

# Biol23 - Ecology

## Summer Online 2024 - June 4 - August 9

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**Instructor:** Colleen Hitchcock, [hitchcock@brandeis.edu](mailto:hitchcock@brandeis.edu)  
Student Support hours: Tuesdays (every other), 8 - 10:00 am ET  
or other times by appointment - email with your availability - schedule using calendar link in Latte  
Zoom: <https://brandeis.zoom.us/j/5101703573>

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### Course Overview

This **writing-intensive** course on Ecology is designed for those students enrolled in the Biology or Environmental Studies majors. We will explore the topics of ecological processes that shape the distribution and abundance of organisms and the influence of climate change at the species and community level. This course requires students to engage online and get outside to explore nature and document ecological processes and phenomena in the world around them via iNaturalist.

**All students must schedule a meet-and-greet with me during the first week of the course. Please note work for this class is due M-F, you may work ahead and submit early if needed.**

### Course Prerequisite(s):

Any of the following satisfy the prerequisite requirements for this course: BIOL 16a (Evolution and Biodiversity), a score of 5 on the AP Biology Exam, or permission of the instructor. If you do not meet any of these requirements, please come talk to me.

### Learning Goals:

**Knowledge:** Students will know the basic principles of ecology and understand how these principles shape the distribution and abundance of organisms. *By the end of the semester, students will be able to:*

- Explain the importance of *variation* in ecology (such as variation among individuals, populations, communities, and ecological processes).
- Evaluate how history influences the current composition and functioning of ecosystems.
- Explain how organisms interact and are both dependent and independent of one another.
- Describe and explain how community composition and ecosystem function relate.
- Apply the power of Natural Selection (and other mechanisms of evolution) to interpret the natural world.
- Apply ecological concepts in different ecosystem settings and at different scales.
- Evaluate the impact of both climate change and biodiversity shifts on ecological relationships.

**Skills:** A successful student in this course will understand how ecologists make observations, apply the scientific method and evaluate research. *By the end of the semester, a successful student will:*

- Demonstrate a mastery of ecological language.
- Be able to make observations about the natural world.
- Translate observations into interesting ecological questions.
- Employ ecological language to communicate scientific ideas to a general audience.
- Employ the scientific method and distinguish between a hypothesis and a theory.

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**Science Communication and Information Literacy:** Upon completion of this **writing-intensive course**, students will be able to:

- Write clear, persuasive, and expressive prose to communicate scientific findings to a non-scientific audience.
- Use appropriate research and composition procedures proficiently.
- Recognize how to evaluate your own written work and critique the work of peers.
- Be able to access and utilize library database search tools.
- Define different types of literature: primary vs. secondary, academic vs. public.
- Compare and contrast the value and efficacy of library database search tools as compared to internet search tools.

### **Major Topics**

- *Adaptation & Natural Selection:* How does evolution shape the morphology, physiology, and behavior of organisms?
- *Biogeography & History:* Why do species only occur in some of the habitats where they can live?
- *Populations:* How and why do populations (and gene frequencies) grow and decline?
- *Communities:* How do organisms interact with each other? How are communities assembled? How do they function?
- *Climate Change:* How is climate change impacting species at the individual through community levels? What evidence for climate change do we see in our local environment?
- *Citizen Science:* How is citizen science influencing ecological, conservation and natural history research? What is the place of citizen science in the future of research? How can you participate now and in the future?

### **Student Appointments:**

Given the asynchronous online nature of the course, I am available by appointment as needed for students and during student support times. Meetings will be held virtually using Zoom, please use the link in Latte to schedule yourself for a meeting during my set appointment times or If these appointments don't work or you would like to meet during a week without scheduled appointments please email to set up a time. When emailing please share 3 options for meeting (I'm generally available early in the day - EDT). I am also available to answer questions via email and will generally respond to emails within 24- 48 hours (Mon- Fri). When emailing to schedule an appointment outside of the appointment slots please include the general topic you wish to discuss and 2-3 windows you are available to meet.

### **Required Materials and Texts:**

Students in this course **need to have the ability to take and upload digital photographs** and **must meet the standard computer/software requirements for online learning at Brandeis**. You will need to purchase (through LATTE) the course textbook and Achieve platform. You will also be required to set-up an account on **iNaturalist**. Please follow the instructions in Latte.

### **Class requirements:**

Success in this 4 credit hour course is based on the expectation that students will spend a minimum of 18 hours of study/work time per week in preparation or active online class engagement (this will include readings, participating in online discussions, completing literature searches to support discussion posts, exploring nature nearby, and completing chapter assignments in Achieve, watching videos, etc.).

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### Course Requirements

#### **Textbook:**

This semester we will use Reylea (9th Edition) Ecology: The Economy of Nature. Book must be accessed through the Macmillan learning website for the text - Achieve. Achieve access includes access to the ebook and learning platform; it should be purchased directly through LATTE. It is important that you only purchase access through LATTE. If you need help purchasing access, please reach out directly to me and we will work together to obtain a voucher.

Course code:

### Evaluation and Grading

#### **Achieve Assignments (40%)**

Weekly assignments will be due on Mondays (at midnight) in Achieve. There are two types of Assignments. These assignments cannot be turned in past the online due dates, penalties are applied as outlined below. The accommodations for this assignment are built in as 9 of the learning curves and 5 of the homework assignments will drop. If you are late, miss an Achieve assignment, or do poorly on a few of these they will be dropped as a result. No additional accommodations will be provided.

- **Adaptive Quiz:** Each week you will have a “Adaptive Quiz” available for each of the upcoming chapters to read for class. These activities are adaptive quizzes on the readings. They will help you navigate through the week’s topics and practice with the concepts. Once you reach the threshold points in an Adaptive Quiz you’ll receive credit for it. There are 21 Adaptive Quizzes assigned below. Each is worth 13 points and grades on 16 of these 21 will be counted toward your grade. Thus, the lowest 5 grades on the 21 assigned will drop. Full credit for this portion of your grade will be based out of 200 points (though mathematically 208 points are available). This flexibility should help you manage your commitments to other things this summer.
- **Homeworks:** With each chapter we cover in class there is also a homework assignment in Achieve. There are 21 homework assignments assigned in Achieve. Each question is graded for accuracy, you have three attempts per question with a 5% penalty. Each is worth 13 points and grades on 16 of these 21 will be counted toward your grade. Thus, the lowest 5 grades on the 21 assigned will drop. Full credit for this portion of your grade will be based out of 200 points (though mathematically 208 points are available). This flexibility should help you manage your commitments to other things this summer.

#### **Applied Ecology through iNaturalist (30%)**

This summer you will be expected to make weekly observations using iNaturalist. Participation on the iNaturalist platform ([www.iNaturalist.org](http://www.iNaturalist.org)) will provide opportunities for students to document ecological interactions in the world around them (including urban, suburban, or rural settings). The course structure embeds opportunities to work on the platform beginning in Week 2. You can expect to engage 2 - 3 hours per week photographing, uploading observations, and identifying unknown observations on iNaturalist. In

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addition, there are four applied ecology writing assignments that allow students to apply their knowledge of ecology in the context of the iNaturalist observations.

### **Science Communication (30%):**

In this is a writing- intensive course you will learn how to do a literature search using library databases (in ecology), be reading scientific literature, writing and revising both in and out of class, and learning to critique the works of your peers constructively as you learn to translate scientific writing into short public communication pieces. These assignments are designed to assist students with developing the necessary skills for writing effectively within the discipline of science communication. Each of these three assignments requires you to critique the work of two peers and to revise your own work based on peer and instructor feedback. For each writing you will identify a primary source and translate the research for the public using the examples and rubrics provided. The primary source you identify must be recent (**e.g. within the past 3 years**), be related to one of our course topics, and be found using a Brandeis library database. **The final of the three writings must focus on the Anthropause or Anthropole.**

### **Grade Scale:**

The following scale will be used to convert percentages to letter grades:

A 93.00-100%	B- 80.00-82.99%	D+ 67.00-69.99%
A- 90.00-92.99%	C+ 77.00-79.99%	D 63.00-66.99%
B+ 87.00-89.99%	C 73.00-76.99%	D- 60.00-62.99%
B 83.00-86.99%	C- 70.00-72.99%	E <60

**Privacy:** This class requires the use of tools that may disclose your coursework and identity to parties outside the class via digital biodiversity identification tools and citizen science platforms.. To protect your privacy you may choose to use a pseudonym/alias rather than your name in submitting such work. You must share the pseudonym/alias with me.

**Accommodations:** Brandeis seeks to create a learning environment that is welcoming and inclusive of all students, and I want to support you in your learning. If you think you may require disability accommodations, you will need to work with Student Accessibility Support (SAS) (781-736-3470, [access@brandeis.edu](mailto:access@brandeis.edu)). You can find helpful student FAQs and other resources on the [SAS website](#), including guidance on how to know whether you might be eligible for support from SAS. If you already have an accommodation letter from SAS, please provide me with a copy as soon as you can so that I can ensure effective implementation of accommodations for this class.

**Academic Integrity:** Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or is not the result of the student's own effort. Infringement of academic integrity by a student subjects that student to serious penalties, which may include failure on the assignment, failure in the course, suspension from the University or other sanctions. Please consult [Brandeis University Rights and Responsibilities](#) for all policies and procedures related to academic integrity. Students may be required to submit work via TurnItIn.com or similar software to verify originality. A student who is in doubt regarding standards of academic integrity as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research assistance can be found at [Brandeis Library Guides - Citing Sources](#).

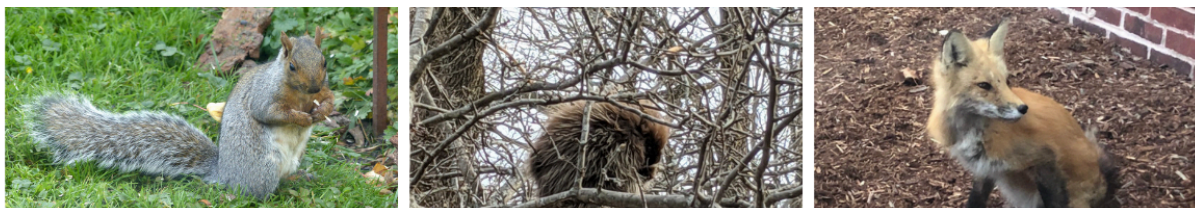
### **Student Support**

Brandeis University is committed to supporting all our students so they can thrive. If a student, faculty, or staff member wants to learn more about support resources, the [Support at Brandeis](#) webpage offers a comprehensive list that includes these staff colleagues you can consult, along with other support resources:

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- The [Care Team](#) , [Academic Services](#) (undergraduate)
- [Graduate Student Affairs](#)
- Directors of Graduate Studies in each department, School of Arts & Sciences
- Program Administrators for the Heller School and International Business School
- [University Ombuds](#)
- [Office of Equal Opportunity](#).



Week 1 (June 3 - June 7): <b>Introduction to Ecology</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>• Describe the hierarchical organization of ecological systems.</li> <li>• Describe how Earth is warmed by the greenhouse effect.</li> <li>• Explain how atmospheric currents affect the distribution of climates.</li> <li>• Describe the role of smaller-scale geographic features in affecting regional and local climates.</li> <li>• Explain how terrestrial biomes are categorized by their major plant growth forms.</li> <li>• Describe the nine categories of terrestrial biomes.</li> <li>• Describe the many aquatic biomes, which are categorized by their flow, depth, and salinity.</li> <li>• Describe the many properties of water that affect how aquatic organisms live.</li> <li>• Understand how adaptations to different temperatures allow terrestrial life to exist around the planet.</li> <li>• Illustrate how variable environments favor the evolution of variable phenotypes.</li> <li>• Understand commonly evolved adaptations in response to variable abiotic conditions.</li> </ul>
Readings/Resources	<b>Read:</b> Chapters 1 - 5, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch 2 - 5 (Normally Due Most Wednesdays but Thursday for Week 1)
Achieve Homework:	<b>Complete:</b> Ch 2 - 5 (Due Mondays of following week)
Week 2 (June 10 - 14): <b>Evolution, Coevolution, &amp; Life History</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>• Define evolution and coevolution</li> <li>• Compare and contrast evolution vs. coevolution</li> <li>• Describe how the process of evolution depends on genetic variation.</li> <li>• Clarify how evolution can occur through random processes.</li> <li>• Explain how evolution can also occur through selection, which is a nonrandom process.</li> <li>• Illustrate how microevolution operates at the population level.</li> </ul>

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	<ul style="list-style-type: none"> <li>Describe the way that macroevolution operates at the species level and higher levels of taxonomic organization.</li> </ul>
Readings/Resources	<p><b>Read:</b></p> <ul style="list-style-type: none"> <li>Chapter 6 &amp; 7</li> <li>Janzen (1980) When is it coevolution? Evolution</li> <li>Janzen (1984) The most coevolutionary animal of them all.</li> <li>Martin and Jazen (1981) Neotropical Anachronisms: The Fruits the Gomphotheres Ate.</li> </ul> <p><b>Read/Complete Latte Blocks:</b></p> <ul style="list-style-type: none"> <li>Information Literacy section in LATTE</li> <li>Case-Study: Ants-Acacia in LATTE</li> </ul>
Achieve Adaptive Quizzes	<b>Read:</b> Ch 6-7 (Due Wednesday), watch posted videos (if applicable)
Achieve Homework	<b>Complete:</b> Ch 6-7 (Due Monday of following week)
Assignment	<p><b>Complete:</b></p> <ul style="list-style-type: none"> <li>Paper Selections due for Writing in Ecology 1 (link to Google Form - June 10)</li> <li>iNaturalist Set-up (June 10)</li> <li>iNaturalist first observations (June 14)</li> </ul>
<b>Week 3 (June 17 - 21): Behavior and Reproduction (Holiday 6/19)</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>Describe life history traits as the schedule of an organism's life.</li> <li>Explain how life history traits are shaped by trade-offs.</li> <li>Recognize that organisms differ in the number of times that they reproduce, but they all eventually become senescent.</li> <li>Explain how life histories are sensitive to environmental conditions.</li> <li>Describe both sexual and asexual reproduction.</li> <li>Explain how organisms can evolve as separate sexes or as hermaphrodites.</li> <li>Describe the typically balanced sex ratios of offspring and how this can be modified by natural selection.</li> <li>Explain how mating systems describe the pattern of mating between males and females.</li> <li>Explain how sexual selection favors traits that facilitate reproduction.</li> <li>Describe how living in groups has costs and benefits.</li> <li>Illustrate the four types of social interactions.</li> <li>Explain how eusocial species take social interactions to the extreme.</li> <li>Describe the social interactions of plants.</li> </ul>
Readings/Resources	<b>Read:</b> Ch 8, 9, 10, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch. 8, 9,10 (Due Thursday - re: Wednesday holiday)
Achieve Homework	<b>Complete:</b> Ch. 8, 9,10 (Due Monday of following week)

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Assignments	<b>Complete:</b> <ul style="list-style-type: none"> <li>● Draft of Writing in Ecology (June 21)</li> </ul>
<b>Week 4 (June 24-June 28): Population Ecology</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>● Explain why the distribution of populations is limited to ecologically suitable habitats.</li> <li>● Give the five important characteristics of population distributions.</li> <li>● Describe how distribution properties of populations can be estimated.</li> <li>● Explain why dispersal is essential to colonizing new areas.</li> <li>● Explain why populations have growth limits that regulate their populations.</li> <li>● Describe how life tables demonstrate the effects of age, size, and life-history stage on population growth.</li> <li>● Recognize that population size fluctuates naturally over time.</li> <li>● Explain how density dependence with time delays can cause population size to be inherently cyclic.</li> <li>● Describe how chance events can cause small populations to go extinct.</li> <li>● Illustrate how metapopulations are composed of subpopulations that experience independent population dynamics.</li> </ul>
Readings/Resources	<b>Read:</b> Ch 11 & 12, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch 11 & 12 (Due Wednesday)
Achieve Homework	<b>Complete:</b> Ch 11 & 12 (Due Monday of following week)
Assignment	<b>Complete:</b> <ul style="list-style-type: none"> <li>● iNaturalist weekly observations, 20 observations (June 24)</li> <li>● Peer Review Due Writing in Ecology Discussions (June 26)</li> <li>● Applied Ecology iNaturalist Assignment 1 (June 28)</li> </ul>
<b>Week 5 (July 1 - 5): Species Interactions (Part 1) and Mimicry (Holiday 7/4)</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>● Demonstrate how predators and herbivores can limit the abundance of populations.</li> <li>● Illustrate how populations of consumers and consumed populations fluctuate in regular cycles.</li> <li>● Describe how predators and herbivores respond to food availability with functional and numerical responses.</li> <li>● Explain how predation and herbivory favor the evolution of defenses.</li> <li>● Compare and contrast the different types of mimicry.</li> <li>● Describe, compare, and contrast the mechanism of the evolution of Batesian and Mullerian mimicry.</li> </ul>
Readings/Resources	<b>Read:</b> <ul style="list-style-type: none"> <li>● Ch. 13, watch posted videos (if applicable)</li> <li>● Mimicry in LATTE</li> </ul>
Achieve Adaptive	<b>Complete:</b> Ch 13 (Due Wednesday)

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Quizzes	
Achieve Homework	<b>Complete:</b> Ch 13 (Due Mondays of following week)
Assignments	<b>Complete:</b> <ul style="list-style-type: none"> <li>● Final Writing in Ecology 1 (July 1)</li> <li>● iNaturalist weekly observations, 20 observations (July 1)</li> <li>● Draft Writing in Ecology 2 (due July 5)</li> </ul>
<b>Week 6 (July 8 - 12): Species Interactions (Part 2)</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>● Identify the many different types of parasites that affect the abundance of host species.</li> <li>● Explain the process of parasites evolving offensive strategies while hosts evolve defensive strategies.</li> <li>● Illustrate that competition occurs when individuals experience limited resources.</li> <li>● Explain the theory of competition as an extension of logistic growth models.</li> <li>● Describe how the outcome of competition can be altered by abiotic conditions, disturbances, and interactions with other species.</li> <li>● Distinguish among exploitation competition, interference competition, and apparent competition.</li> <li>● Describe how mutualisms can provide water, nutrients, and places to live.</li> <li>● Explain how mutualisms can aid in defense against enemies.</li> <li>● Illustrate the role that mutualisms play in facilitating pollination and seed dispersal.</li> <li>● Describe how mutualisms can change when conditions change.</li> <li>● Explain how mutualisms can affect species distributions, communities, and ecosystems.</li> </ul>
Readings/Resources	<b>Read:</b> Ch 14 - 16, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch. 14 - 16 (Due Wednesday)
Achieve Homework	<b>Complete:</b> Ch. 14 - 16 (Due Monday of following week)
Assignment	<b>Complete:</b> <ul style="list-style-type: none"> <li>● iNaturalist weekly observations, 20 observations (July 8)</li> <li>● Peer Review Writing in Ecology 2 (due July 10)</li> <li>● Applied Ecology iNaturalist Assignment 2 (July 12)</li> </ul>
<b>Week 7 (July 15 - 19): Community Ecology (What can natural history records tell us?)</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>● Illustrate how communities can have distinct or gradual boundaries.</li> <li>● Explain why the diversity of a community incorporates both the number and relative abundance of species.</li> <li>● Describe the ways in which species diversity is affected by resource availability, habitat diversity and connectivity, keystone species, and</li> </ul>



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	<p>disturbances.</p> <ul style="list-style-type: none"> <li>• Explain how communities are organized into food webs.</li> <li>• Discuss how succession occurs in a community as species replace each other over time.</li> <li>• Describe the multiple mechanisms by which succession occurs.</li> <li>• Explain the ways in which succession does not always produce a single climax community.</li> <li>• Describe how communities respond to disturbances with resistance, resilience, or switching between alternative stable states.</li> </ul>
Readings/Resources	<b>Read:</b> Ch 17 - 18, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch 17 - 18 (Due Wednesday)
Achieve Homework	<b>Complete:</b> Ch 17 - 18 (Due Monday of following week)
Assignment	<ul style="list-style-type: none"> <li>• iNaturalist weekly observations, 20 observations (July 15)</li> <li>• Final Writing in Ecology 2 (July 15)</li> <li>• Draft Writing in Ecology 3 (July 19)</li> </ul>
<b>Week 8 (July 22-26): Ecology and Climate Change</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>• Explain the signature of climate change in organisms.</li> <li>• Identify and explain regional examples range shift and phenology shifts in species.</li> <li>• Identify and apply the characteristics of organisms that inform climate change studies.</li> <li>• Identify how citizen science research can support documenting change by scientists and understanding of climate change in the public.</li> </ul>
Resources/Readings	<p>Watch required videos</p> <p><a href="#">Hansen, Thor (2020) Hurricane Lizards and Plastic Squids - Section 3: Chapters 7-10</a></p>
Achieve Adaptive Quizzes	None
Achieve Homework	None
Assignment	<p><b>Complete:</b></p> <ul style="list-style-type: none"> <li>• iNaturalist weekly observations, 20 observations (July 22)</li> <li>• Peer Review Writing in Ecology 3 (due July 23)</li> </ul>
<b>Week 9 (July 29- August 2): Ecosystems</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>• Describe how primary productivity provides energy to the ecosystem.</li> <li>• Explain why the net primary productivity differs among different ecosystems.</li> <li>• Explain how the movement of energy depends on the efficiency of energy flow.</li> <li>• Describe how the hydrologic cycle moves many elements through</li> </ul>

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	<p>ecosystems.</p> <ul style="list-style-type: none"> <li>● Explain why the carbon cycle is closely tied to the movement of energy.</li> <li>● Illustrate the ways in which nitrogen cycles through ecosystems in many different forms.</li> <li>● Discuss how landscape ecology concerns ecological patterns and processes at large spatial scales.</li> <li>● Explain why the number of species increases with geographic area.</li> <li>● Describe how the equilibrium theory of island biogeography incorporates habitat area and isolation.</li> <li>● Highlight the causes for biodiversity being highest near the equator and lowest toward the poles.</li> <li>● Explain how the distribution of species around the world is also affected by Earth's history.</li> </ul>
Resources/Readings	<b>Read:</b> Ch. 19 - 20, watch posted videos (if applicable)
Achieve Adaptive Quizzes	<b>Complete:</b> Ch 19 - 20 (Due Wednesday)
Achieve Homework	<b>Complete:</b> Ch 19 - 20 (Due Monday of following week)
	<p><b>Complete:</b></p> <ul style="list-style-type: none"> <li>● iNaturalist weekly observations, 20 observations (July 29)</li> <li>● Final Draft Writing in Ecology 3 (July 29)</li> <li>● Applied Ecology iNaturalist Assignment 3 (Aug 2)</li> </ul>
<b>Week 10 (August 5 - 9): Conservation Biology</b>	
Learning Objectives	<ul style="list-style-type: none"> <li>● Identify the value of biodiversity based on social, economic, and ecological considerations.</li> <li>● Explain why the current rate of extinction is unprecedented.</li> <li>● Describe the ways in which human activities are causing the loss of biodiversity.</li> <li>● Identify conservation efforts that can slow or reverse declines in biodiversity.</li> </ul>
Readings/Resources	<b>Read:</b> Ch. 21 & 22, watch posted videos (if applicable)
Achieve Adaptive Quiz	<b>Complete:</b> Ch 21 & 22 (Aug 6)
Achieve Homework	<b>Complete:</b> Ch. 21 & 22 (Aug 9)