

Alberta's Wild Species



Raptors, Biocides and the Food Pyramid

What is a food pyramid?

A food pyramid is similar to a food chain, as it represents some of the energy relationships between members of a natural community. However, a food pyramid also illustrates the relative number or weights of the different kinds of animals, as they relate to food habits.

How a food pyramid works

In terms of numbers, there are always fewer carnivores (meat eaters) than herbivores (plant eaters), and fewer herbivores than plants in any given community. Biologists have determined that it generally takes about 1000 kilograms (about 2,200 pounds) of plants to feed and maintain 100 kilograms (220 pounds) of herbivores. Likewise, 100 kilograms of herbivores can only feed and support about 10 kilograms (22 pounds) of carnivores.

For example, a field may grow 1000 kilograms of grasses, which supports 100 kilograms of ground squirrels, mice, grouse and insects. These in turn support 10 kilograms of weasels and songbirds, which in turn may support one kilogram of falcon, hawk or eagle.

At each step on the food pyramid, the plants and animals spend about 90 percent of the energy they consume for their own purpose, such as growing, moving around, feeding, digesting, maintaining body heat, and reproducing. Only about 10 percent of the energy consumed at one step is transferred to the next step. That is why there are fewer and fewer animals with each succeeding step on the food pyramid.



Raptors and the food pyramid

Raptors are at the top of the food pyramid of most communities. Raptors eat both herbivores and carnivores, and thus receive energy from more than one level of the pyramid.

Because of their position at the top of the food pyramid, raptors have been especially susceptible to the effects of certain biocides.

About biocides

Biocides are chemicals widely used in agriculture and forestry to destroy or repel animal pests or weeds. Some of these biocides are very selective, acting only on one particular pest species. Others are non-selective, and can affect many organisms.

Insecticides used to control insect pests, and fungicides used as seed dressings can also kill small birds and rodents, reducing a raptor's food supply. The indiscriminate use of herbicides (weed killers) destroys large areas of vegetation.

Persistent pesticides

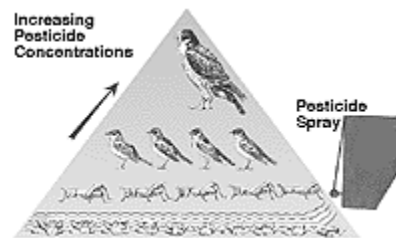
It wasn't until the development of certain "persistent pesticides" that drastic reductions in the numbers of some wildlife species were noticed. The first of these pesticides, DDT, appeared in the mid-1940s. DDT is non-selective, and affects many forms of animal life. DDT was used throughout the world until the late 1960s when major declines in populations of many bird species became evident. (For example, bald eagle, peregrine falcon, brown pelican.)

Unlike other pesticides, persistent pesticides have a very stable chemical structure that resists breakdown, and remain in the environment long after their application. Indeed, their long-lasting effect was one reason they were developed. However, wind or water can transport them to areas far from the site of application. For example, pesticides have been found in animals living in the Arctic, thousands of kilometres from the nearest site of application.

Persistent pesticides and the food pyramid

Persistent pesticides are not easily excreted from the bodies of animals that ingest them. The pesticide is usually sprayed on plants and is eaten by plant-eating animals (insects, rodents, birds, etc.). If the chemical does not kill the animal outright, it is eventually broken down and stored in the animal's body. Unfortunately, some of these by-products are also harmful. Some are stored in the fatty tissue of the body, and remain until the animal is eaten or dies from other causes.

The longer the animal eats food contaminated with pesticide, the greater the concentration of pesticide in its fatty tissues. A predator feeding on a number of these animals then consumes the pesticide in a higher concentration than did the prey species. Thus, the concentration of pesticide in the predator becomes several times larger than that in its prey species. This is called "biological magnification."



Raptors and biocides

Because raptors are at the top of the food pyramid, they can receive large doses of poison with every animal they eat.

Although the slow accumulation of biocides in a raptor's body may not kill the animal outright, it can affect the bird's ability to reproduce. Many populations of raptors have been drastically reduced by DDT because the birds laid infertile or thin-shelled eggs that were broken before the young could hatch.

Questioning biocide use

Although the use of DDT was banned in Alberta during the early 1970s, other persistent pesticides are still used. We must seriously question the value of pesticides that affect the entire food chain. A reduction in numbers of members of any one link on a food chain can be a warning that something is wrong in our environment. We must never forget that we too are members of a food chain, and what is affecting other species may also be affecting us.

May 31, 2002

Last Reviewed: March 9, 2009