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Title: Natural History of Yellowstone Natl. Park & the Upper Great Plains (Nat. Hist. YNP & UGP)  
Dept. Prefix: BIOLOGY 451/651 (grad credit for Biology only) or GEOLGY 451 (no grad credit offered for Geology)  
Credits: 3 cr. (fulfills travel requirement for Biology and Environmental Sciences majors)  
Prerequisites: Biology 120 or equivalent or consent of instructor.

Registration: Students cannot add or drop the class on WINS. To register for the course you MUST contact the travel study office at 262-472-1003 or cetravelstudy@uww.edu.

Office Hours: Due to the nature of the course there are no regularly scheduled office hours. You will be in contact with the Teaching Assistant (TA) and me all of the time while we are in the field. When not in the field, you can set up an appointment for non-urgent business. For urgent problems come to either of our motel rooms at any time (please knock) or try my cell phone. We’ll provide cell phone numbers at the start of the course. If you need to contact me prior to the start of the course or after the course has finished I can be reached at my University office address listed above.

Course Objectives: The course is designed to provide a foundation in the techniques of field biology and geology. We will introduce the student to the geology, ecology and natural history of the upper Great Plains, the Black Hills and the Yellowstone region. This course is suitable for biology, geology and environmental sciences majors. Non-majors who have a basic biology or geology background may be admitted at the discretion of the instructor. If you lack the science background and are interested, please see Biology/Geology 250. Biology/Geology 250 is held in Yellowstone and is an introductory, summer field course open to all.

Course Textbook & Supplies:  
1) "Yellowstone Resources and Issues", handed out  
2) A dictionary of geologic terms is recommended only; I’ll have a copy or two. "Dictionary of Geologic Terms", Bates and Jackson is available at the UWW bookstore.  
3) Field Notebook, handed out  
4) You must also purchase a tackle or organizer box for specimen collection. A 2 in. x 8 in. x 14 in., clear plastic box with movable dividers or something similar would work fine.

Attendance Policy: Attendance is mandatory at all times for all activities. This is a field course and you are required to participate in everything we do. Attendance will be part of your grade and missing anything may lower you grade. We can only accommodate absence for illness or injury occurring during the course; there will be no absence for University sponsored events since we are too far away from the University. If you are injured or ill you must inform the instructor immediately. We will then transport you to medical facilities as appropriate.

Grading Policy: A, 90% and up; B, 80 – 89%; C, 70 – 79%; D 60 – 69%. There will not be a curve, and there is no extra credit.

Undergraduate Grading List (BIOLOGY 451 or GEOLGY 451):  
1) 2 Lecture exams: 30% each  
2) 2 Practical exams: 10%  
3) Notebook (see “Notebook” handout): 10%  
4) Field collections: 10%  
5) Class participation: + or – up to 2.5%

Details of Grading:  
1) The 2 written exams will be short answer / essay. They will be given at the K-Z or a motel.  
2) For the 2 practical exams there will be a number of specimens on display. You will need to identify the specimens and answer questions about them. The exams will be given on the same day as the written exams; they are timed.  
3) Compilation of a comprehensive field notebook (see "Notebook" below) will be required of all students.
4) Students will assemble plant, rock and mineral collections from the study areas. The collections will be evaluated for completeness and used as a study aid for the practical and written exam. We will instruct the students as to what may be lawfully collected. We'll collect the notebooks and collections on the return trip to grade them.

5) Class Participation is expected. It is imperative that you stay current with the information given. In other words if we tell you or show you something it is fair game for us to ask you about it later. You will also be asked to discuss and apply information from the assigned readings in the context of fieldwork activities. You also need to participate in all of the activities. If it looks like you don’t know what is going on or you are not participating you may be marked down. Likewise if you show that you are up on the topics and are into it you may be marked up.

Graduate Grading List (BIOLOGY 651):

1) You will be graded as per the “Undergraduate Grading List” above but you will be graded at a higher standard than that expected from an undergraduate (see “Content” and “Intensity” below). The total from the Undergraduate Grading List will be 80% of your final grade.

   Content: Graduate students will be expected to explore the course and readings at greater depth than undergraduates during discussion (see 5 in "Undergraduate Grading List" above). They will also be expected to participate in class discussion more frequently than undergraduates. Graduates will be expected to have a more complete field collection both in specimens and descriptions of specimens (see 4 in "Undergraduate Grading List" above).

   Intensity: In general graduate students will be expected to demonstrate standards that reflect greater intellectual intensity and rigor in all aspects of the course. In class participation (see 5 in "Undergraduate Grading List" above) and during written exams (see 1 in "Undergraduate Grading List" above) they will be graded with this in mind. They will be expected to have a notebook that is more extensive than undergraduates (see 3 in "Undergraduate Grading List" above). When appropriate they will be expected to be leaders in group activities.

2) You will be expected to accomplish an extra assignment as listed below under "Self-directed Study". The total from the extra assignment will be 20% of your final grade.

   Self-directed Study: Graduate students will organize and present a lecture or activity to the class. The presentation should be of about 2 hours in length and demonstrate self-directed learning, outside research and an extensive depth of understanding. Graduate students will consult with the instructors and a topic will be mutually agreed upon at least 1 month prior to the start of the course. Since there is minimal access to research material and there are time limitations while traveling, this presentation must be completed before the start of the course.

For both undergraduate and graduate students: To fully participate, this course requires moderate physical activity. We will be going on hikes at 11,000 ft. elevation, hikes that cover rough, rocky terrain and hikes over areas where there are no trails. Students will be expected to ford and wade in small streams, climb steep hills and in general work in rugged environment. The course cannot be conducted otherwise. For a complete grade students must participate in all activities to the best of their abilities.

The University of Wisconsin-Whitewater is dedicated to a safe, supportive and non-discriminatory learning environment. It is the responsibility of all undergraduate and graduate students to familiarize themselves with University policies regarding Special Accommodations, Academic Misconduct, Religious Beliefs Accommodation, Discrimination and Absence for University Sponsored Events (for details please refer to the Schedule of Classes; the “Rights and Responsibilities” section of the Undergraduate Catalog; the Academic Requirements and Policies and the Facilities and Services sections of the Graduate Catalog; and the “Student Academic Disciplinary Procedures (UWS Chapter 14); and the “Student Nonacademic Disciplinary Procedures" (UWS Chapter 17).
This is a field course and as such field events will determine to a degree what will be taught. We plan to teach numerous basic concepts but we will also rely on opportunities as they present themselves. Due to weather conditions or logistics we may not cover the topic on the day listed but we will cover all of the topics listed.

As stated above, at any time during the course you will be expected to participate in discussions and answer questions on previously presented material or material from the reading. You will be graded on your response.

Note: The actual dates are listed in the “Itinerary”.

Monday, 8/3/15: Discussion of WI and MN biomes, geology, unique vegetation and climate change. As we travel we will point out and discuss formation and significance of the unique features of Wisconsin geology including: the pre-Cambrian Baraboo Hills, Late Wisconsin Glacial features and Cambrian and Ordovician outcrops and structure. We will talk about folding, metamorphism, depositional environments and geomorphology. We will discuss large scale climatic influences such as air circulation cells and the effects of mountain ranges on rainfall. As we progress from east to west we will point out changes in vegetation brought about by these climatic changes. As opportunity presents we will discuss unique biomes of the region such as oak savannas and unique fauna and their adaptations. Any rock, geologic formation, plant or animal that we point out or sample will be expected to be recorded in the student's field notebook. This applies throughout the course.

Tuesday, 8/4/15: During the AM we will travel across North Dakota. We will continue the study of climatic changes and discuss both natural vegetation changes and agricultural changes dictated by the climate change. We will discuss the mid states flyway for migratory water fowl and cover how land use has impacted this resource. We will stop at Theodore Roosevelt National Park and discuss the formations of the badland topography including: deposition of the easily eroded Cenozoic formations, sources of the bedrock (Eocene volcanism and erosion from the Rock Mtn. orogeny). As opportunity presents we will discuss unique biomes of the region such as tall and short grass prairies, prairie pot holes and unique fauna and their adaptations. We will be on site @ Glendive MT, in the PM. (See below for specifics). Basic use of GPS will be taught so that students can locate specimen collection sites (more extensive instruction will be given later).

Wednesday, 8/5/15: Glendive, MT base. We'll work in the field all day. Depending on arrangements with the rangers of Makoshika State Park we will tour the park Tue PM or some time on Wed. During the tour we will discuss extreme desert habitats and point out adaptations that flora and fauna have that allow them to survive this environment. We will cover Cretaceous depositional environments such as point bars, channel deposition and cross bedding. Students will be able to view a hadrosaur skeleton in situ. During the middle of the day we'll go to the Yellowstone River. We will collect hand specimens for analysis. Possible specimens include: petrified wood, Cenozoic vegetation fossils, coal and agates. We will tie in the current depositional patterns found on the river with the Cretaceous deposits found at Makoshika. The river site is at an irrigation dam and we will discuss the impact of water use especially as it relates to the endangered paddle fish population threatened by that use. We’ll introduce various stream sampling devices. We will do basic water chemistry (water will be studied at several sites during the trip). During the rest of the day we'll look for fossil (dinosaurs, ammonites, shrimp and clams), study the stratigraphy of the Pierre Shale, Fox Hills Sandstone, Hell Creek Shale and Fort Union Shale formations and look at desert biomes. During this time we will be working in an active oilfield. We will discuss structural formations of oil fields and use of this resource. We will cover paleo-environments and how one can analyze them. We’ll compare fossil forms to modern forms and discuss evolution. If we are able to find shrimp borrows we will discuss “fossilized behavior”.

Thursday, 8/6/15: We will travel across Montana through the Beartooth Mountains to the K-Z Guest Ranch (this will be our base of operation while in the Yellowstone region). Along the way we will make a few stops to study local geology and the Beartooth uplift. When we arrive at the K-Z we will unpack all equipment (this is a group effort), tour the surrounding region for orientation and introduce some basic field equipment depending on time.

Friday, 8/7/15: We will travel to Yellowstone National Park (YNP) to study the two major types of geothermal features found in the Park. These are represented by Norris Geyser basin and Mammoth Hot Springs. We will study fumaroles, hot springs, mud pots, geysers, travertine terraces and sinter deposits. We will explore the unique micro environment created by the geothermal features and discuss the thermophilic bacteria and algae that live in these extreme environments. We will
also stop at Obsidian Cliffs and the Golden Gate petrology and continue to explore the volcanic activity that produced the Park. While in YNP we will observe the flora and fauna.

Saturday, 8/8/15: We will cross the Beartooth Mountains to Rock Creek overlook to study alpine glacial processes and high altitude ecology. We'll stop at Beartooth Lake for landslides and the ecologic disturbance they cause and at Beartooth Pass for tundra biomes and permafrost geology. We will view adaptations that the various plants have that allow them to survive in the harsh environments found at elevation. We will see unique micro ecosystems such as “pink snow”.

Sunday, 8/9/15: We’ll offer a van to Cody for the museums (Buffalo Bill Museum, Whitney Gallery of Western Art, Plains Indian Museum, Cody Firearms Museum and Draper Natural History Museum), the Cody Rodeo, whitewater rafting, etc. These activities cost money and all extra expenses are the responsibility of the student. There will be free options also.

Monday, 8/10/15: We will continue our tour of the Park and visit Artists’ Paint Pots, Grand Prismatic Springs and Old Faithful. Geology and ecology discussions will continue.

Tuesday, 8/11/15: We will visit several sites associated with the mining district north of Cooke City, MT. This mine was a moderate source of gold in the early 1900. It has been reclaimed to some degree but there is still significant disturbance. The topics are mining and its impact. Exercises include: 1) discussion of the impact of the gold mines in the area, 2) observation of reclamation efforts, 3) comparison of mined and non-mined areas in regards to ecology, diversity and water chemistry.

Wednesday, 8/12/15: There will be a hike around the K-Z to observe plant communities, local geology and biomes and the effects of forest fires on the ecosystems. We will learn how to use GPS, read USGS quadrangle maps and determine position by compass and GPS. We will establish a trapping grid for small mammals. This trapping grid will be the basis for the major field project for the course. We will conduct a capture/recapture study and analyze the data using various statistical methods. Students will be required to verify the location of the trapping grid, locate their position and participate in a “treasure hunt” using the GPS, compass and USGS maps.

Thursday, 8/13/15*: Will travel to Cody, WY to study geology, paleontology and ecology along WY Hwy. 296. We’ll stop along Sunlight Creek and take a look at White Mt., a volcanic neck with intricate structure, and interpret the sequence of geologic events. There are several interesting landforms and geologic features (terminal moraines, ice rafted boulders, striations, entrenched valley, spring line) along the Creek. We will discuss their formation and significance. We'll look for fossils and study the Paleozoic rock column from Cambrian to Permian. We will view the uplifted block of the Beartooth plateau. *Traps will need to be checked in the morning and afternoon. The 1st test will be held at the K-Z after dinner. There will be a written exam of short answers/essays and a practical exam. Any specimens collected up to this point are fair game on the practical. We will collect your field notebook and view your collections for grading

Friday, 8/14/15*: We’ll split into 2 groups and run two labs. Groups will switch off at lunch (lunch @ K-Z). Labs are: 1) Stream Analysis: We will visit Swamp Lake for work on water chemistry and biology. You will learn techniques such as chemical analysis and identification of organisms using keys. We will expand on the use of sampling devices used at the Yellowstone River in Glendive, discussing their appropriate uses and limitations. You will get wet. 2) Vegetation Analysis by Plot & Plot-Less Methods: We will learn several sampling techniques for vegetation. We will analyze the data using various statistical methods. *Traps will need to be checked in the morning and afternoon. The trapping grid will be disassembled in the afternoon.

Saturday, 8/15/15: We'll leave the K-Z (ca. 4:30 am) to be on site in Lamar Valley at 6:00 am. Dr. Jim Halfpenny, wildlife biologist/naturalist, will talk on carnivore ecology of YNP and the reintroduction of wolves. This is an all-day exercise with Dr. Halfpenny and he will be conducting the study. He is an expert on large mammals and conducts research in the park. We will learn various field techniques for studying large carnivores and interpreting their behavior. We will learn tracking techniques and their interpretations. We'll try to view wolves (we have seen a pack every year we have been there) and any other large mammal we can find (coyote, pronghorn, bison, bear, etc.).

Sunday, 8/16/15: This is a free day. See the previous Sunday for activities.
Monday, 8/17/15: We will view the Grand Canyon of the Yellowstone and the Tower Falls basalt flows. We will discuss how the Canyon formed. We will see effects of hot springs on geology and ecology. We will discuss the 3 caldera events that shaped Yellowstone. We will look at a basaltic lava flow and see paleosols. At Mt. Washburn we will examine areas for fire destruction and recovery and discuss the adaptations that allow the flora and fauna to survive periodic fires. Ecologic succession will be explained and viewed. We’ll collect and pack all equipment. If time permits, there may be an optional horseback ride in the evening (fee for ride).

Tuesday, 8/18/15: Leave K-Z in AM and drive to Devils Tower WY, then Hulett WY. We will cover the desert climates again and cross through the Big Horn Mountain. We will stop at a fish hatchery and coal strip mine. We will tour Devils Tower and discuss the formation of this feature. There are several unique Cretaceous fossils that we will study. We will look at a lower elevation pine forest and compare it to the higher elevation forests near Yellowstone. There are several unique microclimates that we will examine and we will observe behavior of a prairie dog community. During travel students may review via radio.

Wednesday, 8/19/15: We’ll finish with Devils Tower then travel to Spearfish, SD. In Spearfish we will listen to Dr. Jace Decory on the importance of the Black Hills to American Indians. Dr. Decory is a pipe carrier of the Lakota Sioux and will also discuss native medicine and the uses of plants found in the region. We will look at the micro environment of Bridal Veil Falls and discuss the impact that gold mining has had on Spearfish Creek. We’ll eat lunch with Dr. Decory.

Thursday, 8/20/15: We will visit Jewel Cave and various road cuts. We will discuss why the Black Hills is such a unique environment and why the forests are so prevalent in the hills vs. the surrounding plains. In Jewel Cave we will learn of the conditions that produce caves and cave formations. We will discuss the impact that tourism has had on the resource itself (a problem that is recurrent in many of the sites we visit). Some of you may be able to take a spelunking tour of the cave. The rest of us will visit Mt. Rushmore or a pegmatite mine. We will discuss formation of pegmatites and why they are economical important. We will discuss both high and low grade metamorphic processes and some of the minerals that form from them at the various road cuts we visit. Specimens will be collected at the mine and road cuts. At Mt. Rushmore we’ll discuss the conflict that the development of the Black Hills has generated with the American Indian culture.

Friday, 8/21/15: We'll travel to Mitchell, SD with a stop at Keystone, SD for garnets. During travel students may review via radio.

The 2nd exam will be held at the motel. It will consist of short essay, a few multiple choice and true false and a practical section. Although the exam is not designed as a comprehensive exam there may be concepts and information that span both the 1st and 2nd exam. Any specimen collected from the 1st exam up to this point is fair game on the practical. We will collect your field notebook and view your collections for grading.

Saturday, 8/22/15: Leave Mitchell in AM, arrive UWW PM, we'll stop along the way for contact calls for your ride.