Topic #3 Biodiversity and Conservation

Content Area: **Science**
Course(s): **IB Environmental Sciences and Societies, SL**
Time Period: **Second Marking period**
Length: **13 hours**
Status: **Published**

Unit Overview

The aims of the ESS course are to enable students to:

1. acquire the knowledge and understandings of environmental systems at a variety of scales

2. apply the knowledge, methodologies, and skills to analyze environmental systems and issues at a variety of scales

3. appreciate the dynamic interconnectedness between environmental systems and societies

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

5. 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

6. develop awareness of the diversity of environmental value systems

7. 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

8. engage with the controversies that surround a variety of environmental issues

9. create innovative solutions to environmental issues by engaging actively in local and global contexts

In studying biodiversity and conservation, students will be become familiar with the origins and types of biodiversity and threats to biodiversity. It is then that the importance and ways of conserving biodiversity become relevant.

STAGE 1- DESIRED RESULTS

2020 New Jersey Student Learning Standards- Science

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

Cross Cutting Concepts

- Cause and Effect
- Energy and Matter
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

Disciplinary Core Ideas

Physical Sciences

- PS1A: Structure and Properties of Matter
- PS1B: Chemical Reactions
- PS1C: Nuclear Processes
- PS2A: Forces and Motion

- PS2B: Types of Interaction
- PS3A: Definitions of Energy
- PS3B: Conservation of Energy and Energy Transfer
- PS3C: Relationship Between Energy and Forces
- PS3D: Energy in Chemical Processes and Everyday Life
- PS4A: Wave Properties
- PS4B: Electromagnetic Radiation
- PS4C: Information Technologies and Instrumentation

Life Sciences

- LS1A: Structure and Functions
- LS1B: Growth and Development of Organisms
- LS1C: Organization for Matter and Energy Flow in Organisms
- LS1D: Information Processing
- LS2A: Interdependent Relationships in Ecosystems
- LS2B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2C: Ecosystems Dynamics, Functioning, and Resilience
- LS2D: Social Interactions and Group Behavior
- LS3A: Inheritance of Traits
- LS3B: Variation of traits
- LS4A: Evidence of Common Ancestry and Diversity
- LS4B: Natural Selection
- LS4C: Adaptation
- LS4D: Biodiversity and Humans

Earth and Space Sciences

- ESS1A: The Universe and its Stars
- ESS1B: Earth and the Solar System
- ESS1C: The History of Planet Earth
- ESS2A: Earth Materials and Systems
- ESS2B: Plate Tectonics and Large-Scale Systems
- ESS2C: The Role of Water in Earth's Surface Processes
- ESS2D: Weather and Climate
- ESS2E: Biogeology
- ESS3A: Natural Resources
- ESS3B: Natural Hazards

- ESS3C: Human Impacts on Earth Systems
- ESS3D: Global Climate Change

Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution

Essential Questions

To what extent have the solutions emerging from this topic been directed at preventing environmental impacts, limiting the extent of the environmental impacts or restoring systems in which environmental impacts have already occurred?

What value systems are at play in the causes and approaches to resolving the issues addressed in this topic?

How does your personal value system compare with the others you have encountered in the context of issues raised in this topic?

How are the issues addressed in this topic relevant to sustainability or sustainable development?

In which ways might the solutions explored in this topic alter your predictions for the state of human societies and the biosphere decades from now?

Enduring Understanding

- 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.
- 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.
- 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.
- 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.

Students will know...

Abiotic factor, Biochemical oxygen demand (BOD), Biodegradable, Biodiversity, Biomass, Biome Biosphere , Biotic factor, Carrying capacity Climax community, Community, Competition, Correlation, Crude birth rate, Crude death rate, Demographic transition, Diversity, Genetic Diversity Habitat Diversity, Diversity index, Species Diversity, Doubling time, Ecological footprint, Ecosystem, Entropy, Environmental impact assessment (EIA), Equilibrium, Eutrophication, Evolution, Feedback, Feedback, negative Feedback, positive, Fertility, Gaia, Global warming, GNP,Greenhouse gases, Habitat, Halogenated, organic gases, Isolation, *K*-strategist, Latitude, LEDC, MEDC, Model, Mutualism, Natural capital, Natural capital, non-renewable, Natural capital, renewable, Natural capital, replenishable, Natural increase, rate of, Niche Parasitism, Plate tectonics, Pollution, Pollution, non-point source Pollution, point source, Population Productivity, gross (GP), Productivity, gross primary (GPP), Productivity-gross secondary (GSP), Productivity-net (NP) , Productivity-net primary (NPP), Productivity-net secondary (NSP), Productivity, primary Productivity, secondary, *r*-strategist, Sere Smog, Society, Soil, Soil profile, Speciation Species, Stable equilibrium, Standing crop, Steady-state equilibrium, Succession, Sustainability, System, System-closed System-isolated, System-open, Trophic level, Zonation

Predictable misconceptions

Populations coexist in an ecological system because of their compatible needs and behaviors: they need to get along

Populations exist in states of either constant growth or decline depending upon their position in a food chain

Some ecosystems are limitless resources and provide an opportunity for limitless growth of a population

Students will be able to...

• 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.

• Explain how plate activity has influenced evolution and biodiversity.

• Discuss the causes of mass extinctions.

• 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.

• Explain the criteria used to design and manage protected areas.

• Evaluate the success of a given protected area.

• Evaluate different approaches to protecting biodiversity.

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check
- Questions & Answers
- Quiz

- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

• Values and attitude surveys or questionnaires

• Interviews

• Issues-based inquiries to inform decision-making

• Observational fieldwork (natural experiments)

• Field manipulation experiments

• Ecosystem modelling (including mesocosms or bottle experiments)

• Laboratory work

• Models of sustainability

• Use of systems diagrams or other valid holistic modelling approaches

• Elements of environmental impact assessments

• Secondary demographic, development, and environmental data

• Collection of both qualitative and quantitative data

Benchmark Assessments

IB test questions, essays, and case studies.

STAGE 3- LEARNING PLAN

Instructional Map

2nd Marking Period

Topic 3: Biodiversity and conservation

3.1 An introduction to biodiversity

3.2 Origins of biodiversity

3.3 Threats to biodiversity

3.4 Conservation of biodiversity

Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials

- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

504 Plans

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating

- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

DI = ppt/air mac, co-operative learning (mixed ability)

ESL students: speaking, reading, writing, peer tutoring

SPEDs: restating, reading aloud, quided questions, additional problems and teacher's observations

Rephrase/Clarify/Repeat Directions

Study Guides

Extended Time on Tests / Assignments

Modify Tests / Assignments

Visual Aides

Word Bank

Use a Calculator

Repeated Drill and Practice

Teacher Notes

Preferential Seating

Oral Directions

Use of Additional Reference Materials

Break Down Assignments into Smaller Tasks

Academic Ability

1. Struggling: Think--Pair-- Share with gifted students.

2. Gifted: Think-- Pair-- Share with struggling students

Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments
- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style

- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

Horizontal Intergration- Interdisciplinary Connections

See Appendix

Vertical Integration- Discipline Mapping

Students will have been exposed to the Performance Expectations for Life Sciences and Engineering Design outlined in the Next Generation Science Standards (NGSS) starting in 1st grade through Chemistry, which is offered during the sophomore year of High School. Science classes are designed around the Performance Expectations, Science and Engineering Practices, Discplinary Core Ideas, and Croscutting Concepts in the NGSS. In grade 6, students complete a unit on "Diversity of Life". This leads into "Populations and Ecosystems" in grade 7. In grade 8 students study "Human System Interactions" and Heredity and Adaptations." In grade 9 students study Biology, a full year recquired course, Following Biology in 9th grade students will take Chemistry. After students will be able to chose from Physics, Anatomy and Physiology, Human Impact on the Environment, Forensics and Zoology, IB Environmental Systems and Societies, IB Biology, Physics or Chemistry.

Additional Materials

Kognity (website)

Online Curriculum Center (an IB site)