



GRADE 7 LESSON #1

The Prairie Grassland Ecosystem

METHOD

Copy of The Prairie Grassland Ecosystem

Copy of Apply Your Knowledge

MATERIALS

This lesson introduces the concept of how populations, communities, and nonliving physical elements combine to create an ecosystem. These ideas are introduced by using the prairie grassland ecosystem as a specific example.

1) Make copies of student pages The Prairie Grassland Ecosystem for each student.

2) Introduce and explain the terms listed at the beginning of the student pages.

biotic - refers to parts of an ecosystem that are alive (e.g., bacteria and other microbes, and any plants and animals that are part of an ecosystem)

abiotic - refers to parts of an ecosystem that are not alive (e.g., rocks, soil nutrients, presence of water, availability of sunlight, fire events, etc.)

population - number of organisms of one species living in an area (e.g., all sugar maple trees in one forest, all small mouth bass in one lake).

community - all the organisms living in one ecosystem (e.g., the plant and animal species living around and in a lake; all the trees, grasses, shrubs, wildflowers, insects etc. that live in the specific area)

3) Read the introduction together, drawing students' attention to the terms defined above. Then read The Prairie Grassland Ecosystem or assign it as independent reading. You may wish to refer to the following websites for additional information and images; www.blackfootedferret.org www.prairiewildlife.org

4) Assign Apply Your Knowledge. Factors affecting populations may include

Organism	Biotic factors	Abiotic factors
soil microbes	- worms, insects (eat microbes)	- water - sunlight (warmth) - organic matter in soil
earthworms	- microbes (food source) - presence of predators (e.g., birds)	- same as above
locusts	- presence of food plants - predators (e.g., birds)	- same as above
wheatgrass	- presence of plant eating animals	- same as above
June grass	- worms, microbes add to soil nutrients	- fire events - space to grow



black-tailed prairie dog-	availability of food plants	- water
	- presence of predators (e.g., ferret, hawk)	- sunlight (warmth)
	- population pressures (numbers in on area)	- suitable area for burrows
ferruginous hawk	- availability of prey species (food)	- water
black-footed ferret	- presence of predators, insect pests (especially for young animals)	- sunlight (warmth)
		- suitable habitat for burrows or nest sites

Students should note some common factors for different populations. All animal species need food (biotic factor), water, warmth, and space (abiotic factors). All plant species need sunlight, water, space, and soil nutrients (abiotic factors) but are often eaten by animals (biotic factors).

5) Points made above should also be seen in question 3) where students consider populations in a vacant lot near their school.



The Prairie Grassland Ecosystem

Terms: biotic abiotic population community

Introduction

Biologists describe an ecosystem as a community of living things that interact with each other and the physical world. An ecosystem is made up of living things (the different animal and plant species that live in a community) and nonliving things (physical features like rocks, soil, sunlight, temperature, or precipitation). The living things in an ecosystem are called the **biotic** elements of the ecosystem, while the non-living things are referred to as the **abiotic** elements of the ecosystem. Within an ecosystem the number of animals or plants of the same species are called **populations**. The population of all living things within an ecosystem is called a **community**. Let us explore these definitions relating to ecosystems by examining a specific ecosystem found in Canada, the **prairie grassland ecosystem**.

The Prairie Grassland Ecosystem

The most noticeable feature of the prairie grassland ecosystem in Canada is the lack of trees. Prairie grassland areas have a climate that includes hot, dry summers and very cold winters. The plant community is made up of different **populations** of grasses and sedges (e.g., wheatgrass, June grass, three-leaf sedge) and some small shrubs. Most prairie plants have extensive root systems that help them find water during periods of drought. Since grass fires are natural events on the prairie, many plants are adapted to survive fires and spread into soil areas after a fire. Some grasses are also adapted to survive and grow after being clipped by grazing animals. The grassland community also includes the microbes, worms, and insects that live in close contact with the soil. These **populations** break down dead plant and animal matter, returning it to the soil as nutrients that can be used by plants. Other grassland animals include populations of insects, birds, reptiles, amphibians, and mammals (e.g., locust, black-tailed prairie dog, black-footed ferret, ferruginous hawk). Each survives by eating grassland plants, grassland animals, or a combination of both.

All of the species that live in the grassland ecosystem form a **community**. The grassland ecosystem includes the **community** of organisms that live there, plus the non-living features of this environment that affect these living things.



Apply Your Knowledge - The Prairie Grassland Ecosystem

1) Explain the following terms in your own words or using a diagram; population, community, ecosystem.

2) Populations in the Prairie Grassland Community

soil microbes	wheat grass	ferruginous hawk
earthworms	June grass	black-footed ferret
locusts	black-tailed prairie dog	

a) Choose one population from the table above. Make a list of the biotic and abiotic factors that affect this population.

b) Do the same for a different population from the table.

c) Are any biotic or abiotic factors in both lists? Which ones?

3) Suppose there is a vacant lot beside your school. Some of its possible populations are listed below;

ants	crickets	dandelions	crabgrass
robins	mice	June beetles	

a) What other living things might be found in this community?

b) List the biotic and abiotic factors that might affect populations in this ecosystem?



GRADE 7 LESSON #2

Connections Within an Ecosystem

MATERIALS

Copy of Connections Within an Ecosystem

Copy of Apply Your Knowledge

METHOD

This lesson introduces the concept that matter is recycled within an ecosystem by producers, consumers, and decomposers. Students are also introduced to the food web as a way of understanding food relationships within an ecosystem. The prairie grassland ecosystem is used as an example.

- 1) Make copies of student pages Connections Within an Ecosystem for each student.
- 2) It may be helpful to introduce and define terms used in this section that may be new to students:

chlorophyll - chemical present in green plants that allows energy from the sun to be used in the creation of simple sugars which plants then use as food

photosynthesis - chemical process in which chlorophyll and energy from the sun is used to create simple sugars, which plants then use as food

producers - living things that create their own food

consumers - living things that get energy by eating other living things

decomposers - living things that reduce once-living matter into its basic components

herbivores - living things that eat only plants

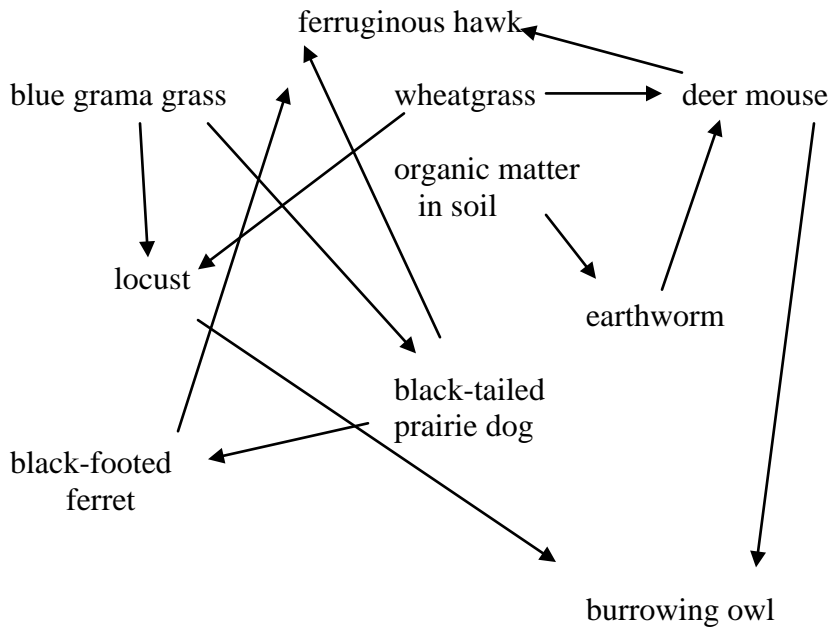
carnivores - living things that eat only other animals

omnivores - living things that eat both plants and animals

- 3) Read the student pages Connections Within an Ecosystem together or assign them as independent reading. Emphasize that while food chains show food relationships within an ecosystem, food webs give a better idea of the complexity of relationships found in most ecosystems. The web shows that if one food source for an animal is absent, it may rely on other organisms in the ecosystem to get the energy it needs to survive.
- 4) Have students work on Apply Your Knowledge. You may wish to do question 1) together, working your way through each component of the web as the overall result contains many lines. The finished web is below.



Prairie Grassland Food Web



5) As students work on question 3 remind them that the black-footed ferret's prey species is the black-tailed prairie dog, which is a herbivore. Without an ecosystem filled with plants to support a prairie dog population the ferret will have no prey.

6) As students work on question 4 have them refer to the prairie grassland food web. If, for example, the deer mouse was removed from the food web, organisms that rely on it for food would end up eating more of the other things that they can use for food. This could change the balance in the web as a species like the ferruginous hawk eats more prairie dogs or ferrets.



Connections Within an Ecosystem

Terms: decomposition chlorophyll photosynthesis producers
 herbivores carnivores omnivores consumers
 decomposers

You Are Recycled Matter

Living things are mostly made up of atoms of carbon, oxygen, hydrogen, and nitrogen. These atoms have been part of the Earth and its atmosphere since the beginning of time. This means that the atoms in your body may have also been part of an ancient fern or even a dinosaur. As living things die they are broken down into basic nutrients in the process of **decomposition**. Living things use these nutrients (available in air, water, and soil) to build complex matter once again. Since matter in ecosystems is constantly recycled, organisms depend on each other.

The Cycle of Matter and Energy

The matter cycle begins with plants. Plants use energy from the sun to produce their own food. They do this using a green chemical called **chlorophyll** in a process called **photosynthesis**. Since plants with chlorophyll produce their own food they are referred to as the **producers** in an ecosystem.

Animals do not have chlorophyll so they cannot make their own food. They get food by eating plants or by eating other animals. Animals that eat plants are called **herbivores**. Those that eat other animals are called **carnivores**. Animals that eat both plants and animals are called **omnivores**. In each case, animals are actually capturing energy that originally came from the sun. Since these animals must eat to survive they are called **consumers**.

Once animals and plants die, their bodies are returned to the form of nutrients by living things like bacteria, moulds, and fungi. These organisms get their energy by breaking down dead material, which is then available in an ecosystem. These organisms are referred to as **decomposers** because they break down the final remains of living things and recycle the nutrients back into the food web.



Dependence in Ecosystems

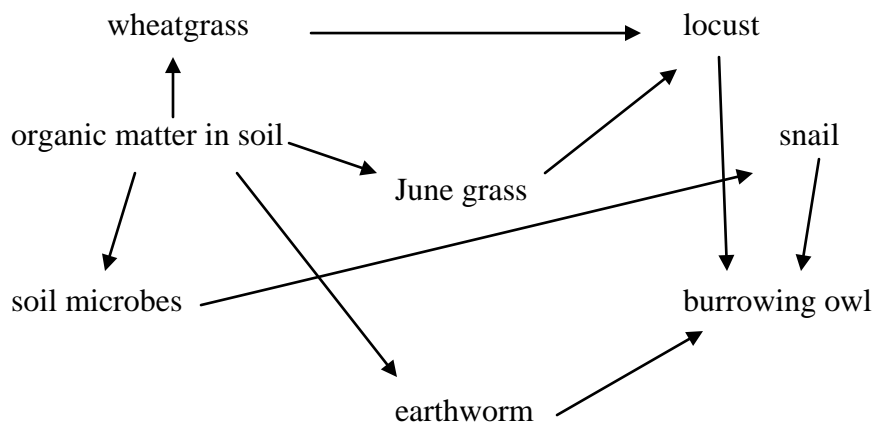
Food relationships in an ecosystem can be shown using a food chain;

June grass → locust → burrowing owl

In the food chain for a prairie grassland meadow the June grass is the producer, while the locust (herbivore) and the burrowing owl (carnivore) are the consumers. The arrows show the energy flow; energy in the grass becomes part of the locust, and energy in the locust becomes part of the burrowing owl.

In most ecosystems, consumers rely on more than one source of food (a locust will eat more than one type of plant, and a burrowing owl will eat more than just locusts). These more complex relationships could be shown in a **food web**, which is a better way of showing how living things interact within an ecosystem.

Simplified Prairie Grassland Food Web

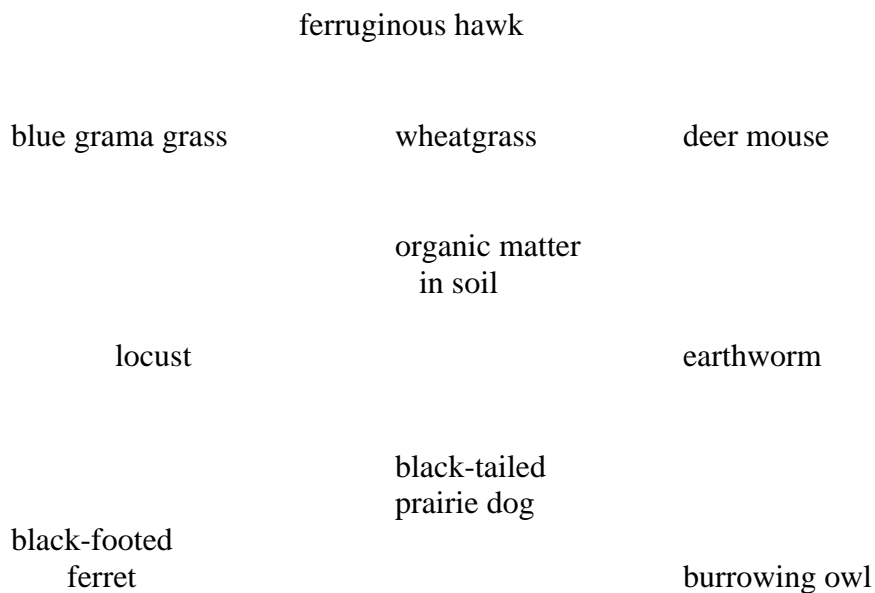




Apply Your Knowledge - Prairie Grassland Food Web

1) Complete the prairie grassland food web shown below by drawing arrows to show food relationships. The arrow goes from one organism to the one that consumes it - this shows the flow of energy in the ecosystem.

Prairie Grassland Food Web



- 2) How is a food chain different from a food web? Why might you choose to represent an ecosystem using a food web rather than a food chain?
- 3) Explain why black-footed ferrets could not live in an ecosystem without plants even though they are not part of their food source.
- 4) What would happen to a consumer if one of its food sources was removed from the ecosystem? Could this change/affect other living things in the ecosystem? Explain using the prairie grassland food web as an example.



GRADE 7 LESSON #3

The Black-footed Ferret – An Endangered Animal

MATERIALS

Copy of The Black-footed Ferret – An Endangered Animal

METHOD

This lesson presents specific information on a grassland animal that was considered to be extinct a few decades ago. The return of populations of the black-footed ferret to some areas of its original range is the result of the efforts of many scientists and conservationists, as well as organizations like the Toronto Zoo. The Zoo has been a leader in establishing captive breeding programs and supervising the reintroduction of the black-footed ferret, which has brought this species back from the brink of extinction. The Toronto Zoo is also the only Canadian breeding facility for black-footed ferrets.

While it may seem like the black-footed ferret is a small part of the prairie grassland ecosystem it is important for students to understand two points. First, extinction is a permanent event; once a species is lost it is gone for good and represents a bit of creation that can never be seen, heard, appreciated or truly understood ever again. When this occurs due to human influence, it is a sad commentary on how we are handling our environment. Second, an ecosystem is a linked system of several parts that function as a whole. When one part of that system is removed, it is often difficult to predict how the entire system will be affected. It is better for all (humans included) if balance is preserved by protecting and maintaining all elements of an ecosystem whenever possible.

1) Copy and distribute the The Black-footed Ferret – An Endangered Animal to each student. Introduce the black-footed ferret by recalling the prairie grassland food web in Lesson #2.

2) Discuss the term extinction with students. Emphasize that

a) Extinction is permanent

b) Its effects on an ecosystem are sometimes impossible to predict.

*It is worth noting that humans are often the cause of extinctions. Humans can also help by trying to prevent extinctions, but human efforts are sometimes not enough. So far, the story of the recovery of the black-footed ferret has been one of good news.

3) Read the student pages together. You may wish to refer to additional material (Zoo pamphlet on the black-footed ferret) or the following websites for added information and images;

www.blackfootedferret.org

www.prairiewildlife.org

www.torontozoo.com/conservation/captive-breeding.asp?pg=bff

www.pc.gc.ca/eng/pn-np/sk/grasslands/edu/edu1/f.aspx

4) Assign questions. As an option instead of question 3 hold a class discussion on the idea of avoiding extinction and helping species recover. The issue in question could be dealt with in other ways.



Options include:

Debate – assign groups to argue for and against the preservation of the black-footed ferret. (Have students consider both sides of the conservation argument; those for the saving of the species can use the points presented in the introductory paragraph above; those arguing against preservation efforts might use issues like the cost of recovery programs and the barriers to development that are needed in the habitat of a protected species as arguments for their case).

Ad campaign – design a print, radio or TV ad to convince others of the importance of saving species that are on the brink of extinction.

Research other Canadian species that are in danger - report on what caused the species to become endangered and what (if anything) is being done about it.



The Black-footed Ferret – An Endangered Animal

One animal that is part of the prairie grassland ecosystem and is currently endangered is the black-footed ferret. What follows is a description of this animal and how it lives, as well as some information on how it became endangered and what is being done about it.

Description

Ferrets belong to the same family, known as mustelids, as weasels, mink, badgers, wolverines, and otters. Black-footed ferrets live in prairie grassland areas where they use prairie dog burrows as shelters and to raise their young. Adult ferrets are 45-60 cm long and weigh about 1 kg. They have a long, slender body with short legs. They are equipped with long claws for digging, and sensitive ears. The ferret's coat is a yellow-buff colour, with a black mask, feet, and tail tip. Black-footed ferrets live 3-4 years in the wild or 8-9 years in captivity. In the spring, adult female ferrets give birth to a litter of up to 7 kits (average litter size 3-4) in a prairie dog burrow. Kits emerge from the burrow in July and are fully mature after one year.

Behaviour

Black-footed ferrets are nocturnal, so they are most active at dusk and during the night. They are agile, curious animals with keen senses of smell, sight, and hearing. Black-footed ferrets are solitary, which means that they live alone for most of the year, except during the breeding season when they mate and mothers raise their young. When in danger, they retreat to the safety of an abandoned prairie dog burrow. They may also defend themselves with their sharp claws and powerful jaws. Black-footed ferrets are less active during the winter and may stay underground in a burrow for up to a week at a time.

Food

Black-footed ferrets have a very specific diet. Prairie dogs make up over 90% of a ferret's diet. Their sharp teeth and strong jaws are adapted for hunting prairie dogs that are often twice the size of the ferret itself. Ferrets have therefore adapted to hunting prairie dogs at night when they are sleeping. The black-footed ferret will sometimes eat ground squirrels, mice, voles, rabbits, and birds.



Threats

Black-footed ferrets once lived throughout the North American prairies in parts of Canada, the United States, and Mexico. As these areas were settled, prairie dog habitat was reduced. Farmers also hunted, trapped, and poisoned the remaining prairie dogs as they were seen as pests. By the early 1900s the prairie dog's range had been reduced by 98% in North America. The prairie dog population has always been limited in Canada and is now a protected species. Since prairie dog numbers were so low, there was little prey available for the black-footed ferret. In addition, a number of diseases (including canine distemper, sylvatic plague and human influenza) also reduced ferret populations. Urban development also continues to threaten black-footed ferret habitat. By the 1970s the ferret was thought to be extinct.

Recovery

In the 1980s a small population of black-footed ferrets was found in the wild. They were captured and used to start a captive breeding program. This is where scientists supervise the breeding and raising of ferrets in a controlled environment. These ferrets are then released into areas where ferrets once existed, if these areas now have stable prairie dog populations. The Toronto Zoo has been a participant in the recovery of the black-footed ferret. Hundreds of kits have been born at the Zoo and released into the wild. In 2009 the Toronto Zoo, Parks Canada, and numerous partners were involved in the first Canadian release of black-footed ferrets in Grasslands National Park, Saskatchewan.



Apply Your Knowledge – The Black-Footed Ferret

1) Describe the process that led to the decline and near extinction of the black-footed ferret.

Include the following in your description;

- where and how the black-footed ferret lived
- what happened to their habitat and food supply
- other factors that led to their decline

2) Explain how the black-footed ferret was saved from extinction.

3) Efforts continue to reintroduce the black-footed ferret into its former range. This takes a lot of time and effort, and considerable financial resources. Do you think that it is worthwhile to make sure that this species survives? Explain.