High School Biology Lesson Plan: Biodiversity and Ecosystem Stability at Rocky Face Ridge

Standards:

SB5: Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

- **a.** Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems.
  (*Clarification statement:* Factors include population size, carrying capacity, response to limiting factors, and keystone species.)
- **c.** Construct an argument to predict the impact of environmental change on the stability of an ecosystem.
- **d.** Design a solution to reduce the impact of a human activity on the environment.
  (*Clarification statement:* Human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.)

Essential Question:

How does biodiversity impact ecosystems, and how can human activities at Rocky Face Ridge have an effect on both?

Time:

85 minutes

Background Information:

Biodiversity refers to the variety of living organisms in an ecosystem, including plants, animals, and microorganisms. High biodiversity contributes to ecosystem stability by supporting food webs, nutrient cycling, and resilience to environmental changes. Keystone species play critical roles by maintaining balance, and the removal of such species can cause cascading effects on the ecosystem.

Rocky Face Ridge is a biodiverse area in Whitfield County providing habitats for various species and serving as a natural buffer against environmental threats like soil erosion and flooding. However, human activities such as deforestation, urban development, and pollution threaten this balance. Understanding these dynamics is essential for designing sustainable solutions.

Materials:

- Species profile cards (variety of plants, animals, and microorganisms found at Rocky Face Ridge) (https://www.canva.com/design/DAGoSJO9pak/B0_GAjzYF_1gHn4k-Kd73A/view?utm_content=DAGoSJO9pak&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=h7a998909ed)
- Yarn (to represent interactions)
- Web Key (https://www.canva.com/design/DAGoTf3oxEc/oUJhBQ-SDONQpSKfZn2Grw/view?utm_content=DAGoTf3oxEc&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=he9d1be2348)
- Slide Deck (https://www.canva.com/design/DAGoSrizNng/52GV-IUuoWEZil67_PoLDQ/view?utm_content=DAGoSrizNng&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=he35d2cf546)
- GIS Map
- Entry Ticket Papers
- Species Profile Sheets (https://www.canva.com/design/DAGnVOaOa8Y/Un_WU3fzQB9tR7Qbn38e4Q/view?utm_content=DAGnVOaOa8Y&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=h5869e8bf2c)
- Biology Scenarios (https://www.canva.com/design/DAGoS5ULcAY/rMp0xMyX5nXMxNFSzSNYUg/view?utm_content=DAGoS5ULcAY&utm_campaign=designshare&utm_medium=link2&utm_source=uniquelinks&utlId=ha920ac5f1f#3)

Pre-Assessment (5 minutes):

Entry ticket: Have students write one to two sentences answering. “What does biodiversity mean to you, and why is it important for ecosystems like Rocky Face Ridge?”

Activities:

1. Ridge Overview and GIS Map Analysis (15 minutes):

Display the GIS map on the board. Use the GIS map to explore the species diversity and ecological significance of Rocky Face Ridge. Point out key areas of dense biodiversity and explain how they contribute to flood prevention, erosion control, and temperature regulation.

Discuss Whitfield County’s population growth using provided data. Ask students how increased population might affect the ridge’s ecosystems.

Key Question: How does Rocky Face Ridge protect our community, and what challenges arise as Dalton grows?

2. Biodiversity and Stability Web (25 minutes)

- **Step 1:** Assign each student an ecosystem role card (e.g., tree, deer, soil, rainfall, fungus). Cards include basic information about what the species does in the ecosystem and how it interacts with others.
- **Step 2:** Arrange students in a circle. Explain that they will create a "web" to show how all the parts of the ecosystem are connected.
- **Step 3:** Use yarn or string to connect species based on their relationships (e.g., a tree connects to soil for nutrients, soil connects to rain for moisture, rain connects to plants, and plants connect to herbivores).
- **Step 4:** Gradually remove key species (e.g., trees) to simulate biodiversity loss caused by deforestation, climate change, etc.. Each time a species is removed, discuss how it affects the remaining web and the carrying capacity. Discuss the limiting factors related to the relationships of species (e.g., less trees leads to less birds leads to more insects). When it makes sense, some species may be added back in.
- **Step 5:** Ask students: "What happens to the ecosystem's stability when we lose biodiversity? How does this relate to Rocky Face Ridge?"

2. Why Biodiversity Matters (5 minutes): Key Points Discussion

- Briefly explain how biodiversity benefits humans using the provided slide deck:
    - **Ecosystem services** such as clean air, water filtration, and crop pollination.
    - **Stability** by making ecosystems more resilient to environmental changes.
    - **Resources** like medicine, food, and materials.
- Emphasize that loss of biodiversity weakens these benefits, making ecosystems more vulnerable to collapse and reducing quality of life for humans.

3. Whole-Class Activity (25 minutes): Designing a Solution

- **Setup:** Present the following solution options for the Rocky Face Ridge to the class with brief descriptions using the slide deck:
    - **Tree Planting Program:** Restores habitats, reduces runoff, and improves air quality. Trees take a long time to grow and it risks losing biodiversity as many programs plant the same types of trees.
    - **Green Infrastructure:** Introduces rain gardens and permeable pavement to manage runoff. This will still lead to a loss in habitat and safe areas for animals and may not be able to handle significant flooding or erosion.
    - **Wildlife Corridor:** Connects fragmented habitats to allow safe migration of species. This will still lead to a loss in habitat and will not significantly aid flooding and erosion.

    - **Steep Slope Ordinance:** Limits construction on steep slopes to reduce erosion. Builders and developers may oppose the ordinance as it reduces viable land for projects such as housing and businesses.
    - **Protected Land Designation:** Restricts development to preserve biodiversity and ecosystem services. Builders and developers may oppose the ordinance as it reduces viable land for projects such as housing and businesses.
- **Task:** Facilitate a class discussion for each solution, listing its pros and cons on the board or chart paper. Example prompts:
    - "How does this solution help biodiversity?"
    - "What challenges might we face implementing this solution?"
    - “What are some ways this solution is lacking?”
- After discussing all options, the class votes with a raise of hands on the solution they believe would be most effective for Rocky Face Ridge.

Wrap-Up (5 minutes):

- **Reflection:** Discuss why the chosen solution was selected and how it could be implemented realistically. Discuss if solutions could be combined and if they would do enough to protect the biodiversity of the area.

Post Assessment (10 minutes):

- **Exit Ticket:** On the other side of their pre-assessment ticket, students respond to the prompts:
    1. One way human activities can affect biodiversity at Rocky Face Ridge.
    2. One reason biodiversity is essential for ecosystem stability.
    3. One solution to balance development and the need for biodiversity in Dalton.

Differentiation:

For Struggling Learners:

- Provide simplified species profiles with visuals and key details highlighted.

Extensions:

- Investigate the role of non-native species and propose methods to control their impact.

Lesson developed by:

The Dalton Resilient Community Group with Keep Dalton-Whitfield Beautiful, Whitfield County 4-H, Sarah Ott, and the Dalton-Whitfield Solid Waste Authority.

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Preserving Dalton's Rocky Face Ridge

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