*I.B. ESS Syllabus List*

*Compiled June 2008*

*Lake Tahoe Level 1 Conference*

Topic 7: Environmental Value Systems (6 hours)

* 7.1.1 State what is meant by an environmental value system
* 7.1.2 Outline the range of environmental philosophies with reference to figure 6 (p. 47 of ESS guide)
* 7.1.3 Discuss how these philosophies influence the decision-making process with respect to environmental issues covered in this course
* 7.1.4 Outline key historical influences on the development of the modern environmental movement
* 7.1.5 Compare and contrast the environmental value systems of two named societies
* 7.1.6 Justify your personal viewpoint on environmental issues

Topic 1: Systems and Models (5 hours)

* 1.1.1 Outline the concept and characteristics of systems
* 1.1.2 Apply the systems concept on a range of scales
* 1.1.3 Define the terms *open system*, *closed* *system* and *isolated system*
* 1.1.4 Define how the first and second laws of thermodynamics are relevant to environmental systems
* 1.1.5 Explain the nature of equilibria
* 1.1.6 Define and explain the principles of *positive feedback* and *negative feedback*
* 1.1.7 Describe transfer and transformation processes
* 1.1.8 Distinguish between flows (inputs and outputs) and storages (stock) in relationship to systems
* 1.1.9 Construct and analyse quantitative models involving flows and storages in a system
* 1.1.10 Evaluate the strengths and limitations of models

Topic 3.1: Population Dynamics (5 hours)

* 3.1.1 Describe the nature and explain the implications of exponential growth in human populations
* 3.1.2 Calculate and explain, from given data, the values of crude birth rate, crude death rate, fertility, doubling time and natural increase rate
* 3.1.3 Analyse age/sex pyramids and diagrams showing demographic transition models
* 3.1.4 Discuss the use of models in predicting growth of human populations3.7: Limits to Growth (2.5 hours)
* 3.7.1 Explain the difficulties in applying the concept of carrying capacity to local human populations
* 3.7.2 Explain how absolute reductions in energy and material use, reuse and recycling can affect human carrying capacity

Topic 3.2: Resources Natural Capital (8 hours)

* 3.2.1 Explain the concept of resources in terms of natural income
* 3.2.2 Define the terms *renewable*, *replenishable* and *non-renewable* *natural capital*
* 3.2.3 Explain the dynamic nature of the concept of a resource
* 3.2.4 Discuss the view that the environment can have its own intrinsic value
* 3.2.5 Explain the concept of sustainability in terms of natural capital and natural income
* 3.2.6 Discuss the concept of sustainable development
* 3.2.7 Calculate and explain sustainable yield from given data

Topic 3.8: Environmental Demands on Human Population (6.5 hours)

* 3.8.1 Explain the concept of an ecological footprint as a model for assessing the demands that human populations make on their environment
* 3.8.2 Calculate from appropriate data the ecological footprint of a given population, stating the approximations and assumptions involved (p. 33, ESS guide)
* 3.8.3 Describe and explain the differences between the ecological footprints of two human population, one from an LEDC and one from an MEDC
* 3.8.4 Discuss how national and international development policies and cultural influences can affect human population dynamics and growth
* 3.8.5 Describe and explain the relationship between population, resource consumption and technological development, and their influence on carrying capacity and material economic growth

Topic 2.1: Structure (4 hours)

* 2.1.1 Distinguish between biotic and abiotic (physical) components of an ecosystem
* 2.1.2 Define the term *trophic level*
* 2.1.3 identify and explain trophic levels in food chains and food webs selected from the local environment
* 2.1.4 Explain the principles of pyramids of numbers, pyramids of biomass, and pyramids of productivity, and construct such pyramids from given data
* 2.1.5 Discuss how the pyramid structure affects the functioning of an ecosystem
* 2.1.6 Define the terms *species*, *population*, *habitat*, *niche*, *community* and *ecosystem* with reference to local examples
* 2.1.7 Describe and explain population interactions using examples of named species

Topic 2.2: Measuring Abiotic Components of the System (1 hour)

* 2.2.1 List the significant abiotic (physical) factors of an ecosystem
* 2.2.2 Describe and evaluate methods for measuring at least three abiotic (physical) factors within an ecosystem

Topic 3.4: Soil System (4 hours)

* 3.4.1 Outline how soil systems integrate aspects of living systems
* 3.4.2 Compare and contrast the structure and properties of sand, clay and loam soils, including their effect of primary productivity
* 3.4.3 Outline the processes and consequences of soil degradation
* 3.4.4 Outline soil conservation measures
* 3.4.5 Evaluate soil management strategies in a named commercial farming system and in a named subsistence farming system

Topic 2.3: Measuring Biotic Components of the System (4 hours)

* 2.3.1 Construct simple keys and use published keys for the identification of organisms
* 2.3.2 Describe and evaluate methods for estimating the abundance of organisms
* 2.3.3 Describe and evaluate methods for estimating the biomass of trophic levels in a community
* 2.3.4 Define the term *diversity*
* 2.3.5 Apply Simpson’s diversity index and outline its significance (p. 19, ESS guide)

Topic 4.1: Biodiversity in Ecosystems (3 hours)

* 4.1.1 Define the terms biodiversity, genetic diversity, species diversity and habitat diversity
* 4.1.2 Outline the mechanism of natural selection as a possible driving force for speciation
* 4.1.3 State that isolation can lead to different species being produced that are unable to interbreed to yield fertile offspring
* 4.1.4 Explain how plate activity has influenced evolution and biodiversity
* 4.1.5 Explain the relationships among ecosystem stability, diversity, succession and habitat

Topic 4.2: Evaluating Biodiversity and Vulnerability (6 hours)

* 4.2.1 Identify factors that lead to loss of diversity
* 4.2.2 Discuss the perceived vulnerability of tropical rainforests and their relative value in contributing to global biodiversity
* 4.2.3 Discuss current estimates of numbers of species and past and present rates of species extinction
* 4.2.4 Describe and explain the factors that may make species more or less prone to extinction
* 4.2.5 Outline the factors used to determine a species’ Red List conservation status
* 4.2.6 Describe the case histories of three different species: one that has become extinct, another that is critically endangered, and a third species whose conservation status has been improved by intervention
* 4.2.7 Describe the case history of a natural area of biological significance that is threatened by human activities

Topic 4.3: Conservation of Biodiversity (6 hours)

* 4.3.1 State the arguments for preserving species and habitats
* 4.3.2 Compare and contrast the role and activities of intergovernmental and non-governmental organizations in preserving and restoring ecosystems and biodiversity
* 4.3.3 State and explain the criteria used to design protected areas
* 4.3.4 Evaluate the success of a named protected area
* 4.3.5 Discuss and evaluate the strengths and weaknesses of the species-based approach to conservation

Topic 2.5: Function (7 hours)

* 2.5.1 Explain the role of producers, consumers and decomposers in the ecosystem
* 2.5.2 Describe photosynthesis and respiration in terms of inputs, outputs and energy transformations
* 2.5.3 Describe and explain the transfer and transformation of energy as it flows through an ecosystem
* 2.5.4 Describe and explain the transfer and transformation of materials as they cycle within an ecosystem
* 2.5.5 Define the terms *gross productivity*, *net productivity*, *primary productivity* and *secondary productivity*
* 2.5.6 Define the terms and calculate the values of both gross primary productivity (GPP) and net primary productivity (NPP) from the given data
* 2.5.7 Define the terms and calculate the values of both *gross secondary productivity* (GSP) and *net secondary productivity* (NSP) from given data

Topic 2.6: Changes (7 hours)

* 2.6.1 Explain the concepts of limiting factors and carrying capacity in the context of population growth
* 2.6.2 Describe and explain s and J population curves (p. 22, ESS guide)
* 2.6.3 Describe the role of density-dependent and density-independent factors, and internal and external factors, in the regulation of populations
* 2.6.4 Describe the principles associated with survivorship curves including K- and r-strategists
* 2.6.5 Describe the concept and processes of succession in a named habitat
* 2.6.6 Explain the changes in energy flow, grow and net productivity diversity and mineral cycling in different stages of succession
* 2.6.7 Describe factors affecting the nature of climax communities

Topic 5.4: Eutrophication (3 hours)

* 5.4.1 Outline the processes of eutrophication
* 5.4.2 Evaluate the impacts of eutrophication
* 5.4.3 Describe and evaluate pollution management strategies with respect to eutrophication

2.4: Biomes (3 hours)

* 2.4.1 Define the term biome
* 2.4.2 Explain the distribution, structure and relative productivity of tropical rainforests, deserts, tundra and any other biome

Topic 5.1: Nature of Pollution (1 hour)

* 5.1.1 Define the term pollution
* 5.1.2 Distinguish between the terms point source pollution and non-point source pollution, and outline the challenges they present for management
* 5.1.3 Describe and explain an indirect method of measuring pollution levels using a biotic index

Topic 5.8: Acid Deposition (2 hours)

* 5.8.1 Outline the chemistry leading to the formation of acidified precipitations
* 5.8.2 Describe three possible effects of acid deposition of soil, water and living organisms
* 5.8.3 Explain why the effect of acid deposition is regional rather than global
* 5.8.4 Describe and evaluate pollution management strategies for acid deposition

Topic 5.5: Solid Domestic Waste (2 hours)

* 5.5.1 Outline the types of solid domestic waste
* 5.5.2 Describe and evaluate pollution management strategies for solid domestic (municipal) waste

Topic 5.2: Detection and Monitoring of Pollution (3 hours)

* 5.2.1 Describe two direct methods of monitoring pollution
* 5.2.2 Define the term *biochemical oxygen demand* (BOD) and explain how this indirect method is used to assess pollution levels in water
* 5.2.3 Describe and explain an indirect method of measuring pollution levels using a biotic index

Topic 2.7: Measuring Changes in the System (5 hours)

* 2.7.1 Describe and evaluate methods for measuring changes in abiotic and biotic components of an ecosystem along an environmental gradient
* 2.7.2 Describe and evaluate methods for measuring changes in abiotic and biotic components of ecosystem due to a specific human activity
* 2.7.3 Describe and evaluate the use of environmental impact assessments (EIAs)

Topic 5.3: Approaches to Pollution Management (2 hours)

* 5.3.1 Outline approaches to pollution management with respect to figure 5. (p. 40, ESS guide)
* 5.3.2 Discuss the human factors that affect the approaches to pollution management
* 5.3.3 Evaluate the costs and benefits to society of the World Health Organization’s ban on the use of the pesticide DDT.

Topic 5.6: Depletion of Stratospheric Ozone (3 hours)

* 5.6.1 Outline the overall structure and composition of the atmosphere
* 5.6.2 Describe the role of ozone in the absorption of ultraviolet radiation
* 5.6.3 Explain the interaction between ozone and halogenated organic gases
* 5.6.4 State the effects of ultraviolet radiation on living tissues and biological productivity
* 5.6.5 Describe three methods of reducing the manufacture and release of ozone-depleting substances
* 5.6.6 Describe and evaluate the role of national and international organizations in reducing the emissions of ozone-depleting substances

5.7: Urban Air Pollution (2 hours)

* 5.7.1 State the source and outline the effect of trophospheric ozone
* 5.7.2 Outline the formation of photochemical smog
* 5.7.3 Describe and evaluate pollution management strategies for urban air pollution

6: Issue of Global Warming (6 hours)

* 6.1.1 Describe the role of greenhouse gases in maintaining mean global temperature
* 6.1.2 Describe how human activities add to greenhouse gases
* 6.1.3 Discuss qualitatively the potential effects of increased mean global temperature
* 6.1.4 Discuss the feedback mechanisms that would be associated with an increase in mean global temperature
* 6.1.5 Describe and evaluate pollution management strategies to address the issue of global warming
* 6.1.6 Outline the arguments surrounding global warming
* 6.1.7 Evaluate contrasting human perceptions of the issue of global warming

3.3: Energy Resources (4 hours)

* 3.3.1 Outline the range of energy resources available to society
* 3.3.2 Evaluate the advantages and disadvantages of two contrasting energy sources
* 3.3.3 Discuss the factors that affect the choice of energy sources adopted by different societies

3.6: Water Resources (3 hours)

* 3.6.1 Describe the Earth’s water budget
* 3.6.2 Describe and evaluate the sustainability of freshwater resource usage with reference to a case study

3.5: Food Resources (6 hours)

* 3.5.1 Outline the issues involved in the imbalance in global food supply
* 3.5.2 Compare and contrast the efficiency of terrestrial and aquatic food production systems
* 3.5.3 Compare and contrast the inputs and outputs of materials and energy (energy efficiency), the system characteristics, and evaluate the relative environmental impacts for two named food production systems
* 3.5.4 Discuss the links that exist between social systems and food production systems