BIOL-140: ECOLOGY

Effective Term
Fall 2025

BOT Approval Date
12/14/2023

Discipline
BIOL - Biology
Course Number
140

Course Title
Ecology

Short Title
Ecology

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
3.00

Lab Units
1.00

Total Units
4.00

Hours

Lecture Contact Hours
48-54
Out of Class Hours Lecture
96-108

Lab Contact Hours
48-54
Out of Class Hours Lab
0.00

Total Contact Hours
96 - 108

Total Out of Class Hours
96 - 108

Total Student Learning Hours
192 - 216

Is this an existing Extensive Lab?
Yes

Distance Education
Yes

Distance Education

Distance Education Type
Both Fully Online and Hybrid Online

Fully Online Delivery Requirements:
a. Students must be notified via the college schedule of classes and the syllabus for the class if proctored tests are required for this course
b. Any planned face-to-face meetings, such as an orientation or study session, must be optional
c. The MSJC curriculum committee requires the use of accessible, asynchronous discussion as a component of every fully online course

Are you using publisher content?
No

Regular Substantive Interaction
Instructor-to-student, student-to-student, and student-to-content contact shall be distributed in a manner that will ensure regular substantive interaction (RSI) is maintained not only weekly but also for the duration of the course. Instructor interactions should be equivalent in time, quality and consistency to the engagement students would receive in a face-to-face course—for example, through announcements, discussion participation, personalized feedback, video messages, or other instructional communications. Instructors are expected to be responsive to student inquiries within a 24-72 hour time frame excluding holidays. RSI will be maintained through a variety of methods: • Orientation - Students must be oriented to the online and face-to-face portions at the start of the course. • Announcements - Announcements using the course management system must be posted at least weekly to keep students current on course events, due dates, materials, etc. • Discussion Forums - Content-related discussion forums within the designated CMS will include appropriate instructor participation and will be initiated and maintained, with timely feedback provided. Instructors are required to monitor the discussions and related activities to provide guidance and direction. Open-ended discussion boards may be used to further learning and interaction. • MSJC Communication – Instructor will use MSJC-administered communication tools (such as email or the designated CMS communication tools) to regularly communicate with and provide ease of access to students. • Timely Feedback - Timely feedback on student work will be provided by the instructor, which may include comments and/or rubrics, within the Grades area of the designated CMS. • Scheduled Meetings – Hybrid and synchronous courses will meet at regularly scheduled times. ADA Compliance - All course interactions and content must be designed with accessibility in mind and meet ADA requirements.

Catalog Description
This course covers ecological principles with a focus on biodiversity, ecosystem function, and the inter-relationship of the biotic and abiotic components of the environment. Several major ecosystem types will be emphasized including ocean, mountain, chaparral, and desert biomes.

Codes

TOP Code (CB 03)
0401.00 - Biology, General

CIP Code
26.0101 - Biology/Biological Sciences, General.

Repeatability Code
No

Grading Option
Letter grade OR P/NP

GE Information

Check GE Types Requested
AA/AS A - Natural and Physical Sciences

Cal-GETC Areas

Approved Cal-GETC Area
AREA-5B

Approved Second Cal-GETC Area
AREA-5C

Learning Objectives

Learning Objectives

Learning Objective
1. Examine the relationship of ecology to other fields of science, based on common themes including the scientific method, sampling, data collection, study design and statistical analysis.
2. Diagram and relate the levels of hierarchy in ecology.
3. Classify various ecosystems.
4. Analyze how the Law of Entropy applies to ecology.
5. Assess productivity within an ecosystem, with reference to food chains, food webs, and trophic levels.
6. Diagram ecological pyramids.
7. Investigate basic biochemical cycles such as water, carbon, and nitrogen.
8. Review the biotic and abiotic constraints to population growth.
9. Compare the intrinsic rate of growth to actual growth in a population and outline the process of cyclical population growth.
10. Compare and contrast density-dependent and density independent population growths.
11. Categorize population dispersions.
12. Relate population structures to aggregation, the Allee effect, and refugia.
13. Compare and contrast competition with coexistence.
14. Distinguish between various symbiotic relationships.
15. Compare species diversity, genetic diversity, and structural diversity.
16. Analyze the edge effect, ecotones, and geographical gradients.
17. Review some of the contributions women and people of color have made to the field of ecology.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. The student will demonstrate the ability to apply the scientific method and to evaluate data with regards to ecology.
2. The student will organize their time and exhibit persistence in completing course work.
3. The student will critically examine the diversity of scientists and career pathways in biology and ecology, fostering an inclusive mindset towards various identities and experiences within the scientific community.

Program Learning Outcomes

Learning Outcome
1. Students through persistence will develop problem solving skills in science thinking both critically and abstractly about issues using science as the foundation for understanding.
2. Students will gain scientific awareness with a flexible approach including a willingness to change perspectives and an ability to weigh alternative options while staying rooted in the understanding of their impact as local, national, and global citizens.
3. Students will apply past knowledge to new scientific situations, being able to think abstractly regarding science and communicate this newfound knowledge in the language of science and the scientific method.
4. Students will achieve literacy in the language of science and the scientific method, demonstrating a willingness to respond with wonderment and awe with regards to the physical and biological principles of science, and gather data through all senses.

5. Students will learn hands-on skills in the laboratory, demonstrate how to measure and collect data from experiments with accuracy and precision, and think critically about the results.

Institutional Learning Outcomes

Critical Thinking: The student will analyze problems, gather and synthesize relevant information, evaluate ideas, information, and evaluate alternative points of view to create, innovate and implement effective solutions.
Scientific Awareness: The student will apply the scientific method of inquiry to assess potential solutions for real-life challenges by employing science-based knowledge and methodologies in daily life.
Social Awareness: The student will recognize and analyze the interconnectedness of global, national, and local concerns, analyzing cultural, political, social, and environmental issues from multiple perspectives and appreciate similarities and differences among cultures.
Civic
Personal
and Professional Responsibility

Content

Course Lecture Content

I. Introduction
- A. Scope of ecology
- B. In relation to other biological sciences
- C. Modeling
- D. Scientific method

II. The ecosystem
- A. Ecosystem defined
- B. Study methodologies
- C. Gaia hypothesis
- D. Ecosystem examples

III. Energy in the ecosystem
- A. Entropy
- B. Productivity
- C. Food chains
- D. Food webs
- E. Trophic levels
- F. Energy quality
- G. Metabolism and surface area
- H. Ecological pyramids
- I. Carrying capacity

IV. Biochemical cyles
- A. Water cycle
- B. Carbon cycle
- C. Nitrogen cycle

V. Limiting factors and the environment
- A. Leibig's Law
- B. Factor compensation and ecotypes

VI. Population dynamics
- A. Intrinsic rates
- B. Cyclic populations
- C. Density-dependent and density-independent internal distribution
- D. Alee's principle
- E. R and k strategies
- F. Life history and tactics

VII. Population in communities

A. Species interactions
    1. Commensalism
    2. Predation
    3. Mutualism
    4. Herbivory
    5. Allopathy
B. Contributions by diverse scientists and female researchers such as Jane Goodall
C. Niche, habitat and guild
D. Gradients
    1. Ecotones
    2. Edge effect

Course Lab Content

I. Introduction to the scientific method
    A. Introduction to scientific writing
    B. Critical analysis of scientific articles
    C. Development of an abstract from an journal article
II. Ecological field studies
    A. Introduction to statistics
    B. Parametric and non parametric analysis
    C. Data collection
    D. Random sampling techniques
    E. Experimental error and bias
    F. Mock statistical analysis
    G. Field trips to the desert, mountain, ocean, and chaparral environments
III. Ecosystem processes
    A. Soil analysis
    B. Oxygen and carbon dioxide cycling
IV. Population modelling
    A. Age distribution and survivorship
        1. Analysis and discussion of age structure in several countries from all continents highlighting diverse cultures
V. Terrestrial Plant Ecology
    A. Communities and Species Diversity
    B. Primary production
    C. Plant adaptations to the environment
    D. Riparian ecosystems
    E. Micro-community assessment sampling
    F. Plant communities sampling
VI. Animal ecology
    A. Communities and species diversity
    B. Competition
    C. Natural selection

Methods of Instruction

Method

Discussion

Integration

Students will engage in discussions of the application of ecological principles to real world scenarios as a model for sustainability. Scientists from diverse backgrounds that have contributed to ecological research will be highlighted in the discussion prompts. Students will consider how their interaction with the environment is a product of our gender, culture, race, and individual identity. Students will explore ecological issues that affect marginalized communities both domestically and abroad.

DE Adaptations for MOI

Asynchronous group discussions will use the accessible discussion board feature of the CMS.

Method

Field Trips

Integration

Students will be engaged on field trips to the major ecosystem types in the southern California region and will engage in data gathering and interpretation exercises to strengthen their ability to apply the scientific method. Diverse approaches to land use will be discussed including the sustainable practices of historical native populations of California. All students will participate in ecological field work and recognize themselves as a citizen scientist.

DE Adaptations for MOI

Students are able to use official websites that are accessible and compatible with screen readers and accessible captioned videos from ecological/conservation organizations, museums, or zoos to observe, identify, and gather data and information. Care will be taken to make sure that all materials assigned for online field trips are made accessible for all students. Corresponding worksheets or assignment instructions will be provided within the CMS as either accessible documents or as an accessible webpage.

Method

Film/video Viewing and Discussion

Integration

Students will be exposed to global biomes via multi-media presentations and will apply principles of ecology to discussions of proper management and conservation as applied to diverse scenarios. Students will discuss the ethical considerations of past and current ecology conservation issues and how ecological degradation has a larger impact on marginalized populations.

DE Adaptations for MOI

Films will be provided with captions for accessibility and will be posted/linked from within the CMS pages. After students view videos there will be asynchronous discussions via the accessible CMS Discussion Board or discussion can also be provided synchronously using accessible video conferencing tools with the CMS.

Method

Lab Activities

Integration

Laboratory activities will explore the major principles of ecology incorporating analysis, critical thinking and the graphic or written presentation of results.

DE Adaptations for MOI

Lab demonstrations are posted to the CMS via accessible images and accessible captioned videos and/or delivered live via accessible video conferencing tools. Accessible laboratory simulations may be utilized as well. Students may be asked to utilize an online interactive microscope to observe and compare different organisms or tissues. Laboratory write-ups are submitted in the CMS.

Method

Lecture

Integration

Interactive lectures with multimedia will be used to present the concepts in the learning objectives. Active learning approaches will be implemented that engage all of the students in the class. As an example, the application scientific method will be presented to address ecological problems and issues.

DE Adaptations for MOI

Lecture content may be provided in the CMS, asynchronously using tools such as course pages or creating accessible captioned videos. Lecture can also be provided synchronously via accessible video conferencing tools within the CMS.

Method

Observation and Demonstration

Integration

Instructor-guided classroom demonstrations will demonstrate mathematical applications as they relate to the cycling of matter and energy in ecological systems.

DE Adaptations for MOI

Observation and identification of key specimens of biodiversity including examples of bacteria, protists, fungi, animal, and plants will be performed through the use of images provide in the CMS as well as through the use of accessible biodiversity websites.

Methods of Evaluation

Method

Exams/Tests

Integration

Objective examinations will draw from lecture and reading materials and be focused on overriding principles of ecology as well as their application to broader fields such as sustainability and development. Exams will incorporate a variety of question types and will be graded based on student's mastery of ecological concepts.

DE Adaptations for MOE

Examinations are presented online in the CMS and may include multiple choice, multiple answer, matching, labeling, true/false, short answer, long essay questions, or oral based questions. Oral exam answers would be submitted via studio video in the CMS or synchronously using a video conferencing platform. Multiple choice, true/false, etc. style questions would be automatically graded for correctness within the CMS. Short/long essay answers or oral based exam questions would be graded by the instructor within 2 weeks and evaluation would be based on thoroughness and correctness of answers. There is no requirement for proctored, on campus attendance for examinations.

Method

Homework

Integration

Written assignments will be based on lecture material as well as directed laboratory activities, the proper application of the scientific method, analysis of data, and presentation of results in scientific format. Article summaries and essays on current topics in ecology will be used to discuss current issues in ecology. Students will research the work of diverse scientists that have contributed to our understanding of these issues. Lab assignments will be graded based on proper application of scientific principles and student's ability to draw valid conclusions from data. Papers will be evaluated by the instructor within 2 weeks and will be graded for completeness, comprehension, content accuracy, and quality using the provided rubric.

DE Adaptations for MOE

Students engage in weekly assignments within the CMS and submit assignments through the CMS. Students will be assessed on the correctness of their answers, their ability to accurately keep experimental records, analyze lab data, and evaluate their data to create thoughtful conclusions. Prompt feedback will be provided by the instructor through the CMS to promote continued learning and help students prepare for examinations. All assignment materials will be provided in an accessible format with alt text for images.

Method

Class Performance

Integration

Students must demonstrate a familiarity with lab safety, the use of common materials and techniques, the application of the scientific method, and a familiarity with concepts covered in directed lab activities. Grading will be based on student's ability to perform proper lab techniques.

DE Adaptations for MOE

Laboratory practical exams will evaluate the ability to apply the scientific method. Laboratory practical exams will be given through the CMS. These exams will be evaluated for completeness and the questions will assess student's ability to identify the most accurate answer, scrutinize experimental design, use and identify laboratory equipment, evaluate data from laboratory experiments, and apply the scientific method. Lab Practical feedback will be provided by the CMS and by the instructor through the CMS to correct misunderstanding and promote continued learning. Exam materials, questions, and images will be designed to be accessible with alt text for images as needed.

Method

Class Work

Integration

Problem sets will be based on the application of concepts and mathematical approaches such as population dynamics in ecosystems and evolutionary trends in populations. Grading may be based on correct answers and/or proper application of analytical techniques.

DE Adaptations for MOE

Problem sets will be submitted and evaluated through the CMS. Grading may be based on correct answers and/or proper application of analytical techniques.

Method

Quizzes

Integration

Quizzes will test students' knowledge of ecosystem function, processes related to the cycling of matter and energy, and the relationships and interactions between species. Quizzes may use multiple choice, essay or other types of questions.

DE Adaptations for MOE

Weekly evaluations will be accomplished using instructor evaluations in the CMS similar to those used in the on-campus course. Questions will be chosen from a bank of questions such that individual students will have similar but not necessarily the same questions on evaluations. Questions will be developed to be accessible in the CMS.

Assignments

Assignment Type

Writing

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Read the following overview of a study conducted on the vegetation of coastal sage scrub. Write a 50 word abstract that summarizes the research and describes the female scientist that conducted the research. Choose one animal and one plant from the desert, mountain, ocean, and chaparral environments and propose in detail how the organisms adapt to their habit. Be sure to include details ranging from the biochemical to the ecological level. Describe the types of studies you would conduct to investigate the adaptations of this organisms. In your own words, explain what it would be like to be the ecological researcher conducting this study. Can you picture yourself as a scientist? Present your findings in a 2-3 page paper. Evaluate the data on the annual catch of orange

roughy populations worldwide. Investigate the biology of that species of fish and propose a hypothesis for their decline. Present your hypothesis in a 1-2 page paper outlining your rationale.

How assignment will be adapted in online format

The article to read will be provided in the CMS. Students will be assigned an initial online discussion board to present their abstract to receive and provide feedback. Online research guidance using the library databases will be provided and students will be encouraged to work with the librarians and peer tutors in the library. Research and written work will be assessed according to a provided rubric like the on campus class that evaluates the appropriateness and quality of the chosen articles, demonstration of critical thinking, and the quality of the argument in support of the assigned position. Grades will be posted in the CMS within 2 weeks of the submission of the second online discussion board.

Assignment Type

Writing

In-class and/or outside of class

In-class

Formative or Summative

Summative

Assignment

At least three exams will be given during the semester to assess understanding of ecology content covered in the lecture and lab material. Examinations may include a variety of question formats such as multiple-choice, written, fill in the blank, and labeling. Exams will be assessed based on the correctness of the responses as well as the quality and thoroughness of written answers. Scores will be posted to the CMS within 2 weeks of the exam date.

How assignment will be adapted in online format

Online exams will be administered in the CMS and are not required to be proctored. Most types of exam questions can be automatically graded by the CMS based on the correctness of the responses except written responses which will be scored based on correctness of the response as well as the quality and thoroughness of written answers. Scores will be posted to the CMS within 2 weeks of the exam date.

Assignment Type

Reading

In-class and/or outside of class

In-class

Formative or Summative

Formative

Assignment

Choose a species listed on the IUCN Red List as critically endangered from the list of provided species with the students in your group. Investigate the human impacts on the ecology that have caused the endangerment of your species by reading reputable online sources. Each group will identify two or more sources to read. Do any of these human impacts affect the quality of life for the people living where this species is found? Do we have an ethical obligation to intervene in the ecology of this area to save this species and will conservation efforts also benefit the people that live there? Share your discoveries with the class and collaborate with the whole class to identify which human impacts on the environment are affecting species survival the most.

How assignment will be adapted in online format

Students will randomly assigned to a group and provided with a list of IUCN Red Listed species to choose from in the CMS. Only one group will be able to choose each species on the list. Student groups will share their discoveries about the human impacts on ecology through a discussion board in the CMS. Student will respond to the discussion board to collaborate and identify which human impacts on the environment are affecting species survival the most. Grades and constructive feedback will be provided to students in a timely manner by utilizing the appropriate features within the CMS.

Course Materials

Textbooks

Sher, Anna and Molles, Manuel (2022). Ecology 4th Edition, McGraw-Hill. ISBN: 9781605356181
Singer, Fred (2016). Ecology in Action, Cambridge University Press. ISBN: 110711537X

Class Size Information

Class Size

32

Class Size Category

G - Large lab 32

Diversity and Inclusion

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.

This course provides a broad framework in ecology literacy with a focus on how interactions between diverse organisms and the environment are impacted by humans. How humans interact with the environment is a product of our gender, culture, race, and individual identity. Assignments invite students to explore ecological issues that affect marginalized communities both domestically and abroad. For example, students will consider how several cultural groups differ in terms of their interactions with the environment they live in. As well as the extent to which individuals and populations are impacted by changes to the environment around them including global changes that are out of their control. Considerations of social justice, such as environmental migration, are integrated into the content and students are invited to explore the ways in which the effects of ecological degradation impacts cultures and genders in diverse and unequal ways.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.

The course centers on ecological interactions and conservation issues that provide exposure to diverse cultures, voices, and lived experiences. Instruction is focused on eliminating structural barriers to success by incorporating open educational resources and presenting a diverse array of media to connect with a spectrum of learning styles. In addition, students are expected to interact with one another in discussions focused on contemporary ecological issues and to share their perspectives and personal experiences while adhering to norms of inclusivity. Students are encouraged to challenge normative expectations of what it means to engage with discussions of science as reflected in the interactions between humans and the environment and are provided with the tools to be active in the scientific endeavor regardless of their chosen major or career path.

Interactions

Explain how the course will incorporate student-to-student interaction.

Students will have frequent opportunities to interact with one another in online or in-person discussions focusing on ecological and conservation issues. These interactions will augment the other forms of content delivery employed in this course by exposing students to diverse perspectives held by members of their own communities. Students will be encouraged to develop and abide by norms of tolerance and inclusivity.

Explain how the course will incorporate instructor-to-student interaction.

Instructors will participate in and guide group discussions. In the distance education modality, these interactions may be either asynchronous, taking place in the discussion forum or via email communication, or synchronous, via video conferencing. For challenging assignments and projects, instructors will model metacognitive approaches, engaging with students to guide them through complex critical thinking processes. This may include demonstrations of ecological issues, data interpretation approaches, or interactions with complex primary literature sources. Feedback will be provided either verbally, in writing, or in the course management system. Instructors will be available to answer questions and interact with students directly.

Explain how the course will incorporate student-to-content interaction.

Students will be provided with a variety of accessible forms of media for content delivery. These may include written narratives, journal articles, textbook materials, videos, or verbal lectures. A diverse array of approaches will be employed to accommodate a spectrum of learning styles. For the online modality, these materials will be posted in an accessible format in the course management system, with the lecture component being recorded and captioned. Students will work towards concept mastery through formative assessments, engage in deeper more reflective work through critical writing assignments, and will assess their assimilation of the content through summative assignments. Students will engage with content in active ways, bringing their schema to bear with reading assignments, mining data for meaning, and providing feedback to enhance relevance and relatability.

Explain how the course will incorporate student-to-self interaction (metacognitive).

Students will engage in critical thinking activities that require them to explore environmental issues that directly affect their lives. They will be encouraged to critically assess their ethical stance on conservation challenges. Students will have the opportunity to reflect on any discordance between their subjective worldview and their understanding of objective science. Students will consider their own relationship to the environment and through a variety of analysis projects explore differences in the ways people around the world interact with the environment in the development of their ethnic identity. Through reflection, students will be immersed in the global context of ecology and discover how ecology impacts diverse human populations.

Key: 476