Field Biology

Analysis of Populations

ESSENTIAL QUESTION	BIG IDEAS
How do environmental conditions impact the organisms living within an ecosystem?	• Students will be able to collect and interpret data to determine population sizes in their environments. • Students will understand how changes in the environment impact the populations of organisms.

GUIDING QUESTIONS

Content:

- What is a Carrying Capacity?
    - How do factors like living (predation, competition, and disease) and nonliving resources in an ecosystem influence the carrying capacity?
- What are some of the complex interactions that can keep the carrying capacity and diversity relatively constant under stable conditions?
- How will a MODEST biological or physical disturbance impact the carrying capacity of an ecosystem?
- How will an EXTREME biological or physical disturbance impact the carrying capacity of an ecosystem?

Process:

- How will students collect scientific data to determine population sizes in the local environments?
- How will students use the data collected to analyze population size and dynamics?

Reflective:

- **What would your grocery store look like if all pollinators went extinct?**
- **What happens if we outlaw all hunting and fishing?**
- **Why are there limits to hunting and fishing licenses?**
- **Why are greenspaces/trees important in urban environments?**
- **Why do cities have requirements to plant trees during new construction projects?**
- **What is the health biodiversity level of the environments that surround us?**
- **How does the biodiversity of an ecosystem impact its health?**
- **What is healthier for the environment- a prairie, lawn, or agricultural field?**

FOCUS STANDARDS

- HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Field Biology

Energy Flow & Nutrient Cycling

ESSENTIAL QUESTION	BIG IDEAS
How do organisms obtain and use energy they need to live and grow? **How do matter and energy move through ecosystems?**	• Students can construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. • Students understand how organisms obtain resources, change the environment, and how these changes affect both organisms and ecosystems. https://www.nextgenscience.org/sites/default/files/HSTopic.pdf https://www.nextgenscience.org/search-standards?keys=&type%5B0%5D=performance_expectation&tid%5B0%5D=107&tid_3%5B0%5D=96&page=1

GUIDING QUESTIONS

Content:

- What is the relationship of biomass and energy transfer in ecosystems from one trophic level to another?
- Can you describe the flow of matter and energy through different organizational levels of living systems, including the vital chemical elements and compounds that recombine in different ways to form different products?

Process:

- Can you use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales?
- Can you use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales?
- Can you use mathematical models of stored energy in biomass to describe the transfer of energy from one trophic level to another?

Reflective:

- **What happens to the trash and waste left in school parking lots?**
- **Should we fertilize our lawns and fields?**
- **What if dead things didn't decay?**

- **What would happen to ecosystems if keystone species were introduced or removed?**
    - **Steams ⇒ Beavers**
    - **Woodlands ⇒ Woodpeckers**
    - **Grasslands ⇒ Bison**
- **Is Oxygen a poison or necessary for life?**
- **What would happen if the sun stopped shining?**
- **What would happen if certain trophic levels in food web were removed?**

FOCUS STANDARDS

- HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Field Biology

Human Impacts and Mitigation

ESSENTIAL QUESTION	BIG IDEAS
What impact does the human population have on ecosystems?	• Students will understand how modern human activity affects ecosystems and has led to negative environmental impacts. • Students will create and evaluate solutions to the negative impacts of human activity, and evaluate the solution's costs and benefits to human society.

GUIDING QUESTIONS

Content:

- How do complex interactions within an ecosystem keep its numbers and types of organisms relatively constant over long periods of time under stable conditions?
- What impact will modest biological or physical disturbances have on an ecosystem occurs?
- What impact will extreme fluctuations in conditions have on the functioning of ecosystems in terms of resources and habitat availability?
- What effect does human activity (habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change) have on the environment?
- How is biodiversity decreased by the loss of species (extinction)?
- How are humans dependent on the living world for the resources and other benefits provided by biodiversity?
- How does sustaining biodiversity aid humanity?
- When evaluating solutions, why is it important to take into account a range of constraints including cost, safety, reliability and aesthetics and to consider social, cultural and environmental impacts?

Process:

- How will students engage in argument from evidence using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s)?
- How will students evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments?
- How will students design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations?

Reflective:

- **What would the impact be if all humans ate vegetarian diets?**
- **How should governments restrict water usage?**
- **How much available water should be used for farming, cities, wildlife areas, recreation?**
- **How much land should be left as natural areas versus developed for human use?**
- **Would you want to live in a city that all the grass areas are prairie habitat?**
- **How would Johnson County change if humans went extinct? 5 years? 20 years? 100 years?**
- **If we had the ability/resources to solve one local environmental problem which should we solve? Why?**
- **Should water be legal to bottle and sell? Oxygen?**

FOCUS STANDARDS

- **HS-LS2-6.** Evaluate Claims, Evidence, and Reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in new ecosystems.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.