Year 2, Unit 4 Ecology

Content Area: **Science**
Course(s): **IB Biology, HL**
Time Period: **Second Marking period**
Length: **3 weeks**
Status: **Published**

Unit Overview

Students will learn about the stability of ecosystems and how the small parts of the ecosystem allow for the full functioning of healthy ecosystems. Students will also learn about the affects of climate change related to the increase in carbon dioxide in the atmosphere.

STAGE 1- DESIRED RESULTS

4.1 Looking for patterns, trends and discrepancies—plants and algae are mostly autotrophic, but some are not.

4.2 Use theories to explain natural phenomena—the concept of energy flow explains the limited length of food chains.

4.3 Making accurate, quantitative measurements—it is important to obtain reliable data on the concentration of carbon dioxide and methane in the atmosphere.

4.4 Assessing claims—assessment of the claims that human activities are producing climate change.

Standards

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

Life Sciences

- LS1C: Organization for Matter and Energy Flow in Organisms
- 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
- LS4D: Biodiversity and Humans

Earth and Space Sciences

- ESS2D: Weather and Climate
- 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

4.1 How does the continued survival of living organisms including humans depend on sustainable communities?

4.2 How do ecosystems require a continuous supply of energy to fuel life processes and to replace energy lost as heat?

4.3 How does continued availability of carbon in ecosystems depends on carbon cycling?

4.4 How do concentrations of gases in the atmosphere affect climates experienced at the Earth's surface?

Enduring Understanding

Students will understand and appreciate the interactions between all the ecosystems and the sustabability of the planet. Students will have a long sustaining appreciation for how intricate pieces play major roles in the stability of the planet.

Students will know...

4.1

- Species are groups of organisms that can potentially interbreed to produce fertile offspring.
- Members of a species may be reproductively isolated in separate populations.
- Species have either an autotrophic or heterotrophic method of nutrition (a few species have both methods).
- Consumers are heterotrophs that feed on living organisms by ingestion.
- Detritivores are heterotrophs that obtain organic nutrients from detritus by internal digestion.
- Saprotrophs are heterotrophs that obtain organic nutrients from dead organisms by external digestion.
- A community is formed by populations of different species living together and interacting with each other.
- A community forms an ecosystem by its interactions with the abiotic environment.
- Autotrophs obtain inorganic nutrients from the abiotic environment.
- The supply of inorganic nutrients is maintained by nutrient cycling.
- Ecosystems have the potential to be sustainable over long periods of time.

4.2

- Most ecosystems rely on a supply of energy from sunlight.
- Light energy is converted to chemical energy in carbon compounds by photosynthesis.
- Chemical energy in carbon compounds flows through food chains by means of feeding.
- Energy released from carbon compounds by respiration is used in living organisms and converted to heat.
- Living organisms cannot convert heat to other forms of energy.
- Heat is lost from ecosystems.
- Energy losses between trophic levels restrict the length of food chains and the biomass of higher trophic levels.

4.3

- Autotrophs convert carbon dioxide into carbohydrates and other carbon compounds.
- In aquatic ecosystems carbon is present as dissolved carbon dioxide and hydrogencarbonate ions.
- Carbon dioxide diffuses from the atmosphere or water into autotrophs.
- Carbon dioxide is produced by respiration and diffuses out of organisms into water or the atmosphere.
- Methane is produced from organic matter in anaerobic conditions by methanogenic archaeans and some diffuses into the atmosphere or accumulates in the ground.
- Methane is oxidized to carbon dioxide and water in the atmosphere.
- Peat forms when organic matter is not fully decomposed because of acidic and/or anaerobic conditions in waterlogged soils.
- Partially decomposed organic matter from past geological eras was converted either into coal or into oil and gas that accumulate in porous rocks.
- Carbon dioxide is produced by the combustion of biomass and fossilized organic matter.
- Animals such as reef-building corals and mollusca have hard parts that are composed of calcium carbonate and can become fossilized in limestone.

4.4

- Carbon dioxide and water vapor are the most significant greenhouse gases.
- Other gases including methane and nitrogen oxides have less impact.
- The impact of a gas depends on its ability to absorb long wave radiation as well as on its concentration in the atmosphere.
- The warmed Earth emits longer wavelength radiation (heat).
- Longer wave radiation is absorbed by greenhouse gases that retain the heat in the atmosphere.
- Global temperatures and climate patterns are influenced by concentrations of greenhouse gases.
- There is a correlation between rising atmospheric concentrations of carbon dioxide since the start of the industrial revolution 200 years ago and average global temperatures.
- Recent increases in atmospheric carbon dioxide are largely due to increases in the combustion of fossilized organic matter.

Students will be able to...

4.3

- Hypothesize the estimation of carbon fluxes due to processes in the carbon cycle.
- Analyze data from air monitoring stations to explain annual fluctuations

4.4

- Explain the threats to coral reefs from increasing concentrations of dissolved carbon dioxide.
- Describe the correlations between global temperatures and carbon dioxide concentrations on Earth.
- Evaluate claims that human activities are not causing climate change.

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- Debriefing
- Exit Card / Ticket
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- One Minute Essay
- Quiz
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

4.1

- Skill: Classifying species as autotrophs, consumers, detritivores or saprotrophs from a knowledge of their mode of nutrition.
- Skill: Setting up sealed mesocosms to try to establish sustainability. (Practical 5)
- Skill: Testing for association between two species using the chi-squared test with data obtained by quadrat sampling.
- Skill: Recognizing and interpreting statistical significance.

4.2

- Skill: Quantitative representations of energy flow using pyramids of energy.

4.3

- Skill: Construct a diagram of the carbon cycle.

Laboratories will be used for assessment

Quizzes will be given.

Benchmark Assessments

Chapter tests will be given.

STAGE 3- LEARNING PLAN

Instructional Map

Helpful guidance for implementing the IB Biology curriculum

4.1

- Mesocosms can be set up in open tanks, but sealed glass vessels are preferable because entry and exit of matter can be prevented but light can enter and heat can leave. Aquatic systems are likely to be more successful than terrestrial ones.
- To obtain data for the chi-squared test, an ecosystem should be chosen in which one or more factors affecting the distribution of the chosen species varies. Sampling should be based on random numbers. In each quadrat the presence or absence of the chosen species should be recorded.

4.2

- Pyramids of number and biomass are not required. Students should be clear that biomass in terrestrial ecosystems diminishes with energy along food chains due to loss of carbon dioxide, water and other waste products, such as urea.
- Pyramids of energy should be drawn to scale and should be stepped, not triangular. The terms producer, first consumer and second consumer and so on should be used, rather than first trophic level, second trophic level and so on.
- The distinction between energy flow in ecosystems and cycling of inorganic nutrients should be stressed. Students should understand that there is a continuous but variable supply of energy in the form of sunlight, but that the supply of nutrients in an ecosystem is finite and limited.

4.3

- Carbon fluxes should be measured in gigatonnes.

4.4

- Carbon dioxide, methane and water vapor should be included in discussions.
- The harmful consequences of ozone depletion do not need to be discussed and it should be made clear that ozone depletion is not the cause of the enhanced greenhouse effect.

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

Modification Strategies

- Cooperative Grouping
- Interactive Notebook
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Tutorials

Differentiation Strategies

High Preparation

- Alternative Assessments
- Group Investigations
- Independent Research / Project
- Multiple Intelligence Options
- Multiple Texts

Low Preparation

- Goal Setting With Student
- Open-ended Activities
- Use of Collaboration
- Work Alone / Together

Horizontal Intergration- Interdisciplinary Connections

See Appendix

Vertical Integration- Discipline Mapping

Previous courses

6th grade – Diversity of life

7th grade – Populations and Ecosystems

8th grade – Human Systems Interactions and Heredity and Adaptations

9th grade – Honors Biology

10th grade – Honors Chemistry

Possible next courses

Honors Physics

Anatomy & Physiology

IB Physics

Zoology

Forensics

Additional Materials

Videos used through McGraw Hill, Crash Course and Howard Hughes Medical Institute.

Current Research articles supplied through Newsela.