**NOTE:** This is John Roach’s syllabus. Feel free to modify it as needed! Text that is likely only relevant to John Roach’s course is indicated with gray font. Feel free to contact John with questions – his contact information can be found on the syllabus.

**Syllabus**

**General Ecology (BIO XYZ)**

**MTG DAYS & TIMES**

Instructor: Dr. W. John Roach Office: SimBio, 1280 S. 3rd St. W.

Missoula, MT 59801

Email: john.roach@simbio.com Office Phone: 833.314.7701 Ext 707

Office Hours: TBD

The course website is being hosted here: https://college.class.edu

Teaching Assistants (lab): C.C. Carson (cc@simbio.com)

Classmates – people who you can contact to discuss class content:

Name: Email: Phone:

Name: Email: Phone:

What is ecology?

In 1873, Ernst Haeckel, a German zoologist, coined *Ökologie* by combining the Greek word oikos, meaning “house, dwelling place, or habitation” and –logia, meaning “study of”. According to this definition, ecology is the study of the relationship of organisms with their environment. Today, ecologists like those at the Cary Institute of Ecosystem Studies, define it more specifically. To them (and to us), ecology is:

*“The scientific study of the processes influencing the distribution and abundance of organisms, the interactions among organisms, and the interactions between organisms and the transformation and flux of energy and matter.”*

Clearly, the study of ecology covers a lot of terrain. In this class, we will investigate how evolution interacts with individual, population and community-level processes to determine the distribution of plants and animals. We will learn about population growth and regulation, competition, predation, succession, and community dynamics. We will also examine aspects of ecosystem ecology including nutrient cycles, energy flow, ecosystem services and climate change.

Ecology is quantitative! **There will be math!** Ecologists rely on mathematical models to describe how populations grow, how species interact, and how elements cycle. They use statistics to describe what they have observed and to make inferences about their observations. Simply stated, ecology is impossible to practice without doing a calculation or two here and there.

Philosophy on Teaching and Learning:

Research shows that students learn best when they actively engage with the material. To that end, this class will emphasize student participation and collaboration. You will complete dynamic reading assignments in preparation for class and will work collaboratively with me and your colleagues during class to master key ecological concepts and resolve outstanding questions. Wherever possible, we will model the scientific method as a tool for generating knowledge.

Instructor Information:

As an author at SimBio, I help develop the content in SimUText Ecology. Additionally, I am an Adjunct Professor at the University of Montana where I periodically teach this course in General Ecology. I received my MA from Idaho State University where I investigated pikas and community ecology. I received my PhD from Arizona State University where I explored nutrient cycling in an urban stream.

Prerequisite Courses:

Any required courses.

Key Learning Outcomes:

Exercises in SimUText Ecology and classroom activities are designed to help you develop the ability to do the following:

1. Demonstrate how a systems-thinking approach in which the structures, functions, relationships, and emergent properties of living systems are explicitly described can help explain ecological patterns and processes.
2. Show how models—including mathematical, graphical, and conceptual models—can be used to generate testable, often quantitative predictions about system dynamics.
3. Employ the scientific method in the investigation of ecological patterns and processes.
4. Demonstrate how predictions derived from clear hypotheses can be evaluated with ecological data.

Course Schedule

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| --- | --- | --- | --- |
| Day | Lect | Topic | Readings |
| Mon | **1** | What is Ecology? How is it studied? |  |
| Wed | **2** | How does evolution impact ecology? | **Evolutionary Ecology**  1: Evolution and Ecology are Intertwined  2: The Logic of Evolution by Natural Selection |
| Fri | **3** | How are genetics, evolution, and management linked? | **Evolutionary Ecology**  3: Genetics and Evolution  4: Managing the Evolution of Resistance |
| Mon | ***Labor Day - No class*** | | |
| Wed | **4** | How do temperature and precipitation affect distribution?  How do organisms respond to change? | **Physiological Ecology**  1: Trade-offs and Species Distributions  2: Adaptation and Acclimation |
| Fri | **5** | How do organisms maintain their temperature and water budgets? | **Physiological Ecology**  3: Homeostasis |
| Mon | **6** | Why do some plants rely on C3 photosynthesis while others use C4 or CAM? | **Physiological Ecology**  4: Plant Metabolism |
| Wed | **7** | How many different ways can one "win" the game of life?  What are demographics? Age pyramids? | **Life History**  1: Life Cycles and Life Histories  2: Life-History Parameters |
| Fri | **8** | What are the trade-offs that drive variation in life history strategies? | **Life History**  3: Life Tables and Survivorship Curves  4: Trade-Offs and Life-History Evolution |
| Mon | **9** | What drives global patterns in species richness?  What can islands tell us about immigration and extinction? | **Biogeography**  1: Species Richness and the Extinction Crisis  2: Ecological Biogeography |
| Wed | **10** | How do evolutionary patterns affect species distributions?  What drives global biome distribution? | **Biogeography**  3: Historical Biogeography  4: Global Patterns in Physical Conditions |
| Fri | **11** | How should the growth of a population that is not limited by resources be modeled? | **Population Growth**  1: Geometric Growth  2: Exponential Growth |
| Mon | **12** | How does resource limitation affect population growth?  What determines metapopulation persistence? | **Population Growth**  3: Logistic Growth  4: Dispersal and Metapopulations |
| Wed | **13** | Why do some populations fluctuate over time? | **Population Growth**  5: Variability in Populations |
| Fri |  | ***EXAM 1*** | |

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| --- | --- | --- | --- |
| Day | Lect | Topic | Readings |
| Mon | **14** | What is resource limitation? How does it affect intraspecific competition? | **Competition**  1: Limited Resources and Competition  2: Intraspecific Competition |
| Wed | **15** | How can interspecific competition be modeled?  Why does environmental complexity matter? | **Competition**  3: Interspecific Competition  4: Competition in Complex Environments |
| Fri | **16** | How many ways can two species interact?  Why do predator and prey populations cycle? | **Predation, Herbivory, and Parasitism**  1: Natural History of Exploitation  2: Predator-Prey Dynamics |
| Mon | **17** | What do Lotka and Volterra have to say about predator-prey interactions? | **Predation, Herbivory, and Parasitism**  3: Lotka-Volterra and Beyond |
| Wed | **18** | Why does it matter how a predator finds its food?  What does the Red Queen have to say about parasitism? | **Predation, Herbivory, and Parasitism**  4: Functional Responses to Exploitation  5: The Evolutionary Arms Race |
| Fri | **19** | What affects where a wise animal forages?  How much time it spends foraging?  And what food it gathers? | **Behavioral Ecology**  1: So Many Choices  2: Behavior in the Marketplace |
| Mon | **20** | What can you learn from a prison cell? | **Behavioral Ecology**  3: Playing Games |
| Wed | **21** | Why are there so many mating strategies? Why is cooperation common even though it’s costly? | **Behavioral Ecology**  4: Family Matters  5: Cooperation |
| Fri | **22** | What is an ecological community?  How might it change over time?  What happened when Yellowstone burned? | **Community Dynamics**  1: Communities, Disturbance, and Succession |
| Mon | **23** | On wolves, beaver, and trophic cascades. Or, what drives community structure? | **Community Dynamics**  2: Food Chains and Indirect Effects  3: Top-Down vs. Bottom-Up Control |
| Wed | **24** | When does the song remain the same? | **Community Dynamics**  4: Community Stability |
| Fri | **25** | What causes infectious diseases?  What determines how a disease spreads? | **How Diseases Spread**  1: Pathogens and Infectious Disease  2: Modeling Epidemics |
| Mon | **26** | How can a disease's spread be slowed? Why are vector-borne diseases different? Why does evolution matter? | **How Diseases Spread**  3: Controlling Disease Spread  4 & 5: Vector-Borne and Evolving Nature of Disease |
| Wed | **27** | What can ecology tell us about the spread of Lyme Disease? | No readings: case study |
| Fri | ***EXAM 2*** | | |

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| --- | --- | --- | --- |
| Day | Lect | Topic | Readings |
| Mon | **28** | Why do ecosystems need a constant supply of energy?  How are primary production and respiration related? | **Ecosystem Ecology**  1: Energy Powers Ecosystems  2: Primary Production and Respiration |
| Wed | **29** | Why are there so few predators? | **Ecosystem Ecology**  3: Secondary Production |
| Fri | **30** | How does energy flow through an ecosystem?  What do people gain from ecosystem processes? | **Ecosystem Ecology**  4: Ecosystem Energetics  5: Ecosystem Services |
| Mon | **31** | What determines decomposition rates? How do local conditions affect decomposition? | **Decomposition**  1: Decomposition Rates  2: Physical Environment |
| Wed | **32** | What is high-quality detritus?  How do decomposer organisms affect decomposition? | **Decomposition**  3: Litter Quality  4: Decomposer Organisms |
| Fri | **33** | Why do nutrients cycle if energy flows? What are the key components of the C-cycle?  Of the P-cycle? | **Nutrient Cycling**  1: Nutrient Cycling Fundamentals |
| Mon | **34** | Who drives the nitrogen cycle and why? What can we learn from small watersheds? | **Nutrient Cycling**  2: Ecosystem-Level Nutrient Cycles |
| Wed  & Fri | ***Thanksgiving Break - No Class*** | | |
| Mon | **35** | What can nutrient budgets tell you?  How have people altered global biogeochemical cycles? | **Nutrient Cycling**  3: Nutrient Budgets 4: Global Biogeochemical Cycles |
| Wed | **36** | What's the big deal about temperature? How do we know the world is warming? | **Climate Change**  1: Why Does Climate Change Matter? 2: Detecting Climate Change |
| Fri | **37** | How do models help us understand Earth's climate? | **Climate Change**  3: Earth’s Climate and Climate Models |
| Mon | **38** | How do we know that humans are responsible for modern climate change? | **Climate Change**  4: Humans and Climate Change |
| Wed | **39** | What are the consequences of a changing climate? | **Climate Change**  5: Biological Consequences of Climate Change |
| Fri | **40** | Wrap up. |  |

**Grading:**

Your final grade for this course will be given according to the +/- grading system based on the percentage of points accumulated over the course of the semester, which will be distributed as follows:

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| --- | --- |
| **Exam 1** | 300 points |
| **Exam 2** | 300 points |
| **Final Exam (Cumulative)** | 300 points |
| **SimUText Readings (33 x 10 points/each)** | 330 points |
| **In-Class Exercises** | 330 points |
| **Total** | **1560 Points** |

SimUText Readings & Questions

Part of your grade will be based on answering the questions imbedded in SimUText, an interactive general ecology text.

**There will be approximately 37 assignments in SimUText, which means you can expect to read something in preparation for nearly every class. Assignments are listed by due date when you log in to the SimUText application.**

Approximately 21% of your final grade will be based on the questions imbedded in the SimUText Ecology chapters. There are three types of questions:

* 1. **Instant-feedback questions** are found throughout the text and designed to help you check your understanding of the material.
  2. **Graded questions** are found at the end of each section and designed to assess your understanding of the material.
  3. **Ask-Your-Instructor questions** are open-ended questions found at the end of each section that allow you to raise questions about topics you find confusing or unclear.

SimUText Grades (10 points per assignment):

* 6 points for the proportion of the *instant-feedback questions* you attempt
* 4 points for the proportion of the *graded questions* you answer correctly

Time will be set aside in lecture periods to review concepts from assignments that seemed to be especially challenging. Additionally, we will address a subset of questions posed via *Ask-Your-Instructor*.

* Prior to each exam, prizes will be awarded to the students who pose the best Ask-Your-Instructor questions!
* **All assignments are due at *6:00 AM* the day of class.**   
  Assignments are due early so that I can adjust the lecture to respond to questions raised by the class.
* **Late submission policy.**
* **The *four* lowest assignment scores will be dropped.** Thus, out of the 37 reading assignments listed in SimUText, only 33 will count. This means you could earn up to 330 points for your readings.

**Additional Notes**

**Students with Disabilities.**

Class accommodation policies.

**Student Conduct Code**

Class conduct policy.

**Grading Option Statement**

Class grading options.

**Course Withdrawal Deadlines Statement**

School Add/Drop Dates.