**GENERAL EDUCATION ASSESSMENT AND REVIEW FORM = NATURAL SCIENCE (GROUP XI, N) 5/15**

Please attach/submit additional documents as needed to fully complete each section of the form.

### I. COURSE INFORMATION

*Department: geosciences  
Course Number: GEO107N*

*Course Title: Natural Disasters  
Lab Status: Without Lab  
Type of Request: New  
Rationale:*

*If course has not changed since the last review and is taught by the same tenure-track faculty member, you may skip sections III-V.*

**JUSTIFICATION FOR COURSE LEVEL**

Normally, general education courses will not carry pre-requisites, will carry at least 3 credits, and will be numbered at the 100-200 level. If the course has more than one pre-requisite, carries fewer than three credits, or is upper division (numbered at the 300 level or above), provide rationale for exception(s).

This is an Introductory class with no prerequisites, offered at the 100 level.

### II. ENDORSEMENT / APPROVALS

*Instructor: bendick@msu.montana.edu  
Signature  
Date 1/20/14  
Phone / Email: 5774  
Program Chair:  
Signature  
Date 1/24/14  
Dean:  
Signature  
Date 1/29/16*

*Form must be completed by the instructor who will be teaching the course. If the instructor of the course changes before the next review, the new instructor must be provided with a copy of the form prior to teaching the course.*

### III. DESCRIPTION AND PURPOSE

General Education courses must be introductory and foundational within the offering department or within the General Education Group. They must emphasize breadth, context, and connectedness; and relate course content to students’ future lives: See Preamble

This course introduces the scientific context and latest research on natural hazards and disasters, including storms, flood, drought, mass wasting (landslides and avalanches), earthquakes and tsunamis, volcanic eruptions, and wildfires.
At the end of the semester, students are expected to have a general understanding of the following concepts:

- The difference between hazard and risk,
- How humans evaluate and quantify hazards,
- How communities work to mitigate or ameliorate hazards,
- How communities develop resilience,
- How plate tectonics produces earthquake and volcano hazards,
- How water moves through landscapes,
- How climate and climate change influence water availability or excess,
- How the ocean-atmosphere system influences both weather and climate.

Further, students are expected to become sufficiently informed about natural hazards that they can contribute critically and meaningfully to societal discourse and make good decisions about their exposure.

IV. CRITERIA

BRIEFLY EXPLAIN HOW THIS COURSE MEETS THE CRITERIA FOR THE GROUP.

1. Courses explore a discipline in the natural sciences and demonstrate how the scientific method is used within the discipline to draw scientific conclusions:

   This course introduces integrated earth system science in the context of natural disasters. Because this field is very dynamic, with many emerging new results, it is an excellent illustration of scientific method. Students will see how, in each type of natural disaster system, new hypotheses are developed and tested, and subsequent findings integrated into the science and implementation of human activities responsive to the hazard. Students use supplied datasets to evaluate sources of hazards (such as plate motions) and tools for hazard assessment (such as historical flood records or spatial data layers).

2. Courses address the concept of analytic uncertainty and the rigorous process required to take an idea to a hypothesis and then to a validated scientific theory;

   This course integrates the concept of scientific uncertainty throughout the materials. In particular, all of the cost-benefit analyses within the process of hazard mitigation and community resilience development require assimilation of well-defined uncertainty information. In the context of hazards, the notion of uncertainty is very tangible, because the difference between taking costly action in response to a well-constrained hazard and in response to a poorly-constrained hazard is entirely intuitive. Thus, both the importance and the methods of assessing uncertainty can be demonstrated clearly.

3. Lab courses engage students in inquiry-based learning activities where they formulate a hypothesis, design an experiment to test the hypothesis, and collect, interpret, and present the data to support their conclusions.

   Case studies for each of the hazards demonstrate the process of scientific method. The students implement their own scientific process in group activities embedded in each hazard module. In-class, group assignments generate discussion of course concepts and applications. Students discuss and extrapolate from textbook examples to other
examples. In-class discussions use diverse student backgrounds to discuss natural hazards and their impacts. Students also learn why and when disasters happen and apply these concepts to real locations and scenarios.

V. STUDENT LEARNING GOALS

BRIEFLY EXPLAIN HOW THIS COURSE WILL MEET THE APPLICABLE LEARNING GOALS.

1. Understand the general principles associated with the discipline(s) studied;

   Specific principles include:
   a. How plate tectonics produces earthquake and volcano hazards,
   b. How water moves through landscapes,
   c. How climate and climate change influence water availability or excess,
   d. How the ocean-atmosphere system influences both weather and climate.

   Basic principles of interacting natural and human systems will be discussed. Students will develop proficiency with ideas of causation, nonlinear feedbacks, physical cycles, basic mechanics and scientific uncertainty. Methods of data collection are routinely integrated into lecture discussions.

2. Understand the methodology and activities scientists use to gather, validate and interpret data related to natural processes;

   Specific principles include:
   a. The difference between hazard and risk,
   b. How humans evaluate and quantify risk,
   c. How scientists use time series data for hazard occurrence.

   Students use supplied datasets to evaluate sources of hazards (such as plate motions) and tools for hazard assessment (such as historical flood records or spatial data layers).

3. Detect patterns, draw conclusions, develop conjectures and hypotheses, and test them by appropriate means and experiments;

   Specific principles include:
   a. The role of scientific method in natural hazard studies,
   b. How scientists develop numerical simulations
   c. How scientists develop statistical models
   d. How hazard data are measured and compiled, specific to each hazard type

   Students learn why and when disasters happen and apply these concepts to real locations and scenarios.

4. Understand how scientific laws and theories are verified by quantitative measurement, scientific observation, and logical/critical reasoning; and

   Current events (hurricanes, tsunamis, pollution), etc. will be used as case studies. Student ability to apply scientific principles to events is tested through examinations, problem sets, and projects.

5. Understand the means by which analytic uncertainty is quantified and expressed in the natural sciences.

   All of the case studies and the group data projects will incorporate both formal uncertainty analysis and bias, both in the scientific data and in the economic, philosophical, and social decisions required for mitigation and resilience
VI. ASSESSMENT

A. HOW ARE THE LEARNING GOALS ABOVE MEASURED? Describe the measurement(s) used, such as a rubric or specific test questions that directly measure the General Education learning goals. Please attach or provide a web link to the rubric, test questions, or other measurements used.

1. Problem sets and group activities: Group analyses of disaster data, either from historical catalogs or single events will be completed every other week. These activities will test the students’ ability to apply the scientific method, reduce basic data, and assimilate uncertainty.

2. Exams: The course will include two exams during the semester and a final exam. These will specifically evaluate students’ ability to apply key concepts, including definitions of hazard and risk, nonlinearity, uncertainty, time series assimilation, forecasting, and application of theoretical and statistical models.

3. Final project: The final group project will entail working through a single case study of a major disaster including consideration of the basic scientific data, application of scientific models, and assessment of the integration of scientific findings into policy decisions.

A General Education Assessment Report will be due on a four-year rotating cycle. You will be notified in advance of the due date. This will serve to fulfill the University’s accreditation requirements to assess general education and will provide an opportunity to connect with your colleagues across campus and share teaching strategies. Items VI.B-D will be helpful in compiling the report.

B. ACHIEVEMENT TARGETS

[This section is optional. Achievement targets can be reported if they have been established.]

Describe the desirable level of performance for your students, and the percentage of students you expected to achieve this:

1. Demonstrate basic proficiency with the scientific method and data assimilation (100%).

2. Demonstrate an understanding of the strengths and weaknesses in scientific data, including formal uncertainty and systematic bias (100%).
3. Demonstrate an ability to apply scientific concepts to a novel problem or case study (80%).

C. ASSESSMENT FINDINGS

[This section is optional. Assessment findings can be reported if they are available.]

What were the results/findings, and what is your interpretation/analysis of the data? (Please be detailed, using specific numbers/percentages when possible. Qualitative discussion of themes provided in student feedback can also be reported. Do NOT use course grades or overall scores on a test/essay. The most useful data indicates where students' performance was stronger and where it was weaker. Feel free to attach charts/tables if desired.)

This is a new course, so I have no data with which to assess efficacy.

D. ASSESSMENT FEEDBACK
Given your students’ performance the last time the course was offered, how will you modify the course to enhance learning? You can also address how the course could be improved, and what changes in the course content or pedagogy you plan to make, based upon on the findings. Please include a timeframe for the changes.

VII. SYLLABUS AND SUBMISSION

Please submit syllabus in a separate file with the completed and signed form to the Faculty Senate Office, UH 221. The learning goals for the Natural Science Group must be included on the syllabus. An electronic copy of the original signed form is acceptable.
GEO107N: Natural Disasters

Overview
This class provides an overview of the natural disasters that most impact human communities, including storms, flood, drought, mass wasting (landslides and avalanches), earthquakes and tsunamis, volcanic eruptions, and wildfires. These events will be used to explore how humans interact with the physical world, how Earth systems respond and change over time, and how people can use science to improve community resilience against catastrophes. We will use case studies from recent disasters as well as current events to learn about the science of disaster processes, evaluation of hazards, and the economics, politics, and sociology of disasters.

Learning goals
Key concepts to be explored in this course include application of the scientific method, the meaning of scientific uncertainty, feedbacks in natural systems, and the means by which scientific information is assimilated into human communities.

Assignments and grading
Course work will include problem sets or group activities every other week, two exams during the semester, a final exam, and a final group project. The course grade will be calculated based on equal weighting of these four components.

Text

Instructor
Rebecca Bendick, SC 331, Bendick@moso.umt.edu

Schedule of topics
Week 1: Hazard and Risk; Disasters and Humans
   Case study: comparison of Sumatra and Tohoku-oki earthquakes
Week 2: Plate tectonics overview
   Case study: hazards and the Ring of Fire
Week 3: Earthquakes
   Case study: Cascadia
Week 4: Tsunamis
   Case study: Indonesia
Week 5: Volcanos
   Case study: Yellowstone
Week 6: Landslides and avalanches
   Case study: the Alps
Week 7: Weather overview; Atmospheric and oceanic circulation
   Case study: El Nino
Week 8: Climate overview: long term trends in weather
   Case study: global climate change
Week 9: Storms
Case study: Hurricane Katrina

Week 10: Drought
  Case study: California

Week 11: Food security
  Case study: East Africa

Week 12: Wildfires
  Case study: Western Montana

Week 13: river processes
  Case study: Western Montana

Week 14: Floods
  Case study: the Mississippi Basin

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/SA/PSA/index.cfm/page/1321.