



SENATE COMMITTEE ON CURRICULAR AFFAIRS
COURSE SUBMISSION AND CONSULTATION FORM

Principal Faculty Member(s) Proposing Course

Name	User ID	College	Department
LES MURRAY	ldm12	Abington College (AB)	Not Available

Academic Home: Abington College (AB)

Type of Proposal: Add Change Drop

Message for Reviewers:

Course Designation

(BIOL 144Z) Climate Change: Biological Impacts - Linked

Course Information

Cross-Listed Courses:

Prerequisites:

Corequisites:

Concurrents:

Recommended Preparations:

Abbreviated Title: Climate Change: Biology-Linked
Discipline: General Education
Course Listing: Linked

Special categories for Undergraduate (001-499) courses

Foundations

- Writing/Speaking (GWS)
- Quantification (GQ)

Knowledge Domains

- Health & Wellness (GHW)
- Natural Sciences (GN)
- Arts (GA)
- Humanities (GH)
- Social and Behavioral Sciences (GS)

Additional Designations

- Bachelor of Arts
- International Cultures (IL)
- United States Cultures (US)
- Honors Course
- Common course number - x94, x95, x96, x97, x99
- Writing Across the Curriculum

First-Year Engagement Program

- First-Year Seminar

Miscellaneous

Common Course

GE Learning Objectives

GenEd Learning Objective: Effective Communication

GenEd Learning Objective: Creative Thinking

GenEd Learning Objective: Crit & Analytical Think

GenEd Learning Objective: Global Learning

GenEd Learning Objective: Integrative Thinking

GenEd Learning Objective: Key Literacies

GenEd Learning Objective: Soc Resp & Ethic Reason

Bulletin Listing

Minimum Credits: 3
Maximum Credits: 3
Repeatable: NO
Department with Curricular Responsibility: Abington Administration (ABAB_ABADM)
Effective Semester: Upon Approval
Travel Component: NO

Course Outline

A brief outline or overview of the course content:

This course introduces students to the basic mechanisms of climate change and the biological impacts of climate change on individuals, populations, species, communities, and ecosystems. Examples of topics to be discussed include health, disease, birth, mortality, extinction risk, parasitism, mutualism, energy flow, and nutrient cycling. The course will also be explicitly linked to ART 144Z through the use of art as a stimulus to further investigate the science of climate change and PSYCH 144Z through discussion of the psychological factors that influence peoples' interpretation of science regarding climate change; successful completion of any two of these courses fulfills 6 credits of Integrative Studies.

A listing of the major topics to be covered with an approximate length of time allotted for their discussion:

Below is a list of major topics to be covered in the course; a more detailed description can be found in the attached syllabus.

Basics of climate and climate change: ~300 minutes
Acclimatization and evolution by natural selection: ~150 minutes
Biological impacts of climate change on individuals: ~450 minutes
Biological impacts of climate change on populations: ~450 minutes
Biological impacts of climate change on biological communities: ~450 minutes
Biological impacts of climate change on ecosystems: ~400 minutes

Course Description:

A study of the interactions of organisms with their environment through exploration of the biological impacts of climate change on individuals, populations, ecological communities, and ecosystems. Students will develop skills to make informed judgments about the implications of climate change using scientific information and expand their understanding of how and why science works to generate knowledge to address biological issues relative to climate change. Students will construct evidence-based explanations of the impacts of climate change on biological processes such as disease transmission, population dynamics, and ecosystem functioning. In addition, students will develop skills to integrate biological knowledge with the psychological factors that influence peoples' views of climate change and the use of artistic expression to increase awareness of environmental issues. BIOL 144Z fulfills 3 credits of the GN Domain General Education requirements. BIOL 144Z may also be used in combination with either ART 144Z or PSYCH 144Z as linked courses to fulfill 6-credits of Integrative Studies. Because of duplication of subject matter a student may receive credit for only one of the following courses: BIOL 144, BIOL 144Z, BIOL 220W.

The name(s) of the faculty member(s) responsible for the development of the course:

Name: LES MURRAY (ldm12)

Title:

Phone:

Address:

Campus: AB

City:

Fax:

Course Justification

Instructional, Educational, and Course Objectives:

This section should define what the student is expected to learn and what skills the student will develop.

Expected Learning Outcomes:

- 1) Students will be able to apply principles of scientific inquiry to make informed judgments about the impacts of climate change on biological processes.
- 2) Students will be able to synthesize and analyze information to form evidence-based conclusions of the impacts of climate change on biological processes.
- 3) Students will be able to apply the theories of natural selection and evolution as it pertains to biological responses to climate change.
- 4) Students will be able to apply the principles of population growth and extinction risk within the framework of the impacts of climate change on populations.
- 5) Students will be able to apply the principles of species interactions within the framework of the impacts of climate change on communities.
- 6) Students will be able to apply the principles of ecosystem processes within the framework of the impacts of climate change on ecosystems.
- 7) Students will be able to integrate ideas expressed through art activism with scientific understanding of climate change.
- 8) Students will be able to integrate the understanding of psychological processes that shapes peoples' views of scientific information and climate change with scientific understanding of climate change.

Evaluation Methods:

Include a statement that explains how the achievement of the educational objective identified above will be assessed.

The procedures for determining students' grades should be specifically identified.

Achievement of objectives will be assessed through quizzes, exams, writing assignments, and/or projects. Objectives 1-6 above are best addressed through a combination of quizzes, exams, writings, and projects that assess students ability to apply scientific and biological principles to issues associated with climate change. These assessments will specifically stress application of material learned beyond remembering or understanding by asking students to apply biological principles to novel scenarios and scientific information not explicitly discussed in class. As scientific and biological information comprise the majority of the information to be covered in the course approximately 80% of student evaluation will be based on these quizzes, exams, writings, and projects.

The remaining 20% of student evaluation will be based on development of integrative thinking skills over the course of the semester based on assessment through a series of writing prompts and/or presentations spread throughout the semester. These assessments would be used to judge students ability to integrate information from art, biology, and psychology at the beginning of the semester, mid-semester, and end of the semester and students would be evaluated based on development of integrative thinking over the course of the semester using prior assignments as a base-line comparison.

Integration of art and biology would be assessed by asking students to describe and interpret a piece of art that relates to some aspect of climate change and biology with the expectation that students' abilities to integrate science into their interpretation and explanation of art will improve throughout the course.

Integrative thinking connecting biology and psychology will be assessed through writing prompts, exam questions, and presentations that ask students to predict how scientific results relating to climate change and biology would be viewed by people with different psychological perspectives with the expectation that students' predictions will become more based on psychological theory rather than personal conjecture and experiences.

Relationship/Linkage of Course to Other Courses:

This statement should relate the course to existing or proposed new courses. It should provide a rationale for the level of instruction, for any prerequisites that may be specified, or for the course's role as a prerequisite for other courses.

BIOL 144Z includes explicit curricular links with ART 144Z: Climate Change: Arts, Agency and Activism and PSYCH 144Z: Climate Change: Individual Behaviors and Societal Attitudes.

Relationship of Course to Major, Option, Minor, or General Education:

This statement should explain how the course will contribute to the major, option, or minor and indicate how it may function as a service course for other departments.

BIOL 144Z Climate Change: Biological Impacts (3) is proposed as an approved course for General Education (GN). The course will satisfy 3 GN credits toward the General Education requirement, and can satisfy 3 credits towards the 6 credit integrative studies component of the general education requirement, provided students also take either ART 144Z: Climate Change: Arts, Agency and Activism or PSYCH 144Z: Climate Change: Individual Behaviors and Societal Attitudes to complete the integrative studies requirement.

A description of any special facilities:

NA

Frequency of Offering and Enrollment:

No restrictions on the frequency of offerings.

Enrollment is flexible, but enrollments that allow for class discussions would be best. 24-36 students is recommended.

Alignment with General Education Objectives

EFFECTIVE COMMUNICATION – the ability to exchange information and ideas in oral, written, and visual form in ways that allow for informed and persuasive discourse that builds trust and respect among those engaged in that exchange, and helps create environments where creative ideas and problem-solving flourish.

KEY LITERACIES – the ability to identify, interpret, create, communicate and compute using materials in a variety of media and contexts. Literacy acquired in multiple areas, such as textual, quantitative, information/technology, health, intercultural, historical, aesthetic, linguistic (world languages), and scientific, enables individuals to achieve their goals,

to develop their knowledge and potential, to lead healthy and productive lives, and to participate fully in their community and wider society.

CRITICAL AND ANALYTICAL THINKING – the habit of mind characterized by comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating a conclusion. It is the intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.

INTEGRATIVE THINKING – the ability to synthesize knowledge across multiple domains, modes of inquiry, historical periods, and perspectives, as well as the ability to identify linkages between existing knowledge and new information. Individuals who engage in integrative thinking are able to transfer knowledge within and beyond their current contexts.

CREATIVE THINKING – the capacity to synthesize existing ideas, images, or expertise in original ways and the experience of performing, making, thinking, or acting in an imaginative way that may be characterized by innovation, divergent thinking, and intellectual risk taking.

GLOBAL LEARNING – the intellectually disciplined abilities to analyze similarities and differences among cultures; evaluate natural, physical, social, cultural, historical, and economic legacies and hierarchies; and engage as community members and leaders who will continue to deal with the intricacies of an ever-changing world. Individuals should acquire the ability to analyze power; identify and critique interdependent global, regional, and local cultures and systems; and evaluate the implications for people's lives.

SOCIAL RESPONSIBILITY AND ETHICAL REASONING – the ability to assess one's own values within the social context of problems, recognize ethical issues in a variety of settings, describe how different perspectives might be applied to ethical dilemmas, and consider the ramifications of alternative actions. Individuals should acquire the self-knowledge and leadership skills needed to play a role in creating and maintaining healthy, civil, safe, and thriving communities.

What component(s) of the course will help students achieve the General Education Learning Objectives covered in the course? Provide evidence that students in the course have adequate opportunities to achieve the identified learning objectives.

Key Literacies: Students will develop the ability to interpret and communicate results of scientific studies in order to develop knowledge through study of biological principles and research on the biological impacts of climate change. In addition, students will develop skills to evaluate scientific information to make better-informed decisions as a member of their community and wider society.

Critical and Analytical Thinking: This course will develop students' abilities to analyze, evaluate, synthesize, and apply scientific information before accepting or formulating a conclusion. Students will develop skills to closely examine information to identify the essential elements in order to make information useable. Students will also increase their ability to synthesize information from multiple sources in order to evaluate scientific information as a guide to belief and action.

Integrative Thinking: Integrative thinking skills will be strengthened in this course through the explicit linkage of the biological ideas presented with the social and artistic viewpoints emphasized throughout the course. Students will synthesize people's thoughts of scientific information with the psychological understanding of how people process new information based on individual behaviors and societal attitudes. Students also will transfer biological knowledge to develop a deeper understanding of the interaction of scientific information and art. Students will further develop integrative thought if they choose to take one of the courses linked with this course (ART 144Z, PSYCH 144Z) that will explicitly incorporate biological impacts of climate change within the respective domain (GA, GS).

How will students be assessed to determine their attainment of the Learning Objective(s) of General Education covered in this course? This assessment must be included as a portion of the student's overall performance in this course.

Evaluation of this course will focus on achievement of the objectives of this course to develop key literacies, critical and analytic thinking, and integrative thinking. Several instruments will be used to assess student attainment of the General Education Learning Objectives.

Scientific literacy and critical and analytic thinking will be assessed through a combination of quizzes, exams, writings, and/or projects that require students to clearly demonstrate understanding and application of the biological principles discussed in the course (e.g., natural selection, homeostasis, population growth, species interactions). Critical and analytic thinking will be specifically assessed through activities that prompt students to apply scientific principles and synthesis of information to analyze the biological impacts of climate change before formulating a conclusion. For example, students might be asked to write a paper describing the potential impacts of climate change on polar bear populations using scientific information to support their conclusions.

Integrative thinking will be assessed through exam questions, writings, and/or projects that prompt students to evaluate their scientific conclusions within the context of psychology and art. Assessments of integration of the natural and social sciences would ask students to communicate or explain how scientific conclusions may be interpreted differently based on the psychology of individual behavior and societal attitudes. Assessments of integration between art and science will take the form of prompts that ask students to draw scientific inspiration from art leading students to formulate and research scientific questions and integrate their biological knowledge into their interpretation of the art. Assessment will employ a series of assignments throughout the semester that will be used to evaluate growth of integrative thinking over the duration of the course.

General Education Domain Criteria

General Education Designation: Linked

Linked Courses

- | ART 144Z
- | PSYCH 144Z

GN Criteria

Explain the methods of inquiry in the natural science fields and describe how the contributions of these fields complement inquiry in other areas

- Construct evidence-based explanations of natural phenomena**
- Demonstrate informed understandings of scientific claims and their applications**
- Evaluate the quality of the data, methods, and inferences used to generate scientific knowledge**
- Identify societal or philosophical implications of discoveries in the natural sciences, as well as their potential to address contemporary problems**

What components of the course will help students achieve the domain criteria selected above?

This course will help students to increase their abilities to meet of the GN domain criteria described. Throughout the course, students will learn about methods of inquiry in the natural sciences used to understand climate change and the biological impacts of climate change, and construct evidence-based explanations for climate change and the biological impacts of climate change. Students increase their ability to demonstrate understanding of scientific claims and their application through investigation of case studies of the impact of climate change on the biota from the individual to the ecosystem level. Emphasis on evaluation of scientific research by examining the quality of the data, methods, and inferences used to generate scientific knowledge will be key to the course for students to be able to form conclusions about the impacts of climate change and the societal implications of these discoveries.

Integrative Studies

Explain how the intellectual frameworks And methodologies of each course's Knowledge Domain will be explicitly addressed in the course and practiced by the students.

BIOL 144Z will help students to increase their abilities to meet of the GN domain criteria described. Throughout the course, students will learn about methods of inquiry in the natural sciences used to understand climate change and the biological impacts of climate change, and construct evidence-based explanations for climate change and the biological impacts of climate change. Students increase their ability to demonstrate understanding of scientific claims and their application through investigation of case studies of the impact of climate change on the biota from the individual to the ecosystem level. Emphasis on evaluation of scientific research by examining the quality of the data, methods, and inferences used to generate scientific knowledge will be key to the course for students to be able to form conclusions about the impacts of climate change and the societal implications of these discoveries.

PSYCH 144Z is intended to be an introduction to environmental attitudes and behavior research within the social sciences (GS), especially the fields of social and environmental psychology. This course allows students to understand the varied psychological processes, including individual attitudes, societal values, and personality traits, that shape a person's interactions with and feelings toward the physical environment within the context of global climate change. Drawing on methodology and theory in the areas of attitude change, social cognition, environmental perception, pro-social behavior, and emotions, this course will provide students with insight into how individual and group actions and mental processes can impact beliefs and actions toward global climate change while also providing a foundation for ways to alter those behaviors in meaningful ways.

ART 144Z will use an intellectual framework centered around the natural way artists see, learn, describe and communicate the world around them. Combining a research-based approach with a randomized system of juxtapositions with both imagery and words, will expose students to new ways of thinking and new possibilities in solving global problems, and here the most challenging problem of our time. Students will begin by communicating their basic competence in understanding climate change, they will be exposed to several ways of making art, and will then combine ideas and process. Throughout the semester students will build on their knowledge through interactive assignments, discussions reflections and art making. Thus, art making, research on artists, lectures about art and social change, discussions and critiques will deepen all aspects of the Art Knowledge Domain.

Explain how the courses in the Linkage will be linked with each other. It is anticipated that courses will usually be linked by subject matter, but they should additionally be linked by some purposeful component that provides opportunities for students to experience and practice integrative thinking across Knowledge Domains. The Linkage component between courses needs to be intentional and explicit to students. However, each course in a Linkage must be self-contained such that students can successfully complete just one course in the Linkage if they so choose.

The theme of climate change inherent in BIOL 144Z, ART 144Z, and PSYCH 144Z creates a natural linkage for these courses. In addition, intentional and explicit components to strengthen the linkages between these courses have been embedded in each course with particular emphasis on opportunities for students to experience and practice integrative thinking across Knowledge Domains.

BIOL 144Z will be explicitly linked with PSYCH 144Z through activities and assignments that prompt students to integrate scientific information with the psychological understanding of how people process new information based on individual behaviors and societal attitudes. For example, after a brief introduction to confirmation bias students will be asked to infer the response of people to scientific information when they previously had strong beliefs that agreed with or contradicted the scientific conclusion.

PSYCH144Z will be explicitly linked to BIOL144Z through activities and assignments that prompt students to integrate their knowledge of individual and collective human behavior and attitudes with research in biology and ecology. For example, after reading an article on psychological processes related to empathy and concern for wildlife, students will be asked to apply that research to a specific species being impacted by climate change. Similarly, after reading articles on central and peripheral processing of information, students may be asked to create two different infographics—one central and one peripheral—for a scientific finding on climate change in ecology to aid in swaying public understanding of the data.

BIOL 144 Z will be explicitly linked with ART 144Z by present students artistic representations of climate change and environmental issues through out the semester to initiate thought and research of biological issues related to climate change. For example, an image of an artistic piece by Ashley Cecil depicting the impacts of droughts on human food availability could be presented to students for their interpretation prior to discussing the impacts of climate change on agriculture and food for human populations in regions that will be impacted by more severe and frequent droughts.

ART 144Z will be explicitly linked with BIOL 144 Z by using scientific data throughout the semester to support art making in response to climate change. This data will be delivered in the form of readings, discussions and lectures. Students will respond to the information in discussions, journal entries and art making. Specific linkage to the biology course will occur in the lectures on

biological impact. Students will create a collage assignment juxtaposing images of impacted populations, biology and ecosystems.

Briefly explain the staffing plan. Given that each Linked course is approved for a single Knowledge Domain, it will be taught by an instructor (or instructional team) with appropriate expertise in that domain, who will also be expected to implement the Linkage's shared component as defined in this proposal

BIOL 144Z will be taught by an instructor with biological expertise that possesses knowledge of individual response to environment, population dynamics, community interactions among species, ecosystem processes, and basic processes influencing climate change. This instructor also will be responsible for the explicit linkages to ART 144Z and PSYCH 144Z as described above with consultation with instructors of ART 144Z and PSYCH 144Z.

Describe the assessments that will be used to determine students' ability to apply integrative thinking.

Integrative thinking will be assessed through exam questions, writings, and/or projects that prompt students to evaluating their scientific conclusions within the context of psychology and art. Assessments of integration of the natural and social sciences would ask students to communicate or explain how scientific conclusions maybe interpreted differently based on the psychology of individual behavior and societal attitudes. Assessments of integration between art and science will take the form of prompts that ask students to draw scientific inspiration from art leading students to formulate and research scientific questions and integrate their biological knowledge into their interpretation of the art. Assessment will employ a series of assignments throughout the semester that will be used to evaluate growth of integrative thinking over the duration of the course.

Campuses That Have Offered () Over The Past 4 Years

semester	AB	AL	BK	BR	BW	CR	DS	ER	FE	GA	GV	HB	HN	HY	LV	MA	NK	PC	SH	SL	UP	WB	WC	WS	XC	XP	XS	YK
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Potential Impact

Pre-Requisites

is *listed as a pre-requisite or concurrent course* for the following courses:

Note: Not all courses may be listed here, due to lionpath requirement incomplection.

No pre-requisites or concurrent courses found

Penn State - Abington

Biology 144Z: Biological Impacts of Climate Change

Dr. Les Murray
Office: 228 Woodland

Phone: 215-881-7940
Email: ldm12@psu.edu

Office Hours: **MW 11:00-1:00**
 R 9:00-10:00
 Other times by appointment.

Lecture Classes (All Sections): **M,W,F 1:25-2:15 pm, 313W**

Required Materials for the Course:

Course readings will be comprised of scientific papers, government reports, and book chapters on the biological implications of climate change distributed through Canvas. *Climate Change: A Very Short Introduction* by Mark Maslin (ISBN: 978-0-19-871904-5) will be used as recommended text to supplement other readings.

Course Overview

Course Description: This course introduces students to the basic mechanisms of climate change and the biological impacts of climate change on individuals, populations, species, communities, and ecosystems. Topics that will be discussed will include health, disease, birth, mortality, extinction risk, parasitism, mutualism, energy flow, and nutrient cycling among others.

Expected Learning Outcomes:

- 1) Students will be able to apply principles of scientific inquiry to make informed judgments about the impacts of climate change on biological processes.
- 2) Students will be able to synthesize and analyze information to form evidence-based conclusions of the impacts of climate change on biological processes.
- 3) Students will be able to apply the theories of natural selection and evolution as it pertains to biological responses to climate change.
- 4) Students will be able to apply the principles of population growth and extinction risk within the framework of the impacts of climate change on populations.
- 5) Students will be able to apply the principles of species interactions within the framework of the impacts of climate change on communities.
- 6) Students will be able to apply the principles of ecosystem processes within the framework of the impacts of climate change on ecosystems.

Integrative Studies: This course may be used to fulfill the Integrative Studies General Education requirement as part of a pair of linked courses if either ART 144Z (GA) or PSYCH 144Z (GS) are also successfully completed.

The societal implications that become apparent from study of biological research provide a window for integrating the ideas of science and biology with other domains and developing integrative thinking. The linked courses will foster integrative thinking through the synthesis of knowledge across domains and the transfer of knowledge beyond the context of a single field of study. Course activities and assignments will explicitly demonstrate the linkages that radiate from biological aspects of climate change to both the psychological influences of peoples' opinion on climate change and how art can bring about new ways of thinking about and a greater awareness to climate change issues. Integrative thinking will be assessed through a series of assignments that measure students' development of integrative thinking across the semester.

Integrative Thinking Expected Learning Outcomes:

- 1) Students will be able to integrate ideas expressed through art activism with scientific understanding of climate change.
- 2) Students will be able to integrate the understanding of psychological processes that shapes peoples' views of scientific information and climate change with scientific understanding of climate change.

Course Schedule

The following is a tentative schedule for the class. Chapter assignments include all of the material covered in the entire chapter unless otherwise noted in class handouts and/or announcements in class. Changes in the material to be covered, as well as the dates and content of exams, can be made at the instructor's discretion.

Week	Date	Topic
1	M	What is climate?
	W	Is climate changing?
	F	Why is climate changing?
2	M	Is climate really changing? What is the debate?
	W	How does science work?
	F	What are the potential impacts of climate change?
3	M	NO CLASS – MLK Day
	W	Current Events: Biological Impacts of Climate Change
	F	How do organisms respond to climate change?
4	M	Acclimitization vs. adaptation
	W	Evolution by natural selection
	F	Homeostasis & physiological stress
5	M	Ectotherms and changing temperatures
	W	Endotherms and changing temperatures
	F	Mortality and climate change
6	M	Reproduction and climate change: plants
	W	Reproduction and climate change: animals
	F	Humans and Climate Change: Births and Deaths
7	M	Extinction risk and climate change
	W	Population growth and decline (BIDE model)
	F	The extinction vortex and small populations
8	M	Climate change and population fragmentation
	W	Species threatened and endangered by climate change
	F	Humans and Climate Change: Populations of Concern
9	M	
	W	
	F	
10	M	Movement of populations in response to climate change: migration and redistribution
	W	Humans and Climate Change: Migration and Redistribution
	F	Climate Change and Evolution of Populations
11	M	Biological communities: the whole is greater than the parts
	W	Climate change and parasites
	F	Climate change and disease
12	M	Humans and Climate Change: Disease
	W	Climate change and food webs
	F	Humans and Climate Change: Agriculture & Food

13	M	Climate change and habitat
	W	Climate change and invasive species
	F	Climate change and biodiversity
14	M	Introduction to Ecosystems
	W	Nutrient Cycling in Ecosystems
	F	Climate change and nutrient cycling: Carbon
15	M	Climate change and nutrient cycling: Nitrogen
	W	Energy Flow in Ecosystems
	F	Climate Change and Energy Flow
16	M	Climate Change and Decomposition
	W	Humans and Climate Change: Ecosystem Goods and Services
	F	Class Discussion/Wrap Up