ENVR SCI 202: THE HEALTH OF THE BIOSPHERE

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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:

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:
3 problem sets 30%
2 midterms (20% + 25%) 45%
Final project 25%
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/8 Introduction: what is ecology? Ch. 1*
Th/10 Temperature Ch. 4
Tu/15 Energy; foraging Ch. 6
Th/17 Distribution & abundance Ch. 9

SECTION II: THE GROWTH & REGULATION OF POPULATIONS
Tu/22 Population dynamics; life tables Ch. 10
Th/24 Population growth; logistic growth Ch. 11
Tu/29 Life history; r- & K-selection Ch. 12
Th/31 Competition Ch. 13

February
Tu/5 Midterm 1 (covers lectures from 1/8 through 1/29, inclusive)
Th/7 Predation & parasitism Ch. 14
Tu/12 Mutualism Ch. 15

SECTION III: BIOLOGICAL COMMUNITIES & BIODIVERSITY
Th/14 Biodiversity Ch. 16
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