Marietta City Schools

2024–2025 District Unit Planner

Grade & Course: Environmental Science	**Topic:** Unit 3: Functional Ecosystems	**Duration:** 7 Weeks
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Georgia Standards and Content: SEV1.b.d., SEV2. c, d

SEV1. Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem.

b. Develop and use a model based on the Laws of Thermodynamics to predict energy transfers throughout an ecosystem (food chains, food webs, and trophic levels). (Clarification statement: The first and second law of thermodynamics should be used to support the model.)

d. Evaluate claims, evidence, and reasoning of the relationship between the physical factors (e.g., insolation, proximity to coastline, topography) and organismal adaptations within terrestrial biomes.

SEV2. Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.

c. Construct an argument to predict changes in biomass, biodiversity, and complexity within ecosystems, in terms of ecological succession.

d. Construct an argument to support a claim about the value of biodiversity in ecosystem resilience including keystone, invasive, native, endemic, indicator, and endangered species.

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Ecosystems rely on cycles to maintain their sustainability. What other cycles or models help scientists understand the sustainability of an ecosystem?

Year-Long Anchoring Phenomena: (LEARNING PROCESS)

Human activities have negatively impacted ecosystems, global climate, energy resources, and population.

Unit Phenomena (LEARNING PROCESS)
The decline in pollinator populations highlights the intricate interactions within ecosystems and demonstrates how disruptions can impact energy flow and global sustainability.

MYP Inquiry Statement:

The intricate interactions within ecosystems are essential for maintaining balance and biodiversity. The decline of pollinator populations demonstrates how changes in one part of an ecosystem can disrupt energy flow and impact global sustainability. By investigating these relationships, we can design and implement solutions to promote an ecosystem's resilience.

MYP Global Context:

- *Orientation in space and time*

Approaches to Learning Skills:

SEPs
- Analyze and Interpreting Data
- Develop and Use Models
- Plan and Carry Out Investigations

Disciplinary Core Ideas:
(KNOWLEDGE & SKILLS)

- Energy Transfers in Ecosystems
- Physical Factors and Organismal Adaptations
- Ecological Succession
- Value of Biodiversity in Ecosystem Resilience

Crosscutting Concepts:
(KNOWLEDGE & SKILLS)

- Patterns
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter: Flows, Cycles, and Conservation
- Structure and Function
- Stability and Change

MYP Key and Related Concepts:

- *Communities*
- *Connections*
- *Relationships*
- *Systems*
- *Time, Place, and Space*
- *Systems*
- *Balance*
- *Interactions*
- *Transformation*

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Energy is Created: Students may mistakenly believe that energy can be created, rather than understanding the first law of thermodynamics, which states that energy can only be transferred or transformed.
All Organisms Can Adapt to Any Environment: Students might believe that any species can adapt to any environment given enough time, without recognizing the specific limitations and conditions that influence adaptation.
More Species Equals Better Ecosystem Health: Students may oversimplify the relationship between biodiversity and ecosystem health, thinking that more species automatically mean a healthier ecosystem, without considering the role of keystone and invasive species.

Vocabulary: (KNOWLEDGE & SKILLS)
Thermodynamics: The branch of physics concerned with heat and temperature and their relation to energy and work. The first law states that energy cannot be created or destroyed, only transferred or transformed, while the second law states that energy transfers lead to increased entropy (disorder).

Energy Transfer: The movement of energy from one part of an ecosystem to another, typically from one organism to another through food chains and food webs.

Food Chain: A linear sequence of organisms where each is eaten by the next member in the chain. It shows how energy and nutrients flow through an ecosystem.

Food Web: A complex network of interrelated food chains in an ecosystem, illustrating the multiple paths through which energy and nutrients flow.

Trophic Levels: The levels in a food chain or food web, representing a step in the transfer of energy and nutrients from primary producers (plants) to consumers (herbivores, carnivores) and decomposers.

Insolation: The amount of solar radiation reaching a given area, critical in determining climate and influencing the adaptations of organisms in various biomes.

Topography: The arrangement of the natural and artificial physical features of an area, which affects climate, weather patterns, and organismal adaptations.

Biome: A large naturally occurring community of flora and fauna occupying a major habitat, such as a forest or tundra, with distinct climate, soil, and life forms.

Adaptation: A change or the process of change by which an organism or species becomes better suited to its environment, allowing for survival and reproduction.

Ecological Succession: The process of change in the species structure of an ecological community over time, following a disturbance or the creation of new habitat.

Biomass: The total mass of organisms in a given area or volume, often used as a measure of the amount of energy available at each trophic level in an ecosystem.

Biodiversity: The variety of life in the world or in a particular habitat or ecosystem, crucial for ecosystem health and resilience.

Keystone Species: A species on which other species in an ecosystem largely depend, such that if it were removed, the ecosystem would change drastically.

Invasive Species: Non-native species that spread widely and become dominant in a community, often causing harm to the environment, economy, or human health.

Native Species: Species that occur naturally in a particular region or ecosystem without human intervention.

Endemic Species: Species that are native to and found only within a limited area, often having a small range and being vulnerable to extinction.

Indicator Species: Species whose presence, absence, or abundance reflects a specific environmental condition, used as a gauge for the health of an ecosystem.

Ecosystem Resilience: The ability of an ecosystem to withstand disturbances or changes and still maintain its essential functions and structure.

Inquiry Questions:

Factual

What does the first law of thermodynamics state?
How much energy is typically transferred from one trophic level to the next in a food chain?
What is the difference between a food chain and a food web?

Conceptual

What role does biodiversity play in the resilience of an ecosystem facing environmental changes?
In what ways does ecological succession increase the complexity and biodiversity of an ecosystem over time?
How might the removal of a keystone species affect an entire ecosystem?

Debatable

Should humans intervene in natural processes like ecological succession to restore ecosystems, or should nature be allowed to take its course?
Is it ethical to prioritize the preservation of certain species over others when managing biodiversity? Why or why not?
In what situations might invasive species have a positive impact on an ecosystem, and should they ever be protected?

MYP Objectives	Summative assessment	
Sciences **Design**	Assessment Task: Energy Transfer Diagrams Biome Adaptation Presentations Succession Storyboards Debate on Invasive Species Biodiversity Restoration Plan Unit 2 Assessment	Relationship between summative assessment task(s) and statement of inquiry: Assessments will allow students to demonstrate their understanding of the interconnectedness between the parts, both biotic and abiotic, of an ecosystem.

Unit Objectives:

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)
Week 1: Thermo-dynamics	• Introduction to the Laws of Thermodynamics. • Energy transfer in ecosystems, focusing on food chains, food webs, and trophic levels (SEV1.b).	Diagram and analysis of a simple food web, emphasizing energy loss.	• **Class Discussions:** Students share prior knowledge and misconceptions about energy transfer and thermodynamics. • **Small Group Collaboration:** Groups work together to create and explain a basic food web diagram, focusing on energy transfer and the laws of thermodynamics. • **Exit Tickets:** Students summarize what they learned about thermodynamics and energy transfer, providing a quick reflection.
Week 2: Thermo-dynamics and Physical Factors in Biomes	• Continue energy transfer discussions using thermodynamic principles. • Introduction to physical factors affecting biomes: insolation, proximity to coastlines, topography (SEV1.d).	• Hands-on activity modeling energy transfer through an ecosystem. • Case study analysis of how physical factors influence biome characteristics and organismal adaptations.	• **Think-Pair-Share:** Students discuss how energy is transferred between trophic levels and how physical factors influence biomes. • **Case Study Presentations:** Students present their findings from the case study on how physical factors affect biome characteristics and adaptations. • **Peer Review:** Students give and receive feedback on each other's diagrams and models of energy transfer.
Week 3: Biomes and Ecological Succession	• Complete discussions on physical factors and their impact on biomes.	• Students create succession storyboards to visualize changes in ecosystems over time. • Group discussions on examples of primary and secondary succession.	• **Group Storyboarding:** Students collaborate to create storyboards showing ecological succession and present their work to the class. • **Class Discussion:** Engage in a guided discussion about the differences between primary and secondary

Week 3: Biomes and Ecological Succession	• Begin exploring ecological succession and its impact on biomass, biodiversity, and ecosystem complexity (SEV2.c).		succession and their impacts on biodiversity. • **Reflective Journals:** Students write reflections on the process of succession and its long-term effects on ecosystems.
Week 4: Ecological Succession and Bio-diversity	• Continue exploring ecological succession. • Introduction to biodiversity's role in ecosystem resilience, with a focus on keystone, invasive, native, and indicator species (SEV2.d).	• Concept mapping to connect ecological succession, biodiversity, and ecosystem resilience. • Debate on the importance of preserving biodiversity and controlling invasive species.	• **Concept Mapping:** Students work in pairs or small groups to create and explain concept maps that connect ecological succession, biodiversity, and ecosystem resilience. • **Debate:** Students participate in a structured debate on the importance of biodiversity and strategies for managing invasive species. • **Peer Teaching:** Students explain key concepts from their concept maps to another group, reinforcing their understanding.
Week 5: Mid-Unit Review and Application of Concepts	• Review and solidify understanding of energy transfer, biomes, succession, and biodiversity. • Begin applying concepts through a performance task or project, such as a biodiversity restoration plan.	• Mid-unit quiz (CFA) to assess understanding. • Group work on developing a biodiversity restoration plan, incorporating lessons on ecosystem resilience.	• **Small Group Discussions:** Students discuss their initial ideas for the biodiversity restoration plan, seeking input from peers. • **Mid-Unit Quiz Discussion:** After the quiz, students discuss their answers in small groups to clarify misunderstandings. • **Draft Presentations:** Groups share draft versions of their biodiversity restoration plans and receive peer feedback.
Week 6: Completing and Presenting Projects	• Finalize and present biodiversity restoration plans or other performance tasks. • Peer review and feedback sessions to enhance understanding and integration of concepts.	• Students present their projects, focusing on how their plans address the standards. • Peer evaluation and teacher feedback on projects.	• **Project Presentations:** Each group presents their biodiversity restoration plan to the class, explaining how their plan addresses the unit standards. • **Peer Review Sessions:** Students provide constructive feedback on other groups' presentations, focusing on strengths and areas for improvement. • **Class Discussion:** Discuss common themes and challenges from the projects, encouraging students to think critically about ecosystem management.

Week 7: Final Review and CSA	• Comprehensive review of all concepts covered in the unit. • Focus on areas where students have shown weaknesses or misconceptions.	Practice questions, review games, and interactive discussions.	• **Test Reflection:** After completing the test, students can write a reflection on what they found challenging and what they felt confident about. • **Post-Test Discussion:** In the next class session, discuss key takeaways from the unit and address any lingering questions or misconceptions.

Resources (hyperlink to model lessons and/or resources):
National Geographic
Khan Academy
GPB Lets Go Enviro

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
Establish Prior Knowledge: • Use pre-assessments, concept maps, or KWL charts (Know, Want to Know, Learned) to gauge students' prior knowledge and misconceptions. **Set Clear Learning Goals:** • Clearly articulate the learning objectives and inquiry goals. Students should understand what they are expected to achieve by the end of the unit, which will guide their inquiry process.	**Facilitate Student-Driven Inquiry:** • Allow students to take ownership of their learning by formulating their own questions and pursuing answers through research, experimentation, and collaboration. Provide scaffolding as needed but encourage independence. **Incorporate Formative Assessments:** • Use ongoing assessments such as reflective journals, peer reviews, and check-ins to monitor student progress. These assessments provide opportunities for feedback and adjustments to the inquiry process. **Encourage Multiple Perspectives:** • Facilitate activities that allow students to explore different viewpoints, such as debates, role-playing, or case studies. This broadens their understanding and helps them see the complexity of real-world issues. **Support Reflection and Metacognition:** • Regularly ask students to reflect on their inquiry process, the challenges they face, and the strategies they use to overcome them. Encourage them to think about how they are learning, not just what they are learning.	**Evaluate the Inquiry Process:** • Assess both the content knowledge gained and the effectiveness of the inquiry process. This could include evaluating the quality of questions asked, the research conducted, and the conclusions drawn by students. **Promote Application and Extension:** • Encourage students to apply their learning to new contexts or real-world situations. This could involve community projects, presentations to external audiences, or further research on related topics. **Facilitate Self and Peer Assessment:** • Provide opportunities for students to assess their own work and the work of their peers. This fosters critical thinking and helps students recognize the strengths and areas for improvement in their inquiry process. **Reflect on Impact and Growth:** • Engage students in discussions about how their understanding has changed and how the inquiry has impacted their thinking. Consider the broader implications of their learning, such as its relevance to their lives and future learning.