

Summary

Topic 4 - Water and Aquatic Food Production Systems and Societies

Subject	Year	Start date	Duration
Environmental Systems & Societies	IB2	Week 1, January	4 weeks 15 hours

Course Part

Core

Description

This topic may be particularly appropriate for considering big questions A, B, E and F.

Curriculum

Aims

Acquire the knowledge and understandings of environmental systems at a variety of scales

Apply the knowledge, methodologies and skills to analyse environmental systems and issues at a variety of scales

Appreciate the dynamic interconnectedness between environmental systems and societies

Value the combination of personal, local and global perspectives in making informed decisions and taking responsible actions on environmental issues

Be critically aware that resources are finite, and that these could be inequitably distributed and exploited, and that management of these inequities is the key to sustainability

Develop awareness of the diversity of environmental value systems

Develop critical awareness that environmental problems are caused and solved by decisions made by individuals and societies that are based on different areas of knowledge

Engage with the controversies that surround a variety of environmental issues

Create innovative solutions to environmental issues by engaging actively in local and global contexts

Objectives

Demonstrate knowledge and understanding of relevant

facts and concepts

methodologies and techniques

values and attitudes

Apply this knowledge and understanding in the analysis of

explanations, concepts and theories

data and models

case studies in unfamiliar contexts

arguments and value systems

Evaluate, justify and synthesise, as appropriate

explanations, theories and models

arguments and proposed solutions

methods of fieldwork and investigation


cultural viewpoints and value systems

Engage with investigations of environmental and societal issues at the local and global level through

evaluating the political, economic and social contexts of issues

selecting and applying the appropriate research and practical skills necessary to carry out investigations

suggesting collaborative and innovative solutions that demonstrate awareness and respect for the cultural differences and value systems of others

 Syllabus Content

Topic 3: Biodiversity and conservation

3.1 An introduction to biodiversity

Significant ideas:

Biodiversity can be identified in a variety of forms, including species diversity, habitat diversity and genetic diversity.

The ability to both understand and quantify biodiversity is important to conservation efforts.

Knowledge and understanding:

Biodiversity is a broad concept encompassing the total diversity of living systems, which includes the diversity of species, habitat diversity and genetic diversity.

Species diversity in communities is a product of two variables: the number of species (richness) and their relative proportions (evenness).

Communities can be described and compared through the use of diversity indices. When comparing communities that are similar, low diversity could be indicative of pollution, eutrophication or recent colonization of a site. The number of species present in an area is often indicative of general patterns of biodiversity.

Habitat diversity refers to the range of different habitats in an ecosystem or biome.

Genetic diversity refers to the range of genetic material present in a population of a species.

Quantification of biodiversity is important to conservation efforts so that areas of high biodiversity may be identified, explored, and appropriate conservation put in place where possible.

The ability to assess changes to biodiversity in a given community over time is important in assessing the impact of human activity in the community.

Applications and skills:

Distinguish between biodiversity, diversity of species, habitat diversity and genetic diversity.

Comment on the relative values of biodiversity data.

Discuss the usefulness of providing numerical values of species diversity to understanding the nature of biological communities and the conservation of biodiversity.

3.2 Origins of biodiversity

Significant ideas:

Evolution is a gradual change in the genetic character of populations over many generations, achieved largely through the mechanism of natural selection.

Environmental change gives new challenges to species, which drives the evolution of diversity.

There have been major mass extinction events in the geological past.

Knowledge and understanding:

Biodiversity arises from evolutionary processes.

Biological variation arises randomly and can either be beneficial to, damaging to, or have no impact on, the survival of the individual.

Natural selection occurs through the following mechanism.

1. Within a population of one species, there is genetic diversity, which is called variation.
2. Due to natural variation, some individuals will be fitter than others.
3. Fitter individuals have an advantage and will reproduce more successfully than individuals who are less fit.
4. The offspring of fitter individuals may inherit the genes that give that advantage.

This natural selection will contribute to the evolution of biodiversity over time.

Environmental change gives new challenges to species: those that are suited will survive, and those that are not suited will not survive.

Speciation is the formation of new species when populations of a species become isolated and evolve differently from other populations.

Isolation of populations can be caused by environmental changes forming barriers such as mountain formation, changes in rivers, sea level change, climatic change or plate movements. The surface of the Earth is divided into crustal, tectonic plates that have moved throughout geological time. This has led to the creation of both land bridges and physical barriers with evolutionary consequences.

The distribution of continents has also caused climatic variations and variation in food supply, both contributing to evolution.

Mass extinctions of the past have been caused by various factors, such as tectonic plate movements, super-volcanic eruption, climatic changes (including drought and ice ages), and meteorite impact—all of which resulted in new directions in evolution and therefore increased biodiversity.

Applications and skills:

Explain how plate activity has influenced evolution and biodiversity.

Discuss the causes of mass extinctions.

3.3 Threats to biodiversity

Significant idea:

While global biodiversity is difficult to quantify, it is decreasing rapidly due to human activity. Classification of species conservation status can provide a useful tool in the conservation of biodiversity.

Knowledge and understanding:

Estimates of the total number of species on Earth vary considerably. They are based on mathematical models, which are influenced by classification issues and a lack of finance for scientific research, resulting in many habitats and groups being significantly under-recorded.

The current rates of species loss are far greater now than in the recent past, due to increased human influence. The human activities that cause species extinctions include habitat destruction, introduction of invasive species, pollution, overharvesting and hunting.

The International Union of Conservation of Nature (IUCN) publishes data in the “Red List of Threatened Species” in several categories.

Factors used to determine the conservation status of a species include: population size, degree of specialization, distribution, reproductive potential and behaviour, geographic range and degree of fragmentation, quality of habitat, trophic level, and the probability of extinction.

Tropical biomes contain some of the most globally biodiverse areas and their unsustainable exploitation results in massive losses in biodiversity and their ability to perform globally important ecological services.

Most tropical biomes occur in less economically developed countries (LEDCs) and therefore there is conflict between exploitation, sustainable development and conservation.

Applications and skills:

Discuss the case histories of three different species: one that has become extinct due to human activity, another that is critically endangered, and a third species whose conservation status has been improved by intervention.

Describe the threats to biodiversity from human activity in a given natural area of biological significance or conservation area.

Evaluate the impact of human activity on the biodiversity of tropical biomes.

Discuss the conflict between exploitation, sustainable development and conservation in tropical biomes.

3.4 Conservation of biodiversity

Significant ideas:

The impact of losing biodiversity drives conservation efforts.

The variety of arguments given for the conservation of biodiversity will depend on EVSs.

There are various approaches to the conservation of biodiversity, each with associated strengths and limitations.

Knowledge and understanding:

Arguments about species and habitat preservation can be based on aesthetic, ecological, economic, ethical and social justifications.

International, governmental and non-governmental organizations (NGOs) are involved in conserving and restoring ecosystems and biodiversity, with varying levels of effectiveness due to their use of media, speed of response, diplomatic constraints, financial resources and political influence.

Recent international conventions on biodiversity work to create collaboration between nations for biodiversity conservation.

Conservation approaches include habitat conservation, species-based conservation and a mixed approach.

Criteria for consideration when designing protected areas include size, shape, edge effects, corridors, and proximity to potential human influence.

Alternative approaches to the development of protected areas are species-based conservation strategies including:

CITES

captive breeding and reintroduction programmes, and zoos

selection of “charismatic” species to help protect others in an area (flagship species)

selection of keystone species to protect the integrity of the food web.

Community support, adequate funding and proper research influence the success of conservation efforts.

The location of a conservation area in a country is a significant factor in the success of the conservation effort. Surrounding land use for the conservation area and distance from urban centres are important factors for consideration in conservation area design.

Applications and skills:

Explain the criteria used to design and manage protected areas.

Evaluate the success of a given protected area.

Evaluate different approaches to protecting biodiversity.

ATL Skills

Approaches to Learning



Thinking

- In this unit, we will
 - ask students to formulate a reasoned argument to support their opinion or conclusion
 - give students time to think through their answers before asking them for a response
 - reward a new personal understanding, solution or approach to an issue
 - ask open questions
 - set students a task which required higher-order thinking skills (such as analysis or evaluation)
 - build on a specific prior task
 - help students to make their thinking more visible (for example, by using a strategy such as a thinking routine)
 - require students to take an unfamiliar viewpoint into account when formulating arguments
 - ask questions that required the use of knowledge from a different subject from the one you are teaching
 - include a reflection activity
 - make a link to TOK



Social

- In this unit, we will
 - have students work in small groups
 - allocate, or ask students to allocate among themselves, different roles in a classroom discussion or activity
 - have students peer assess their group performance or process
 - support students in resolving a conflict in a team
 - give a group assessment task
 - give students feedback on how they worked as a group
 - have students discuss their understanding of a text or idea among themselves and come up with a shared understanding
 - provide an opportunity for students to analyse the impact of their behaviour on the class or on a group performance
 - encourage students to consider alternative points of view or to take the perspective of others
 - provide opportunities for students to make decisions



Communication

- In this unit, we will

- ask students to explain their understanding of a text or idea to each other
- construct a task around the use of different vocabulary and examples when speaking to different audiences
- have students give an oral presentation without reading from their notes
- ask students to monitor and check the quality of their writing
- construct a task so that students practise their listening skills
- assess or give feedback on speaking or writing concisely
- provide opportunities for students to read and understand different types of texts
- encourage or require students to plan a response before they begin
- ask students to formulate arguments clearly and coherently
- encourage all students to contribute to discussions



Developing IB Learners

☆ Learner Profile



Inquirers



Knowledgeable



Thinkers



Communicators



Principled



Open-minded



Risk-takers (Courageous)



Balanced



Reflective