



Brightwater Site

Brightwater Science and Environmental High School Programming Science 10 (Pre-Renewal) DRAFT

Rational

Saskatchewan is the home to many human activities such as agriculture, forestry, mining, and tourism, and First Nations traditional land use. Each of these activities impacts the health and lifestyle of the people within the province. Varying cultural perspectives provide Saskatchewan Curriculum documents (2005) advocate:

Students should develop a greater understanding of how personal, social, economic, and political decisions influence our environment and how these choices are rooted in cultural understanding of our relationships with the natural environment. As students develop these understandings, they are better able to make informed decisions that enhance the sustainability of our world. (p.28)

By helping students learn to document biodiversity and investigate characteristics such as population dynamics within the context of carrying capacity, they are able to understand better the health of an ecosystem, and see relationships between organisms and within their environment. The curriculum encourages students to develop actions plans that maintain or enhance the sustainability of our environment at a local, regional, national, or international level. This is important for higher level thinking in making personal choices, career choices, and developing community relationships in the future.

Vision

The goal of Brightwater programming for Science 10 is to help teachers meet curricular objectives outlined by the sustainability of ecosystems unit through experiences at Brightwater. The activities are designed to take place while students are immersed in the unit of study or as summative activities where students can showcase their understanding of the major unit themes. Teachers can be involved in the planning process through a half day in-service prior to the field trip.

Brightwater Science 10 Sustainability of Ecosystems Programming Choices

- Mapping Energy Flow Through Brightwater
- Managed vs. Natural Ecosystem – School yard and Brightwater Exploration
- Risky Species – Invasive and At-Risk Species at Brightwater
- Sampling Database – Pictorial Classification of Biodiversity at Brightwater

Mapping Energy Flow through Brightwater

Curricular Connections from Saskatchewan Science 10, 2005 Curriculum

Foundational Objective SE2 Examine biodiversity within local ecosystems

Learning Objectives:

- Identify biotic and abiotic components of an ecosystem (Objective 3)
- Identify energy flow in ecosystems using the concept of the pyramid of energy, numbers, or biomass. (Objective 5)

Pre-Teaching Requirements

Understand Brightwater's Norms of Learning

Build on knowledge of cultural perspectives of sustainability

Students should understand that organisms may be classified as **producers** or **consumers** depending on their relation to energy flow through an ecosystem. They should be able to identify an organism's **trophic level** and position in the **energy flow pyramid** of an ecosystem. Students should be familiar with the structure of a **food chain** and a **food web**. Students should be aware of **biomass, pyramids of energy, pyramids of numbers, and pyramids of biomass**.

Students should be aware that FNM peoples have traditional teachings about what energy is and the importance of respecting life energies in relation to spirits and Mother Earth.

Brightwater Inquiry Experience Possibilities

Students can walk and observe the wonders of the prairie ecosystem to gather information required to map how energy and nutrients flow through the Brightwater ecosystem using their knowledge of food chains, food webs, pyramids of energy, numbers, and biomass, while paying attention to trophic levels and classification within the organization of the map.

Possible Ideas for energy and nutrient flow documentation include:

- Digital Camera's and Photostory
- Sketches
 - o Scientific and artistic interpretation
- Story telling – oral or written
 - o Ideas for dramatization/documentary
 - o Musical inspiration and reflection of the natural world

Post Teaching Possibilities

- Class presentations or small group presentations of the maps created
- Evaluation using a rubric that was co-constructed prior to the experience
- Development of a personal code of ethics for sustainability

Managed vs. Natural Ecosystem – School yard and Brightwater Exploration

Curricular Connections from Saskatchewan Science 10, 2005 Curriculum

Foundational Objectives:

- SE2 – Examine biodiversity within local ecosystems
- SE5 – Investigate human impact on ecosystems

Learning Objectives:

SE2

- Observe and document a range of organisms to illustrate the biodiversity within a local ecosystem (Objective 1)
- Select and use apparatus and materials safely when documenting biodiversity (Objective 2)
- Identify biotic and abiotic components of an ecosystem (Objective 3)

SE5

- Compare a natural and a disturbed (altered) ecosystem and suggest ways of assuring their sustainability (Objective 2)
- Propose a course of action on social issues related to sustainability, taking into account human and environmental needs (Objective 5)

Pre-Teaching Requirements

Understand Brightwater’s Norms of Learning

Build on knowledge of cultural perspectives of sustainability

Understand the components and connections within ecosystems and what the term biodiversity represents.

Pre-planning of how observation and record keeping should be done within both ecosystems.

Observation of the abiotic and biotic components found within your school yard.*Can be done after the Brightwater experience also.

Brightwater Inquiry Experience Possibilities

“How have human actions impacted an ecosystem?” To help students answer the question they will compare a managed ecosystem (your school yard) to a natural ecosystem (Brightwater) in terms of biodiversity.

Have the students brainstorm (independently or collectively) the benefits of using an ecosystem as well as the negative effects of using an ecosystem. Have the students consider how these can be balanced to help maintain natural equilibrium.

Using the knowledge gained from both environments, students should provide recommendations using visuals to increase the health of both ecosystems after careful observation. Recommendations should be considered based on the three pillars of sustainability.

Students need to determine what equipment is appropriate to use for data collection and how to collect data without harming organisms or habitats. For example, students may use tools such as a quadrat, data loggers, or a GPS receiver. Students should develop a data table to organize the information they collect about biotic and abiotic factors within each ecosystem.

Students can learn about how traditional FNM protocols of practicing restraint and exercising caution when in the natural world are part of ancient spiritual believe systems. Students can consider how this contributes to sustainability.

This experience fits nicely with the PBL case Endeavour Green available through the University of Saskatchewan's College of Agriculture and Bioresources. Please contact the Brightwater Project Leader if you require more information.

Post Teaching Possibilities

- Presentation of findings in the form of action plans

Risky Species – Invasive and at-Risk Species at Brightwater

Curricular Connections from Saskatchewan Science 10, 2005 Curriculum

Foundational Objective SE2 Examine biodiversity within local ecosystems

Learning Objectives:

- Examine the impact of invasive species on an ecosystem (Objective 10)
- Identify factors that result in species becoming at-risk in Saskatchewan, the Prairies, and Canada (Objective 11)

Pre-Teaching Requirements

Understand Brightwater's Norms of Learning

An understanding of what the terms *invasive* and *at-risk* species mean.

Research of one or more Canadian at-risk species and examine the natural and human factors (e.g., habitat loss, genetic and reproductive isolation, environmental contamination, climate change, disease, invasive species, and suppression of natural events) that contributed to the at-risk classification of the species.

Determine what the potential invasive species or at-risk species found in prairie ecosystems. *Brightwater at-risk species that have been located include low milk vetch and grape fern. Invasive species include leafy spurge (wolf's milk).

Students can learn about traditional FNM perspectives of life forms through such literature as *Practicing the Laws of Circular Interaction* (available from the Saskatchewan Indian Cultural Centre, Saskatoon, SK) or other sources to develop an understanding that animals (including mammals, birds, fish), plants and micro-organisms are all important parts of a healthy ecology. Students can also reference the COSEWIC Aboriginal Traditional Knowledge subcommittee and the National Aboriginal Council on Species at Risk websites to learn more about how they advise the Government of Canada and other about species conservation.

Brightwater Inquiry Experience Possibilities

- A. Students can work with the Ethno-botanist at Brightwater to explore and understand the species that are at-risk within that environment. Students could prepare a presentation on their species that includes range maps, distribution and population maps, habitat, threats, legislative protection, and any recovery initiatives. Students could use GIS software to produce and analyze maps demonstrating population and distribution data for that species. Students should also identify specific methods that might help restore the natural balance of that species in the region(s) where it is at-risk. As an extension, students might predict the effect on one or more ecosystems if that species became extinct.

Students can consider the importance of the collective knowledge, including scientific, Aboriginal and local community knowledge in addressing issues of species-at-risk, habitat and sustainability of healthy ecosystems.

- B. Students could research species that humans introduced into an ecosystem to determine why and how these species were introduced and to determine the positive and negative effects of this new species on the local ecosystem. Students can work with the Ethno-botanist at Brightwater to understand better the invasive species Leafy Spurge and the current management methods. Students should consider what factors enable many introduced species to become firmly established in their new homes. Students should determine potential consequences (positive and negative) on the entire ecosystem of removing, or attempting to remove, these invasive species at a later date. Examples of other primary invasive species in the Prairies include: purple loosestrife, reed canary grass, leafy spurge (wolf's milk), smooth brome grass, and Canada thistle. Note that not all introduced species are considered invasive.

Students could research methods of removing invasive or introduced species (e.g., herbicide control, physical control, prescribed burning, biological control, and integrated pest management methods) and describe the effectiveness of various methods. They should also consider what future problems these methods might cause. (IL, CCT)

Post Teaching Possibilities

- Presentation of their research findings in the form of an action plan

Sampling Database – Pictorial Classification of Biodiversity at Brightwater

Curricular Connections from Saskatchewan Science 10, 2005 Curriculum

Foundational Objective SE3 Analyze population dynamics within an ecosystem

Learning Objectives:

- Explain various ways in which natural populations maintain equilibrium and relate this equilibrium to the resource limits of an ecosystem (Objective 1)
- Construct and/or interpret graphs of population dynamics (Objective 2)

Pre-Teaching Requirements

Understand Brightwater's Norms of Learning

Group planning to determine sampling plan, gathering equipment, and creation of data table for organization of information gathered. Knowledge of potential species (plant/animal) found in a prairie ecosystem.

Orientation to the purposefulness of oral tradition of FNM cultures, and, the role of intergenerational knowledge in sustainability. Consider multi-dimensions of personal and collective knowledge including intellectual, spiritual, ethical/emotional and physical aspects of understanding.

Brightwater Inquiry Experience Possibilities

Students can work collectively to document the biodiversity at Brightwater WITHOUT removing species. Suggested method of data collection is digital photos. Cameras can be booked from Central Office. Students will need to determine what equipment is appropriate for the data collection and how to collect the data without harming organisms or habitats. For example, students may use tools such as a quadrat, data loggers, or a GPS receiver. Students should develop a common data table to organize the information they collect about biotic and abiotic factors within the ecosystem. Students should augment their tasks with personal reflections in journals to develop writing and communication skills as well as record ideas that can be expanded on at a later time.

Post Teaching Possibilities

- Develop a classification key for species (plant/animal) found at Brightwater
- Graph the diversity and use knowledge from the unit of study to provide recommendations for Brightwater to increase biodiversity
- Create a photostory to document the biodiversity found within Brightwater. Use the personal reflection journal and sketches to create a scientific report, artistic expression or other form of data interpretation