

## ECOS Inquiry Template

**1. Contributor's Name:** Matthew Corsi & Flo Gardipee

**2. Name of Inquiry:** What is Winter?

**3. Goals and Objectives:**

**a. Inquiry Questions:** What does winter really mean?

**b. Ecological Theme(s):** Winter Ecology, Senescence, Physiology

**c. General Goal:** To perform an investigation to determine what winter really means.

**d. Specific Objectives:** Make observations of the ecological changes that are occurring as Fall is ending. Nature journaling.

**e. Grade Level:** 4-8

**f. Duration/Time Required:**

→ **Prep time** Minimal: dressing in warm clothes, gathering journals.

→ **Implementing Exercise during Class;** 2 hours: 15 minutes for in-class brainstorm, 45 minutes for travel to and from a natural site, 1 hour for exploration and journaling.

→ **Assessment** 15-20 minutes to debrief, discuss observations made. 10 minutes to make a new definition of winter

**4. Ecological and Science Context:**

**a. Background (for Teachers):** Winter is one of the four seasons of meteorological change in temperate zones. The common definitions of winter are similar to each other but differ depending on the construct used to define the season. For example, meteorologically speaking, winter includes the months of December, January, and February (in the northern hemisphere). From an astronomic prospective, winter begins on the winter solstice and ends on the spring equinox. Ecologically speaking, however winter's beginning is not a discrete date, but a continuum from the first frost to the deepest snowfall. Ecologists of all ages have long recorded the start date of winter as the day the last leaves fell from a tree, the first ice on the pond, the day the last robin has left for warmer climates, or the first day that snow falls, but does not melt away for several months. Professional ecologists often think of winter as the season for which organisms have behavioral, morphological, or physiological adaptations to deal with cold temperatures, snow, ice, and short days. It is also important to remember that within a certain area, whether or not it is winter can depend on elevation, how much sunshine a location gets (aspect), etc.

**b. Background (to present to Students):** Winter has many definitions, depending on who is asked. A skier may say it is winter only when there is enough to ski, but an osprey or a wood duck tell us it is winter as soon as they leave our local waters. An oak or maple may declare it is winter as soon as all of their leaves have fallen to the ground. Winter, as we see it, is when organisms begin making behavioral or physiological (biological, biochemical, physical, etc.) changes prepare for or react to cold temperatures. There are many signs that winter is here that can be seen in the environment near your school and homes.

**5. Motivation and Incentive for Learning:** Students get opportunity to be outside and make their own decisions about whether or not winter has arrived. They get to investigate the available evidence and determine for themselves what the correct answer to this scientific question is.

## 6. Vocabulary:

**Hibernation;** physiological state where a mammal lowers its body temperature significantly to that of its external environment, heart rate and respiratory rate are also greatly reduced. This event is seasonal and occurs within certain range of time

**Torpor;** physiological state where a mammal reduces its body temperature to save energy, heart rate respiratory rate are also reduced, but not as greatly altered as in hibernation. This is a temporary state and may occur in response to exposure to cold temperatures to save energy and prevent death to the mammal.

**Dormancy;** a state of inactivity when biological activity is suspended, no active growth takes place during this time, vulnerable plant structures may develop structures for protection(i.e. bud scales) from the environment.

**Migration;** the regular, seasonal movement of a population or species of organisms in response to the change of seasons, allows access to resources and increases probability of survival.

Senescence;

**7. Safety Information:** Students will need to have warm clothing to prevent hypothermia. Students should be carefully supervised at the field site to prevent them from injuring themselves or wandering away from the class.

**8. Materials List (including any handouts or transparency masters):** Journals, pencils, pens, markers, and warm clothing.

## 9. Methods/Procedure for students:

**a. Pre-investigation work:** Brainstorm in the classroom: how many signs of winter can the class come up with as a group? To focus the discussion, it may be wise to make list headings for the brainstorm. Those headings could include, but are not limited to observations of evident signs of the impending winter season in weather, soil, daylight, birds, plants, arthropods (insects, spiders, centipedes, etc.), fungi, fishes, mammals, trees, and other organisms.

### **b. Investigation work:**

**1) What evidence (data, samples) do students collect?** Students make observations: they record at least 5 observations implying it is winter and at least 5 observations implying that winter has not yet arrived.

**2) How do students present the evidence (data)?** Tally marks are placed on the board next to each sign of winter that was recorded during the brainstorm.

**3) What conclusions are drawn from the evidence students collect?** A debate is held among the students in the class... is it winter or has winter yet to begin? Students are required to defend any of their arguments with observations and scientific reasoning.

**4) Include examples of data sheets.** Use nature journals.

**10. Assessment:** Observations, scientific reasoning, and critical thinking skills can be assessed through classroom interactions with fellow students and journal entries.

**11. Extension Ideas:** The inquiry may be repeated in the late winter/early spring with discussion focused on how organisms recover from winter and physiologically prepare in the spring for summer when growth and reproduction may occur.

**12. Scalability:** This inquiry could be adapted for K-12.

## 13. Science Standards Accomplished:

- Earth science
  - Changes in earth and sky

- Life Science
  - Characteristics of organisms
  - Life cycles of organisms
  - Organisms and environments
  - Structure and function in living systems
  - Regulation and behavior
  - Populations and ecosystems
  - Diversity and adaptations of organisms
  - Interdependence of organisms
  - Biological evolution
  - Matter, energy, and organization in living systems
  - Behavior of organisms
- Physical science
  - Transfer of energy
  - Chemical reactions
- Science in personal and social perspectives
  - Characteristics and changes in populations
  - Types of resources
  - Changes in environments
  - Populations, resources, and environments
  - Natural hazards
  - Risks and benefits

#### **14. References:**

Foresman, K.R. 2001. The Wild Mammals of Montana. American Society of Mammalogists, Allen Press, Inc., Lawrence. Kansas.  
 Merriam Webster On-line Dictionary; <http://www.m-w.com/>.  
 Wikipedia On-Line Encyclopedia; [http://en.wikipedia.org/wiki/Main\\_Page](http://en.wikipedia.org/wiki/Main_Page).

#### **15. List of Experts and Consultants:**

#### **16. Evaluation/Reflection by Fellows and Teachers of how it went:**

Most students responded very well to the opportunity to think creatively about what winter really means by making their own observations. Journal entries following the inquiry were interesting and insightful. It is advisable not to make too many observations for the students, as teacher observations dominated the lists of most students. We conducted this inquiry in a river floodplain where many organisms, current weather, and environmental features gave us observational opportunities. It was occasionally difficult to keep exceptionally chatty students on task, but leading questions and pointing out particularly interesting observations helped refocus those groups. Our debate went exceptionally well, with many students making creative and informed arguments. We held our debate outside where students could use objects and organisms around them to back-up their arguments.