempt to help everyone understand why a 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, with two exceptions: (1) graduate students will be expected to participate in **all** field trips, (2) expectations as per the quality of the research paper will be slightly greater for graduate students.

**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 quizzes and a final exam, all of which will be of essay/short answer/definition format, along with some (few) objective questions. The quizzes will be given during the last half of class. **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.

**Research Paper:** All students will write a 3-4 page (exclusive of references, figures, and tables) research paper on a topic of their choice. This is to be a scientific paper written in scientific paper format.

**The paper must include more than simple literature review and compilation.** Some aspect of *field work with data collection, map (topo, soils, hydrologic, geologic, etc.) interpretation, process measurement, quantitative observational data, or historical geomorphology/land use analysis* **must** be a component of the paper. **All papers must present some original data**, and analyze and interpret that data; papers that do not will be hard-pressed to achieve a passing grade (50%).

It is strongly suggested that the student discuss their paper topic with the professor early in the semester--as often as is necessary - to avoid avenues of research that are inappropriate or may prove to be inappropriate, unfruitful, too involved, too complex, or too simplistic. **ALL students must have a one paragraph (emailed) prospectus regarding your proposed paper topic to Dr. Schaetzl by Nov 1.** These prospectuses will be evaluated and can earn up to 5 bonus points, if well-done and thought-out.

I will be happy to examine and comment on ONE proofed draft of your complete paper, provided that it is typed (please type double-spaced so I can have space to write comments). The paper will be graded on several components (approximately as follows):

|  |     |
|--|-----|
| Research design and scientific method.....         | 40% |
| Neatness, grammar, spelling, writing style, etc... | 30% |
| Quality of original data set.....                  | 10% |
| Organization.....                                  | 10% |
| Imagination and creativity.....                    | 10% |

I will keep the paper you hand in; if you want a copy, please make one for yourself prior to handing it in. Please do NOT hand in papers with plastic-coated pages; it hinders my ability to write comments on the paper directly. I prefer papers to simply be stapled in the upper left corner; there is no need to dress them up in a fancy binder. Excessive length will not improve your grade, and may in fact detract from it.

Quality matters more than quantity. The paper must be handed in **no later than 5:00 p.m. on the last day of lecture (Dec 6)**. 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. Papers must be neatly typed, single-spaced, and all pages must be numbered. Spelling and grammar COUNT! Use of metric and Celsius units will be viewed favorably. All figures and tables should have a title/caption. References to at least some scholarly works **MUST** be included in your paper; use of your textbook as a reference is acceptable but additional citations will be needed. Use of lecture notes as a citation/reference is **not** acceptable. I suggest you use GEOREF or MAGIC2 at the library as search tools to find some sources of work similar to yours. You may use any reference style that you wish, as long as you are consistent. Please **limit** the use of web pages as references; these 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. I will be checking for plagiarism. If I find evidence of blatant plagiarism this may result in an automatic failing grade in the class and, potentially, dismissal from the University. Make your paper look and be organized! I have found that the two most common sources of "point loss" for the papers in GEO 306 are (1) lack of appropriate subheadings (*e.g.*, Introduction, Literature Review, Methods, Study Area, Results, etc.), (2) improper referencing or lack thereof, (3) choice of a paper topic that is inappropriate, *e.g.*, no original data are gathered, and (4) no maps or figures are included for studies that would have benefitted from them. All information that is not "common knowledge" must be referenced appropriately. All papers must have a short but explanatory title page with your name, the date, etc. Examples of good papers completed by students from previous years are located on the "Courses Taught" section of my home page: [http://www.geo.msu.edu/geo333/courses\\_taught.html](http://www.geo.msu.edu/geo333/courses_taught.html)

Please also feel free to stop by my office to browse the stack of old papers that I have on hand.

**Field Trips:** There will be three field trips in GEO 306; each trip can accommodate 9 students. Bonus points are awarded for students that go on these trips (see below). For undergraduates, the trips are not required but strongly recommended. Trips are required for graduate students. Field trips are a very important part of this course; do not count yourself out for anything less than a very important conflict.

Trip 1: SW Michigan interlobate region, and the Lake Michigan shoreline and dunes: Sunday, Sep 17 - *worth 5 bonus points*

Trip 2: The Thumb and landscapes of Glacial Lake Saginaw: Sunday, Oct 8 - *worth 5 bonus points*

Trip 3: Northern lower Michigan landforms, soils and glacial geomorphology: Friday-Sunday, Oct 27-29 - *worth 10 bonus points*

To go on a trip, just email me and tell me which trip you are interested in attending. I will compile a list. Withdrawal from the list will cost 5 points, so be sure you are really “in” before you sign up. For all trips, the Geography Department will cover the cost of transportation. Lunches will be usually be eaten “on the run” from coolers. 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. Schaetzel a non-refundable, partial payment of \$40 to cover lodging (a small balance will be due after the trip is over)**. There will also be at least two one-day field trips. Each of these trips is open to the **first nine students who sign up. Please do not sign up and later withdraw, i.e., be sure you can go before you sign up.**

### **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 quiz.....  | 30 points  |
| Second quiz..... | 30 points  |
| Third quiz.....  | 40 points  |
| Final exam.....  | 100 points |
| Paper.....       | 100 points |
| Total:           | 300 points |

**BONUS POINTS** available for students that (1) participate in field trips, and (2) get in a quality and acceptable term paper prospectus by Nov 1. Students with less than 150 total points will receive a grade of 0.0 - **no exceptions**.

### **RELATED COURSES**

Graduate and advanced undergraduate level courses offered at MSU that are related in content to GEO 306 are listed below. (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: Plant Geography
- GEO 407: Regional Geomorphology of the United States (offered this coming spring)
- GEO 408: Soil Geomorphology Field Study (offered next fall)
- 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
- 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

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| DATE   | TOPICS   | READINGS                           |
|--------|--|------------------------------------|
| Aug 28 | Introduction, geomorphology and geomorphic surfaces, slopes  |                                    |
| Aug 30 | Geomorphic concepts and models: Davis, King, Penck   | 330-333; 352-354                   |
| Sep 6  | Geomorphic thresholds, systems theory  |                                    |
| Sep 11 | Relative dating techniques: weathering and soil formation  |                                    |
| Sep 13 | Numerical dating techniques: tephrochronology, <sup>10</sup> Be, <sup>14</sup> C and OSL                     | 433                                |
|        | Sunday, Sep 17 - Field Trip 1 - SW Michigan interlobate region, and the Lake Michigan shoreline and dunes    |                                    |
| Sep 18 | Numerical dating techniques, continued   |                                    |
| Sep 20 | Rocks vs minerals, bedrock-controlled landforms  | 214-227; 355-358; 366-377          |
| Sep 25 | Bedrock-controlled landforms: I. Flat-lying and sedimentary folded rocks                                     |                                    |
| Sep 27 | Bedrock-controlled landforms II. Faulted rocks, basin-and-range topography                                   | 348-351                            |
| Oct 2  | Alluvial fans and bajada; catch up; QUIZ 1   |                                    |
| Oct 4  | Vulcanism and volcanic landforms   | 246-280                            |
|        | Sunday, Oct 8 - Field Trip 2 - The Thumb and landscapes of Glacial Lake Saginaw                              |                                    |
| 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   |                                    |
| Oct 23 | Mass movement  | 287-297                            |
| Oct 25 | Fluvial geomorphology: channel initiation and the drainage basin   | 298-300                            |
|        | Friday-Sunday, Oct 27-29 - Field Trip 3 - Northern lower Michigan landforms, soils and glacial geomorphology |                                    |
| 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 |
| 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                            |
| 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 | No class- Thanksgiving vacation  |                                    |
| 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                            |

### OTHER IMPORTANT DATES

- Nov 1 One paragraph (emailed) prospectus regarding your proposed paper topic to Dr. Schaetzl
- Dec 6 Papers due to Dr. Schaetzl by 5:00 pm
- Dec 13 FINAL EXAM (12:45-2:45)