Lesson Plan:
Clark the Nutcracker Story

Note:
This activity builds on the Endangered Species theme found in the *May/June 2007* issue of Green Star!

Grades: K-4, depending on further discussion.

Materials:
- *Clark the Nutcatcher* Story (provided)
- *Draw a Food Web* Evaluation Tool (provided)

Keywords:
- Blue-listed
- Conifer
- Clark's Nutcracker
- Ecosystem
- Endangered
- Extirpation
- Habitat
- Keystone Species
- Midden
- Mutualism
- Red-listed
- Threatened
- Whitebark Pine
- Yellow-listed

Objective:

BC's list of *threatened* and *Endangered species* continues to grow, while some species remain dangerously close to the brink of extinction. Through story telling and discussion, students learn the connections of plants and animals, and their importance to species survival and ecosystem balance. Students are introduced to the *Clark's Nutcracker*, a bird whose relationship with the Whitebark Pine plays a very important role in the forest. Learning the roles these keystone species have and understanding the precarious balance they hold contributes to students' knowledge of food webs, interconnectness, and ultimately, our place in the world.

Procedure:

1. Teachers should become familiar with the keywords provided (sidebar). Reading the *Teacher's Backgrounder: Clark's Nutcracker and Whitebark Pine* will give further information on this bird and its relationship with the White Pine.
2. Teachers should prepare the class first by going over some keywords that may be present in the story. They may wish to discuss the meaning of these words, give examples, or brainstorm other similar examples.
3. Read aloud to the class the story: *Clark the Nutcracker*.
4. Discuss some of the relationships addressed in the story.
   a. What importance did the plants and animals of the forest have for each other? Brainstorm the connections (*water, soil, bugs, salmon, plants, trees, etc*).
   b. What was the special relationship between Clark had the White Pine trees of his forest?
      i. How is the white pine dependant on Clark?
      ii. How is Clark dependant the White Pine?
   c. What importance did the Whitebark Pine have in the forest? Why was the Whitebark pine so "special"?
   d. What animals would be affected if all the Whitebark Pine were to dies? What could happen to the whole forest as a result?
   e. What would happen if Clark were to disappear from the forest? (Alternatively, what would happen to Clark if all the pine trees were to die?)
   f. What other relationships can students come up with that are similar? (ie. bees/flowers)
5. Discuss why is habitat protection important
6. Discuss what we can do to contribute to habitat protection. Refer to the *Teacher's Backgrounder* for more information.

Evaluation:

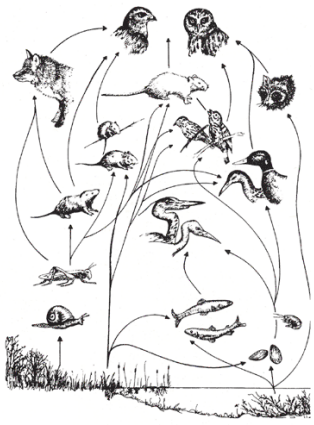
1. Hand out the *Draw a Food Web* activity and evaluation tool that accompanies this lesson plan.
2. Have students draw lines between the plants and animals that have some sort of connection with each other, either as predator or prey. Refer to the answers below for assistance.

Follow-up Activities:

1. Have students think of a B.C. plant or animal that is threatened or endangered. Refer to the following sites for examples.
    - Sierra Club of Canada, BC Chapter http://www.sierraclub.ca/bc/programs/education/ecomap/
    - Government of BC http://www.env.gov.bc.ca/atrisk/
    - Committee on the Status of endangered wildlife in Canada http://www.cosewic.gc.ca/
2. Have each student draw a picture of their favourite at-risk animal to include in a class-made book of endangered species.
3. Display this outside your classroom with a certificate that says this is an ***Endangered Species Friendly Classroom!***

Answers to Draw a Food Web activity:

Salmon is eaten by the orca whale and bear. Bears carry the dead salmon into the forest and the trees absorb the nutrients. Maggots also grow in the dead salmon and turn into flies. Flies are eaten by song birds and newts. Birds eat seeds from tree cones and digested seeds are left to germinate in the ground. In the case of the Clark's Nutcracker, seeds stored in the soil grow into trees. Old trees full of salmon nutrients fall over and become nurse logs, which provide nutrients to mushrooms and baby trees!



Teacher's Backgrounder

Clark's Nutcracker and the Whitebark Pine

The pine forests that scatter across the northern hemisphere are closely associated with the distribution of jays, crows, magpies and especially nutcrackers. This is because such birds have the ability to crack open the cones with their strong beaks and retrieve the seeds found inside.

It is said that the Clark's Nutcracker will plant an entire forest in its lifetime! Considered a major seed disperser of the Whitebark pine, the Clark's Nutcracker can cache 30,000 to 100,000 seeds each year in small, widely scattered locations, usually in 2 to 3 cm of soil or gravelly substrate. These cashes are revisited to feed their young and in times of food scarcity. However, the seeds not retrieved will germinate, thus contributing to forest regeneration. As a result, the Whitebark Pine often grows in clumps of several trees, originating from a single cache of 2-15 or more seeds.

Whitebark Pine is especially dependant on the Clark's Nutcracker because its seeds are wingless and lie trapped inside the cone until the bird retrieves it. By the time the cone falls from the tree and naturally opens up, the seed is no longer viable (able to germinate). So while these birds benefit from a high calorie diet (a diet primarily provided by the Whitebark pine), the tree in turn is able to regenerate its forests! Because of this, scientists refer to Clark's nutcrackers and Whitebark pines as co-evolved mutualists. *You scratch my back, I'll scratch yours!*

Fun Facts!

- The Clark's Nutcracker has a special pouch under its tongue that it uses to carry seeds long distances.
- They hide thousands of seeds each year and studies show that it had a tremendous memory and can find most of the seeds it hides.
- This nutcracker feeds its nestlings pine seeds from its many winter stores (caches). Because of this it can breed as early as January or February, despite the harsh winter weather in its mountain home.
- The Clark's Nutcracker is one of very few members of the crow family where the male incubates the eggs. A brood patch develops on his chest (like the female) and he takes his turn keeping the eggs warm while the female goes off to get seeds out of her caches.

Source: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/Clarks_Nutcracker.html

The Whitebark Pine (*Pinus albicaulis*)

This species of pine occurs in the mountains of the Western United States and Canada, specifically the subalpine areas. In Canada, it can be found in the Pacific Coast Ranges and the northern Rocky Mountains.

Considered a *keystone species*, the trees provide important habitat for many species, including grizzly bears, nutcrackers, and squirrels. Pine Squirrels store the cones in their middens, grizzly and black bears raid these middens for the Whitebark Pine seeds (a crucial pre-hibernation food); while squirrels, Northern Flickers, and Mountain Bluebirds often nest in Whitebark Pines. Elk and Blue Grouse use Whitebark Pine communities as summer habitat.

Besides having a large number of species depend on it for survival, the Whitebark Pine provides other ecosystem services such as controlling runoff and erosion and influencing regeneration and succession. As a keystone species, the health and balance of the whole ecosystem is largely dependant on the survival of this species.

A decline in Whitebark Pine distribution however has been documented and is believed to be caused from fire suppression, the mountain pine beetle infestation, which has been further complicated by climate change, and an introduced blister rust. Normally B.C.'s mountain pine beetle infestations are kept to lower elevation pines (lodgepole, ponderosa); however a recent series of unusually warm years, many attribute to climate change, have allowed this insect to expand its range into the higher elevations. As such, Whitebark pine ecosystems have met with devastating consequences.

Endangered Species

Plants and animals in B.C. can be protected under various laws, however very little is being done to protect these species. For more information on Endangered Species in Canada, look for the Sierra Club of BC's *Endangered Species Toolkit*, available online late Spring 2007.

Students learning about endangered or threatened species should first learn the basics in food webs and habitat. See the Mar/Apr *Grasslands Habitat*, Jan/Feb *Life Cycle of a Frog*, and Nov/Dec *Wolf Habitat* lesson plans. This lesson plan builds on these, making connections between the various plants and animals in an ecosystem. The health and survival of species is dependant on many factors; the presence of other species is a prime factor. This lesson plan demonstrates the interconnectedness of ecosystems and the role interacting species have on overall forest health.

Key Words

Blue Listed: Vulnerable species particularly sensitive to disruptive impacts on their habitat (they are not yet extirpated, endangered or threatened).

Conifer trees: Evergreen trees (ie. pine, fir, spruce) that make seeds in cones.

Ecosystem: All plants and animals together with its environment–an entire community of life.

Endangered: Species are facing immediate disappearance, and/or extinction altogether.

Extirpation: Complete removal of a living thing from a specified geographic area.

Habitat: The place that naturally provides all that is necessary for life and growth.

Keystone Species: A species of which a large number of other species in the ecosystem depends. If it is removed from a system, the many others it supports also will disappear.

Midden: An area of storage where food is kept in one place.

Mutualism: Relationship between two or more species where the growth and survival of both populations is benefited. Neither species can survive indefinitely without the other. For ex:

- Bees & flowers
- The Clark's Nutcracker & White Pine trees
- Egyptian Plover & crocodiles

Red Listed: Species that are *Endangered, Extirpated* or *Threatened*.

Threatened: Species are likely to become endangered if their vulnerability is not reversed.

Yellow Listed: Species of *conservation concern* that have a restricted distribution, perceived future threats, or are associated with a habitat element that is rare or becoming rare.