

# IB Environmental Systems and Societies Standards Alignment Table of Contents

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**There are currently no state standards for Environmental Systems and Societies**

**\*\*Each unit is correlated to the Environmental Systems and Societies Assessment statements.**

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## Topic 1: Systems and Models

Objectives	Met in Lessons
Introduction to Environmental Systems	1 and 2
<p>Topic 1.1.1</p> <p>Outline the concept and characteristics of a system</p> <p>1.1.2 Apply the systems concept at a range of scales</p>	3 and 4
1.1.3 Define the terms open system, closed system and isolated system	5
<p>1.1.4 Describe how the first and second laws of thermodynamics are relevant to environmental systems.</p> <p>1.1.5 Explain the nature of equilibria.</p>	6 and 7
1.1.6 Define and explain the principles of positive feedback and negative feedback	8
<p>1.1.7 Describe transfer and transformation processes</p> <p>1.1.8 Distinguish between flows (inputs and outputs) and storages (stock) in relation to systems.</p>	9 and 10
1.1.9 Construct and analyze quantitative models involving flows and storages in a system.	11, 12
1.1.10 Evaluate the strengths and limitations of models	13, 14

## Topic 2: The Ecosystem

Objectives	Met in Lessons
<p>2.1 Structure</p> <p>2.1.1 Distinguish between biotic and abiotic (physical) components of an ecosystem.</p> <p>2.1.2 Define the term trophic level.</p> <p>2.1.3 Identify and explain trophic levels in food chains and food webs selected from the local environment.</p>	1 and 2
<p>2.1.4 Explain the principles of pyramids of numbers, pyramids of biomass and pyramids of productivity, and construct such pyramids from given data.</p>	3 and 4
<p>2.1.5 Discuss how the pyramid structure affects the functioning of an ecosystem.</p> <p>2.1.6 Define the terms species, population, community, niche and habitat with reference to local examples.</p>	5 and 6
<p>2.1.7 Describe and explain population interactions using examples of named species.</p>	7 and 8
<p>2.2 Measuring Physical Components of the System</p> <p>2.2.1 List the significant abiotic (physical) factors of an ecosystem.</p> <p>2.2.2 Describe and evaluate methods for measuring at least three abiotic factors within an ecosystem.</p>	9 and 10

## Topic 2: The Ecosystem

Objectives	Met in Lessons
2.3 Measuring Biotic Components of the System 2.3.1 Construct simple keys and use published keys for the identification of organisms.	11
2.3.2 Describe and evaluate methods for estimating abundance of organisms.	12
2.3.3 Describe and evaluate methods for estimating the biomass of trophic levels in a community.	13
2.3.4 Define the term diversity. 2.3.5 Apply Simpson's diversity index and outline its significance.	14
2.4 Biomes 2.4.1 Define the term biome. 2.4.2 Explain the distribution, structure and relative productivity of tropical rainforests, deserts, tundra and any one other biome	15
2.5 Function 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.	16 and 17
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.	18, 19
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)	20, 21, 22

## Topic 2: The Ecosystem

<p>from given data.</p> <p>2.5.7 Define the terms and calculate the values of both gross secondary productivity (GSP) and net secondary productivity (NSP) from given data.</p>	
<p>2.6 Changes</p> <p>2.6.1 Explain the concepts of limiting factors and carrying capacity in the context of population growth.</p>	23
<p>2.6.2 Describe and explain “S” and “J” population growth curves.</p>	24
<p>2.6.3 Describe the role of density-dependent and density-independent factors, and internal and external factors, in the regulation of populations.</p>	25
<p>2.6.4 Describe the principles associated with survivorship curves including, K- and r-strategists.</p>	26
<p>2.6.5 Describe the concept and processes of succession in a named habitat.</p>	27
<p>2.6.6 Explain the changes in energy flow, gross and net productivity, diversity and mineral cycling in different stages of succession.</p>	28
<p>2.7 Measuring Changes in the System</p> <p>2.7.1 Describe and evaluate methods for measuring changes in abiotic and biotic components of an ecosystem along an environmental gradient.</p> <p>2.7.2 Describe and evaluate methods for measuring changes in the abiotic and biotic components of an ecosystem due to a specific human activity</p>	29, 30
<p>2.7.3 Describe and evaluate the use of environmental impact assessments (EPAs)</p>	31

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## *Topic 3: Human Population, Carrying Capacity and Resource Use*

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<b>Objectives</b>	<b>Met in Lessons</b>
3.1 Population Dynamics 3.1.1 Describe the nature and explain the implications of exponential growth in human populations.	<b>1</b>
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.	<b>2</b>
3.1.3 Analyse age/sex pyramids and diagrams showing demographic transition models.	<b>3</b>
3.1.4 Discuss the use of models in predicting the growth of human populations.	<b>4</b>
3.2 Resources—Natural Capital 3.2.1 Explain the concept of resources in terms of natural capital and natural income.	<b>5</b>
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	<b>6</b>
3.2.4 Discuss the view that the environment can have its own intrinsic value	<b>7</b>

### Topic 3: Human Population, Carrying Capacity and Resource Use

Objectives	Met in Lessons
3.2.5 Explain the concept of sustainability in terms of natural capital and natural income.	8
3.2.6 Discuss the concept of sustainable development	9
3.2.7 Calculate and explain sustainable yields from given data	10
3.3 Energy Resources 3.3.1 Outline the range of energy sources available to society 3.3.2 Evaluate the advantages and disadvantages of two contrasting energy sources 3.3.3 Discuss the factors which affect the choice of energy sources adopted by different societies	11,12,13
3.4 The Soil System 3.4.1 Outline how soil systems integrate aspects of living systems.	14
3.4.2 Compare the structure and properties of sand, clay and loam soils, including their relevance to primary productivity	15
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	16,17,18,
3.5 Food Resources 3.5.1 Outline the issues involved in the imbalance in global food supply. 3.5.2 Compare the efficiency of terrestrial and aquatic food production systems	19, 20
3.5.3 Compare 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.	21, 22



### Topic 3: Human Population, Carrying Capacity and Resource Use

Objectives	Met in Lessons
3.5.4 Discuss the links that exist between soil systems and food production systems	23
<p>3.6 Water Resources</p> <p>3.6.1 Describe the Earth's water budget.</p> <p>3.6.2 Describe and evaluate the sustainability of freshwater resource usage with reference to a case study</p>	24, 25
<p>3.7 Limits to Growth</p> <p>3.7.1 Explain the difficulties in applying the concept of carrying capacity to local human populations</p>	26
3.7.2 Explain how absolute reductions in energy and material use, reuse and recycling can affect human carrying capacity.	27
<p>3.8 Environmental Demands of Human Populations</p> <p>3.8.1 Explain the concept of an ecological footprint as a model for assessing the demands human populations make on their environment.</p> <p>3.8.2 Calculate from appropriate data the ecological footprint of a given population, stating the approximations and assumptions involved.</p>	28, 29, 30
3.8.3 Describe and explain the differences between the ecological footprints of two human populations; one from an LEDC and one from an MEDC.	31
3.8.4 Discuss how national and international development policies and cultural influences can affect human population dynamics and growth	32
3.8.5 Describe and explain the relationship between population, resource consumption and technological development, and their influence on carrying capacity and material growth	33

## Topic 4: Conservation and Biodiversity

Objectives	Met in Lessons
4.1 Biodiversity in Ecosystems (3h) 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.	1
4.1.3 State that isolation can lead to different species being produced that are unable to interbreed to yield fertile offspring.	2
4.1.4 Explain how plate activity has influenced evolution and biodiversity	3
4.1.5 Explain the relationships among ecosystem stability, diversity, succession and habitat.	4
4.2 Evaluating Biodiversity and Vulnerability 4.2.1 Identify factors that lead to loss of diversity.	5
4.2.2 Describe the vulnerability of tropical rainforests and their relative value in contributing to global biodiversity.	6
4.2.3 Discuss current estimates of numbers of species and past and present rates of species extinction.	7
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.	8,9

## Topic 4: Conservation and Biodiversity

Objectives	Met in Lessons
4.2.6 Describe the case histories of three different species: one that has become extinct, another that is critically endangered, and a third 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	10, 11, 12
4.3 Conservation of Biodiversity  4.3.1 State the arguments for preserving species and habitats.	13
4.3.2 Compare the role and activities of governmental and non-governmental organizations in preserving and restoring ecosystems and biodiversity.	14
4.3.3 Outline the World Conservation Strategy.	15
4.3.4 State and explain the criteria used to design reserves.	16
4.3.5 Evaluate the success of a named protected area.	17
4.3.6 Discuss and evaluate the strengths and weaknesses of the species-based approach to conservation.	18, 19, 20

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## Topic 5: Pollution Management

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Objectives	Met in Lessons
5.1 Nature of Pollution 5.1.1 Define pollution. 5.1.2 Distinguish between the terms point source pollution and non-point source pollution and the challenges they present for management.	1
5.1.3 State the major sources of pollutants.	2, 3
5.2 Detection and Monitoring of Pollution 5.2.1 Describe two direct methods of monitoring pollution.	4
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
5.2.3 Describe and explain one indirect method of measuring pollution levels using a biotic index.	6
5.3 Approaches to Pollution Management 5.3.1 Outline approaches to pollution management with respect to the following model: Process of Pollution and Strategies for reducing impacts	7
5.3.2 Discuss the human factors that affect the approaches to pollution management	8
5.3.3 Evaluate the costs and benefits to society of the World Health Organization's ban on the use of the pesticide DDT.	9
5.4 Eutrophication 5.4.1 Outline the processes of eutrophication	10
5.4.2 Evaluate the impacts of eutrophication.	11
5.4.3 Describe and evaluate pollution management strategies with respect to eutrophication.	12
5.5 Solid Domestic Waste	13, 14

## Topic 5: Pollution Management

5.5.1 Outline the types of solid domestic waste 5.5.2 Describe and evaluate pollution management strategies for solid domestic (municipal) waste.	
5.6 Depletion of Stratospheric Ozone 5.6.1 Outline the overall structure and composition of the atmosphere	15
5.6.2 Describe the role of ozone in the absorption of ultraviolet radiation.	16
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.	17, 18
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.	19, 20
5.7 Urban Air Pollution 5.7.1 State the source and outline the effect of tropospheric ozone. 5.7.2 Outline the formation of photochemical smog.	21, 22
5.7.3 Describe and evaluate pollution management strategies for urban air pollution.	23
5.8 Acid Deposition 5.8.1 Outline the chemistry leading to the formation of acidified precipitations. 5.8.2 Describe three possible effects of acid deposition on soil, water and living organisms.	24, 25, 26
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.	27, 28

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## Topic 6: The Issue of Global Warming

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Objectives	Met in Lessons
The Issue of Global Warming 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.	1, 2
6.1.3 Discuss qualitatively the effects of increased mean global temperature	3
6.1.4 Discuss the feedback mechanisms that would be associated with an increase in mean global temperature	4
6.1.5 Describe and evaluate pollution management strategies to address the issue of global warming	5
6.1.6 Outline the arguments that are surrounding global warming 6.1.7 Evaluate contrasting human perceptions of the issue of global warming	6,7

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## *Topic 7: Environmental Value Systems*

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<b>Objectives</b>	<b>Met in Lessons</b>
7 Environmental Value Systems 7.1.1 State what is meant by an environmental value system	1
7.1.2 Outline the range of environmental philosophies with reference to the model below Ecocentrism, Anthropomorphism Technocentrism	2, 3
7.1.3 Discuss how these philosophies influence the decision-making process with respect to environmental issues covered in this course	4, 5
7.1.4 Outline key historical influences on the development of the modern environmental movement	6
7.1.5 Compare the environmental value systems of two named societies	7, 8
7.1.6 Justify your personal viewpoint on environmental issues	9

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