

Eye of the Falcon Curriculum Outline

The following is a list of units and lessons in the Eye of the Falcon curriculum. For each unit, a unit overview is provided, along with selected outcomes, and a key to the National Science Education Standards. Lessons marked with an asterisk have been fully developed. Other lessons listed are still under development. Lessons are labeled as follows according to the types of activities featured in the lesson:

Classroom activities involve experiential and constructivist learning activities in the classroom.

Outdoor Lab activities involve field experiments, usually in the schoolyard.

Class Lab activities involve experiments or modeling done in the classroom.

Technology activities involve GIS-based research projects, often involving satellite-tracking data.

Library/Web activities involve literature research projects using the library and/or web resources.

Research activities involve in-depth investigations into an issue, which includes literature research as well as interviewing different stakeholders.

Media involves the usage of different audio-visual media, including videos, overheads, and PowerPoint presentations.

Unit 1: Applications of Geospatial Technologies to Wildlife Conservation

Overview:

This unit is designed to introduce students to the various technologies used to locate, track and map wildlife and other natural resources. Students will review basic mapping skills and explore the different kinds of information that maps communicate; they will map their neighborhoods using paper maps, GPS (if available), and Geographic Information Systems; they will be introduced to GIS and to different types of data layers including remote sensing data; they will be introduced to satellite telemetry; and they will learn how these various technologies are applied to wildlife research.

Outcomes:

After completing this unit, students will be able to:

- ❖ Define the purpose of different kinds of maps and identify what the maps communicate;

- ❖ Interpret the symbols, lines, and colors used on different types of maps;
- ❖ Map objects to scale;
- ❖ Create maps using symbols and the cardinal points to communicate information about a local area;
- ❖ Create simple maps using GIS;
- ❖ Make connections between a paper map and a GIS map;
- ❖ Understand how remote sensing maps are generated and interpret a variety of maps generated using remote sensing data;
- ❖ Understand how satellite telemetry works
- ❖ Apply these technologies to wildlife conservation

Key to Content Standards:

Unifying Concepts and Processes: Change, constancy, and measurement.

Science as Inquiry: Abilities necessary to do scientific inquiry.

Earth and Space Science: Structure of the earth system.

Science and Technology: Abilities of technological design; understandings about science and technology.

Lessons:

Classroom	Lesson 1*: What do Maps Say?
Classroom	Lesson 2*: A Sketch Map of Your Classroom
Outdoor Lab	Lesson 3*: Neighborhood Map
Outdoor Lab/ Technology	Lesson 4: Using GPS to map your neighborhood
Technology/ Media	Lesson 5*: Introduction to GIS
Technology	Lesson 6: Mapping Your Neighborhood Using GIS
Technology	Lesson 7: Interpreting Remote Sensing Data
Classroom/ Media	Lesson 8*: Tracking Wildlife With Satellites
Classroom/ Technology	Lesson 9: Application of Geospatial Technologies to Wildlife Research

Unit 2: Earth's Diverse Environments

Overview:

In this unit, students will learn about the physical and chemical factors that determine the major patterns of the distribution of life on earth, they will examine the characteristics of the major biomes of the world, and will create maps showing their distribution. Students will use GIS to research the characteristics of temperature and rainfall for the different biomes. Finally, each student will conduct literature and web searches to write a report on a biome of her/his choice, or, alternatively, on different ecoregions within their local biome, and present the report to the class.

Outcomes

After completing this unit, students will be able to:

- ❖ Define the major biomes of the world and their general geographic distributions;

- ❖ Describe the characteristics of temperature, rainfall, major vegetation types, biodiversity, and conservation issues for each biome;
- ❖ Identify their local biome and both global and local factors that threaten it;
- ❖ Use GIS to research the average annual rainfall and temperature in the different biomes;
- ❖ Write a research paper and communicate the results of their projects in a class presentation.

Key to Content Standards:

Unifying Concepts and Processes: Systems, Order, and Organization; Change, constancy and measurement.

Science as Inquiry: Abilities necessary to do scientific inquiry.

Life Science: Populations and Ecosystems; Diversity and adaptations of organisms; Interdependence of organisms.

Earth and Space Science: Structure of the earth system

Science and Technology: Abilities of technological design

Science in Personal and Social Perspectives: Populations, resources, and environments; Natural resources; Natural and human-induced hazards.

Lessons:

Classroom	Lesson 1: Physical and Chemical Factors Influence Life in the Biosphere
Outdoor Lab/ Technology	Lesson 2*: Exploring Your Local Biome
Technology	Lesson 3*: GIS Project: Climate and Biomes
Library/Web	Lesson 4*: Biome Research Projects
Classroom	Lesson 5: Earth's Waters
Technology	Lesson 6: Exploring Oceanographic Data Using GIS

Unit 3: Organisms in their Environments
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Overview

In this unit, students will learn about the interactions between organisms and their environment and the ecological factors that regulate animal behavior. The unit begins with an introduction to one important aspect of animal behavior – migration – and the ecological factors that influence migratory behavior. Students will explore different examples of migratory behavior around the world, and will learn why migratory species are particularly susceptible to population declines. Each student will conduct a literature search on a migratory species and write a report on their findings. Students will then conduct a field research project to census migrating American Robins in the schoolyard. They will determine the timing of migration and the relationship between average daily temperature and robin migration. Finally, students will conduct a research project using GIS and satellite tracking data to determine the habitat preferences of Swainson's Hawks.

Outcomes

After completing this unit, students will be able to:

- ❖ Describe the migratory cycles and pathways of various species around the world;
- ❖ Explain why and how animals migrate;
- ❖ Report in detail on the migratory behavior of one particular species that they choose;
- ❖ Conduct a census on migrating robin populations;
- ❖ Analyze the relationship between migration and temperature;
- ❖ Develop a research project to investigate the habitat preferences of migrating birds using satellite tracking data and GIS;
- ❖ Investigate the impacts of environmental pollutants on wildlife;
- ❖ Use research results to develop solutions to conflicts between humans and wildlife.

Key to Content Standards:

Unifying Concepts and Processes: Change, constancy and measurement.

Science as Inquiry: Abilities necessary to do scientific inquiry.

Life Science: Structure and function in living systems; Regulation and behavior; Populations and Ecosystems; Diversity and adaptations of organisms; Behavior of organisms

Earth and Space Science: Structure of the earth system

Science and Technology: Abilities of technological design

Science in Personal and Social Perspectives: Populations, resources, and environments; Natural resources; Natural and human-induced hazards; Environmental quality; Science and Technology in local, national and global challenges.

Lessons:

Classroom/ Media

Lesson 1: Adaptations to the Environment

Outdoor Lab

Lesson 2: Identifying Niches in a Schoolyard Ecosystem

Library/Web

Lesson 3: Research Project: Amazing Animal Adaptations

Classroom/ Media

Lesson 4*: Why Do Animals Migrate?

Classroom

Lesson 5: Travelers in Danger

Outdoor Lab

Lesson 6*: Backyard Census of Robin Migration

Technology

Lesson 7*: GIS Project: Habitat Selection and the effects of pesticide use in Swainson's Hawks

Unit 4: Population Dynamics

Overview

This lesson introduces students to population dynamics, and the concepts of limiting factors, carrying capacity, and population equilibrium. It uses an experiential classroom activity to demonstrate the factors that limit population growth in an ecosystem.

Outcomes

After completing this lesson, students will be able to:

- ❖ Describe the limiting factors to population growth;
- ❖ Model the population dynamics of an oak forest ecosystem;
- ❖ Predict the effects of human actions on the carrying capacity of an ecosystem.

Key to Content Standards:

Unifying Concepts and Processes: Change, constancy, and measurement; Evolution and equilibrium; Evidence, models and explanations.

Science as Inquiry: Abilities necessary to do scientific inquiry.

Life Science: Structure and function in living systems; Regulation and behavior; Populations and Ecosystems; Diversity and adaptations of organisms; Behavior of organisms; Interdependence of organisms.

Earth and Space Science: Structure of the earth system.

Science and Technology: Abilities of technological design.

Science in Personal and Social Perspectives: Populations, resources, and environments; Natural resources; Natural and human-induced hazards; Environmental quality; Population growth.

Lessons:

Classroom	Lesson 1*: Introduction to Population Dynamics
Classroom	Lesson 2*: Squirrels and Hawks in an Oak Forest Ecosystem
Outdoor Lab	Lesson 3: Calculating Carrying Capacity in a Local Ecosystem
Classroom/ Media	Lesson 4: Human Population Growth on a Stressed Planet
Technology	Lesson 5: GIS Project: Changes in Human Population and Land Use Practices in Your Local Region

Unit 5: Communities and Ecosystems

Overview

In these activities, students will learn core concepts in community and ecosystems ecology, including transfer of energy, food webs, community interactions, and biodiversity. Students will perform a research project comparing species diversity and abundance in a backyard ecosystem to a less disturbed ecosystem. Students will then learn about watersheds, with a special focus on the Chesapeake Bay watershed. Students will do a classroom project demonstrating how water flows in a watershed, and will then use GIS to: map the flow of water from their school to the Bay; track a tributary to its source; and identify different watersheds around the world. Students will learn about how different species (including humans) use the Chesapeake Bay, and the factors that threaten the Bay. The unit will conclude with a research project using GIS to examine how coastal development impacts nesting success in Bald Eagles on the Chesapeake Bay.

Outcomes

After completing this unit, students will be able to:

- ❖ Define the following terms: ecosystem, community, producers, consumers, biodiversity, watershed;
- ❖ Describe the interactions between different members of a community, such as predation and competition;
- ❖ Measure species diversity and abundance in an ecosystem;
- ❖ Use graphs to compare species diversity and abundance in different ecosystems;
- ❖ Demonstrate how water flows in a watershed;
- ❖ Track the flow of water in their local watershed using GIS;
- ❖ Describe the ways different species use the Chesapeake Bay;
- ❖ Explain how human activities threaten the Bay;
- ❖ Perform research projects using GIS to examine how coastal development impacts Bald Eagle nesting success;
- ❖ Write a research paper and communicate the results of their projects in a class presentation.

Key to Content Standards:

Unifying Concepts and Processes: Change, constancy and measurement; Evolution and equilibrium; Evidence, models and explanations.

Science as Inquiry: Abilities necessary to do scientific inquiry.

Life Science: Structure and function in living systems; Regulation and behavior; Populations and Ecosystems; Diversity and adaptations of organisms; Behavior of organisms; Interdependence of organisms.

Earth and Space Science: Structure of the earth system.

Science and Technology: Abilities of technological design.

Science in Personal and Social Perspectives: Populations, resources, and environments; Natural resources; Natural and human-induced hazards; Environmental quality; Population growth; Science and technology in local, national, and global challenges.

Lessons:

Classroom	Lesson 1*: Energy Flow and Food Webs
Outdoor Lab	Lesson 2*: Schoolyard Ecosystem Research Project
Classroom	Lesson 3*: Community Interactions: Competition, Predation, Symbiosis, Parasitism
Class Lab	Lesson 4: Determined Decomposers: Nutrient Cycling
Classroom/Field Trip	Lesson 5: Nothing Stays the Same: Ecological Succession
Class Lab	Lesson 6: Measuring Ecosystem Dynamics in a Terrarium
Classroom	Lesson 7*: Introduction to Watersheds
Technology	Lesson 8*: Tracking Tributaries Using GIS
Library/Web	Lesson 9*: Who Uses the Bay?
Classroom	Lesson 10*: Humans and the Chesapeake Bay
Class Lab/Outdoor Lab	Lesson 11*: Measuring Water Quality

Ongoing Satellite Tracking Projects**Overview**

The following projects are designed to be taught as ongoing units throughout the semester or school year. Teachers may choose to track one or all of the different species as a class, or have different students tracking different species. Most of the lessons can be taught in 15-minute blocks once per week, though some of the activities will take up a full class session. The objectives of these units are to use real-time tracking data to improve skills in inquiry, math, language arts, mapping, graphing, using GIS, and doing group work. By spreading this unit out over the course of the year, students will not only have the opportunity to track the movements of different species over an extended period of time, but they will also be able to slowly build and reinforce their inquiry skills and will learn to do increasingly sophisticated analyses using GIS.

Real-time Projects for 2003/4:

White Pelican Habitat Use and Conflicts With Fish Farms
Habitat Use in Juvenile Bald Eagles in the Chesapeake Bay
Migration of Tundra Peregrine Falcons
Foraging Ecology of Pink-footed Shearwaters Breeding on the Juan Fernandez Islands, Chile

Additional Real-time Projects for 2004/5

Migration Patterns and Breeding Behavior in Sea Turtles
Linking Foraging Patterns and Reproductive Success of Blue-eyed Shags with Remotely-Sensed Oceanographic Data
Energy Management and Migration in Turkey Vultures

The following units are still under development:**Unit 6: Animal Behavior**

Class Lab/Outdoor Lab	Lesson 1: Opening Our Eyes: Learning to Observe the Behavior of Animals
Classroom/Media	Lesson 2: Innate vs. Learned Behavior
Classroom	Lesson 3: Circadian Rhythms
Technology	Lesson 4: GIS Project: How a Leopard Spends its Day
Classroom/ Media	Lesson 5: How Animals Communicate
Outdoor Lab	Lesson 6: Eavesdropping: Finding Signs of Communication
Class Lab	Lesson 7: Territorial Behavior in Crayfish

Class Lab	Lesson 8: Kin Recognition in Ants
Outdoor Lab	Lesson 9: Courtship Behavior in House Sparrows
Technology	Lesson 10: Researching Parental Care in Peregrines Using Web Cams
Outdoor Lab	Lesson 11: Studying Social Dynamics in Humans

Unit 7: Humans and the Environment

Classroom/Research	Lesson 1: Technology and Industry: Friend or Foe?
Technology	Lesson 2: GIS Project: Powerlines and Migrating Birds
Classroom/Research	Lesson 3: Global Warming
Technology	Lesson 4: GIS Project: Global Warming Impacts on Oceanic Primary Productivity and Reproductive Success in Blue-eyed Shags
Classroom/Research	Lesson 5: Environmental Pollutants
Technology	Lesson 6: GIS Project: Using Satellite Tracking to Locate Sources of DDT Contamination in White-faced Ibis
Classroom/Research	Lesson 7: Habitat Destruction
Technology	Lesson 8: GIS Project: Impacts of Farming Practices on Leopards in Botswana
Classroom/Research	Lesson 9: Coastal Development
Technology	Lesson 10: GIS Project: Impacts of Coastal Development on Breeding Loggerhead Sea Turtles
Classroom/Research	Lesson 11: Fishing Industry
Technology	Lesson 12: GIS Project: Conflicts between fisheries and shearwaters off the Chilean coast