Geomorphology EarthSci 3300/5300
Fall 2021

This syllabus is subject to change over the course of the semester…

Lecture:	Mon., Wed., Fri.	10:00 to 10:50	Latham Hall 133
Lab:	Tuesday	14:00 to 15:50	
Professor:	Dr. Chad E. Heinzel		Latham Hall 116/126
Office hours:	M, W, F 9:00 to 9:50, and by appointment		
Office phone:	273-6168		
Email:	chad.heinzel@uni.edu		
Social Media:	Twitter @Ubreccia Facebook: UNI Earth and Environmental Sciences Dept.		
Text:	Key Concepts in Geomorphology by Bierman and Montgomery, 2nd Edition		
Credits:	Four - This course meets the Course Credit Hour Expectation outlined in the Course Catalog. You should expect to work approximately 2 hours per week outside of class for every course credit hour, (so at least 8 hours per week).		
Final Exam:	**Friday, December 10, 10:00-11:50, Latham 133**		

UNI Geomorphology Learning Outcomes –

A. Understand the relationships between the Earth's landforms and the processes responsible for their creation and variability over space and time.
B. Develop the ability to estimate geomorphic rates, landform size/shape, and timing, by employing the laws of conservation (mass, momentum, etc.) through applied mathematics.
C. Understand how geomorphic frequency-magnitudes and processes throughout Earth history, especially the Quaternary have influenced our modern landscapes.
D. Gain an appreciation of how the Earth's Core/structural geology, the sun's energy/its uneven distribution and climatic variability work together to drive geomorphic processes and shape our landscapes.
E. Work to understand the interrelationships between geomorphic processes and products as they relate to and are partially governed by anthropogenic activities.
E. An intermediate knowledge of applied Geographic Information Systems used to delineate and interpret the Earth's Surface.
F. An intermediate knowledge of field methods used to study fluvial and glacial systems in Iowa.

Course Description –

Classification, description, origin, and development of landforms and their relationship to underlying structure and lithology; emphasis on geomorphic processes. Includes fluvial, glacial, periglacial, eolian, karstic, weathering, and mass-movement processes and features. Discussion, 3 periods; labs and field trips, 2 periods. Prerequisite(s): EARTHSCI 1300 (870:031) or GEOG 1210 (970:026); junior standing.

This course focuses on the origin/evolution of landforms and the physical processes responsible for their creation and modification. Each topic will relate to the following recurring themes that we use as guiding principles for the course: laws of conservation, transport rules, and event magnitude/frequency. The course will begin with the "big picture" view of geomorphology (whole-earth shape and the large-scale details of the continents and ocean basins). The variable roles of time, tectonic construction and climatic-driven processes upon Quaternary landscapes common to the Midwest, Glacial, Eolian and Fluvial environments of deposition will be emphasized.

Class Schedule – Subject to minor changes throughout the semester

		Text/Reading
Week One	Earth's Dynamic Surface	Chapter 1
(Aug. 23-27)	A Geomorpholgist's Tool Kit	Chapter 3
L*ab:*	*Developing your Tool Kit*	

Article: Hooke, R.L., 2000, On the history of humans as geomorphic agents: Geologic Society of America, Geology, v.28, no.9, p. 843-846.

Week Two	Structure/Processes/Time	Chapter 1&3
(Aug. 30/3)	A Geomorpholgist's Tool Kit	
Lab:	*Aug. 31, Cedar Valley Field Trip*	

Week Three	Geomorphology and Climate	Chapter 14
(Sept. 6-10)	**Test 1 prep quiz (Friday Sept. 10)**	
Lab:	*Applying soil knowledge, NRCS Soil Surveys*	
	No Class Monday May 6	

Article: Fitch, E.P., and Meyer, G.A., 2016, Temporal and spatial climatic controls on Holocene fire-related erosion and sedimentation, Jemez Mountains, New Mexico: Quaternary Research, v.85, p.75-86.

Week Four	Weathering, Soil Characteristics and Landscapes	Chapter 5 and 6
(Sept. 13-17)	Lab: *Soil characterization and soil lab work*	

Week Five	Gravity, Hillslopes and Mass wasting	Chapter 7
(Sept. 20-24)	Lab: Gros Ventre Landslide, Wyoming	

Week Six	Geomorphic Hydrology and Channels	Chapters 8 and 9
(Sept. 27/1)	**TEST 1 Monday Sept. 27**	
Lab:	Fluvial morphometry	

Weekend Field Trip - *Saturday/Sunday field trip, Jackson County, Iowa*

Week Seven	Channels & Drainage Basins	Chapter 8 and 9
(Oct. 4-8)		
Lab:	*Fluvial morphometry cont.*	

Week Eight	Glacial Geology	Chapter 13
(Oct. 11-15)		

Lab: Glacial Geology of Black Hawk County, Field Trip - *Bad weather back up weekend*

Article: Alley, R.B., et al., Ice-sheet and Sea-level Changes: Science, v.310, p. 356-360

Week Nine	Glacial and	Chapter 13
(Oct. 18-22)	Periglacial Geomorphology	
Lab:	Glacial Geology Lab	

Article - Walters, J.C., 1994, Ice-wedge casts and relict polygonal patterned ground in Northeast Iowa: Permafrost and Periglacial Processes, v.5, p.269-282.

Week Ten	Wind as a geomorphic agent	Chapter 11
(Oct. 25-29)	Lab: Fieldwork at Casey's Paha	

Article: *Mason, J.A., 2015, Up in the refrigerator – Geomorphic response to periglacial environments in the Upper Mississippi River Basin USA: J. of Geomorphology, v.248, p.363-381*

Week Eleven (Nov. 1-5)	Aeolian Deposits of Iowa Lab: Complete Field Report of Casey's Paha	Chapter 11
Week Twelve (Nov. 8-12) Lab:	Tectonic Geomorphology **Test 2, Monday Nov. 8** Coastal landforms	Chapter 15
Week Thirteen (Nov. 15-19)	Coastal Geomorphology Lab: Open	Chapter 10
Week Fourteen	***Thanksgiving Break*** (Nov. 22-26)	
Week Fifteen *(Nov. 29-3)*	Landscape Evolution Lab: Physiographic provinces of Iowa	Chapter 16

Article: Heinzel, C.E., and Kolb, M.J., 2011, Late Holocene Land use on the Island of Sicily: A geoarchaeological perspective, in Human Interactions with the Geosphere: The Geoarchaeological perspective, Wilson, L. (ed.): Geological Society of London, London, England, Special Publication #352, p. 97-107.

Week Sixteen (Dec. 6-10+)	**Final exam (Comprehensive)** **Monday, December 10, 10 to 12, Latham 133**

Grading procedures and policies

A >93%, A->90%
B+>87%, B >83%, B->80%
C+>77%, C >73%, C->70%
D+>67%, D >63%, D->60%
F < 60%

If you earn 93% of the total points you are guaranteed a grade of A. The lower limit for each grade range will not move up. **A curve will not be used in this class.**

There will be no make-up exams after the scheduled exams are given. Should you have a scheduled conflict, please visit with me at least two weeks before the exam date. An unexcused absence during an exam will lead to an automatic zero. If there is an emergency, we will work together on a solution.

Estimated Point distribution

		Points
Tests	#1 @ 100	= 100
	#2 @ 100	= 100
+ Final exam	#3 @ 150	= 150
Homework, Lab & Field reports	200	= 200
	Total =	**550 points**

A = 500; B = 440; C = 385; D = 330

Class Attendance and Participation

Course questions will reflect and cover class 1) discussions, 2) field and lab activities, 3) text/journal readings, and 4) small group activities. Anything I say/discuss is fair game for a quiz or exam. Attendance is essential. If you listen, ask questions, take very good notes, and study for tests chances for earning a good grade are high! And the general guidelines of UNI's attendance policy will be employed, https://policies.uni.edu/306).

UNI – Statements for Student Success

UNI Information and regulations regarding Free Speech, Equity, Accessibility, The Learning Center and potential Covid guidelines should be accessed here… https://provost.uni.edu/syllabus-statements

Additional recommendations from UNI's Center for Excellence in Teaching & Learning

A. Course materials, accessibility and opportunities for enhanced success

a. Textbook – Key Concepts in Geomorphology, will be available from UNI Bookstore, there are options hard or e-copy, choose the one that is right for you.

b. Computers, GIS software and data – Computers and necessary software will be available in the Latham Hall first floor computer lab. The following websites will be useful for gathering GIS & data: 1. https://geodata.iowa.gov/, 2. http://ortho.gis.iastate.edu/ , 3. https://www.iihr.uiowa.edu/igs/geosam/home, 4. https://www.geotree.uni.edu/en/

c. Field trips – There will be multiple Friday field trips and one extended Friday, Saturday, Sunday field trip. Every attempt should be made to attend, participate and learn from these opportunities. At first you will be instructed how to choose and use proper geomorphic tools and conduct geomorphic fieldwork, toward the semester's end you will be expected to apply your knowledge of geomorphic field research on your own and/or in small groups.

d. Course webpage – You will have access to some course materials and additional learning resources through the following webpage - https://www.exploreiowageology.org/UNI_GeoMorph.php

e. UNI-E-Learning – https://elearning.uni.edu/, This software will be used to help you keep track of your course progress - primarily scores from homework, fieldwork, tests, etc.

f. Optional resources

1) Earth Surface Processes, by Philip A. Allen, Blackwell Science
2) Process Geomorphology (5th ed.), by Ritter Kochel and Miller, McGraw Hill
3) Geomorphology (3rd ed.), by Bloom, Prentice Hall
4) Soils and Geomorphology (3rd ed.), by Birkland, Oxford University Press
5) The Little Book of Geomorphology by Robert S. Anderson
http://instaar.colorado.edu/~andersrs/The_little_book_010708_print.pdf

B. Geomorphology classroom civility –

a. Be respectful to everyone at all times.
b. Be on time, pay attention (do not hold side conversations during class), and participate.
c. Represent UNI well when on and off campus.
d. Reduce use and silence phones in class and during field trips.

C. Pro-Tips for doing well in this class

- Everyone learns differently, I will do my best to use effective methods generally help students learn geomorphic concepts, if you are struggling to learn the material, are confused by the structure of our content or just overwhelmed let me know ASAP.
- If you are new to using GIS, ask for additional assistance.
- Do the reading assignments before you come to class! I may ask 2 to 4 test questions directly from the textbook readings - that may not be specifically discussed in class.
- Be a good detective, the concepts that you will be learning are connected, so if you don't understand a concept (early on) make sure you ask questions, because you will be applying that knowledge again and again.
- Take great notes, a lot of information will be coming your way.
- Ask a lot of questions in lecture and lab.

Geomorphology
Fundamental Concepts

Concept 1. The same physical processes and laws that operate today have operated throughout geologic time, although not necessarily always with the same intensity as now. (Uniformitarianism)

Concept 2. Geologic structures are a dominant controlling factor/variable in the evolution of landforms and they are reflected in them.

Concept 3. To a large degree the Earth's surface relief is a product of geomorphic processes operating at differential rates.

Concept 4. Geomorphic processes leave their distinctive imprint upon landforms, and each geomorphic process develops its own characteristic assemblage of landforms.

Concept 5. Various erosional agents force their 'will' upon the Earth's surface producing an orderly sequence of landforms.

Concept 6. Complexity in geomorphic evolution is more common than simplicity.

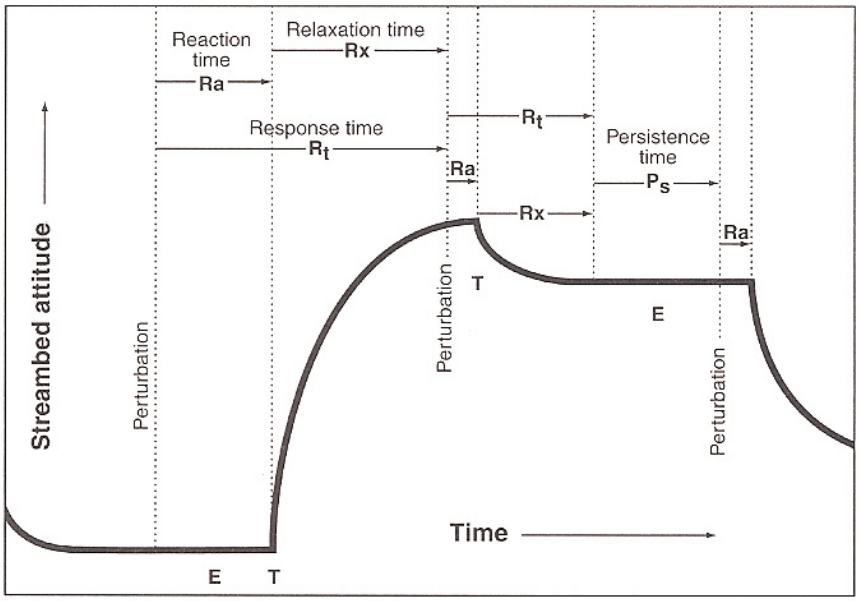
Concept 7. Little of the Earth's topography is older than the Tertiary (66 to 2.6 Ma) and most of it is no older than the Pleistocene (past 2.6 Ma).

Concept 8. Proper interpretation of present-day landscapes is impossible without a full appreciation of the geologic and climatic manifold of changes that occurred throughout the Pleistocene.

Concept 9. An appreciation of the Earth's climatic variance is necessary to form a proper understanding of the evolving importance of its different geomorphic processes.

Concept 10. Geomorphology, although concerned primarily with present-day landscapes, attains its maximum usefulness by historical extension and/or predictive modeling.

After C.L. Matsch



Equilibrium

Geology's 'Big ideas' - You shouldn't leave this class without applying these!

BIG IDEA 1. Geologists use repeatable observations & testable ideas to understand & explain our planet.

1.1 **Earth scientists find solutions to society's needs.** Earth scientists work on challenging problems that face humanity on topics such as climate change and human impacts on Earth. Earth scientists successfully predict hazards to humans and locate and recover natural resources, making possible the flourishing of humans on Earth.

BIG IDEA 2. Earth is 4.6 billion years old.

2.1 Earth's rocks and other materials provide a record of its history. Earth scientists use the structure, sequence, and properties of rocks, sediments, and fossils to reconstruct events in Earth's history. Decay rates of radioactive elements are the primary means of obtaining numerical ages of rocks and organic remains. Understanding geologic processes active in the modern world is crucial to interpreting Earth's past.

BIG IDEA 3. Earth is a complex system of interacting rock, water, air, and life.

3.1 The four major systems of Earth are the geosphere, hydrosphere, atmosphere, and biosphere. The geosphere includes a metallic core, solid and molten rock, soil, and sediments. The atmosphere is the envelope of gas surrounding Earth. The hydrosphere includes the ice, water vapor, and liquid water in the atmosphere, the ocean, lakes, streams, soils, and groundwater. The biosphere includes Earth's life, which can be found in many parts of the geosphere, hydrosphere, and atmosphere. Humans are part of the biosphere, and human activities have important impacts on all four spheres.

BIG IDEA 4. Earth is continuously changing.

4.1 Earth's geosphere changes through geological, hydrological, physical, chemical, and biological processes that are explained by universal laws. These changes can be small or large, continuous or sporadic, and gradual or catastrophic.

BIG IDEA 5. Earth is the water planet.

5.1 Water is found everywhere on Earth, from the heights of the atmosphere to the depths of the mantle. Early in Earth's history, surface water accumulated through both out-gassing from its interior and the capture of some extraterrestrial ice. Water vapor in the atmosphere condensed and rained out as the planet cooled.

BIG IDEA 6. Life evolves on a dynamic Earth and continuously modifies Earth.

6.1 Fossils are the preserved evidence of ancient life. Fossils document the presence of life early in Earth's history and the subsequent evolution of life over billions of years.

BIG IDEA 7. Humans depend on Earth for resources.

7.1 Earth is our home; its resources mold civilizations, drive human exploration, and inspire human endeavors that include art, literature, and science. We depend upon Earth for sustenance, comfort, places to live and play, and spiritual inspiration.

BIG IDEA 8. Natural hazards pose risks to humans.

8.1 Natural hazards result from natural Earth processes.
These hazards include earthquakes, tsunamis, hurricanes, floods, droughts, landslides, volcanic eruptions, extreme weather, lightning-induced fires, sinkholes, coastal erosion, and comet and asteroid impacts.

BIG IDEA 9. Humans significantly alter the Earth.

9.1 Human activities significantly change the rates of many of Earth's surface processes. Humankind has become a geological agent that must be taken into account equally with natural processes in any attempt to understand the workings of Earth's systems. As human populations and per capita consumption of natural resources increase, so do our impacts on Earth's systems.

BIG IDEA 10. Becoming an earth scientist is an extremely meaningful and rewarding career!

Climate Principles - You shouldn't leave this course without applying these!

Principle #1 Humans can take actions to reduce climate change and its impacts.

Actions taken by individuals, communities, states, and countries all influence climate. Practices and policies followed in homes, schools, businesses, and governments can affect climate. Climate-related decisions made by one generation can provide opportunities as well as limit the range of possibilities open to the next generation. Steps toward reducing the impact of climate change may influence the present generation by providing other benefits such as improved public health infrastructure and sustainable built environments.

Principle #2 The Sun is the primary source of energy for Earth's climate system.

Sunlight reaching the Earth can heat the land, ocean, and atmosphere. Some of that sunlight is reflected back to space by the surface, clouds, or ice. Much of the sunlight that reaches Earth is absorbed and warms the planet.

Principle #3 Climate is regulated by complex interactions among components of the Earth system.

Earth's climate is influenced by interactions involving the Sun, ocean, atmosphere, clouds, ice, land, and life. Climate varies by region as a result of local differences in these interactions.

Principle #4 Life on Earth depends on, is shaped by, and affects climate.

Individual organisms survive within specific ranges of temperature, precipitation, humidity, and sunlight. Organisms exposed to climate conditions outside their normal range must adapt or migrate, or they will perish.

Principle #5 Climate varies over space and time through both natural and man-made processes.

Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location. Climate descriptions can refer to areas that are local, regional, or global in extent. Climate can be described for different time intervals, such as decades, years, seasons, months, or specific dates of the year.

Principle #6 Our understanding of the climate system is improved through observations, theoretical studies, and modeling.

The components and processes of Earth's climate system are subject to the same physical laws as the rest of the Universe. Therefore, the behavior of the climate system may be understood and predicted through careful systematic study.

Principle #7 Human activities are impacting the climate system.

The overwhelming consensus of scientific studies on climate indicates that most of the observed increase in global average temperatures since the latter part of the 20th century is very likely due to human activities, primarily from increases in greenhouse gas concentrations resulting from the burning of fossil fuels.

Principle #8 Climate change will have consequences for the Earth system and human lives.

Incidents of extreme weather are projected to increase as a result of climate change. Many locations will see a substantial increase in the number of heat waves they experience per year and a likely decrease in episodes of severe cold. Precipitation events are expected to become less frequent but more intense in many areas, and droughts will be more frequent and severe in areas where average precipitation is projected to decrease.

Source materials =
Geology – www.earthscienceliteracy.org
Climate – www.cleanet.org