

THE HEALTH OF THE BIOSPHERE
ENVR SCI 202
WINTER QUARTER 2009

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Office Hours: Tu, We, Th 2:00-3:00P, or by appointment.

CLASS MEETING TIMES:

Lecture: TuTh 12:30-1:50P, Tech M164. Check CMS/Blackboard regularly for announcements and other information.

PREREQUISITES:

MATH 224 or equivalent. This is 1 quarter of the 3-quarter core ESEP “sequence” (i.e, ENVR SCI 201, 202, 203) that need not be taken in any particular order.

REQUIRED TEXT:

Molles, Manuel C., Jr. 2007. *Ecology: Concepts & Applications*. 4th edition. McGraw-Hill Higher Education, Boston, MA. 604 pages. ISBN 978-0-07-305082-9.

DESCRIPTION:

The functioning of the biosphere is a product of constantly growing populations which are regulated by abiotic conditions and by other populations which compete with them, prey upon them, or help them. All of this occurs in particular geographic and historical contexts. We will study the dimensions of the ecological niche, the processes of population growth and regulation, and the functioning of biological communities. Since a healthy biosphere is a diverse one, we will examine the role of biodiversity in ecosystem functioning, methods used to slow the loss of biodiversity (i.e., how populations are harvested and how they are conserved), and examine the main driving force behind these changes – the recent population explosion of human beings. The emergence of a single species (us) that undergoes a radical new kind of evolution (cultural) is modifying the biosphere a rate so fast that biological adaptation cannot keep pace with the changes it causes; this fact is generating a costly and unnecessary mass extinction.

GRADING:

4 problem sets	40%
2 midterms (20% + 20%)	40%
Final project	20%

The problem sets will be handed out in class. Final projects will be done in small groups of 4 people.

SECTION I: DIMENSIONS OF THE ECOLOGICAL NICHE

January

Tu/6 Introduction: what is ecology? Ch. 1*

Th/8 Temperature Ch. 4

Tu/13 Energy; foraging Ch. 6

Th/15 Distribution & abundance Ch. 9

SECTION II: THE GROWTH & REGULATION OF POPULATIONS

Tu/20 Population dynamics; life tables Ch. 10

Th/22 Population growth; logistic growth Ch. 11

Tu/27 Life history; r- & K-selection Ch. 12

Th/29 Competition Ch. 13

February

Tu/3 Midterm 1 (covers lectures from 1/6 through 1/27, inclusive)

Th/5 Predation & parasitism Ch. 14

Tu/10 Mutualism Ch. 15

SECTION III: BIOLOGICAL COMMUNITIES & BIODIVERSITY

Th/12 Biodiversity Ch. 16

Tu/17 Trophic webs Ch. 17

Th/19 Succession & stability Ch. 20

Tu/24 Landscape ecology Ch. 21

Th/26 Island biogeography & species richness Ch. 22

Tu/3 Project Presentations I

March

Th/5 Project Presentations II

Tu/10 Project Presentations III

Th/12 Midterm 2 (covers lectures from 1/29 to 2/26, inclusive)

Fr/20 Scheduled final exam time, 3-5P, Tech M164. Enjoy Spring Break.

*** Be sure to read all "Investigating the Evidence" sections, inc. unassigned chapters.**

OBJECTIVES:

- Introduce the concept of the ecological niche, and the limits on the distribution and abundance of populations.
- Develop the basic mathematical tools for understanding models of population growth, sustainable harvest, extinction of fragmented populations, and spread of diseases.
- Explore the concept of the biological community and the role of biological diversity in healthy ecosystem functioning.
- Connect the scale of human population growth to its impact on the natural world, and the feedbacks on the human condition, in terms of health, economics, equality, aesthetics, and sustainability.
- Teach students how to apply mathematical-model-based problem-solving to major environmental issues at local and regional scales.

SUGGESTIONS FOR POTENTIAL PROJECTS:

- Population viability analysis (PVA) for an endangered species
- Influence of PVA in conservation
- Sensitivity of PVA's to inputs
- Consequences of habitat fragmentation (SLOSS debate)
- Metapopulation model for Forest Preserves for plants
- Spread of diseases under increased population sizes of humans & livestock
- Cost-benefit analysis of diversity vs. pesticides in agriculture
- Causes of the slowing of human population growth
- What is the carrying capacity of earth?
- Sustainability of harvested populations (fisheries, timber)
- Sensitivity analysis for a harvested population