Type of Request:
Renew

Subject code	Course Number	Catalog Year
BIOB	109N	2021-2022

Course Title
Montana Ecosystems

College/School	Department
Missoula College	Applied Arts and Sciences

Level	Campus	Semesters offered
Undergraduate (U)	Missoula College	Spring, Fall

Does course require a lab?
Yes

Description & Purpose
BIOB 109N: Montana Ecosystems investigates the living systems of Montana with a focus on dominant ecosystem types. Core content is reinforced through laboratory exercises. This course discusses the physical and biological influences that support Montana's remarkable diversity of ecosystems and species. Montana Ecosystems explores the dominant vegetation patterns across Montana and how these patterns affect the distribution of key species of animals. Coursework connects these systems to discussions of energy dynamics in living systems. The course also examines the influence of humans on Montana's natural environment.

BIOB 109N is designed to guide students with little science background toward deeper appreciation of the living systems of Montana and the nature of science as a process of investigation. The content is intended to be broad, approachable, and relevant to students' lives. Continuing to offer this course with N designation at Missoula College helps two-year college students in Missoula fulfill graduation requirements while exploring the life sciences.

Justification / explanation
This is a 100-level course with no prerequisites.

Additional Information (For OCHE Database):

In which MUS Core Category, does this course fit?
Natural Science

Does the course include content regarding cultural heritage of American Indians?
No

Attachments

Syllabus
ME syllabus spring 2020.pdf

Other
BIOB 109N Assessment Example 4 - prompted lab activity.docx, BIOB 109N Assessment Example 5 - independent project.docx

Criteria

Briefly explain how this course meets the criteria for the group:
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Courses explore a discipline in the natural sciences and demonstrate how the scientific method is used within the discipline to draw scientific conclusions:
BIOB 109N guides students to apply of the scientific method through observations and hypothesis formation in field-based laboratory explorations. Ecosystem diversity is explored as a component of Biology, which is presented as a process of asking questions about the living world.

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
BIOB 109N exposes students to the scientific method through field-based opportunities to ask questions, develop meaningful scientific hypotheses, and propose plausible methods to test these hypotheses. BIOB 109N relates hypothesis testing to the deeper development of valid scientific theories by connecting laboratory investigations to unifying scientific principles such as evolution and energy transformations in living systems.

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.
BIOB 109N provides students multiple opportunities to ask questions, develop hypotheses, test hypotheses, and interpret findings through field-based and classroom lab investigations. Students examine how scientists communicate findings by being asked to provide written work explaining their process, data analysis, and conclusions.

Student Learning Goals

Briefly explain how this course will meet the applicable learning goals.
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Understand the general principles associated with the discipline(s) studied.
BIOB 109N explores foundational principles of Ecology through interconnected classroom lectures and student-driven investigations. Topics include core principles that influence local ecosystem diversity:
- Global and regional climate patterns
- Physiographic influences on biotic systems
- The flow of energy in living systems
- Core principles of ecology, including biotic interactions such as predation, competition, and facilitation
- Impacts of humans on living systems

Understand the methodology and activities scientists use to gather, validate and interpret data related to natural process
Students apply scientific methodology in two main ways in this course:
a) through guided interpretation of scientific research and knowledge. This includes discussion of the scope and limits of the scientific method.
b) though direct, student-driven laboratory investigations (both in the lab room and the field) that model the nature of science a process of exploration.

Detect patterns, draw conclusions, develop conjectures and hypotheses, and test them by appropriate means and experiments.
Students in BIOB 109N observe real-world living systems, develop and test hypotheses, and interpret findings through both guided activities and student-driven investigations with no prearranged outcome.

Understand how scientific laws and theories are verified by quantitative measurement, scientific observation, and logical/critical reasoning.
This course explicitly examines core biology theories and their validity. The verification of essential principles is addressed in classroom lecture and discussions. Key concepts include the rejection of alternative hypotheses, the importance of controls in hypothesis testing, valid measurements, and sound interpretation of data.

Understand the means by which analytic uncertainty is quantified and expressed in the natural sciences.
BIOB 109N provides students with direct experience modeling how scientists gather data and communicate findings. Students demonstrate their recognition of scientific uncertainty through critical examination of their own data. The skills developed in lab, which include effective interpretation of results, help students appreciate the strengths and challenges of scientific research. Student's written lab reports connect to published literature, in which the quantification of uncertainty is more thoroughly examined.

Learning Outcomes Assesments

How are the learning goals for the General Education Group measured?
Describe how you will determine that students have met each of the General Education Learning Goals. This should include specific examples of assignments, rubrics or test questions that directly measure the General Education learning goals. (See Sample Form) Please attach or provide a web link to relevant assessment materials.

Understand the general principles associated with the discipline(s) studied.
Assessment Example 1 (unit exam question):
What distinguishes a community from an ecosystem?
a. a community is smaller in area
b. an ecosystem includes the non-living influences of an area
c. a community is larger in area
d. an ecosystem includes only the living components of an area

Assessment Example 2 (unit exam question):
Why do ecotones display higher biodiversity than neighboring landscapes?
a. there are more nutrients available
b. more competition results in greater diversity
c. when species help each other, biodiversity increases
d. overlap of different habitats and resources creates a greater mixture of species

Assessment Example 3 (unit exam question):
Short answer exam questions are evaluated based upon concise and accurate responses, but support a large diversity of reflection.
Please respond to the following question with 2-3 sentences in your own words:
If competition results in a winner and a loser, why is it considered detrimental to all participants? In what kind of environments is competition more common?

Understand the methodology and activities scientists use to gather, validate and interpret data related to natural process.
Meeting this learning goal is assessed primarily through evaluation of student lab activities. Lab activities model the process of science in various ways. Two examples are provided in attached files (assessment examples 4 & 5). In the first example, the lab experience is guided by prompts and direct instructor participation for a scaffolded, skill-building exercise. In the second example, students apply scientific investigation through a much more student-driven independent research project.

This learning goal is addressed by the portions that ask students to measure and interpret their own data.

Detect patterns, draw conclusions, develop conjectures and hypotheses, and test them by appropriate means and experiments.
As above, meeting this learning goal is assessed primarily through evaluation of student lab activities (assessment examples 4 & 5).

This learning goal is addressed by the portions that ask students to develop their own hypotheses and test them through independently developed, proper methodology.

Understand how scientific laws and theories are verified by quantitative measurement, scientific observation, and logical/critical reasoning.
Assessment Example 6: (unit exam question):
Which of the following statements best describes science?
a. Science has become redundant because so much about the world is now understood.
b. Science reliably provides truth that never changes.
c. Science is a method of seeking answers, and is open to revision and questioning.
d. The best scientist is the one who knows the most facts.

Assessment Example 7 (unit exam question):
What is a scientific theory?
a) a well-informed proposal to explain a natural phenomenon
b) a well-tested, repeatedly-supported explanation for broad natural phenomena
c) a best guess
d) a misleading statement

As above, meeting this learning goal is also assessed through evaluation of student lab activities (assessment examples 4 & 5).

This learning goal is addressed by the portions that ask students to relate their findings to existing literature that demonstrates broader principles of ecology.

Understand the means by which analytic uncertainty is quantified and expressed in the natural sciences.
As above, meeting this learning goal is assessed primarily through evaluation of student lab activities (assessment examples 4 & 5).

This learning goal is addressed by the portions that ask students to address validity in their own results and interpretation of those results. Connection to scientific literature further addresses the role of uncertainty through connection to others' methodology and data analysis.

General Education Assessment Report

If this information is not yet available, this section must be completed after the next offering (re-submit the entire form with these sections completed by the curriculum deadline). Your course will be granted provisional status until the report is received. Report not required for one-time-only general education offerings.

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Achievement Targets

The desirable level of success is 100%; all students are assumed capable from day one. However, expected performance on objective questions is from 75-85% successful. Performance on written work is expected to show 70-80% success in measurable results and reflect genuine understanding of core learning goals.

Given the high rate of attrition of freshman at Missoula College, the data reported are from students who complete the class, not enroll. Typically, 10% of enrolled students fail to meet learning objectives simply from failure to complete the course.

Assessment Findings (This section is optional. Assessment findings can be reported if they are available.)

Success rate for assessment examples:

Example 1: 82%
Example 2: 71%
Example 3: full credit 55%, partial credit 25%, no credit 20%
Example 4 (prompt-driven field lab):
For learning goal 2: Understand the methodology and activities scientists use to gather, validate and interpret data related to natural process. Success rate 88%
For learning goal 3: Detect patterns, draw conclusions, develop conjectures and hypotheses, and test them by appropriate means and experiments. Success rate 86%
For learning goal 4: Understand how scientific laws and theories are verified by quantitative measurement, scientific observation, and logical/critical reasoning. Success rate 81%
For learning goal 5: Understand the means by which analytic uncertainty is quantified and expressed in the natural sciences. Success in this learning goal was not adequately measured by assessment example 4; see example 5.
Example 5 (independent investigation and written report):
For learning goal 2: Understand the methodology and activities scientists use to gather, validate and interpret data related to natural process. Success rate: 72%
For learning goal 3: Detect patterns, draw conclusions, develop conjectures and hypotheses, and test them by appropriate means and experiments. Success rate: 77%
For learning goal 4: Understand how scientific laws and theories are verified by quantitative measurement, scientific observation, and logical/critical reasoning. Success rate: 67%
For learning goal 5: Understand the means by which analytic uncertainty is quantified and expressed in the natural sciences. Success rate: 49%
Success rates for assessment example 5 (project and paper) were influenced by a large number of students who did not complete the assignment, but whose results are included because they did complete the course.

Example 6: 82%
Example 7: 100%

Assessment Feedback
Student success in areas of core content and the mechanisms scientific investigation generally met expectations. Student success in some areas of interpreting scientific data and assessing validity failed to meet expected or desired levels, particularly for learning goals 4 & 5. I propose two interpretations and associated solutions to address these concerns.

Firstly, part of the missed target relates to the high number of students who did not complete the independent investigation and written report. From limited anecdotal evidence, I suggest that this relates strongly to a grading scheme in which less-interested students in this 100-level course determine that they can earn a satisfactory grade by focusing on their exams and structured lab activities without completing the project. Others may be intimidated by the project and decline to participate from fear of failure or unwillingness to complete the work. I propose structuring the project with more incremental components to increase investment, comfort, and feedback in the activity. Increasing participation in the independent project is essential as it forms a key component of meeting the GenEd learning goals in this course.

Secondly, the superior student success in areas of content instead of process and uncertainty reflects a cultural pattern in which scientific literacy is stronger in knowledge than procedure. This course can better suit students by acknowledging that their educational and cultural backgrounds have likely prepared them more to absorb scientific knowledge than to adequately address validity and uncertainty. I propose to address this limitation by devoting more classroom time to explicitly examining scientific processes and the evaluation of uncertainty, and by incorporating such analyses into the more iterative process of the revised independent project.
I propose to make these initial changes within one year, monitor and evaluate their impact, and determine any needed next steps soon thereafter.

Learning Outcomes

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Credits

Credit Hours

Min
-

Max
-

Value
-

Operator
-

Contact Hours

Min
-

Max
-

Value
-

Operator
-

Billing Hours

Min
-

Max
-

Value
-

Operator
-

Lecture Hours

Min
-

Max
-

Value
-

Operator
-

Lab Hours

Min
-

Max
-

Value
-

Operator
-

Other Hours

Min
-

Max
-

Value
-

Operator
-

Academic Progress Hours

Min
-

Max
-

Value
-

Operator
-

Financial Aid Hours

Min
-

Max
-

Value
-

Operator
-

Course Count
-

Repeatable
No

Number Of Repeats
-

Number Of Credits
-

Topics

-

Requisites

No Requisites

Components

-