BIOLOGY 271 - PRINCIPLES OF ECOLOGY AND EVOLUTION
FALL 1996 - COURSE SYLLABUS

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Biology 271 Web Page:
http://zorba.uafadm.alaska.edu/iab/biol_ecology

Course Prerequisite: An introductory course or course sequence in Biology, such as Biol. 105 - 106 at UAF.

Course Format: Four lectures each week - MTRF 8:00 - 9:00.
We will also schedule an optional discussion/help session before examinations


Grading:

A. Quizzes: These will usually consist of one question, to be answered in 15 minutes, concerning material covered in class during the previous two weeks.

Dates: Mondays - September 16, October 7 and 28,
November 11 and 25, and December 9.
Value: Collectively, 15% of the final grade.

Note: You may replace your score on a quiz by attending a lecture or seminar given at UAF (live, not video) on an ecological or evolutionary topic and submitting a summary (ca. two pages) of the seminar or lecture, including the name of the speaker, title of the talk, the topic or question under discussion, the approach of the speaker to answering the question, and the results and significance. We will try to inform you of relevant events.

B. Midterm Exams: There will be three midterm exams. Before the exams, sample exams from past years will be made available to acquaint you with the type of questions you will face.

Dates: Thursday, September 26;
Tuesdays October 22 and November 19.
Each midterm exam will contribute 20% to the final grade.
C. **Final Exam:** On Wednesday, December 18, 8:00 - 10:00 AM.

In two parts: material covered since the last midterm (about 2/3 of the exam) and comprehensive (that is, covering the course as a whole) (1/3 of the exam). Total value: 25% of the final grade.

**Important note:** Please do not ask to take the final exam early to accommodate your airline reservations. If you intend to leave the state over the semester break, make your reservations now for a flight after the scheduled examination period.

D. **Make-up exams or early scheduling of an exam:** This will be done only for documented medical reasons or university-mandated absences. For all other cases, see item E.

E. **Term-Paper Option:** You may elect to replace your score on one of the midterms or on the sum of the quizzes with a term paper dealing with any topic in ecology or evolutionary biology that is jointly agreed to by student and instructor. This may replace either a missing exam or a suboptimal exam score. Thus, the term paper option takes the place of make-up exams as well as providing a "second chance". **Term papers are due no later than Monday, December 9.**

The term paper may consist of a review of published literature, development of an original ecological or evolutionary idea, collection and analysis of original data, computer simulation of an ecological or evolutionary problem, etc. The length should be appropriate to content - ca. six to eight pages, and including material from six or more sources. But don’t pad! You know when you are padding, and so do we!

F. **Grading** will be either on a curve or by standard percentage (90-100% = A; 80-90% = B; etc.), whichever is more generous to the students. In assigning final grades, the instructor reserves the right to take into account extenuating circumstances that might justify raising a student into a higher grade category. No student will have their grade reduced by subjective considerations.
I. Ecological organization and the nature of ecological research.

II. The Ecological Theater
   A. Energy and climate
      1. Energy and radiation
      2. Energy balance of the earth
         a. the effects of the atmosphere
         b. carbon balance and global change
      3. Temperature, wind, and precipitation
      4. Patterns of climate
   B. Limiting factors, optimization, and adaptation:
      the search for the best available compromise

III. Primary Production
   A. Light, temperature, and the plant energy balance
      1. Light and photosynthesis
      2. Temperature, photosynthesis, and plant respiration.
      3. Shade tolerance - more than one way to build a plant.
   B. Water...
      1. ... in the environment.
      2. ... in the plant.
   C. Nutrients
      1. The soil
      2. Nutrient cycles
      3. The process of decomposition
      4. Plant responses to variation in nutrient availability
      5. Ecosystems contrasted.
         a. nutrient limitation in northern ecosystems.
         b. tropical agriculture and the "Green Revolution" -
            will it feed a hungry world?

IV. The Evolutionary Play
   A. The strong principle of inheritance, or like begets like.
      1. DNA, genes, and chromosomes.
      2. Genotypes and phenotypes
   B. Variation - the raw material of evolution.
      1. Mutation - creating the variation
      2. Recombination - shuffling the genetic deck.
   C. The nature of genetic populations
2. Genes in equilibrium - Hardy-Weinberg
3. Genes in disequilibrium - mechanisms of evolutionary change.
   a. gene flow
   b. genetic drift
   c. founders and bottlenecks
   d. inbreeding
4. Natural selection
   a. stabilizing and directional
   b. individual, group, and kin
   c. fitness and inclusive fitness
E. Species and speciation
   1. The morphological and biological species concepts.
   2. The process of species formation
   3. The rate and tempo of evolution - gradualism v. punctuated evolution.

V. The Ecology of Populations
A. Abundance
B. Dispersion - distribution in space.
C. Age structure and the Life Table.
   1. Mortality and survivorship
   2. Fertility and fecundity
   3. Replacement rate
D. Population growth
   1. Exponential growth potential
   2. Growth in a finite environment - the logistic model
E. Population limitation and regulation
   1. Stable, unstable and neutral equilibria.
   2. Density-dependent and density-independent effects.
   3. Mechanisms and models of population regulation.
   4. Multiple equilibria - it's a messy world out there.

VI. Community Ecology - the interaction of populations.
A. Competition for limiting resources
B. The ecological niche
C. Biodiversity - Why are there so many species?

VIII. Trophic Dynamics
A. Energy pyramids and trophic webs
B. The trophic link - efficiencies of energy transfer and transformation
C. Why 50,000,000 robins can't be wrong