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OFFICE OF THE SENATE COUNCIL

1. General Information

1a. Submitted by the College of: ARTS &SCIENCES

Date Submitted: 9/19/2014

1b. Department/Division: Earth and Environmental Sciences

1c. Contact Person

Name: Kent Ratajeski

Email: kent.ratajeski@uky.edu

Phone: (859) 257-4444

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Specific Term/Year [1] Fall 2015

1e. Should this course be a UK Core Course? Yes

Inquiry - Nat/Math/Phys Sci

2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: Yes [4]

2b. Prefix and Number: EES 180

2c. Full Title: Geology of the National Parks

2d. Transcript Title:

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 3

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: The American system of national parks and monuments provides a natural and exciting basis for learning about geology, the scientific study of the Earth. These spectacular, diverse natural classrooms will be used to uncover the origin and variety of Earth materials, probe the dynamic processes that have produced and continue to modify internal and surficial environments over geologic time, critically examine the effects of changing patterns of land use on the natural environment, and recount the conservation efforts that have preserved these unique natural environments for future generations. The course includes a required, two-day (Saturday-Sunday) field trip to Mammoth Cave National Park.

2k. Prerequisites, if any: (none)

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Fall,

Will the course be offered every year?: Yes

If No, explain:

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 25

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: No

Will it be of interest to a significant number of students outside the degree pgm?: Yes

If Yes, explain: The course would satisfy UK Core Requirements (Inquiry in Natural Sciences) and provide elective credits in natural science.

8. Check the category most applicable to this course: Traditional – Offered in Corresponding Departments at Universities Elsewhere,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: No

If YES, name the proposed new program:

b. Will this course be a new requirement for ANY program?: No

If YES, list affected programs:

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: No

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

Distance Learning Form

Instructor Name: Kent Ratajeski

Instructor Email: kent.ratajeski@uky.edu

Internet/Web-based: Yes

Interactive Video: No

Hybrid: No

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations? The bulk of the coursework for EES 180 will be completed online during the fall semester. Since online courses generally require more time management and self discipline on the part of students, regular faculty/student interaction will be a priority and ensured in a number of ways. (1) Emails from students will be returned within 24 hours of receipt. (2) The faculty instructor or an assigned TA will conduct regular "checkups" on student progress throughout the semester, probably making use of the Retention Center within Blackboard to flag and notify students not making suitable academic progress. (3) Student progress through the online material in a timely fashion will be incentivized by comprising a portion of the student's grade. (4) The Academic Alert system will be used to notify academic advisors of their students who are not making suitable progress. Some degree of student-to-student interaction will be achieved in the online environment by (1) requiring students to introduce themselves to the rest of the class in the form of a personal information form (with picture attached), and (2) designing a few interactive and collaborative assignments in which the students will work in small groups. In addition to the above provisions, a required 2-day field trip to Mammoth Cave National Park will be included as part of the course. The planning for this trip is currently underway by Mr. Pete Idstein of the EES Department; details have yet to be finalized, but this trip would likely occur during the last three weeks of the semester. This field trip is designed to facilitate a deeper level of personal interaction among faculty, any TA(s), and the students. As far as I am aware, the attached syllabus meets the University Senate Syllabus Guidelines as well as the SACS syllabus requirements as listed on the UK's Office of eLearning webpage (http://www.uky.edu/elearning/development-resources/sacs-syllabus-requirements), including: (1) instructor's virtual office hours, if any (there aren't--all communication is by email and responses are guaranteed within 24 hours), (2) technological requirements for the course, (3) contact information for UK's Technology Customer Service Center, (4) the procedure for resolving technical complaints, (5) the preferred method for reaching the instructor, (6) the maximum timeframe for responding to student communications, (7) language pertaining to academic accommodations, and (8) information on Distance Learning Library Services.

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc. I (Ratajeski) have based this course on the model of a "Geology of National Parks" class which I previously taught at another institution as a regular face-to-face class. In EES 180, students will watch narrated lecture videos similar to PowerPoint lectures delivered in a regular classroom, and have opportunities to email questions or comments to the instructor. The content of these lectures will be comparable to those delivered in the previously-taught class, but will feature more supplementary material in the form of linked webpages, YouTube videos, etc. Students will read written chapters from the required textbook, submit homework assignments, use review sheets to prepare for exams, and take regular quizzes and exams just as my students in my face-to-face classes.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc. All work for the online portion of the course will be carried out within UK's Blackboard online course management system. Entry into the Bb course page will be restricted to enrolled students and will be password protected. From the syllabus, the policies related to academic integrity are as follows: "Student conduct, academic integrity, and resources: Students are expected to maintain decorum that includes respect for other students and the instructor, to regularly log in to the course, and to display an attitude that seeks to take full advantage of the educational opportunity. I expect students to be prepared to work and actively participate in class activities. Consult the UK Student Rights and Responsibilities (http://www.uky.edu/StudentAffairs/Code/) regarding the steps for addressing unresolved academic issues. Cheating of any type will not be tolerated. Cheating is defined in the Student Handbook of Rights and Responsibilities, but in particular for this course, includes relying too much on another student's work (e.g., simply copying another student's work) and/or using your notes, textbook, the Internet, or other sources of information while taking online exams. The following protocol will be followed should there be evidence of cheating on an assignment: 1. Instructor will discuss the matter confidentially with the student(s) involved; if not satisfactorily resolved, 2. Instructor will discuss the matter confidentially with Department Chair and the student; if not yet resolved, 3. Instructor will discuss the matter confidentially with the Academic Ombud and the student. Based on the outcome of this procedure, instances of cheating may result in a grade of "0" for the assignment and possibly additional penalties including a failing grade for the entire course." While they won't be proctored, online quizzes and exams will use timers (10 minutes for 10-question T/F quizzes and 1 hour for 50-question multiple-choice exams) that should require students to rapidly access (by memory) their knowledge of the material, or risk not completing the assessment. Grades for assessments carried out in this manner in my previous online course (EES 110) are not abnormally inflated, suggesting that this procedure works reasonably well to reduce cheating. Exam questions will be collected randomly for each student using question pools assembled in Bb. When a student submits an online quiz, they will typically receive a percentage score, but will not receive feedback as to what the correct answers were until the deadline for the quiz has passed. For exams, no answers will be divulged, even after the exam date, except at the students request and then only within the confines of my office on the UK campus. These procedures should ensure the integrity of the online assessments of student learning. Some limited feedback will be given to the student after homework assignments are completed, but will be phrased in such a way not to divulge the exact answers, but rather to identify where the student went wrong in the assignment. These procedures should ensure the integrity of the assessment of student learning. For submitted projects involving significant amounts of written text, the instructor will use random Google searches of text selections within the document to check for plagiarism.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above? No.

If yes, which percentage, and which program(s)? (no program)

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting? All students will have access to the instructor (by email), all Distance Learning resources available online, online access to the UK Library (e.g., online journals and electronic databases), as well as potential accommodations obtained through the Disability Resource Center.

6.How do course requirements ensure that students make appropriate use of learning resources? Learning resources (such as access to the instructor, all course materials, digital and physical libraries, the Disability Resource Center, etc.) will be made available to all the students and instructions about accessing these resources will be placed on the syllabus AND discussed in an introductory video lecture.

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program. No special access to laboratories, University facilities, or special equipment is required for a student to complete this course. Most of the coursework will be completed online with the exception of a field trip to Mammoth Cave National Park. For that field trip, we will arrange ground transportation from the UK campus to the park, probably making use of Departmental and/or Motor Pool vehicles and certified drivers (the instructor, any assigned TA, and possibly other drivers available from the EES Department.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)? Students will be informed of these procedures often and repeatedly, both in the syllabus, in an introductory video viewed at the beginning of the course, and throughout the semester in the form of emailed announcements as needed. The relevant sections of the syllabus state as follows: "If you experience technical difficulties with accessing course materials, first contact the UK IT Helpdesk at (859) 218-HELP or by e-mail at helpdesk@uky.edu. Please also inform the instructor when you are having technical difficulties." "If you encounter technical problems when taking an exam, follow these steps as far as is necessary: 1.Log off of Bb, log back in, and start the exam again; it should pick up where you left off. Please note that the exam timer will still be running during the time you were off-line, so do this as quickly as possible. 2.If this doesn't solve the problem, call the UK IT Helpdesk at (859) 218-HELP. 3.If this doesn't solve the problem, email or call the instructor. The instructor will be near a computer and phone during each exam."

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? YES

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology. (answer was "yes")

10.Does the syllabus contain all the required components? YES

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name: Kent Ratajeski

SIGNATURE|MOKER|David P Moecher|EES 180 NEW Dept Review|20140813

SIGNATURE|ACSI222|Anna C Harmon|EES 180 NEW College Review|20141007

SIGNATURE|REBEAT1|Ruth E Beattie|EES 180 NEW UKCEC Expert Review|20150427

SIGNATURE|JMETT2|Joanie Ett-Mims|EES 180 NEW UKCEC Review|20150428

SIGNATURE|JMETT2|Joanie Ett-Mims|EES 180 NEW Undergrad Council Review|20150506

New Course Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Generate R

Open in full window to print or save

Attachments:

Browse... Upload File

	ID	Attachment
Delete	3533	Intellectual Inquiry Natural Physical Mathematical
Delete	3536	GlacierNPmodule.pdf
Delete	3890	EES180online-syllabus-revised2-15f.pdf

First 1 Last

(*denotes required fields)

1. General Information

a. * Submitted by the College of: ARTS & SCIENCES Submission Date: 9/19/2014

b. * Department/Division: Earth and Environmental Sciences

c.

* Contact Person Name: Kent Ratajeski Email: kent.ratajeski@uky.edu Phone: (859) 257-4444

* Responsible Faculty ID (if different from Contact) Email: Phone:

d. * Requested Effective Date: ◯ Semester following approval OR ◉ Specific Term/Year [1] Fall 2015

e.

Should this course be a UK Core Course? ◉ Yes ◯ No

If YES, check the areas that apply:

- ☐ Inquiry - Arts & Creativity
- ☐ Composition & Communications - II
- ☐ Inquiry - Humanities
- ☐ Quantitative Foundations
- ☑ Inquiry - Nat/Math/Phys Sci
- ☐ Statistical Inferential Reasoning
- ☐ Inquiry - Social Sciences
- ☐ U.S. Citizenship, Community, Diversity
- ☐ Composition & Communications - I
- ☐ Global Dynamics

2. Designation and Description of Proposed Course.

a. * Will this course also be offered through Distance Learning? ◉ Yes [4] ◯ No

b. * Prefix and Number: EES 180

c. * Full Title: Geology of the National Parks

d. Transcript Title (if full title is more than 40 characters):

e. To be Cross-Listed [2] with (Prefix and Number):

f. * Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours[3] for each meeting pattern type.

3	Lecture		Laboratory[1]		Recitation		Discussion
	Indep. Study		Clinical		Colloquium		Practicum
	Research		Residency		Seminar		Studio
	Other	If Other, Please explain:					

g. * Identify a grading system:

◉ Letter (A, B, C, etc.)
◯ Pass/Fail
◯ Medicine Numeric Grade (Non-medical students will receive a letter grade)
◯ Graduate School Grade Scale

h. * Number of credits: 3

i. * Is this course repeatable for additional credit? ◯ Yes ◉ No
If YES: Maximum number of credit hours:
If YES: Will this course allow multiple registrations during the same semester? ◯ Yes ◯ No

j. * Course Description for Bulletin:

The American system of national parks and monuments provides a natural and exciting basis for learning about geology, the scientific study of the Earth. These spectacular, diverse natural classrooms will be used to uncover the origin and variety of Earth materials, probe the dynamic processes that have produced and continue to modify internal and surficial environments over geologic time, critically examine the effects of changing patterns of land use on the natural environment, and recount the conservation efforts that have preserved these unique natural environments for future generations. The course includes a required, two-day (Saturday-Sunday) field trip to Mammoth Cave National Park.

k. Prerequisites, if any:

(none)

l. Supplementary teaching component, if any: ◯ Community-Based Experience ◯ Service Learning ◯ Both

3. *** Will this course be taught off campus?** ◯ Yes ◉ No

If YES, enter the off campus address:

4. **Frequency of Course Offering.**

a. * Course will be offered (check all that apply): ☑ Fall ☐ Spring ☐ Summer ☐ Winter

b. * Will the course be offered every year? ◉ Yes ◯ No

If No, explain:

5. *** Are facilities and personnel necessary for the proposed new course available?** ◉ Yes ◯ No

If No, explain:

6. *** What enrollment (per section per semester) may reasonably be expected?** 25

7. **Anticipated Student Demand.**

a. * Will this course serve students primarily within the degree program? ◯ Yes ◉ No

b. * Will it be of interest to a significant number of students outside the degree pgm? ◉ Yes ◯ No

If YES, explain:

The course would satisfy UK Core Requirements (Inquiry in Natural Sciences) and provide elective credits in natural science.

8. *** Check the category most applicable to this course:**

☑ Traditional – Offered in Corresponding Departments at Universities Elsewhere
☐ Relatively New – Now Being Widely Established
☐ Not Yet Found in Many (or Any) Other Universities

9. **Course Relationship to Program(s).**

a. * Is this course part of a proposed new program? ◯ Yes ◉ No

If YES, name the proposed new program:

b. * Will this course be a new requirement [5] for ANY program? ◯ Yes ◉ No

If YES [5], list affected programs::

10. **Information to be Placed on Syllabus.**

a. * Is the course 400G or 500? ◯ Yes ◉ No

If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in **10.b**. You must include: (i) identification of add assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR 3.1.4.)

b. ☑ * The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10** attached.

Distance Learning Form

This form must accompany every submission of a new/change course form that requests distance learning delivery. This form may be required when changing a course already approved for DL **fields are required!**

Introduction/Definition: For the purposes of the Commission on Colleges Southern Association of Colleges and Schools accreditation review, ***distance learning*** is defined as a fo educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instructors the same place. Instruction may be synchronous or asynchronous. A distance learning (DL) course may employ correspondence study, or audio, video, or computer technologies

A number of specific requirements are listed for DL courses. **The *department* proposing the change in delivery method is responsible for ensuring that the requiremer are satisfied at the individual course level.** It is the responsibility of the instructor to have read and understood the university-level assurances regarding an equivalent expe students utilizing DL (available at http://www.uky.edu/USC/New/forms.htm).

Course Number and Prefix:	EES 180	Date:	7/18/2014
Instructor Name:	Kent Ratajeski	Instructor Email:	kent.ratajeski@uky.edu

Check the method below that best reflects how the majority of the course content will be delivered.

Internet/Web-based ☑ Interactive Video ☐ Hybrid ☐

Curriculum and Instruction

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University : Syllabus Guidelines, specifically the Distance Learning Considerations?

   The bulk of the coursework for EES 180 will be completed online during the fall semester. Since online courses generally require more time management and self discipline on the part of students, regular faculty/student

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, i of student learning outcomes, etc.

   I (Ratajeski) have based this course on the model of a "Geology of National Parks" class which I previously taught at another institution as a regular face-to-face class. In EES 180, students will watch narrated lecture videos

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academi policy; etc.

   All work for the online portion of the course will be carried out within UK's Blackboard online course management system. Entry into the Bb course page will be restricted to enrolled students and will be password protected.

4. Will offering this course via DL result in at least 25% or at least 50%* (based on total credit hours required for completion) of a degree program being offered via any f as defined above?

   No.

   Which percentage, and which program(s)?

   (no program)

   *As a general rule, if approval of a course for DL delivery results in 50% or more of a program being delivered through DL, the effective date of the course's DL delivery months from the date of approval.

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom settin

   All students will have access to the instructor (by email), all Distance Learning resources available online, online access to the UK Library (e.g., online journals and electronic databases), as well as potential

Library and Learning Resources

6. How do course requirements ensure that students make appropriate use of learning resources?

   Learning resources (such as access to the instructor, all course materials, digital and physical libraries, the Disability Resource Center, etc.) will be made available to all the students and instructions about accessing these

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

   No special access to laboratories, University facilities, or special equipment is required for a student to complete this course. Most of the coursework will be completed online with the exception of a field trip to

Student Services

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or r the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?

   Students will be informed of these procedures often and repeatedly, both in the syllabus, in an introductory video viewed at the beginning of the course, and throughout the semester in the form of emailed announcements as needed.

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)?

   ◉ Yes
   ○ No

   If no, explain how students enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said techn

   (answer was "yes")

10. Does the syllabus contain all the required components, below? ☑ Yes

    - Instructor's ***virtual*** office hours, if any.
    - The technological requirements for the course.
    - Contact information for Distance Learning programs (http://www.uky.edu/DistanceLearning) and Information Technology Customer Service Center (http://www.uky.edu/UKIT/Help/; 859-218-HELP).
    - Procedure for resolving technical complaints.
    - Preferred method for reaching instructor, e.g. email, phone, text message.
    - Maximum timeframe for responding to student communications.
    - Language pertaining academic accommodations:

- "If you have a documented disability that requires academic accommodations in this course, please make your request to the University Disability Resour The Center will require current disability documentation. When accommodations are approved, the Center will provide me with a Letter of Accommodatior details the recommended accommodations. Contact the Disability Resource Center, Jake Karnes, Director at 859-257-2754 or jkarnes@email.uky.edu."

- Specific dates of face-to-face or synchronous class meetings, if any.
- Information on Distance Learning Library Services (http://www.uky.edu/Libraries/DLLS)
  - Carla Cantagallo, DL Librarian
  - Local phone number: 859 257-0500, ext. 2171; long-distance phone number: (800) 828-0439 (option #6)
  - Email: dllservice@email.uky.edu
  - DL Interlibrary Loan Service: http://www.uky.edu/Libraries/libpage.php?lweb_id=253&llib_id=16

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:
Kent Ratajeski

Abbreviations: DLP = Distance Learning Programs ATG = Academic Technology Group Customer Service Center = 859-218-HELP (http://www.uky.edu/UKIT/Help)

Revised 8/09

[1] Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[2] The chair of the cross-listing department must sign off on the Signature Routing Log.

[3] In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. La meeting, generally, represents at least two hours per week for a semester for one credit hour. (from SR 5.2.1)

[4] You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

[5] In order to change a program, a program change form must also be submitted.

Rev 8/09

Course Review Form
Inquiry in the Natural/Mathematical/Physical Sciences

Reviewer Recommendation
Accept ☐ Revisions Needed ☐

Course: EES 180

Using the course syllabus as a reference, identify when and how the following learning outcomes are addressed in the course. Since learning outcomes will likely be addressed multiple ways within the same syllabus, please identify a representative example (or examples) for each outcome.

☒ Course activities that enable students to demonstrate an understanding of methods of inquiry that lead to scientific knowledge and distinguish scientific fact from pseudoscience.

Example(s) from syllabus:
"What is Science?" lecture

Brief Description:
The origins, structure, and practical operation of the scientific method are introduced in the "What is Science?" lecture video that focuses on the historical origin, definition, limits, philosophical assumptions, and methodologies of natural science. This lecture, which is used in another online course that I teach (EES 110), includes a case study investigating the historical development of divergent ideas about the geological origin of Yosemite Valley proposed by Josiah Whitney and John Muir during the 1860's. This material is especially relevant in the context of national parks and illustrates how scientific hypotheses have been (and still are) proposed and tested in the scientific community.

The difference between science and non-science is also covered during this lecture. For example, students will be shown quotes from various scientists and asked to comment whether what was said was "scientific". For example, I use the following quote by Rachel Carson to illustrate the fact that scientists are flesh-and-blood humans who may speak "unscientifically" by making ethical or moral judgments: "The most alarming of all man's assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials. This pollution is for the most part irrecoverable; the chain of evil it initiates not only in the world that must support life but in living tissues is for the most part irreversible. In this now universal contamination of the environment, chemicals are the sinister and little-recognized partners of radiation in changing the very nature of the world—the very nature of its life" (Carson, 1962).

☒ Course activities that enable students to demonstrate an understanding of the fundamental principles in a branch of science.

Example(s) from syllabus:
(various lectures)

Brief Description:
Fundamental principles underlying the theory and practice of geological and environmental science are covered throughout this course. These include the following:

1. the stewardship ethic – this fundamental ethical principle motivates many working in the environmental sciences to share the responsibility to care for the Earth's natural resources, both for themselves and future generations. This has special significance in the context of national parks.

2. the earth as a system – viewed in this manner, the Earth is seen as a complex system composed of

multi-component parts (water, land, atmosphere, and life); these parts mutually adjust to function as a whole, with changes in one component bringing changes in other components.

3. environmental unity – "The principle of environmental unity, which states that one action causes other in a chain of actions, is an important principle in the prediction of changes in the Earth system. For example, since wolves have been reintroduced into Yellowstone National Park, a trophic cascade involving the behavior of other species in and around vegetated areas near the rivers has resulted in changes to rates of erosion along riverbanks and on floodplains (Ripple and Beschta, 2004).

4. sustainability – this important concept in environmental science takes a long-term view of Earth resources: a sustainable practice of resource use ensures future generations equal access to the resources the planet offers. The removal of certain resources from consumption in areas of national parkland has consequences for future use of those resources and will be examined within the course.

5. uniformitarianism – often summarized by the phrase "the present is the key to the past", this fundamental assumption of historical science allows the study of past events using observations made in the present.

6. the rock cycle – this fundamental principle organizes the geologic materials and processes which operate on Earth and other planets to produce igneous, metamorphic, and sedimentary rocks. It provides the overall structure for the course and dictates the sequence whereby individual topics/parks will be presented (e.g., first igneous geology, than sedimentary, then metamorphic).

7. plate tectonics – this fundamental concept of geology brings into a single unifying theory many diverse phenomena previously thought to be unrelated. Based on the principle that the Earth's lithosphere is broken into plates that are in relative motion, it explains how most of the Earth's volcanic and seismic activity originates and why it occurs where it does. Aspects of plate tectonics will be discussed in detail alongside seeral topics covered within the course (e.g., volcanoes and igneous geology, earthquakes, and mountain-building).

8. geohazards as natural processes – a fundamental theme running through the lectures involving geological hazards (e.g., volcanoes and earthquakes) is the idea that flooding, earthquakes, landslides, and other geohazards are not random, unexplained disasters, but are natural processes which are expected to occur on a life-sustaining planet with active plate tectonics and a water-rich atmosphere. Understanding where and under what conditions these hazards normally occur is important to avoid their negative consequences.

9. timescales of Earth processes - the principle that Earth processes, including formation of natural resources and climate change, occur over specific timescales is crucial to understanding geological features within national parks (e.g., glaciers, beaches, etc.). For example, when studying changes in glaciated terrain, as well as changes to glaciers themselves, which have been brought on by global climate change, it is important to distinguish between "weather" (short-term changes in climate) and various scales of longer-term climate change (e.g., El Nino Southern Oscillations, astronomic Milankovitch cycles controlled by changes in the Earth's orbit and rotational axis, and changes controlled by the position of the Earth's continental landmasses and rates of plate motion).

☒ Course activities that enable students to demonstrate the application of fundamental principles to interpret and make predictions in that branch of science.

Example(s) from syllabus:
"Part 1. Volcanism" (several online lectures under this heading)

Brief Description:
Making predictions concerning the likely severity and impact of geohazards is of particular concern in the context of the national parks. Several of these parks (e.g., Hawaii Volcanoes NP, Yellowstone NP, Mount Rainier NP, Lassen NP, Crater Lake NP) contain active or partially-dormant volcanoes which pose varying risks to surrounding (and in some cases distant) communities. The volcanic hazards associated with all of these examples, as well as concepts such as "recurrence interval", will be included in lecture materials.

☒ Course activities that enable students to demonstrate their ability to discuss how at least one scientific discovery changed the way scientists understand the world.

Example(s) from syllabus:
"Part 1. Volcanism" (several online lectures), "Yellowstone" (online lecture)

Brief Description:
Example 1.
Students will be introduced to the concept of plate tectonics in the first part of the course which introduces volcanic features/processes at national parks. Plate tectonics, the idea that the Earth's lithosphere is broken into about a dozen major pieces whose relative motions are powered by heat flow within the Earth's interior, has brought fundamental changes to the way geologists see the world since the theory was developed during the mid-20th century. Plate tectonics has profound relevance to environmental geology since many geologic hazards (earthquakes, volcanoes, tsunamis, etc.) are closely linked to processes occurring at plate boundaries. Plate tectonics is also of great importance in the study of Earth resources: geologic processes at zones of convergent plate motion (subduction zones) are responsible for generating a variety of economically-important mineral deposits, and tectonic processes (continental rifting, continental collision, etc.) are responsible for the formation of much of the Earth's major fossil fuel deposits.

Because of its central importance as a unifying theory in the earth sciences, the theory of plate tectonics and geologic processes associated with plate boundaries (divergent, convergent, and transform types) are highlighted throughout this course. Tectonic processes related to "recent" motion along convergent and transform plate boundaries are illustrated throughout national parks in the American West, but similar processes, operating a longer time ago, helped form features seen in national parks in other areas (e.g., the Appalachians). While no recent divergent plate margins are on display on the North American continent, the Cenozoic extensional tectonics in the Basin and Range Province will serve as a suitable model to study this type of tectonic activity.

Example 2.
By listening to the online lecture on Yellowstone National Park, students will learn about the remarkable discovery of the thermophllic archaea Thermococcus in a Yellowstone hotspring in 1966. Soon after their discovery, the heat-stable enzymes of thermophiles allowed for a major breakthrough application in biotechnology: two thermophilic species from this genus are now used as sources of the enzyme DNA polymerase, for the polymerase chain reaction (PCR) in DNA fingerprinting. This technique has important applications in paleontology, archaeology, various fields of biology, and medical diagnostics, and forensics. "Astrobiologists, including researchers from NASA, suggest that hot springs all over the world provide some of the best "doorways into early Earth." Many scientists believe that life might have begun roughly 3 billion years ago in high temperature environments and that the first organisms might therefore have been thermophiles. Not only does this give insight into the origin of life on Earth, but opens up a new realm of possibilities for life elsewhere in the universe" (Beal, H., "Microbial Life in Extreme Environments", http://serc.carleton.edu/microbelife/extreme/extremeheat/index.html)

☒ Course activities that enable students to demonstrate their ability to discuss the interaction of science with society.

Example(s) from syllabus:
"National Parks in American History and Society" (online module), "Yellowstone" (online lecture), "Yosemite" (online lecture)

Brief Description:
Example 1.
The "National Parks in American History and Society" online module will introduce the history and importance of the national park system in the United States. Using film clips from Ken Burns' recent film "The National Parks: America's Best Idea" (http://www.pbs.org/nationalparks/), this module will summarize how a once radical idea of conservation, often met with opposition and protest, was transformed into our present national park system and spread to other countries around the world. A part of this module will include an online discussion of a recent New York Times article (http://www.nytimes.com/2014/01/10/us/a-national-park-for-maine-proves-a-hard-gift-to-give.html?_r=0) on controversial efforts to make a new national park in northern Maine. Students will be asked to answer and discuss questions about the article, possibly including: (1) What criteria should be used to determine whether a location should be set aside as a national park?, (2) what are the pro's and con's of making a new national park in this location?, (3) what outcome do you favor in this situation, and how should it be achieved?

Also as part of this module, students will access a NPS website on "National Park Geologic Resources" (http://www.nature.nps.gov/geology/index.cfm) to learn how the national park system faces land-use challenges related to geologic hazards (coastal, fluvial, glacial, volcanic/geothermal, landslides and land subsidence, etc.) and use/preservation of geologic resources (energy, minerals, renewable energy, soils, etc.).

Example 2.
The re-introduction of wolves into Yellowstone National Park nearly a dozen years ago was accompanied by some amount of controversy mainly because of known, negative impacts of wolves on human society (mainly livestock ranching). Students will watch a video (http://www.youtube.com/watch?v=ysa5OBhXz-Q) detailing the ecological and geological changes to Yellowstone river valleys which accompanied the reintroduction of wolves into Yellowstone.

Example 3.
From John Muir in the 1860's to the super-athletes of today, Yosemite Valley has played a central role in the birth and development of modern rock climbing culture, and the unique geology of the valley has influenced the direction and technical development of this challenging sport. Ongoing scientific studies are contributing information on the origin, stability, and eventual erosion (often by potentially dangerous rockslides) of the classic big-wall climbs in the valley. Excerpts from two films ("Vertical Frontier: a History of the Art, Sport, and Philosophy of Rock Climbing in Yosemite" and "National Geographic: Secret Yosemite" will examine the connections between geological science and outdoors adventure.

☒ A hands-on student project is required. This project enables students to demonstrate their ability to conduct a scientific project using scientific methods that include design, data collection, analysis, summary of the results, conclusions, alternative approaches, and future studies. Describe the required student product (paper/ laboratory report) based on the hands-on project.

Current plans call for the use of several (3-4?) modules in PowerPoint and Excel format which are already available within the "Spreadsheets Across the Curriculum" (SSAC) National Parks collection at the Science Education Resource Center (http://serc.carleton.edu/sp/ssac/national_parks/index.html). Developed from an NSF-funded collaboration between several NPS Resource Learning Centers and geoscience educators (most of whom teach "Geology of National Parks" courses), these modules combine geoscience topics at selected national parks with quantitative literacy topics within the form of interactive PowerPoint slides and Excel spreadsheets. I (Ratajeski) have obtained written permission from Dr. Len Vacher at the Univeristy of South Florida to use, with proper acknowledgment, any and all material in these modules for EES 180.

Any one of these modules, with a minimum of additional modifications, would satisfy the "hands-on project" requirement for UK Core. For example, one of the modules I plan to use, in a somewhat modified form, in EES 180 is "Glacier (?) National Park" (attached as a separate file "GlacierNPmodule" supplementing this application) which focuses on determining and interpretating rates of glacial recession within the park in a warming climate regime, using data published in the scientific literature. Core quantitative literacy topics in this module include interpolation and extrapolation, supporting quantitative literacy topics include proportion, percentage, and unit conversion, and core geoscience topics include glacial recession and global climate change. After completing the module, students should be able to (1) define "glacier" and "climate", (2) list evidence for global warming as seen in the parks' glaciers, and (3) know how to interpolate and extrapolate data from a graph. In order to more fully satisfy the UK Core requirements, I plan to add a question asking the students, before they complete the module, to make a hypothesis concerning the longevity of glaciers in Glacier National Park. Their hypothesis will, in effect, be tested by completing the spreadsheet calculations within the module; students will then report whether their results support, modify, or contradict their initial hypothesis.

Reviewers are encouraged to view the file "GlacierNPmodule.ppt" attached to this application. Please note that this file is actually the Instructor's version and that the Excel spreadsheet currently does not load when the Exel icon is clicked (I have notified Dr. Vacher at USF about this and he is working to resolve this issue). However, it should be apparent from the rest of the module what this speadsheet would look like.

☒ Course activities that demonstrate the integration of information literacy into the course.

Example(s) from syllabus:
(various)

Brief Description:
Students will be required to access online resources (UK's Blackboard system); use online Discussion Boards to discuss assigned readings; use email to interact with other students and the faculty instructor; access, read and critique newspaper and magazine articles; access online databases to obtain geological data; read chapters from a textbook; use Excel spreadsheets to carry out simple calculations and make charts and graphs; and use Google Earth to view, manipulate, and interpret 3-D digital topographic models and map overlays.

Reviewer's Comments

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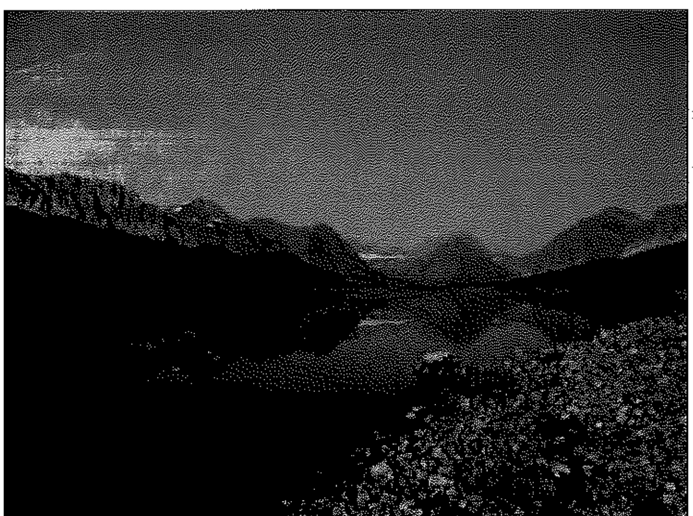
Glacier (?) National Park

Disappearing Glaciers in a Warming Climate



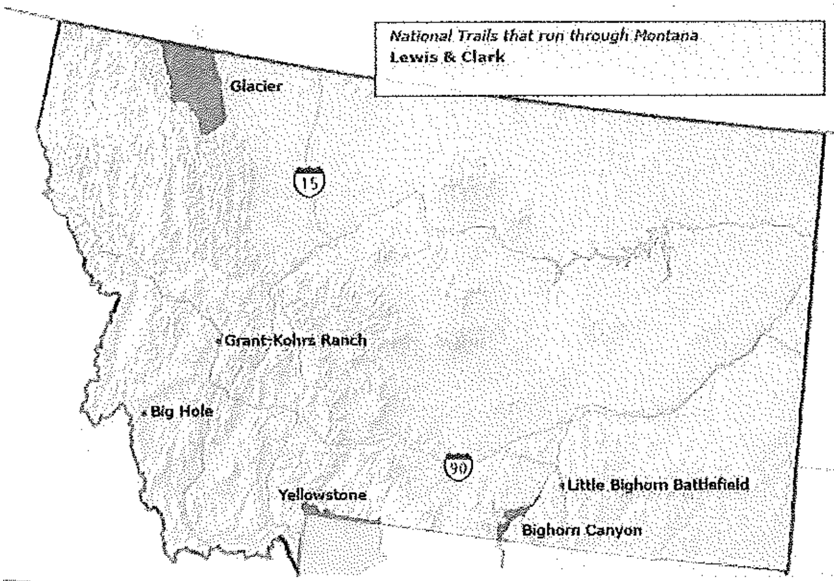
Core Quantitative Literacy Topics
Interpolation and Extrapolation

Supporting Quantitative Literacy Topics
Proportion
Percent
Unit conversion

Core Geoscience Subject
Global change: glacial recession

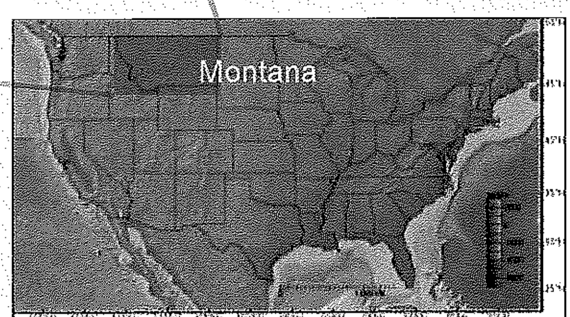
Judy McIlrath
Department of Geology, University of South Florida, Tampa, FL 33620

Getting started



After completing this module you should be able to:

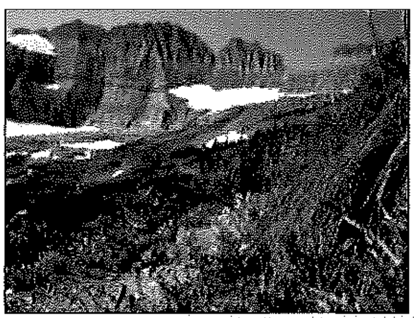
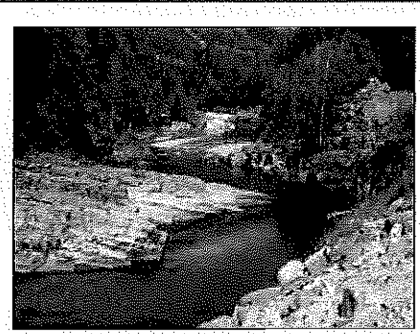
- Define *glacier* and *climate*.
- List evidence for global warming as seen in the park's glaciers.
- Know how to interpolate and extrapolate data from a graph.

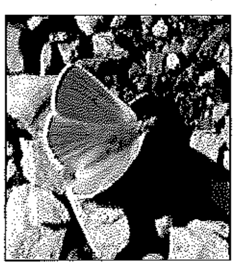


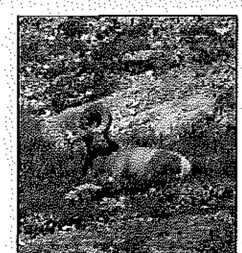
And you should also know where Glacier National Park is.

The setting – Glacier National Park

Glacier National Park is part of the Waterton-Glacier International Peace Park, which was recognized as one of the world's great treasures by being designated a World Heritage Site in 1995. Here, Precambrian (Proterozoic) sedimentary rocks have been thrust upward and eastward and now sit atop younger Cretaceous rocks. More recently, glaciers (huge rivers of ice) have carved these rocks into steep-sided mountains and valleys filled with lakes, rivers, alpine meadows, and old-growth forests. The park is named for these glacial features and the processes that formed them during and since the Ice Ages of the Pleistocene. Now, global climate change threatens to extinguish all that remains of the glaciers.

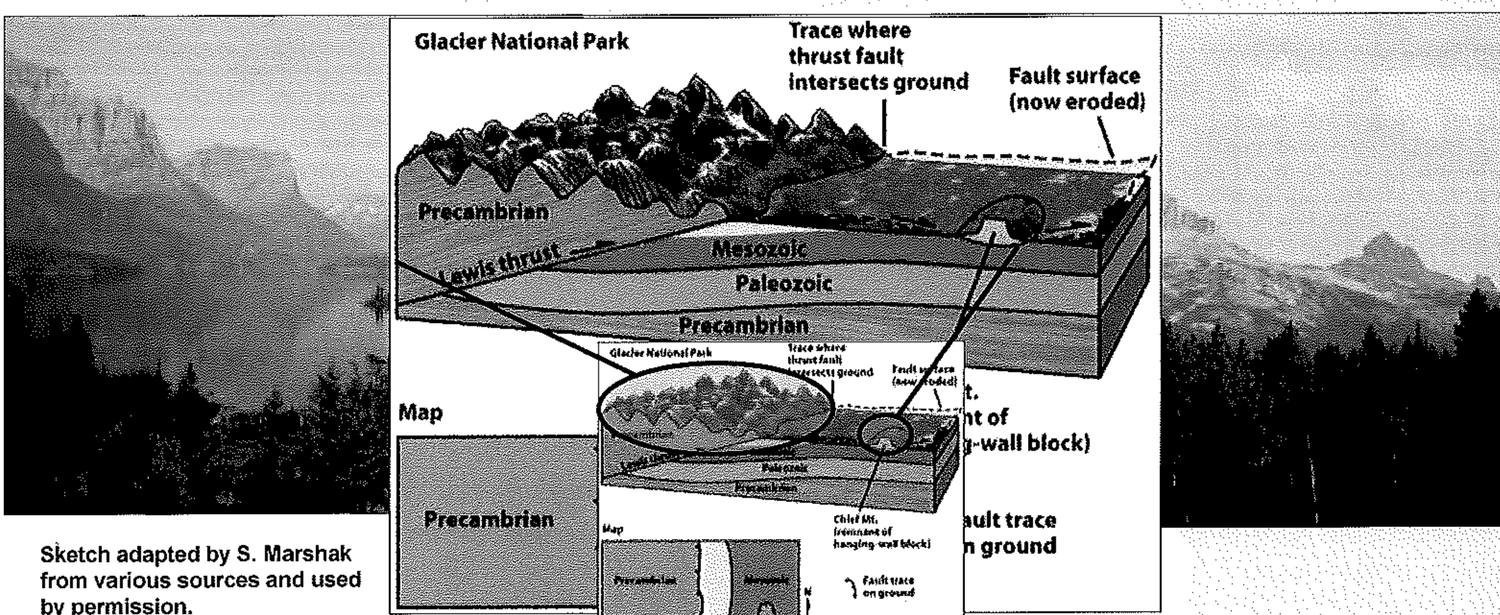




Geology – Lewis Thrust Fault

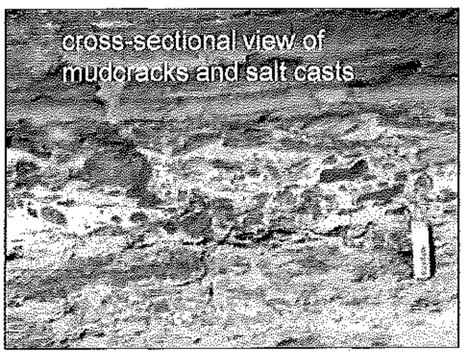
The mountains of Glacier National Park began forming 170 million years ago when compressional forces of colliding crustal plates shoved a huge, relatively strong rock wedge up and over weaker rock. With up to 80 kilometers of displacement, the stronger Precambrian rocks, several miles thick and several hundred miles wide, moved up and over the top of rock layers Cretaceous in age. That's 1,500 million years difference in age! Known as the Lewis Thrust, this structural feature provides insight into the tremendous geologic forces that have shaped our Earth through time. Considerable erosion has occurred on the eastern edge of the thrusted Precambrian rocks, but Chief Mountain, an isolated erosional remnant remains.

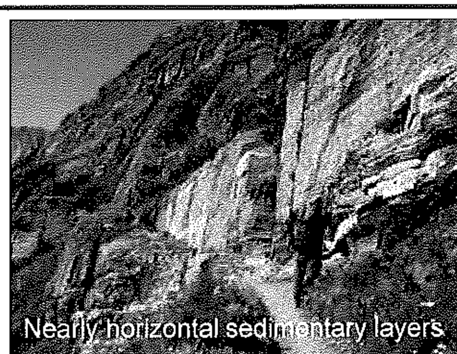


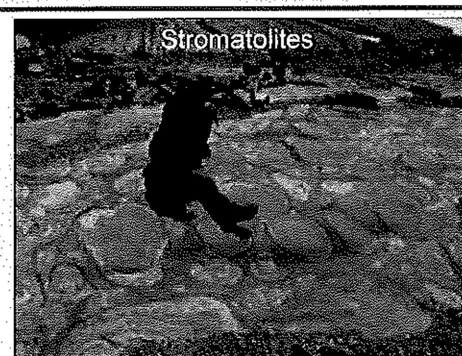
Sketch adapted by S. Marshak from various sources and used by permission.

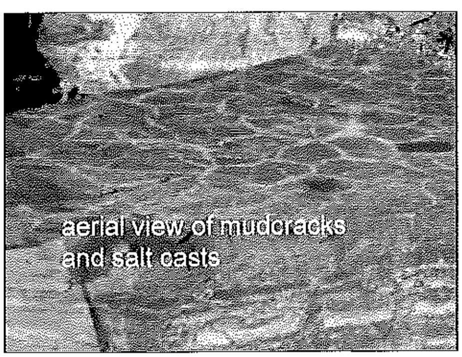
Geology – rock exposures

Globally, Precambrian-age rocks have been extensively altered due to mountain-building processes. But in Glacier National Park, many details of environmental processes, such as mud cracks, ripple marks, and raindrop impressions, that occurred on Earth over a billion years ago remain preserved, along with fossil algae. This makes the park's freshly exposed rocks, due to recent glacial scouring, an outstanding area for scientists to study climate changes through geologic time.





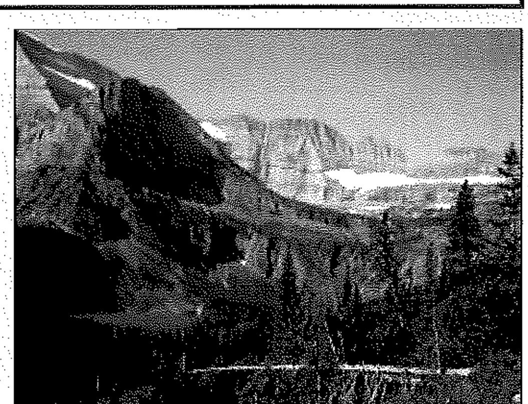


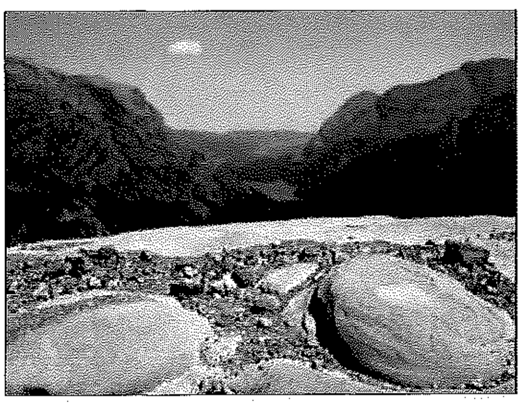


What is a glacier?

The glaciers that carved through the rocks in the park formed thousands of years ago. Glaciers are masses of ice that last year round and flow under the influence of gravity. They form at both high latitudes and high elevations.

Over the past two million years, glaciers formed and melted away due to changes in climate. Around 20,000 years ago the climate was cooler and/or wetter allowing for the growth of glaciers that filled the valleys of the park with thousands of feet of snow so that just the very highest peaks were exposed.





The stromatolites in this photo formed on the seafloor and are now at an elevation of 7,600 ft.

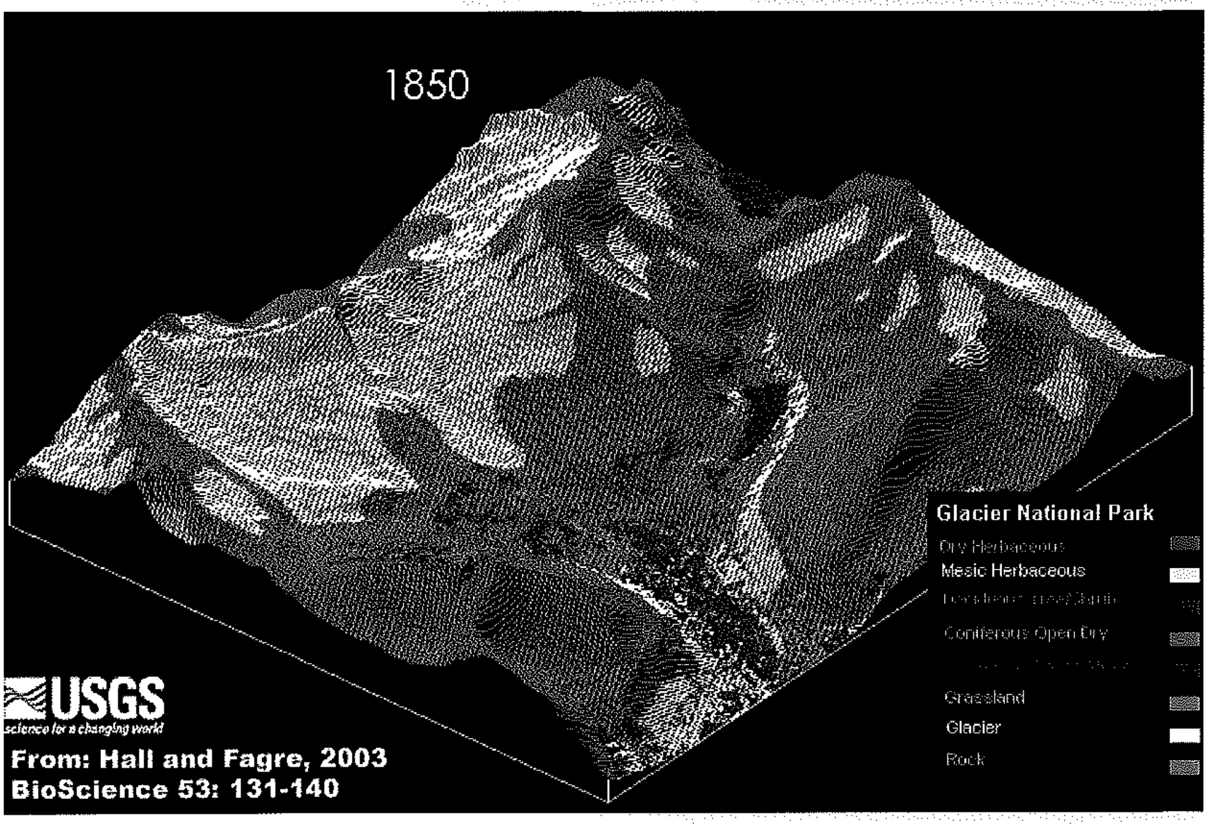
Climate is an average of the weather over some long period of time.

In order, the six hottest years on record since the 1890s are: 2005 (hottest), 1998, 2002, 2003, 2006, and 2004.

Animation of glacier recession

Watch the animation step through time from 1850 to 2100 and note the disappearance of glaciers and the associated environmental changes that occur.

By what year, according to the animation, do the glaciers disappear?



The animation starts automatically in slide show view approximately three seconds after this slide appears and will loop repeatedly until you click to the next slide.

Glacier recession

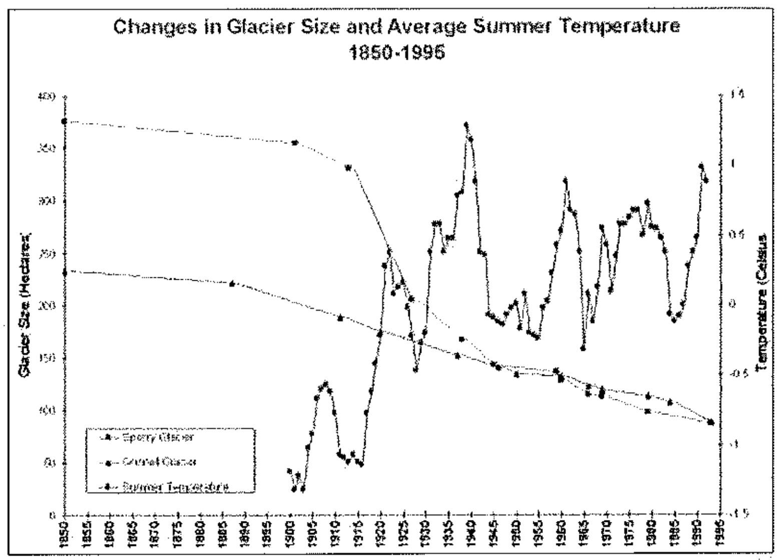
Global climate has changed rapidly with an average increase of 1.5˚F over the past 100 years. While this number may seem insignificant, noticeable changes have occurred in the glaciers in the park. In 1850, glaciers numbered around 150. By 1966, the number dropped to 50 named and unnamed glaciers. As of 2009, 26 glaciers remained. Retreat of Glaciers in Glacier National Park (USGS 2010).

Question 1: Of the 150 glaciers in the park in 1850, what percentage remained in 2009?

Question 2: What is the percent decrease in the number of glaciers from 1850 to 1966 and from 1850 to 2009?

	A	B	C
1	Disappearing Glaciers		
2	Year	Number	
3	1850	150	
4	1966	50	
5	2009	26	
6	Remaining	17	%
7	Change 1850 to 1966	-67	%
8	Change 1850 to 2009	-83	%

Glacier NP TEMPLATE



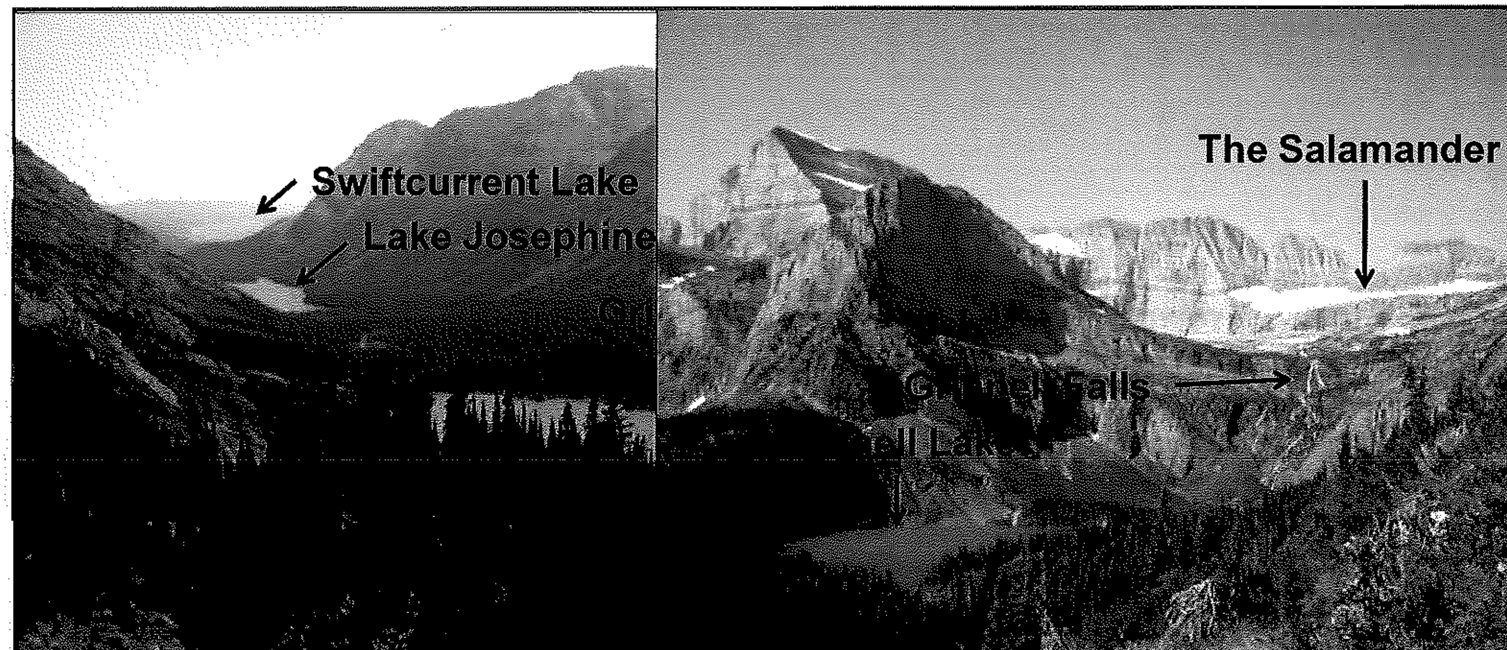
USGS Biological Resources Division, Glacier Field Station, Provisional Data, 1996.

Click on the spreadsheet icon above to access the template for this module. Immediately save the file to your computer to do the calculations.

Enter an Excel formula in each of the orange cells.

Not only have the number of glaciers decreased, but the sizes of the remaining glaciers have greatly decreased as well.

Grinnell Glacier



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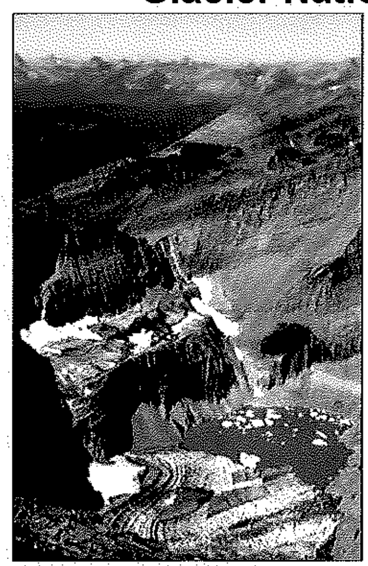
Grinnell Glacier

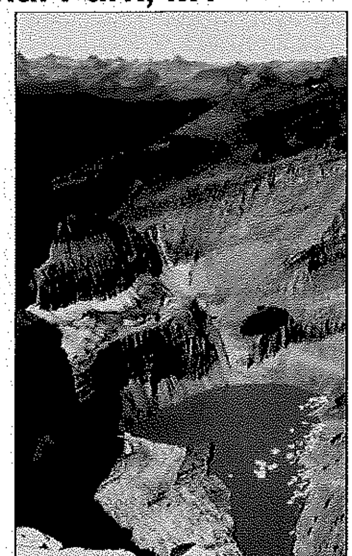
One of the tools that scientists use to monitor changes in glaciers is repeat photography. Scientists use this method to determine the change in **area** of glaciers. Note the visual change in the area of Grinnell Glacier from 1938 to 2006.

Grinnell Glacier
Glacier National Park, MT

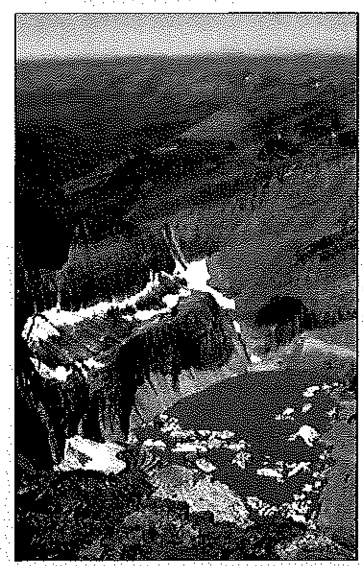
1938 *T. J. Hileman photo Courtesy of GNP Archives*



1981 *Carl Key photo USGS*



1998 *D. Fagre photo USGS*



2006 *Karen Holzer photo USGS*

It is actually better to use **volume** to monitor the health of a glacier, but due to variations in topography and ice thickness, volume is very difficult to determine.

Click here to see other methods used to monitor glaciers.

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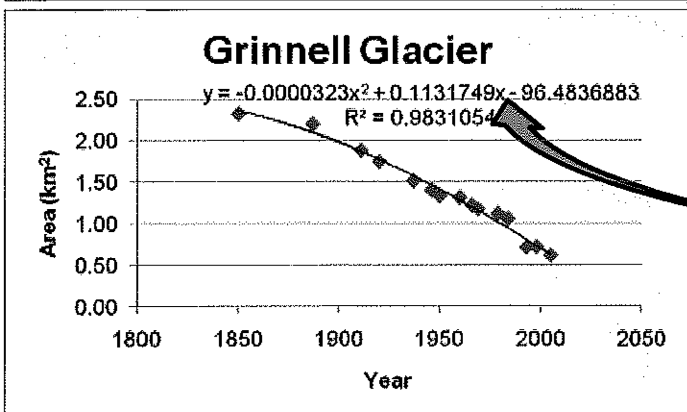
Retreating Grinnell Glacier

The United States Geological Survey (USGS) has area measurements for glaciers within the park as far back as 1850. The graph below plots the area through time for Grinnell Glacier and displays a second-order polynomial equation (a quadratic function) fit to the trend of the data.

Question 3: Using the data provided (m^2), what is the area (km^2, $miles^2$, ft^2) of Grinnell Glacier for each year given?

	A	B	C	D	E
10		Grinnell Glacier Area			
11	Year	(m^2)	(km^2)	($miles^2$)	(ft^2)
12	1850	2,329,918	2.33	0.90	25,081,476
13	1887	2,206,502			
14	1900				
15	1911	1,885,767			
16	1920	1,750,433			



Data were not available for Grinnell for 1900. However, **interpolation**, a means of estimating a value **within** a given set of data, can be used to get an estimate of the area for that year.

Question 4: What is the estimated area (km^2) of Grinnell Glacier for 1900? (interpolate)

	A	B	C
29	Grinnell Glacier area 1900 estimate		
30	Eqtn variables		
31	$x =$	1900	Year
32	$a =$	-0.0000323	
33	$b =$	0.1131749	
34	$c =$	-96.4836883	
35	$y =$	1.95	Area (km^2)

Click here for help with interpolation.

Substitute 1900 into the Excel equation for x and solve for y.

If you wanted to find the year that Grinnell Glacier's area was 1.60 km^2, you would use the quadratic formula and solve the Excel equation for x.

Click here to learn how to obtain and format the equation of a line.

Retreating Grinnell Glacier

The same equation can also be used to extrapolate data. **Extrapolation** is an estimation of the value of a variable **outside** a known data range. One could extrapolate to find the area of Grinnell Glacier in the year 1800 by substituting 1800 in the equation for *x* and solving for *y*. One could also estimate the year in which Grinnell Glacier's area was 2.50 km^2 by substituting 2.50 into the Excel equation for *y* and solving the quadratic formula for *x*.

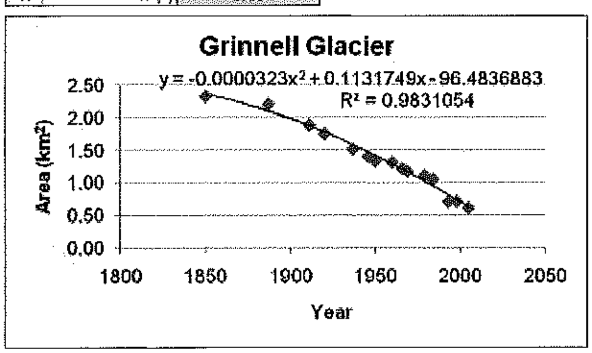
Question 5: Using extrapolation, in what year will ice at what is now Grinnell Glacier be gone (0.0 km^2)?

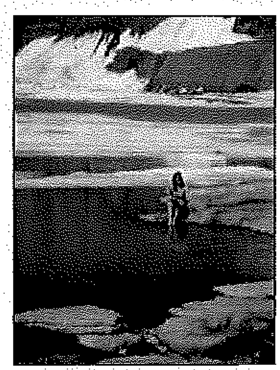
	A	B
37	Year Grinnell Glacier disappears	
38	Set equation to 0:	
39	*c*	-96.4836883
40	*y*	0
41	new value for *c*	-96.4836883
42	Solve equation:	
43	*a*	-0.0000323
44	*b*	0.1131749
45	*c*	-96.4836883
46	*x* (+)	
47	*x* (-)	2039

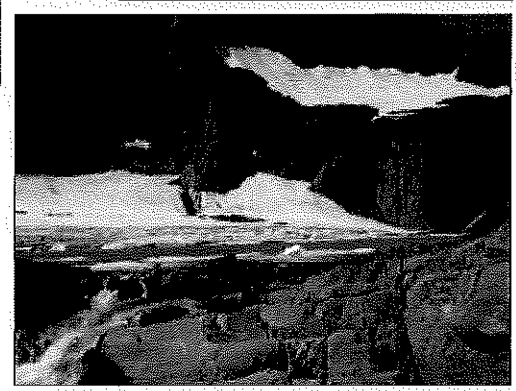
Remember that the quadratic formula contains a ±, so the equation produces two answers. One of them is obviously wrong!

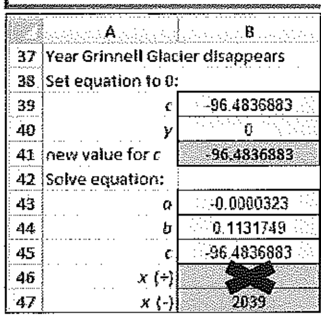
Extrapolation is dangerous. Click here to read Mark Twain's take on it.

Click here for help with extrapolation.





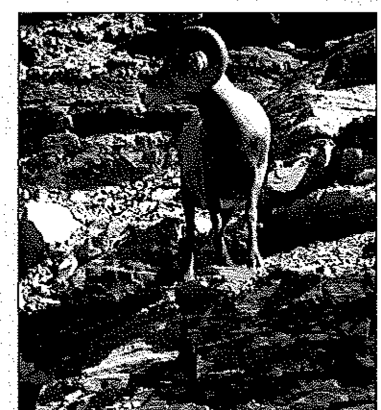




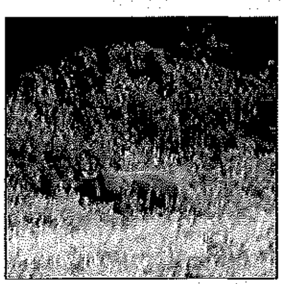
Grinnell Glacier and The Salamander

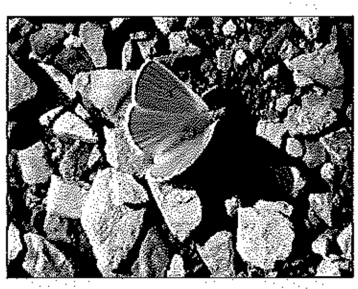
Glacial retreat

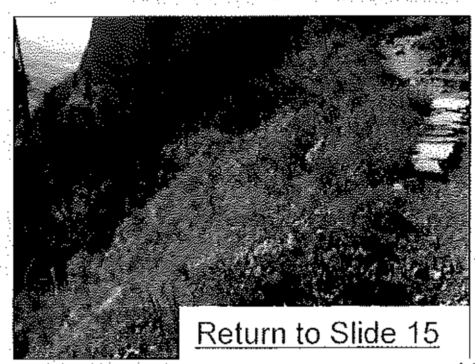
Extrapolation of the data suggest no year-round ice at what is now Grinnell Glacier by the year 2039 (but see End of Module question 5). New findings suggest that If the warming trend continues, glaciers within the park may be gone by 2020. Rapid retreat of mountain glaciers is occurring globally as well. By 2100, Earth's surface could be as much as 10° F warmer than present, causing major changes to biota.



These plants and animals have adapted to the colder climates of high elevations and are especially vulnerable to a warming earth.







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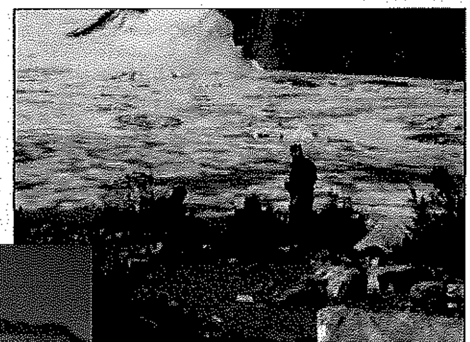
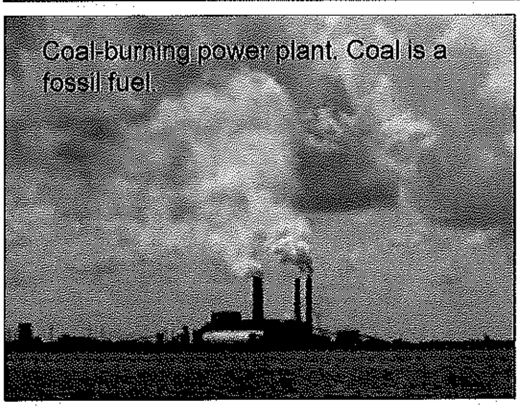
Warming impacts on the hydrologic cycle

The hydrologic cycle will be affected as well. Melt runoff from glaciers in mountain environments provides more than 50% of the world's fresh water supply. Populations downstream depend on this dwindling source not just for drinking water, but also as a means of dilution of pollutants generated at lower elevations. As climate warms, less snow and more rain falls in winter. Spring runoff is happening earlier, leaving less water for the drier months, possibly causing some streams to become intermittent, impacting stream ecology.

Drier climate affects soil moisture and extends the overall fire season.



When fire is too frequent or intense, native species find it more difficult to return.



Coal-burning power plant. Coal is a fossil fuel.

What can you do to help lower greenhouse gas emissions?

Warming trends are not new. The earth periodically goes through climate change, with the last glacial period ending ~10,000 years ago. Greenhouse gases (CO_2, CH_4, N_2O) are thought to play a significant role in the rapid warming climate over the past century. The burning of fossil fuels emits greenhouse gases into the atmosphere, blanketing the earth, and trapping in heat.

End-of-module assignment

After completing each of the spreadsheets in the module, use those same spreadsheets to answer the following questions changing information, values, and units where appropriate:

1. The estimated area of glaciers in North Cascades National Park was 218 km^2 in 1900, 117.3 km^2 in 1958, and 109.1 km^2 in 1998. What per cent of glacial ice remains? What is the per cent decrease in the area of glaciers in the park from 1900 to 1958? From 1900 to 1998?
2. The template includes data for the Sperry Group. What is the area of the Sperry Group in km^2, mi^2, and ft^2.

Create an XY scatter chart of area (km^2) vs. year with a second-order polynomial trendline, equation, and R^2 value and answer the following:

3. Data were not collected in 1865. Using interpolation, what was the area of the Sperry Group for 1865 in km^2? Place this value in cell C13 to calculate the area in m^2, mi^2 and ft^2.
4. Using extrapolation, in which year will the Sperry Group disappear?
5. In Slide 12 we extrapolated to find zero ice at Grinnell Glacier in 2039. Glaciers are no longer considered glaciers when their area diminishes to 25 acres. Recreate the spreadsheet of Slide 12 and use it to find when this will occur at Grinnell Glacier.

Inquiry:

6. Slide 5 has a picture of a geologist sitting on an exposure of stromatolites. What are stromatolites?
7. What other methods are used to monitor glaciers (see link on Slide 10)? Describe one of these other methods.

Critical thinking:

8. Slide 9 states that the Salamander (a glacier) broke away form Grinnell Glacier in 1929, forming two separate glaciers. Which do you think is a better means of determining the state of the glaciers in the park. The number of glaciers or the area of the glacial ice? Why?
9. Slide 13 states that the plants and animals adapted to life at high elevations are especially vulnerable. Why are they?

Percent increase or decrease

A decrease or increase in percentage is calculated with respect to the original value not the final value. The equation is set as follows:

$$\left(\frac{[new\ value]-[original\ value]}{[original\ value]}\right)*100=\%\ increase\ or\ decrease$$

If the new value is greater than the original value, the **percent increase** is calculated. If the new value is less than the original value, the **percent decrease** is calculated.

Example question: If the charge for tuition per credit hour at a university was $38.08 in 1995 and the charge per credit hour was $73.71 in 2007, what is the percent increase?

In this case, the new value is greater than the original value.

$$\left(\frac{[2007\ value]-[1995\ value]}{[1995\ value]}\right)*100=\%\ increase$$

$$\left(\frac{\$73.71-\$38.08}{\$38.08}\right)*100=93.6\%$$

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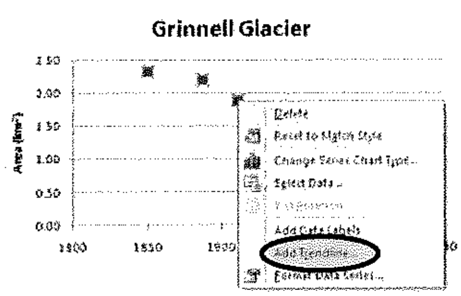
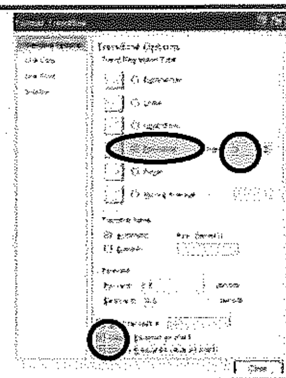
Format the equation of a line

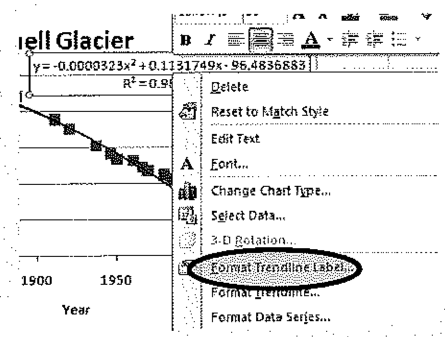
To add a second-order trendline, equation, and R^2 value to an XY scatter plot, place the cursor over one of the data points and right click. Choose "Add Trendline".



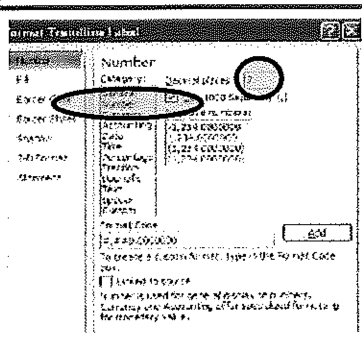
Choose "Polynomial", order:2, and check "Display Equation on Chart" and "Display R-squared Value on Chart".



Click on the equation. A box appears around it. Right click in the box and choose "Format Trendline Label..."



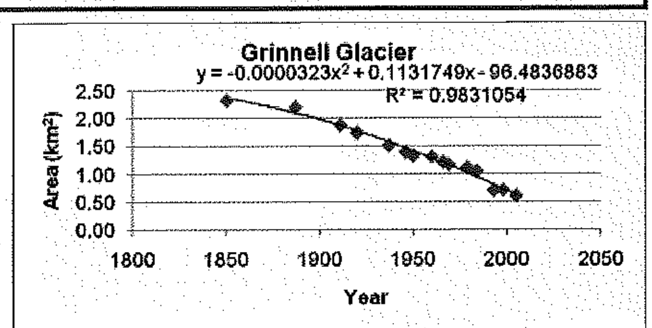
Choose "number" and type 7 in the space for decimal places.



The graph should now display the trendline, equation with seven decimals, and an R^2 value for a second-order polynomial.

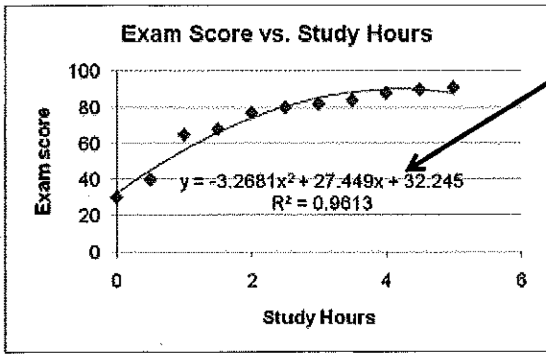
Return to Slide 11

Return to Slide 15



Interpolation and extrapolation

Interpolation is the process of determining a missing value **within** a known set of data points. Data are presented below in the graph indicating the number of hours students study and the test score they receive.



The second-order polynomial equation derived by Excel can be solved for *x* using the quadratic formula to estimate that ~3 hours are needed to study to earn a score of 85 (*y*).

$$85 = -3.2681x^2 + 27.449x + 32.245$$

Set equation to 0:

$$-3.2681x^2 + 27.449x - 52.755 = 0$$

For $ax^2 + bx + c = 0$, the value of x is given by:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Press enter to see the relationship of the variables and values.

	A	B
15	Quadratic Formula	
16	Set equation to 0:	
17	*c*	32.2450
18	*y*	85
19	new value for *c*	-52.7550
20	Solve equation:	
21	*a*	-3.2681
22	*b*	27.4490
23	*c*	-52.7550
24	*x* (+)	2.98

One can also solve the Excel equation to estimate the score a student might earn after studying for 6 hours (*x*).

	A	B
27	Solve Excel equation for y:	
28	*x*	6
29	*a*	-3.2681
30	*b*	27.4490
31	*c*	32.2450
32	*y*	79.3

Which spreadsheet should you use? The answer depends on which variable (*x* or *y*) you are solving for and whether you are interpolating or extrapolating.

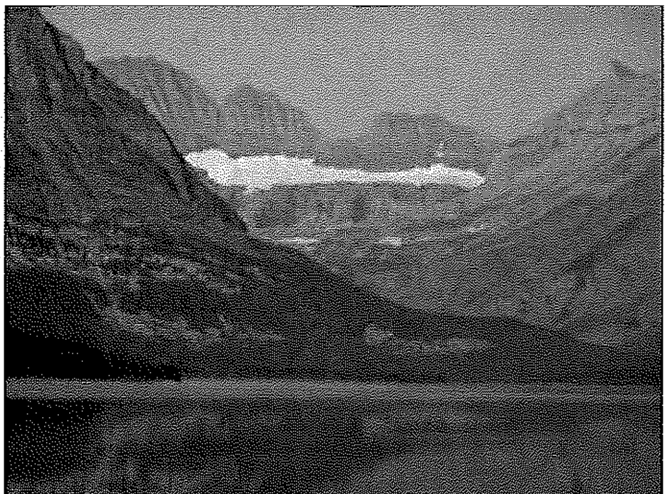
This is an example of **extrapolation**, the process of estimating a value **outside** the known data range. Extrapolation is problematic and more inaccurate than

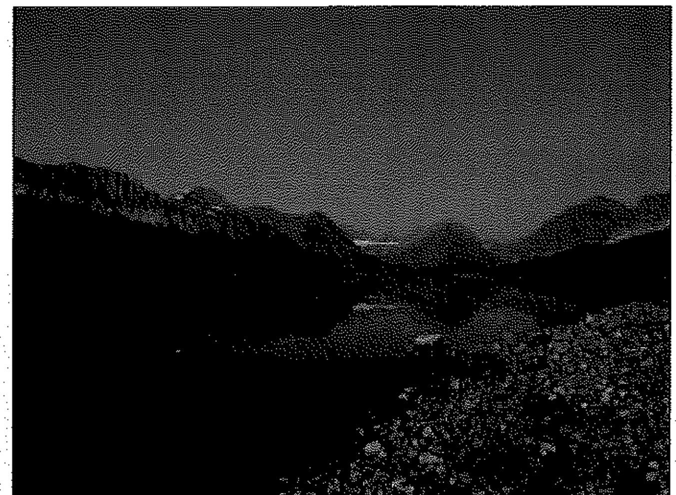
From:http://hood.eas… index.php/Interpolati…

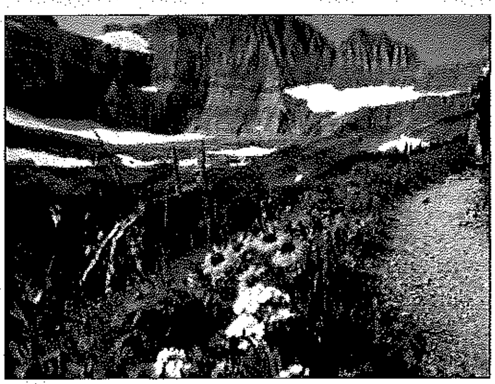
Return to Slide 11

Endnotes

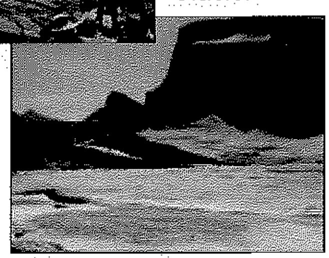
The Salamander from Lake Sherburne



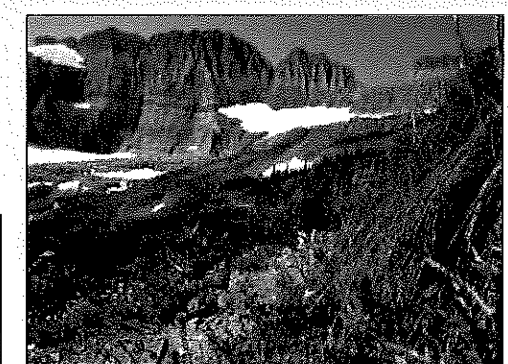




Grinnell Glacier and The Salamander



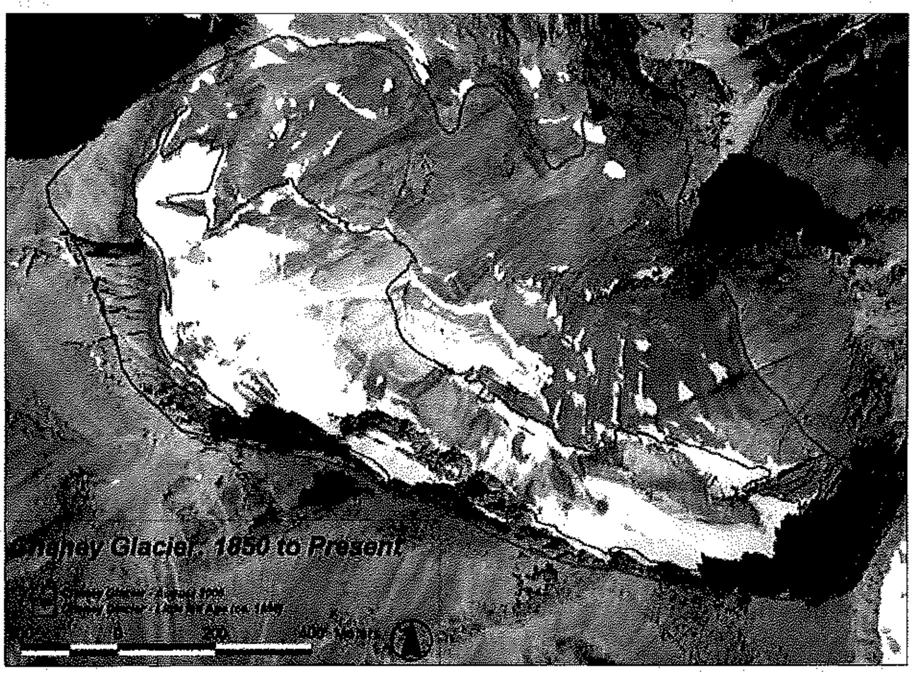
Grinnell Glacier



Grinnell Glacier and The Salamander

Determining the area of a glacier

The extent of the glaciers in 1850 was determined by analysis of terminal moraines. Subsequent years were mapped on the ground by various scientists, or mapped using aerial photography. Recently, area measurements are made by mapping the perimeter of glaciers using high-resolution GPS receivers. Measurements are made in late summer, when the extent of glacial ice is most evident.



Ice mass or flux is a more accurate way to monitor glaciers, but determining these values is quite complicated due to variation in topography and ice thickness. Area measurements are used instead as they are somewhat easier to determine. Significant changes in the ice mass can occur without a significant change in area. Therefore, area measurements alone can be misleading.

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The dangers of extrapolation

EXTRAPOLATION From: http://www.lhup.edu/~dsimanek/twain.htm

The last line of this excerpt from *Life on the Mississippi* is often quoted as an example of the dangers of extrapolation. Here it is in context. One of the Mississippi's oddest peculiarities is that of shortening its length from time to time. If you will throw a long, pliant apple-paring over your shoulder, it will pretty fairly shape itself into an average section of the Mississippi River; that is, the nine or ten hundred miles stretching from Cairo, Illinois, southward to New Orleans, the same being wonderfully crooked, with a brief straight bit here and there at wide intervals. The two-hundred-mile stretch from Cairo northward to St. Louis is by no means so crooked, that being a rocky country which the river cannot cut much.

The water cuts the alluvial banks of the 'lower' river into deep horseshoe curves; so deep, indeed, that in some places if you were to get ashore at one extremity of the horseshoe and walk across the neck, half or three quarters of a mile, you could sit down and rest a couple of hours while your steamer was coming around the long elbow, at a speed of ten miles an hour, to take you aboard again. When the river is rising fast, some scoundrel whose plantation is back in the country, and therefore of inferior value, has only to watch his chance, cut a little gutter across the narrow neck of land some dark night, and turn the water into it, and in a wonderfully short time a miracle has happened: to wit, the whole Mississippi has taken possession of that little ditch, and placed the countryman's plantation on its bank.

Pray observe some of the effects of this ditching business. The Mississippi between Cairo and New Orleans was twelve hundred and fifteen miles long one hundred and seventy-six years ago. It was eleven hundred and eighty after the cut-off of 1722. It was one thousand and forty after the American Bend cut-off. It has lost sixty-seven miles since. Consequently its length is only nine hundred and seventy-three miles at present.

Now, if I wanted to be one of those ponderous scientific people, and 'let on' to prove what had occurred in the remote past by what had occurred in a given time in the recent past, or what will occur in the far future by what has occurred in late years, what an opportunity is here! Geology never had such a chance, nor such exact data to argue from! Nor 'development of species', either! Glacial epochs are great things, but they are vague--vague. Please observe. In the space of one hundred and seventy-six years the Lower Mississippi has shortened itself two hundred and forty-two miles. This is an average of a trifle over one mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the Old Oolitic Silurian Period, just a million years ago next November, the Lower Mississippi River was upward of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And by the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen. There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact.

Mark Twain, *Life on the Mississippi* 173-6 (1883)

Return to Slide 12

The geologic time scale

EON	ERA	PERIOD	EPOCH	Ma
				0
Phanerozoic	Cenozoic	Quaternary	Holocene	0.01
			Pleistocene	1.8
		Tertiary	Pliocene	5.3
			Miocene	23.0
			Oligocene	33.9
			Eocene	55.8
			Paleocene	65.5
	Mesozoic	Cretaceous		145
		Jurassic		200
		Triassic		251
	Paleozoic	Permian		299
		Pennsylvanian		318
		Mississippian		359
		Devonian		416
		Silurian		444
		Ordovician		488
		Cambrian		542
Precambrian: Proterozoic				2,500
Precambrian: Archean				3,800
Precambrian: Hadean				4,600

This scale is provided to show you the ages of the geologic time periods described in this module.

Click here for more information about the geologic time scale.

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Resources for instructors

1. Pre/post Test (Slide 24)
2. Pre/post Test Answer Key (Slide 25)
3. References and Resources (Slide 26)
4. Answer Key for Slides (download from icon, Slide 27)

Pre/Post Test

1. Glacier National Park features:
    a. Mountain landscapes in the Adirondack Mountains of New York.
    b. Prairie lakes in western Nebraska.
    c. Lakes in glacial drift in Minnesota.
    d. Steep-sided mountains and valleys filled with lakes, rivers, alpine meadows, and old-growth forests in Montana.
    e. Coastal marshes along Chesapeake Bay, Maryland.

2. A glacier is ________________
    a. a patch of snow that lasts all winter.
    b. a mass of ice that survives the summer melt and shows signs of flow.
    c. a huge patch of ice that can exist only at high latitudes.
    d. ice that moves material like a bulldozer.

3. Interpolation is used to find a data point ____________ a range of data, while extrapolation is used to find a data point ___________ a range of data.
    a. within, outside
    b. outside, within
    c. within, within (depends on the *xy* values)
    d. outside, outside (depends on the *xy* values)

Pre/Post Test Answers

1. Glacier National Park features:
   a. Mountain landscapes in the Adirondack Mountains of New York.
   b. Prairie lakes in western Nebraska.
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   a. within, outside
   b. outside, within
   c. within, within (depends on the *xy* values)
   d. outside, outside (depends on the *xy* values)

References and Resources

Glacier – climate change handout 0507HO21, National Park Service, U.S. Department of the Interior

Glacier Geology

- http://www.nps.gov/archive/glac/resources/geology.htm#Glaciers

Glacier Monitoring Studies

- http://www.nrmsc.usgs.gov/research/glaciers.htm

US National Park Service (NPS)

- http://www.nps.gov/index.htm

Glacier National Park

- http://www.nps.gov/glac/index.htm

More information about the Geologic Time Scale. USGS

- http://vulcan.wr.usgs.gov/Glossary/geo_time_scale.html

Modeled Climate-Induced Glacier Change in Glacier National Park, 1850-2100

- http://www.nrmsc.usgs.gov/research/glacier_model.htm

The quadratic formula expanded

- http://www.purplemath.com/modules/quadform.htm

North Cascades National Park

- http://www.nps.gov/noca/naturescience/naturalfeaturesandecosystems.htm

Retreat of Glaciers in Glacier National Park (USGS 2010

- http://www.nrmsc.usgs.gov/files/norock/products/GlacierRecession_infosheet2010_SRC_040910.pdf

Instructors Answer Key for Slides

Glacier NP
Instructor
Answer Key.

EES 180 – Geology of the National Parks

Class time and location: With the exception of a two-day fieldtrip to Mammoth Cave, all of the course content, activities, and assessment will be available online. See the information below about accessing the course on Blackboard.

Instructor: Dr. Kent Ratajeski
Slone 301
(859) 321-7537 (cell)
kent.ratajeski@uky.edu
Online office hrs: none, but see below

(TA information will go here)

Email contact is preferred, but communication by phone is also welcome. Responses to emails should be expected within 24 hours upon receipt, unless specified otherwise for special circumstances.

Course description

The American system of national parks and monuments provides a natural and exciting basis for learning about geology, the scientific study of the Earth. These spectacular, diverse natural classrooms will be used to uncover the origin and variety of Earth materials, probe the dynamic processes that have produced and continue to modify internal and surficial environments over geologic time, critically examine the effects of changing patterns of land use on the natural environment, and recount the conservation efforts that have preserved these unique natural environments for future generations. The course includes a required, two-day (Saturday-Sunday) field trip to Mammoth Cave National Park.

Course goals

Students enrolled in this course will be given the opportunity to:

1. gain an appreciation of geologic processes which have shaped the scenic landscapes of the national parks
2. learn about geologic processes currently operating in the national parks and also in more local environments
3. be able to recognize and interpret geologic features and processes in a variety of geologic settings during a future road trip or park visit
4. understand geologic history, particularly in the parks, but also the geologic history of the planet, North America, the Southeast United States, and Kentucky

Student learning outcomes

By the end of the course, you should be able to:

- distinguish modern natural science from classical *scientia*, non-science, and pseudoscience (comprehension)
- practice formulating testable, multiple-working hypotheses (application)
- define and distinguish minerals and rocks (knowledge and comprehension)
- describe the origins of various types of geologic materials (knowledge)
- apply classical geological principles, such as uniformitarianism, superposition, facies changes, as tools to reconstruct past events and processes recorded in the rocks of the national parks (application)
- construct simple cross-sectional diagrams of the three types of plate boundaries (analysis)
- distinguish various types of volcanoes on the basis of their morphology, eruption behavior (explosive vs. effusive), volcanic products (lava flows vs. pyroclastics), and the hazards they pose to human society (comprehension)
- list and describe events that shaped the geological history and development of the North American continent
- use mathematical concepts and formulas, together with Excel spreadsheets, to solve a variety of geologic problems (application and analysis)
- describe the political processes by which areas become protected as national parks, both within the historical context of the past and in today's society
- evaluate the arguments for and against designating an area as a new national park (evaluation)

- explain to a non-scientist some of the scientific methods used to study past, present, and future climate change, using glacial recession as an example
- list and describe various environmental impacts in national parkland (comprehension)
- quantify and evaluate the long-term risks posed by volcanic eruptions, earthquakes, hydrothermal activity, tsunamis, and flooding within several national parks (knowledge, comprehension, and evaluation)

Prerequisites

There are no prerequisites for this course, but a basic knowledge of some high school geography, chemistry, and math will be useful.

Minimal technology requirements and Blackboard course page

In order to participate in this course, you will need access to a computer with the minimum hardware, software and internet configuration. Complete the following steps to make sure your computer is correctly configured and the necessary software is installed. *You will not be able to access course material if you fail to complete these steps.*

1. Go to this site to check the minimum hardware, software and browser requirements for this course: http://wiki.uky.edu/blackboard/Wiki%20Pages/Bb9%20Hardware%20and%20Software%20Requirements.aspx
2. Firefox is the recommended, certified Internet browser for the course, NOT Internet Explorer or Safari. Google Chrome is also compatible, but is not as fully certified as Firefox. Go to https://download.uky.edu/ to download a free version of Firefox. Log in with your Link Blue ID and password and search for Firefox.
3. Go to http://java.com/en/ and click on the Free Java Download button. Run the installer to get the latest version. *Without the latest version of Java, you may not be able to complete the online tests and quizzes.*
4. You will also need Flash, Adobe Acrobat Reader, Windows Media Player, QuickTime and Adobe Shockwave. Go to http://wiki.uky.edu/blackboard/Wiki%20Pages/Browser%20Check.aspx then click BbGO! If you do not have these installed, you can download them from this site.
5. In case you don't already have it, students and faculty can download Microsoft Office Suite (including Word and PowerPoint) from this site: https://download.uky.edu/

Once you have satisfied the minimal technology requirements, you can access the Blackboard page at https://elearning.uky.edu or through MyUK. Log in using your Link Blue ID.

If you experience technical difficulties with accessing course materials, first contact the UK IT Helpdesk at (859) 218-HELP or by e-mail at helpdesk@uky.edu. Please also inform the instructor when you are having technical difficulties.

Textbook

One text is required: *Geology of National Parks, 6th edition*, by Harris, Tuttle, and Tuttle. While my lectures will probably not come directly from this text, there will be a large amount of overlap between the two sources of information. Some of my lectures will refer to figures from the text, and reading the text will help cement the concepts discussed in class. In addition, several questions on each exam will be based on material from the text that was not covered during lecture. In your reading, concentrate on the geologic materials and processes illustrated by each park; you can skip the very detailed "Geologic History" sections at the end of each chapter.

Books may be purchased from a variety of suppliers:

- Kennedy Bookstore, 405 S. Limestone, (859) 252-0331 or 1-800-892-5165, http://www.kennedys.com
- UK Bookstore, 106 Student Center Annex, phone (859) 257-6304 or 1-800-327-6141, http://www.ukbookstore.com
- or any major online bookseller (e.g., amazon.com, bn.com, etc.)

Distance Learning Library Services

As a student of UK's Distance Learning Programs (http://www.uky.edu/DistanceLearning), you have access to Distance Learning Library services at http://www.uky.edu/Libraries/DLLS. This service can provide you access to UK's circulating collections and can deliver to you manuscripts or books from UKs library or other libraries. The DL Librarian (Carla Catagallo) may be reached at 859-257-0500, ext 2171, or 800-828-0439 (option #6) or by mail at dlservice@email.uky.edu. For an interlibrary loan visit:
http://www.uky.edu/Libraries/libpage.php?lweb_id=253&llib_id=16

Exams and assignments

Midterm exams

Material from the online lectures, reading assignments, and homework assignments is fair game for the three online exams. No quantitative problems requiring calculators will occur on any exam. Each midterm exam will consist of 50 questions. All examinations will be available at 7:00 PM on the dates listed below and on the attached schedule. It is your responsibility to make sure that you access the material during that time period. You can access the examination any time during the available time window. For the midterm exams, once you open the exam, you will have 1 hour to complete the exam between 7:00-10:00 PM, so the latest you should begin is 9:00 PM. If you go over the time you will not be able to submit any more answers, but your previous work will be recorded for grading. It is your responsibility to watch the time and submit the examination in time.

Online examinations are closed-book examinations. You cannot access the lecture videos, your textbook, other Internet sites, or any other sources of information when taking an examination, and given the time limits, you will generally not have enough time to do so anyway. You are on your honor to take the examination on your own without the assistance of any other person or materials; violations of this policy will result in a zero grade for the exam. The instructor can access the electronic record of when you access materials from the Blackboard site, and you will receive a 0 if that time coincides with the time you take an exam. Online examinations will be automatically graded and your score will be available immediately. The lowest score from the three regular exams will be dropped from the calculation of your final grade.

If you encounter technical problems when taking an exam, follow these steps as far as is necessary:

1. Log off of Bb, log back in, and start the exam again; it should pick up where you left off. Please note that the exam timer will still be running during the time you were off-line, so do this as quickly as possible.
2. If this doesn't solve the problem, call the UK IT Helpdesk at (859) 218-HELP.
3. If this doesn't solve the problem, email or call the instructor. The instructor will be near a computer and phone during each exam.

The times of the exams are as follows (all times are Lexington, KY time):

Exam 1 – Oct. 8, 7:00-10:00 PM
Exam 2 – Oct. 31, 7:00-10:00 PM
Exam 3 – Dec. 3, 7:00-10:00 PM

If you think there may be a conflict during any of these times with your work schedule, it is your responsibility to make the necessary arrangements well in advance for time off to take the exams at the scheduled times.

Final exam

Material from all of the online lectures, reading assignments, and homework assignments is fair game for the online, comprehensive final exam. No quantitative problems requiring calculators will occur on any quiz or exam.

The final exam is comprehensive and will consist of 100 questions (about half of the material will come from the content covered after Exam 2). For the final exam, you will be given two hours to complete the exam between 7:00-11:59 PM, so the latest you should begin is 10:00 PM. The aforementioned information related to online exams also applies to the final exam.

The final exam will occur on TBA from 7:00-11:59 PM (Lexington, KY time).

Quizzes

Material from the online lectures, reading assignments, and homework assignments is fair game for the six online quizzes. No quantitative problems requiring calculators will occur on any quiz. The purpose of the online quizzes is to encourage you to review your notes on a regular basis and not to wait to learn the material until right before the exam. Each online quiz will be available on Bb sometime soon after the last lecture is given which contains material covered by the quiz, and an announcement that the quiz is ready will be made by email. Quizzes must be submitted by the stated deadline (see schedule). Each quiz will consist of 10 true/false questions answered without the aid of any external source of information (book, notes, internet, other people, etc.) within a span of 10 minutes. Online quizzes will be automatically graded once submitted; your score will be available immediately but the correct answers will not be available until the due date has passed and everyone has taken the quiz. Once midterm grades have been reported, the lowest quiz score will be dropped from the calculation of your running weighted average and final grade.

The due dates of the quizzes are as follows (all times are Lexington, KY time):

Quiz 1 – Sept. 20, 11:59 PM	Quiz 4 – Nov. 1, 11:59 PM
Quiz 2 – Oct. 4, 11:59 PM	Quiz 5 – Nov. 15, 11:59 PM
Quiz 3 – Oct. 18, 11:59 PM	Quiz 6 – Dec. 6, 11:59 PM

Homework exercises

There will be a small number of homework assignments supplementing the lectures. For each assignment, please download the instructions from the EES 110 Bb "Homework Assignments" section. Without an excused absence, late homework will not be accepted and cannot be made up or turned in at a later time. Please note that homework is not completed until you upload your work to the Bb assignment page and click "Submit". I will not accept paper copies or emailed answers. You can work on the homework in small groups (≤ 3), but you must submit your assignment through Bb. Do not let someone else do all the thinking for you or copy someone else's work; the aforesaid rules on cheating and plagiarism apply. Start these assignments early so that you have time to contact me for help if necessary; I may not be able to answer questions about assignments in the 24 hours before an assignment is due. The lowest HW score will be dropped from the calculation of your final grade.

The due dates of the homework exercises are as follows (all times are Lexington KY time):

HW 1 – Sept. 20, 11:59 PM	HW 5 – Nov. 22, 11:59 PM
HW 2 – Oct. 4, 11:59 PM	HW 6 – Nov. 29, 11:59 PM
HW 3 – Oct. 18, 11:59 PM	HW 7 – Dec. 6, 11:59 PM
HW 4 – Nov. 1, 11:59 PM	

Online discussions

Three online discussions (on Blackboard) based on assigned readings will occur throughout the semester. The purpose of these discussions is to include current issues related to the course and to encourage critical thinking and the exchange of ideas related to these issues. For each assigned reading not from your textbook, you are to contribute 3 posts to the relevant discussion forum: 1 post must be a new thread (these are due a few days before the discussion forum closes: see below), and 2 must be replies to existing threads. Further instructions and a grading rubric for these discussions are available on the Bb site in the section "Readings for discussions".

The due dates of the online discussions are as follows (all times are Lexington KY time):

Reading #1 – initial posts due Sept. 16, 11:59 PM; replies due Sept. 20, 11:59 PM
Reading #2 – initial posts due Oct. 28, 11:59 PM; replies due Nov. 1, 11:59 PM
Reading #3 – initial posts due Dec. 2, 11:59 PM; replies due Dec. 6, 11:59 PM

Field trip

A fieldtrip to Mammoth Cave will occur on Saturday and Sunday, Nov. 7-8 (details TBA). Attendance is required, and completion of an interactive worksheet during the fieldtrip will be weighted 10% towards your course grade.

Interpretative Sign Project

A project worth 10% of your course grad and due at the end of term, will require you to design a novel interpretative sign for a specific geologic feature within a national park, seashore, or monument. More details will be made available when this project is assigned in early November.

Relative value of assessments toward course grade

Grades will be calculated as follows:

25%	Exams (3) - lowest score dropped*	10%	Interpretive sign project
20%	HW's (6) – lowest score dropped*	10%	Field trip (attendance+assignment)
15%	Final exam (comprehensive)	10%	Online discussions (3)
10%	Quizzes (6) – lowest score dropped*		

* Low scores will be dropped soon after midterm grades are reported. They will still be visible within your Blackboard grade book, but will not be factored into the calculation of your running weighted average or final course grade.

Course grade

Students will receive a midterm grade sometime between Oct. 14-25 and a final grade at the end of the semester. Weighted average grades will be rounded to the nearest whole number and assigned a letter grade according to the following scale: A = 85-100, B = 75-84, C = 65-74, D = 55-64, and E (or F) = 0-54. No curves will be applied in the grading. A running weighted average will be made available throughout the semester on the Blackboard gradebook, so you can check your grade at any time.

Policies

"Attendance"

With the exception of the two-day fieldtrip to Mammoth Cave, all course materials are online, and it is your responsibility to access the material in a timely manner. To help keep you on track, I have provided a lecture schedule that you should follow. There will also be periodic checkpoints throughout the semester that will help you stay on track.

Excused absences and verification

Missed assignment due dates, quizzes, exams, online discussions, and fieldtrips can be made up only for excused absences related to:

1. Significant illness of the student or serious illness of a member of the student's household (permanent or campus) or immediate family; formal verification must be furnished to allow a makeup.
2. The death of a member of the student's household (permanent or campus) or immediate family; formal verification must be furnished to allow a makeup.
3. Trips for members of student organizations sponsored by an academic unit, trips for University classes, and trips for participation in intercollegiate athletic events. When feasible, the student must notify the instructor prior to the occurrence of such absences, but in no case shall such notification occur more than one week after the absence. Formal notification from appropriate university personnel is required to document the student's participation in such trips and to allow a makeup.
4. Major religious holidays; students are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day for adding a class.

Please note that *conflicts with work schedules are not acceptable reasons for makeups*. Exam times and assignment due dates cannot be changed to accommodate your work schedule.

Make-up opportunities

Credit can be received for excused absences only if you notify Dr. Ratajeski in person, by letter, or by email (must be from your UK email account) within one week of the missed exercise, quiz, exam, or homework due date (there is usually no need to contact me in advance). You must provide the following information: (1) the course you are in (EES 180), (2) the reason for your absence, and (3) formal verification of your absence (this can be in electronic format, or in a paper form that I can keep). If the reason fits one of the criteria above, I will make arrangements to accommodate your situation and extend the deadline for an assignment or online assessment, or provide an alternate assignment in place of the missed fieldtrip. Remember that your lowest quiz, homework, and exam are automatically dropped and not factored into your grade, so it may not be necessary to request a makeup for every one of these missed items.

Submission of assignments

All assignments are to be turned in electronically by the stated deadline via the Blackboard course page. Please see the instructions for each assignment for details. Assignments not turned in by the deadline will receive a zero.

Academic accommodations

If you have a documented disability that requires academic accommodation(s), please see me as soon as possible. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center. The center is located in Room 2, Alumni Gym. If you have not registered with the Disability Resource Center for coordination of campus disability services, please contact the Center by calling (859) 257-2754 or by email to the center director, Jacob Karnes, jkarnes@email.uky.edu.

Academic integrity, cheating, and plagiarism

The University regulations pertaining to this matter can be found at http://www.uky.edu/StudentAffairs/Code/

Of particular relevance is Part II, SELECTED RULES OF THE UNIVERSITY SENATE GOVERNING ACADEMIC RELATIONSHIPS, Section 6.3 that can be found at http://www.uky.edu/StudentAffairs/Code/part2.html

These rules in particular say:

6.3.1 PLAGIARISM All academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work, whether it be published article, chapter of a book, a paper from a friend or some file, or whatever. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain.

6.3.2 CHEATING Cheating is defined by its general usage. It includes, but is not limited to, the wrongfully giving, taking, or presenting any information or material by a student with the intent of aiding himself/herself or another on any academic work which is considered in any way in the determination of the final grade. Any question of definition shall be referred to the University Appeals Board.

The following protocol will be followed should there be evidence of plagiarism or cheating on an assignment:

1. Instructor will discuss the matter confidentially with the student(s) involved; if not satisfactorily resolved,
2. Instructor will discuss the matter confidentially with Department Chair and the student; if not yet resolved,
3. Instructor will discuss the matter confidentially with the Academic Ombud and the student.

Based on the outcome of this procedure, instances of cheating may result in a grade of "0" for the assignment and possibly additional penalties including a failing grade for the entire course.

Group work and student collaborative policy

You are allowed to work in small groups (≤ 3 people) on homework assignments, as long as everyone contributes equally and everyone in the group turns in their own assignment. Do not mindlessly copy answers and/or let someone else do all the thinking for you! This constitutes cheating (see above).

Online behavior, decorum, and civility

Please be respectful of others in the class and engage in civil discourse when topics are discussed that have a diversity of perspectives.

Now you can get started!

Here are the first steps you should take to begin work on this course:

1. Print out a copy of this syllabus for future reference. Make a note of all deadlines (I recommend putting these on a calendar you keep handy).

2. You should check that the e-mail address listed for you at UK is your current e-mail address (it does not have to be a UK address just the e-mail that you regularly use). If it is not your regular e-mail address, then go to TOOLS to change it to your current address (except for Hotmail accounts which sometimes aren't compatible with Bb) and click submit. This is the address that I will use to communicate with you.

3. Download the first lecture and HW assignment. As you work through the course materials, you should take notes the same way you would for a "regular" lecture course. Please be aware that some files that you will be downloading are fairly large and may take a while (several minutes) to download especially if you are accessing the course material using a modem or a slow broadband connection. Given that all course material is delivered through the Internet, occasional problems may arise with accessing course material. If you have problems accessing course material, or if web links appear to be not functioning, please contact me and we will get the problem rectified as quickly as possible.

Good luck, and let me know how I can help you in this class.

Course Schedule

Dates	Lectures and topics	Assignments	Exams, Quizzes, and Field trips
Sept. 2-6	**I. INTRODUCTION** *Introduction* syllabus *What is Science* syllabus, history and philosophy of science, scientific method	HW 1 (due Sept. 20)	
Sept. 7-13	*National Parks in American history and society* the national park system (values, historical development, and contemporary issues)	Reading discussion 1 (due Sept. 16+20)	
Sept. 14-20	**II. VOLCANISM** *Hawaii Volcanoes NP* shield volcanoes, basaltic volcanism, origin of basaltic magma, mantle plumes and hotspots, plate motion		Quiz 1 (due Sept. 20)
Sept. 21-27	*Yellowstone NP* calderas, production of silicic magmas, the Yellowstone hotspot, geothermal features	HW 2 (due Oct. 4)	
Sept. 28-Oct. 4	*Crater Lake NP, Mount Rainier NP, Lassen NP* subduction zones, stratovolcanoes, volcanic domes, volcanic hazards		Quiz 2 (due Oct. 4)
Oct. 5-11	**III. IGNEOUS INTRUSIONS** *Yosemite NP* intrusive rocks, intrusions: plutons, subduction zones, formation of Yosemite Valley, weathering of granite **IV. SEDIMENTATION AND WEATHERING** *Great Sand Dunes NP* production of sediment, sand dunes	HW 3 (due Oct. 18)	Exam 1 (Oct. 8)
Oct. 12-18	*Bryce Canyon NP, Zion NP* sedimentation, sedimentary rocks, erosion		Quiz 3 (due Oct. 18)
Oct. 19-25	*Grand Canyon NP* sedimentary rocks, depositional environments, geologic time *Badlands NP* surficial weathering, soils, fossils	HW 4 (due Nov. 1) Reading Discussion 2 (due Oct. 28+Nov. 1)	

Oct. 26- Nov. 1	*Guadelupe Mountains NP* ancient coral reefs *Carlsbad Caverns NP* limestone caves		Exam 2 (Oct. 31) Quiz 4 (due Nov. 1)
Nov. 2-8	*Mammoth Cave NP* limestone caves, karst hydrology	HW 5 (due Nov. 22)	Mammoth Cave fieldtrip (Nov. 7-8)
Nov. 9-15	**V. MOUNTAINS, METAMORHISM, CRUSTAL DEFORMATION, AND EARTHQUAKES** *Rocky Mountain NP, Grand Teton NP* "young mountains", tectonic history of the mountain West	Project (due Dec. 11)	Quiz 5 (due Nov. 15)
Nov. 16-22	*Pinnacles NP* earthquakes, San Andreas Fault, seismic hazards *Great Smoky Mountains NP* "old mountains", tectonic history of eastern North America	HW 6 (due Nov. 29)	
Nov. 23-29	**VI. COASTAL GEOLOGY** *Cape Hatteras NS* barrier islands, shoreline processes, coastal erosion *Everglades NP* wetlands	Reading Discussion 3 (due Dec. 2+6)	
Nov. 30- Dec. 6	**VII. GLACIERS AND CLIMATE CHANGE** *Glacier NP* glacial erosion, glacial deposits, causes of ice ages, modern climate change	HW 7 (due Dec. 6)	Exam 3 (Dec. 3) Quiz 6 (due Dec. 6)
Dec. 7-13	Review (no lectures)		
TBA			Final exam (TBA)