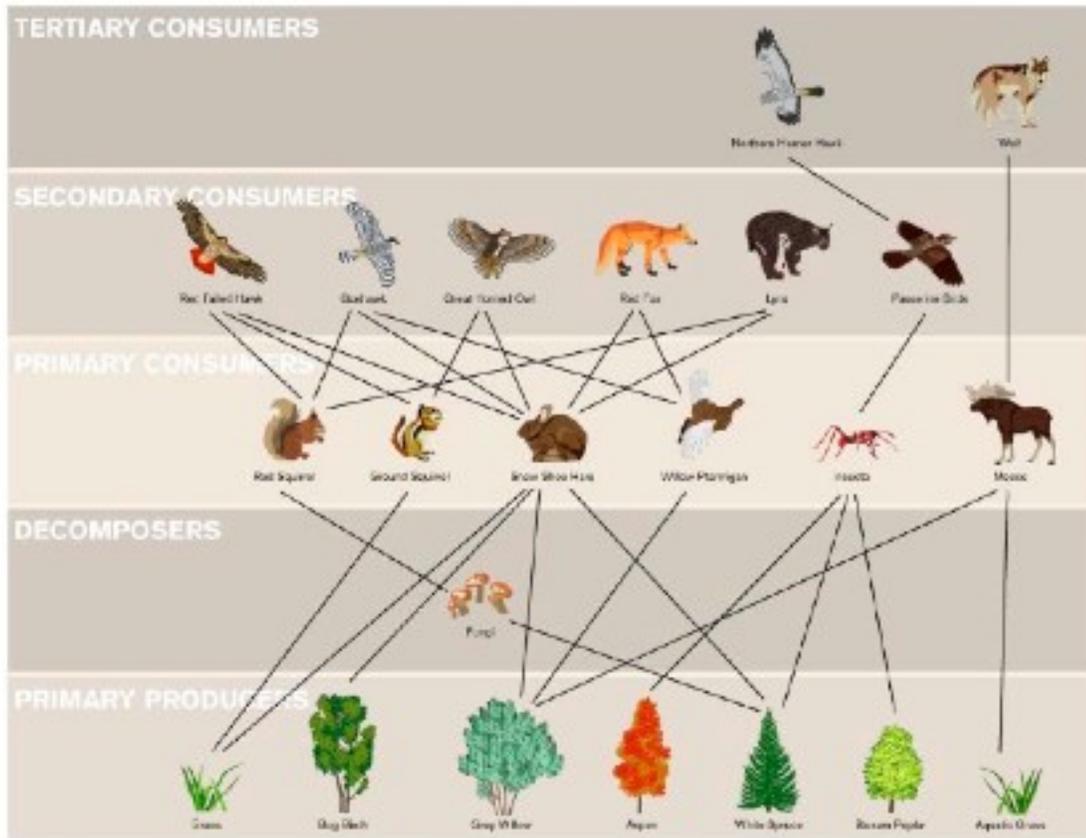


Food webs and redundancy activity

In ecosystems, particular functions show a lot of redundancy; for example, many kinds of critters eat caterpillars, and many kinds of herbs photosynthesize in a meadow. However, even though species share MANY traits in common with MANY other species, the combination of features, (also known as functional traits) is generally thought to be unique for each species. Consider 2 species of native bees, each of which specializes in feeding only on Lupine. One species is an *Andrena* and nests in the ground; its populations are subject to periodic wipeouts in this environment by floods and heavy rains. The other is a species of *Megachile* that lives in dead twigs, it suffers wipeouts whenever there are forest fires (or even cool burning). The redundancy of these two species is in pollination of the same species of Lupine. It is unlikely that both a flood and a forest fire would occur in the same year, so the redundancy of the pollination function is likely to continue for a long time. The two bees are redundant in one pollination function, but in the other aspects to their lives in the ecosystem they are not redundant.

In the diagram of a boreal forest food web below, several diverse feeding relationships are shown.

- 1- How many different pathways are there depicted in the diagram, with one pathway being the links that start with a producer and end with a secondary or tertiary consumer?
- 2- What reasons can you think of for this diversity of pathways of feeding relationships?
- 3- Rearrange the animals in the consumer groups into functional groups. Redraw the diagram using boxes for each functional group.
- 4- How would you find out whether or not any of the animals in each functional group were redundant for one particular trait? What other aspects of their lives in the ecosystem are not redundant?
- 5- Explain how you think this redundancy might benefit the arctic ecosystem under conditions of climate change.



Definitions:

Diversity: the number of different species in an area

Resilience: Amount of disturbance a system can absorb and still remain within the same state, the ability to sustain ecosystem states under normal range of disturbances

Redundancy: different animals living in the same ecosystem that perform the same ecosystem functions.

Functional Groups: Clusters of species that appear to provide the same ecological function. For this exercise we will only consider trophic levels, such as carnivores, leaf eaters, or seed eaters. There will be variability of animal responses within each functional group.

Background information on consumers:

Red squirrel: seeds, nuts and cones of conifers; buds, flowers bark, berries, and mushrooms; also insects, eggs, mice

Ground Squirrel: fruit, seeds, leaves, occasionally newborn snow shoe hare

Snow Shoe Hare: clover, grasses and ferns in summer; buds, saplings and bark in winter

Willow Ptarmigan: needles and buds of coniferous trees

Insects: herbaceous insects will eat aspen and poplar leaves and spruce buds, among other plants

Moose: Twigs, and shrubs, bark of saplings in the winter; Leaves, water plants, grass in the summer

Red Tailed Hawk: small rodents and birds, as well as larger insects

Goshawk: ptarmigan, grouse, rabbits, squirrels

Great Horned Owl: rabbits, mice, rats, grouse, ducks, crows

Red Fox: small rodents, birds, eggs, frogs and even insects. They will often scavenge left-over carcasses of larger game

Lynx: snowshoe hares, smaller rodents, ruffed grouse, reptiles and insects

Passerine birds: mainly insects

Northern Harrier Hawk: birds, mice, voles

Wolf: moose, white-tailed deer and caribou. It will also hunt smaller game such as rabbits, ruffed grouse, beaver, muskrats and rodents even as small as mice, shrews and squirrels

Extension Activity:

- 6- Apply this activity to your study site. What major species of plants and consumers live at your site? Find out what the consumers feed on, and make a diagram of the probable feeding relationships by functional group. How might redundancy benefit your study ecosystem?
- 7- Do you think redundancy might be operating at your site? What evidence would you need to find this out? Design an experiment to test this idea.