Doing Science Outdoors: Field Investigations at the Glacier Creek Preserve

Introduction to Doing Science Outdoors and the Glacier Creek Preserve

Identification of the Science Standards including the Next Generation Science Standards and Subject Structure Content Area

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Introduction to Doing Science Outdoors: Field Investigations at the Glacier Creek Preserve

Why? Doing science outdoors gives students a *feel* for the environment that cannot be duplicated in any indoor classroom. It allows the student to directly connect with the environment without seeing it through static electronic or written eyes.

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*Feel*
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Glacier Creek Preserve is a large, local Tallgrass Prairie preserve with enough space and diversity to support a variety of outdoor science activities to teach K-12 students about our natural history. The preserve provides indoor facilities – restrooms, field lab, etc. --- to support field activities.
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The 320 acre preserve is easily reached from throughout the Omaha metropolitan area.
Glacier Creek Preserve supports a diversity of natural habitats but focuses on the Tallgrass Prairie, the ecosystem that dominates Nebraska’s natural history. The Tallgrass Prairie is one of the most endangered ecosystems of North America with only 4% of the original ecosystem remaining, the remainder mostly having been converted to agriculture.
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Observations in the field and the collection of data on these observations, introduces students to prairie ecology and its importance to society.

Education activities focus on engaging students in STEM disciplines (science, technology, mathematics, and engineering), while using technology as a tool for conducting science and mathematics investigations at the Preserve with connections to engineering.
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Through observations and collecting data at the Preserve, students learn about the plants and animals that make up the Tallgrass Prairie and how three major factors – fire, large-animal grazers-and climate – are essential to Tallgrass Prairie health.
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At this time, the Glacier Creek Preserve curriculum has ten modules addressing three topics (prairie ecology, prairie soils, and prairie creek water quality) geared to four learning levels.

• Level 1: Lower Elementary K-2
• Level 2: Upper Elementary 3-5
• Level 3: Middle School 6-8
• Level 4: High School 9-12

As with all curriculum projects, the Glacier Creek Preserve curriculum is a dynamic project and new modules will continually be added as they are made available.
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SCIENCE STANDARDS?

The Glacier Creek Preserve curriculum modules engage students in authentic scientific inquiry-based activities while teaching Nebraska State Standards and the National Next Generation Science Standards.

The following slides show the standards that the modules address for each of the four levels (k-2, 3-5, 6-8, 9-12).
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<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Nebraska State Science Standards</th>
<th>Next Generation Science Standards (NGSS)</th>
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<tbody>
<tr>
<td>K-2</td>
<td>SC2.1.1 Students will ask questions and conduct investigations that lead to observations and communication of findings. SC2.3.1 Students will investigate the characteristics of living things. SC2.3.1d Students will observe and match plants and animals to their distinct habitats.</td>
<td>K-2 LS1-1: Use observations to describe patterns of what plants and animals need to survive. K-2 ESS3.A: Living things need water, air, and resources from the land and they live in places that have the things they need. LS1.C: All animals need food in order to live and grow. They obtain their food from plants or from other animals. LS1.A: All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air.</td>
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<td>3-5</td>
<td>SC5.1.1 Students will plan and conduct investigations that lead to the development of explanations. SC5.3.3 Students will describe relationships within an ecosystem. SC5.3.3.b Students will identify the role of producers, consumers, and decomposers in an ecosystem. SC2.5.1 Students will investigate and compare the characteristics of living things.</td>
<td>3-5 LS 2.D Students will construct and argument that being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. 3-5 LS 1.A Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.</td>
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| 6-8         | SC8.1.1 Students will design and conduct investigations that will lead to descriptions of relationships between evidence and explanations.  
              SC8.3.3 Students will describe populations and ecosystems.  
              SC8.3.1.e Students will describe how plants and animals respond to environmental stimuli.  
              SC8.3.4.c Use anatomical features of an organism to infer similarities among other organisms.  
              SC8.3.3.b Students will compare the roles of producers, consumers, and decomposers in an ecosystem.  
              SC8.5.1 Students will investigate and describe the structure and function of living organisms.  
              SC8.1.1.d Students will select and use equipment appropriate to the investigation and demonstrate correct techniques.  
              SC8.1.1.e Students will make qualitative and quantitative observations.  
              SC8.1.1.f Students will record and represent data appropriately and review for quality, accuracy, and relevancy. |
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<td>6-8</td>
<td>MS-LS-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. MS-LS-2 Construct an explanation that predicts patterns of interactions among organisms. MS-LS-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem effect population. MS-LS-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.</td>
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<td>9-12</td>
<td>SC12.1.1 Students will design and conduct investigations that lead to the use of logic and evidence in the formulation of scientific explanations and models. SC12.3.3.c Students will explain how distribution and abundance of different organisms in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle materials. SC 12.3.4.a Students will identify different types of adaptations necessary for survival (morphological, physiological, behavioral). SC12.1.1.d Students will use tools and technology to make detailed qualitative and quantitative observations. SC12.1.1 Students will represent and review collected data in a systematic, accurate, and objective manner.</td>
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<td>9-12</td>
<td>HS-LS-1 Use mathematical or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.</td>
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<td>HS-LS-2 Use mathematical or representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems at different scales.</td>
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<td>HS-LS-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 a new ecosystem.</td>
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<td>HS-LS-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</td>
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Doing Science Outdoors Subject Structure – University Level

The following is the umbrella structure for Glacier Creek Preserve Teaching Modules for the Tallgrass Prairie Ecosystem (TGP) (from Dr. T. Bragg, Glacier Creek Preserve Director, 7 December 2014)

1. The Tallgrass Prairie Ecosystem: Overall discussion of the historic distribution of the TGP, the prairie view (e.g. viewsheds, watersheds, topographic diversity), and the big-three factors that maintain TGP - climate, large grazers, and fire.

2. How science works: The scientific method and CER at Glacier Creek Preserve

3. The Prairie Environment
   A. Prairie Soil
   B. Prairie Streams
   C. Climate and Microclimate
   D. Fire
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Doing Science Outdoors Subject Structure –University Level (Continued)

4. Living Components of the Ecosystem
   A. Plants (diversity, roots, seeds, growth)
   B. Animals
      1. Invertebrates of the prairie surface
      2. Invertebrates of prairie streams
      3. Invertebrates of prairie soil
      4. Vertebrates of the prairie: small mammals, reptiles, and amphibians
      5. Vertebrates of the prairie: birds
   C. Other life on the prairie (mosses, lichens, fungi)
   D. Prairie energy flow and nutrient cycles (e.g. decomposition and decomposers)