

## SEMESTER AT SEA COURSE SYLLABUS

Colorado State University, Academic Partner

|                                 |                     |
|---------------------------------|---------------------|
| <b>Voyage:</b>                  | Spring 2019         |
| <b>Discipline:</b>              | Geography           |
| <b>Course Number and Title:</b> | GR 348 Biogeography |
| <b>Division:</b>                | Upper               |
| <b>Faculty Name:</b>            | M. Troy Burnett     |
| <b>Semester Credit Hours:</b>   | 3                   |

**Prerequisites:** A minimum of three (3) geography credits

### COURSE DESCRIPTION

The spatial patterns of species distributions are widely recognized, but few appreciate the complex causes of these patterns. Biogeography is the study of the spatial patterns of biological diversity, and its causes, both in the present and in the past. Biogeographers synthesize information from a very broad range of fields, including ecology, evolution, paleontology, and climatology. This course will provide the ecological and historical foundations for understanding the distribution and abundance of species, and the changes in distribution and abundance over time. Further, we will examine the relevance of biogeography during a time of increasing human impact and climate change. The course begins with an overview of important concepts, including evolutionary mechanisms, earth history, and plate tectonics, as well as concepts of the ecological niche and patterns of distribution at various taxonomic levels. We also study basic ecological concepts, how species are patterned and dispersed on the landscape, and how these patterns have changed over the relatively recent ice age. In the second part of the course, we delve into historical biogeography and study why continents and islands have unique assemblages of species, and the effects of mega-extinctions and biotic interchanges between continents. We also return to conservation in a detailed examination of the equilibrium theory of island biogeography, metapopulation theory, and the landscape approach.

### LEARNING OBJECTIVES

- Describe the historical and ecological factors which influence the distributional pattern of life on earth
- Apply the scientific method and philosophy of hypothesis testing to biogeographic problems
- Explain how advances in paleontology, climatology, evolution, plate tectonics, and ecology have shaped the modern synthesis of biogeography

- Understand the primary biogeographical theories and models involved in our understanding of life patterns, including island biogeography, metapopulation, and landscape ecology
- Understand how biogeography informs and is informed by evolution

## REQUIRED TEXTBOOKS

AUTHOR: Cox, Barry, Peter D. Moore, and Richard Ladle  
 TITLE: Biogeography. An Ecological and Evolutionary Approach  
 PUBLISHER: John Wiley and Sons  
 ISBN#: 9781118968581  
 DATE/EDITION: 2016/9<sup>th</sup> Edition

### Select readings will be accessible on the ship's intranet

Anderson, A. 2006. Applying Nature's Design—Corridors as a Strategy for Biodiversity Conservation  
 Botkin, D. et al. 2016. The Biogeochemical Cycles, in Environmental Science: Earth as a Living Planet.  
 Botkin, D. et al. 2016. Ecosystems and Ecosystem Management, in Environmental Science: Earth as a Living Planet.  
 MacDonald, G. 2003. Introduction to Biogeography—Space, Time, and Life.

## TOPICAL OUTLINE OF COURSE

### Depart Ensenada, Mexico — January 5

#### B1—January 8:

Introduction to the Science of Geography and Biogeography; Basics themes, theories, and issues; Learning to approach the voyage from the perspective of a Biogeographer

#### Readings

Cox, Reynolds, and Ladle. Ch. 1—A History of Biogeography

#### B2—January 10:

Geoscience, Systems, and Cycles (Part I)

#### Readings:

Botkin, D. et al. The Biogeochemical Cycles, in Environmental Science: Earth as a Living Planet.

Cox, Reynolds, and Ladle. Ch. 5—Plate Tectonics

#### B3—January 13:

Island Biogeography

Biogeographical primer of Hawaii

**Readings:**

Cox, Reynolds, and Ladle. Ch7—Life, Death and Evolution on Islands

**Honolulu, Hawaii — January 12**

Assignment #1: Species Report Hawaii

**B4—January 15:**

Science, Systems, and Cycles (Part II)

Defining life; biochemistry basics; biogenesis v. abiogenesis; life classification/organization (taxonomics, standard 'species' concepts, evolutionary significant units);

**Readings**

Botkin, D. et al. Ecosystems and Ecosystem Management, in Environmental Science: Earth as  
a Living Planet.

January 16—International Date Line crossing (Lost Day)

**B5—January 18:**

Ecological hierarchies (structure and interactions); species/community interactions

**Readings:**

Botkin, D. et al. Ecosystems and Ecosystem Management, in Environmental Science: Earth as  
a Living Planet.

**Study Day (No Class) — January 19**

**B6—January 21:**

Evolution: the unifying theory of biosciences; Darwin and Wallace's observations; mechanisms of evolution; on-going science of evolution (part I)

**Readings:**

Cox, Reynolds, and Ladle. Ch. 6—Evolution, the Source of Novelty  
MacDonald, G. Ch. 9: Evolution, Speciation, Extinction

**B7—January 23:**

Evolution: the unifying theory of biosciences; Darwin and Wallace's observations; mechanisms of evolution; on-going science of evolution (part II)

Human evolutionary basics

Biogeographical primer of Japan

**Readings:**

Cox, Reynolds, and Ladle. Ch. 6—Evolution, the Source of Novelty

**Kobe, Japan — January 24-28**

Assignment #2: Species Report Japan

**B8—January 30:**

Floral/Faunal patterns/factors of Distribution—Physical Factors  
Light; temperature; moisture/precipitation; chemical (part I)  
Biogeographical primer of China

**Readings:**

Cox, Reynolds, and Ladle. Ch 2—Patterns of Distribution: Finding a Home

**Shanghai, China — January 31 - February 1**

Assignment #3—Species Report Shanghai

**In-Transit — February 2-3**

**Hong Kong, SAR — February 4-5**

Assignment #4: Species Report Hong Kong

**B9—February 7:**

Floral/Faunal patterns/factors of Distribution—Physical Factors  
Light; temperature; moisture/precipitation; chemical (part II)

Biogeographical primer of Vietnam

**Readings:**

MacDonald, G. Ch 3—The Physical Environment and the Distribution of Life

**Ho Chi Minh City, Vietnam — February 8-13**

Assignment #5: Species Report Vietnam

**B10—February 15:** Floral/Faunal patterns/factors of Distribution—Physical Factors  
Light; temperature; moisture/precipitation; chemical (part III)

**Community Programming (No Class) — February 16**

**B11—February 18:**

Floral/Faunal patterns/factors of Distribution—Biological Factors (Part I)

Biogeographical primer of Myanmar

**Readings:**

MacDonald, G. Ch 4—Biological Interactions and the Distribution of Life

**Yangon, Myanmar – February 19-23**

Assignment #6: Species Report Myanmar

**B12—February 25:**

Floral/Faunal patterns/factors of Distribution—Biological Factors (Part II)

**B13— February 27:**

Aquatic Biogeography (Part I)

The oceanic system; marine environment determinants

Biogeographical primer of India

**Readings:**

Cox and Reynolds. Chapter 9—Patterns in the Oceans

**Cochin, India – February 28 – March 5**

Assignment #7: Species Report India

**B14—March 8:**

Aquatic Biogeography (Part II)

Aquatic Biology (adaptations and distribution); primary marine habitats

**Readings:**

Cox and Reynolds. Chapter 9—Patterns in the Oceans

**Community Programming (No Class) – March 7**

**B15—March 10:**

Exam I

**Port Louis, Mauritius – March 11**

**B16—March 13:**

Community Ecology; Ecological Equivalents; Live Zones; Biomes

**Readings:**

Cox, Reynolds, and Ladle. Chapter 3—Communities and Ecosystems: Living Together

**B17—March 15:**

Disturbance/Succession; Ecology of Change and Recovery

Glaciation and Biogeographic patterns in the Pleistocene/Holocene

**Readings:**

Cox, Reynolds, and Ladle: Chapter 12—Ice and Change

MacDonald, G: Chapter 5—Disturbance

**B18—March 17:**

Glaciation and Biogeographic patterns in the Pleistocene/Holocene

**Readings:**

Cox, Reynolds, and Ladle: Chapter 12—Ice and Change

Biogeographical primer of South Africa

**Cape Town, South Africa — March 18-23**

Assignment #8: Species Report South Africa

**B19—March 25:**

Biodiversity and the Conservation Challenge (Part I)

Defining/measuring biodiversity; patterns of diversity; geographic theories of biodiversity; the knowledge shortfalls

**Readings:**

Cox, Reynolds, and Ladle: Chapter 4—Patterns of Biodiversity

**B20—March 27:**

Biodiversity and the Conservation Challenge (Part II)

The Anthropocene mass extinction event

**Readings:**

Cox, Reynolds, and Ladle: Chapter 13—The Human Intrusion

**B21—March 29:**

Biodiversity and the Conservation Challenge (Part IV)

Conservation Biogeography; Valuing Biodiversity

Biogeographical primer of Ghana

**Readings:**

Cox, Reynolds, and Ladle: Chapter 14—Conservation Biogeography

**Takoradi, Ghana — March 30 - April 1**

**Tema, Ghana — April 2-3**

Assignment #9: Species Report Ghana

**B22—April 5:**

Applying Nature's Design; Y2Y (Banff National Park) and Wildlife Corridors—Future Biogeography Field Studies Program

**Readings:**

Anderson, A. 2006. Applying Nature's Design—Corridors as a Strategy for Biodiversity Conservation

**B23—April 7:**  
Student Presentations of Species Report (I)

**Study Day (No Class) — April 8**

**B24— April 10:**  
Exam II

**Casablanca, Morocco — April 11-15**  
Assignment #10: Species Report Morocco

**B25—April 18: Final Exam**  
Student Presentations of Species Report (II)

**Arrive Amsterdam, The Netherlands— April 21**

## **FIELD WORK**

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage. In addition to the one field class, students will complete independent field assignments that span multiple countries.

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class. Field Classes constitute at least 20% of the contact hours for each course, and are developed and led by the instructor.

### **A. Field Class & Assignment (20%)**

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class.

**The field class for this course is on Monday, March 18 in Cape Town, South Africa.**

### **Whales, Sharks, and Penguins in Hermanus**

From the port of Cape Town, we will travel south to Hermanus, visiting a penguin colony in Stony Point nature preserve along the way. Hermanus is a small coastal town and home to some of the best land-based whale watching on the planet. Also in Hermanus, we will visit the shark lab at the South African Shark Conservancy, where we will learn from a marine biologist and shark researcher about shark research and conservation efforts in South Africa.

**Objectives:** Explore the biogeography and conservation of two iconic apex predator groups: cetaceans (whales and dolphins) and sharks; Identify cetacean species in the wild (especially southern right whales) and quantify abundance estimates and behaviors;

Estimate bioenergetic requirement of right whales observed and their ecological impact, and explore the conservation efforts for marine mammal populations off South Africa; Learn about shark research and conservation efforts in South Africa and compare the ecological roles and conservation challenges for two important groups of apex predators: marine mammals and sharks.

### **Assignment (Due March 29<sup>th</sup>)**

Students will write a field report on the biogeography of Hermanus:

Report to include:

Introduction

Geography of Hermanus

Part I

Species report on Stony Point Nature Preserve and African Penguins.

Part II

Species report on Whales of South Africa.

What is it about Hermanus that makes it one of the best places on Earth to view whales?

Part III

Sharks and Conservation issues

### **B. Independent Field Assignments (40%)**

Students will be expected to conduct species identifications for each location/country visited. Each country invariably has a unique biogeography that includes both endemic and invasive species. As you make your way through urban, rural, and wilderness environments you will inevitably cross the path of a multitude of floral and faunal species.

The goal of the independent field assignment is to gather data on **4 examples of fauna and 4 examples of flora** that you come across. Data to be collected include: species name (taxonomic and common); description of species (physiological); including a photographic image; where the species was found; preferred/natural habitat; conservation status (endangered, protected); 2 distinct characteristics. A field data sheet will be provided.

Each Field Assignment is worth 4% of the grade.

At the end of the term, students will have the option to present a selection of their species to the class.

Field Assignment #1—Hawaii

Field Assignment #2—Japan

Field Assignment #3—Shanghai

Field Assignment #4—Hong Kong

Field Assignment #5—Vietnam

Field Assignment #6—Myanmar



Field Assignment #7—India  
Field Assignment #8—South Africa  
Field Assignment #9—Ghana  
Field Assignment #10—Morocco

## METHODS OF EVALUATION

|   |     |
|---|-----|
| Exam I                                  | 20% |
| Exam II                                 | 20% |
| Field Class Written Report              | 20% |
| Independent Field Assignments (4% each) | 40% |

## GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

| <u>Excellent</u> | <u>Good</u> | <u>Satisfactory/Poor</u> | <u>Failing</u>   |
|------------------|-------------|--------------------------|------------------|
| 97-100%: A+      | 87-89%: B+  | 77-79%: C+               | Less than 60%: F |
| 93-96%: A        | 83-86%: B   | 70-76%: C                |                  |
| 90-92%: A-       | 80-82%: B-  | 60-69%: D                |                  |

## ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance in all Semester at Sea classes, including the Field Class, is mandatory. Students must inform their instructors prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

## LEARNING ACCOMMODATIONS

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation.

A letter from the student's home institution verifying the accommodations received on their home campus (dated within the last three years) is required before any accommodation is provided on the ship. Students must submit this verification of accommodations to [academic@isevoyages.org](mailto:academic@isevoyages.org) as soon as possible, but no later than two months prior to the voyage.

## **STUDENT CONDUCT CODE**

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

## **RESERVE BOOKS FOR THE LIBRARY**

Author: Anderson, Anthony B. and Clinton Jenkins  
Title: Applying Nature's Design—Corridors as a strategy for biodiversity conservation  
Publisher: Columbia University Press  
ISBN# 9780231134118  
Date: 2006.

*Instructor to provide these books:*  
Author: Botkin, Daniel and Edward Keller  
Title: Environmental Science: Earth as a Living Planet  
Publisher: Wiley  
ISBN#: 9781119417323  
Date/Edition: 2014/9<sup>th</sup> edition

MacDonald, G. 2003. Introduction to Biogeography—Space, Time, and Life.

## **FILM REQUEST**

None

## **ELECTRONIC COURSE MATERIALS**

Anderson, A. 2006. Applying Nature's Design—Corridors as a Strategy for Biodiversity Conservation

Botkin, D. et al. 2016. The Biogeochemical Cycles, in Environmental Science: Earth as a Living Planet.

Botkin, D. et al. 2016. Ecosystems and Ecosystem Management, in Environmental Science: Earth as a Living Planet.

MacDonald, G. 2003. Introduction to Biogeography—Space, Time, and Life.

Country specific readings/field guides TBA

### **ADDITIONAL RESOURCES**

None