Ecology

Science 20F

Mrs. Kornelsen

Goal Setting

My goals for Grade 10 Science:

Academic (what do you expect to learn):

Personal (what work ethic you would like to have):

Interpersonal (how you expect to work with others):

Life skills (discoveries you will be able to take with you in life):

Learning checklist – Ecology

Learning increases when you have a goal to work towards. Use this checklist as guide to track how well you are grasping the material. In the center column, rate your understand of the topic from 1-5 with 1 being the lowest and 5 being the highest. Be sure to write down any questions you have about the topic in the last column so that you know what you have yet to learn.

Outcomes	Understanding	Questions?
Understand review: ecosystems, trophic levels, food webs, food chains, etc.		
Illustrate and explain how carbon, nitrogen, and oxygen are cycled through an ecosystem		
Discuss factors that may disturb biogeochemical cycles (carbon cycle and nitrogen cycle)		
Describe bioaccumulation and explain its potential impact on consumers		
Describe the carrying capacity of an ecosystem		
Discuss various limiting factors that influence population dynamics. Include: Density-dependent and density-independent factors		
Construct and interpret graphs of population dynamics		
Discuss the potential consequences of the introduction of a new species and of species extinction to an ecosystem.		
Observe and document a range of organisms that illustrate the biodiversity within a local or regional ecosystem.		
Explain how the biodiversity of an ecosystem contributes to its sustainability.		

Investigate how human activities affect an ecosystem and use the decision-making model to propose a course of action to enhance its sustainability.		

***Do "What do you already know about this unit?"**

DATE: NAME: CLASS:

CHAPTER 1
VOCABULARY PREVIEW

Glossary of Key Terms (Chapter 1)

BLM AP 1-1

Goal • Preview the key terms that will be introduced in Chapter 1.

KEY TERM	DEFINITION
biological magnification	the process by which substances eaten or absorbed by organisms (for example, poisonous chemicals) get passed on through the food chain in greater concentrations toward the top of the food chain; also called "bioaccumulation"
biomass	the "weight" of living things in a community or population, divided by the area
carrying capacity	the maximum amount of organisms that can survive in an area, living off the available resources
competition	the struggle between living things for food or living space; this competition can be between members of different species (interspecific) or between members of the same species (intraspecific)
decomposers	bacteria and fungi that break down dead organisms and animal waste into usable nutrients
detritivores	organisms that eat dead material and animal wastes
ecosystem	all of the interactions between living things in a community and their environment
population	all the members of one species that occupy a geographical area during a certain time
primary consumer	an organism that eats plants (called a "herbivore")
producers	green plants that use the energy of the Sun (photosynthesis) to produce food
productivity	the amount of plant growth in an area during a period of time
pyramid of numbers	the concept that numbers of organisms decrease as you go toward the top of a food chain
secondary consumers	the organisms (carnivores) that eat primary consumers (herbivores) in a food chain
trophic level	the feeding level of an organism in a food chain (for example, a producer is at the first level, a primary consumer is at the second trophic level, and so on)

Activity

- In your groups I would like you to:
  - Make a list of the food you ate in your last two meals (on a separate page)
  - Divide your list into animal matter and plant matter
  - Draw a food chain or food web based on your meals
    - Include and provide definitions for: (on a separate page)
      - Producers
      - Consumers
        - Primary, secondary and tertiary
      - Decomposers
      - Herbivores
      - Carnivores
      - Omnivores

1) Producers –

2) Consumers –

   - Primary –
   - Secondary –
   - Tertiary –

3) Decomposers -

4) Herbivore –

5) Carnivore –

6) Omnivore –

7) Food Chain –

8) Food Web -

DATE: NAME: CLASS:

CHAPTER 1 ASSESSMENT

Matching Feeder Terms

BLM 1

Goal • Assess your knowledge of terms that describe feeding relationships.

What to Do

Match each description in column A with the correct term in column B. Place the letter for the term on the line beside the description.

A	B
____ 1. organism in the highest trophic level of a food chain	(a) trophic level
____ 2. linear feeding relationship between organisms	(b) omnivore
____ 3. feeding level	(c) carnivore
____ 4. something captured by producers from the Sun	(d) food chain
____ 5. organism that eats plants and animals	(e) top carnivore
____ 6. organism that is able to make its own food	(f) herbivore
____ 7. organism that eats only meat	(g) producer
____ 8. organism that is hunted and eaten	(h) food web
____ 9. interconnected network of food chains	(i) consumer
____ 10. organisms that help to recycle valuable nutrients	(j) prey
____ 11. organism that relies on other organisms for food	(k) energy
____ 12. organism that eats only plants	(l) decomposer
	(m) ecosystem
	(n) biomass

CHAPTER 1
VOCABULARY CHECK

Ecology Terms

BLM 1-8

Goal • Review terms related to ecology and animal feeding patterns.

What to Do

Use the terms below to complete the sentences that follow. You may use a term more than once.

food chain	herbivore	producer	pyramid of biomass
decomposer	consumer	detritivore	pyramid of energy flow
food web	top carnivore	carnivore	pyramid of numbers

1. A _____ is the part of a food chain that captures energy from the Sun.
2. An interconnected relationship of the feeding patterns of different organisms in a specific area is a _____.
3. _____ include organisms, such as bacteria and fungi, that feed on dead plant and animal matter.
4. An organism that does not make its own food and relies on other animals for food is a _____.
5. A structure that illustrates the total chemical energy being passed along each trophic level is a _____.
6. A linear representation of feeding patterns between different organisms in a specific area is a _____.
7. The organism in the highest trophic level at the end of a food chain is the _____.
8. An organism that uses sunlight, water, and carbon dioxide to make its own food is a _____.
9. A vegetarian is an example of a _____.
10. Another term for "meat eater" is _____.
11. A _____ shows that organisms in lower trophic levels are usually more abundant than organisms in higher trophic levels.
12. A _____ shows that biomass decreases from each tropic level to the one above.

CHAPTER 1
REINFORCEMENT

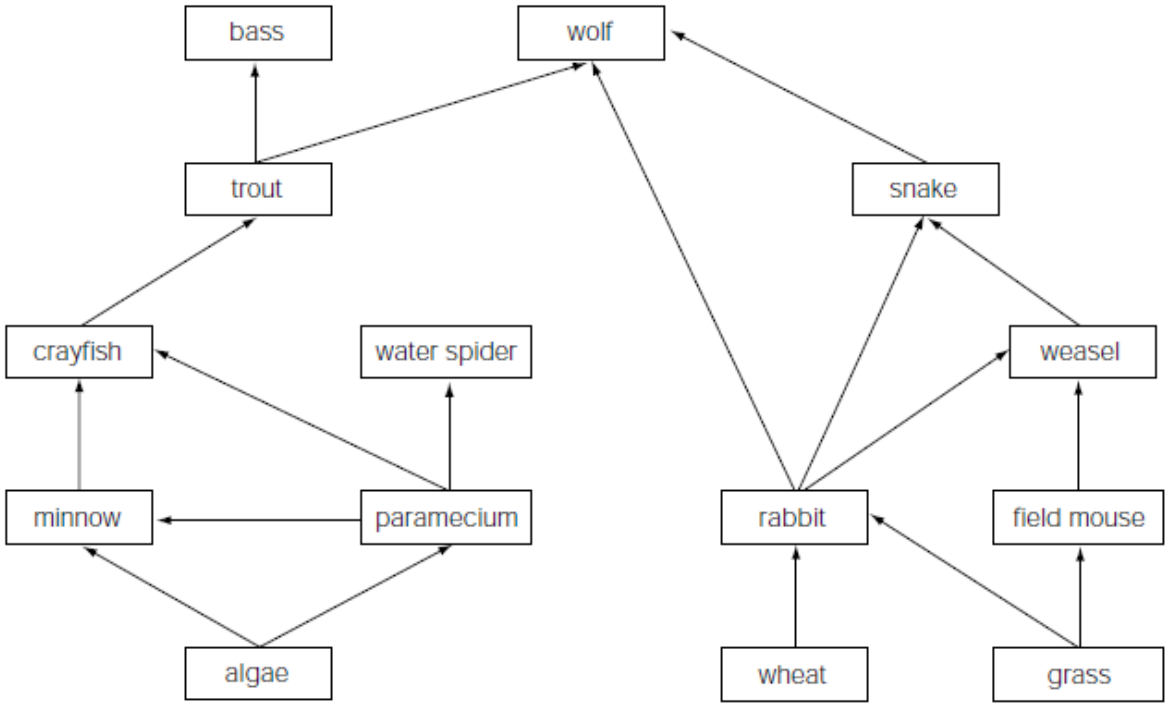
Getting to the Top

BLM 1-4

Goal • Become familiar with the relationships among organisms in food chains and food webs.

What to Do

Study the diagram of feeding relationships. Then answer the questions that follow.



1. What does the diagram show? _____
2. Which organisms are the producers? _____
3. Give an example of an aquatic herbivore. _____
4. Give an example of a terrestrial herbivore. _____
5. Which organism is the top carnivore in the terrestrial ecosystem? _____
6. Give an example of an organism in the second trophic level. _____
7. What is another term for "vegetarian organisms"? _____
8. In which trophic level is the snake? _____
9. Define the term "top carnivore." _____

_____

10. Define the term "omnivore." _____

_____

11. Which organism is clearly an omnivore? _____

Introducing Some Ecology Terms and Concepts

Define the following terms.

1. Ecosystem:

2. Abiotic Factors:

3. Biotic Factors:

Do p. 23 #1

Energy

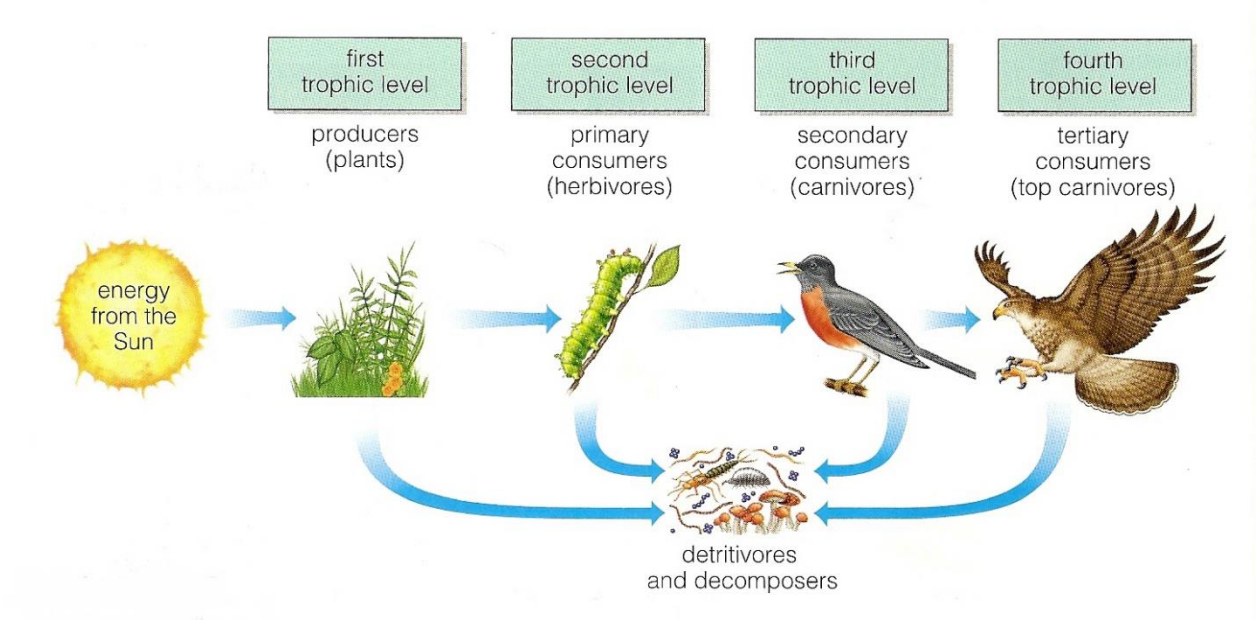
- Living things require both a source of _____ and a source of _____ to survive.
- Ultimately, the source of energy in all ecosystems is the _____.

Why do organisms need energy?

Trophic Levels:

Trophic Levels Diagram:

1st Trophic Level:



- _____
  - _____
    - Use the sun's energy to directly fuel their activities and produce new plant matter
- The energy captured by plants through photosynthesis _____ the amount of energy that is available for all other organisms in the ecosystem

2nd Trophic Level:

- _____
  - _____
  - _____

- They cannot make their own_____
- They feed on _____ in order to survive.
- They _____ the plants they eat and release the _____ stored in the plant cells for their own use

3rd Trophic Level:

- _____
  - _____
  - _____
    - They cannot make their own_____; instead they need to eat other _____ in order to survive.
    - They_____the plants they eat and release the _____stored in the plant cells for their own use

4th Trophic Level:

- _____
  - _____
  - _____
    - They cannot make their own _____; instead they need to eat other _____ in order to survive.
    - They _____ the plants they eat and release the _____stored in the plant cells for their own use

Cycling of Matter in an Ecosystem:

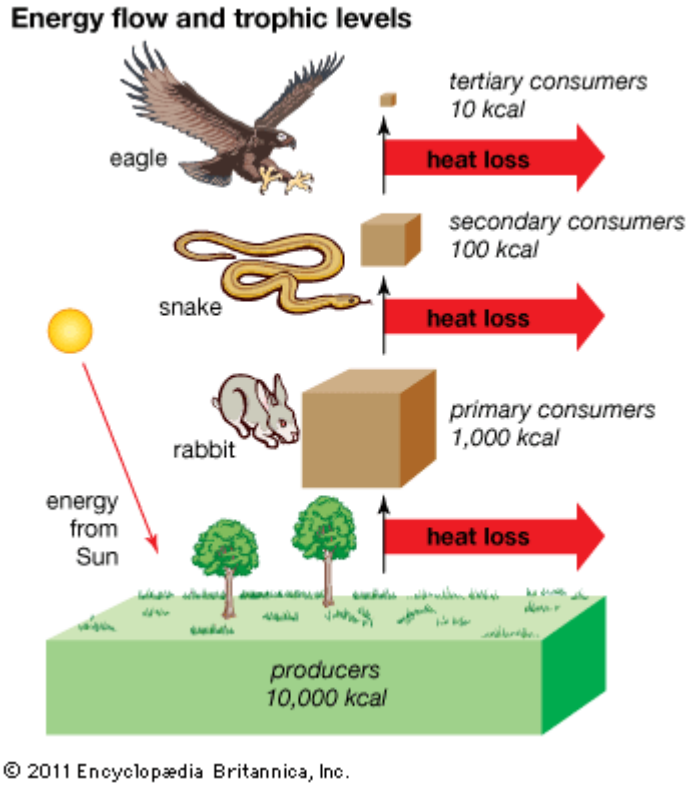
- Detritivores (ex: earthworms – eat wastes)/ Decomposers (ex: bacteria and fungi)- Break down _____ material and animal _____to allow for nutrient recycling in an ecosystem

Text Page 39 #1-7

Energy Flow

- With each transfer from one organism to another (one trophic level to another) a large part of the chemical energy is _____ as _____
- The flow of _____ is greatly _____ with each successive trophic level.
    - Only a _____ percentage (_____) of the energy remains stored in each organism

Energy Flow Diagram:



Do BLM 1-4 "Getting to the Top"

Do BLM 1-5 "Matching Feeder Terms"

Ecological Pyramids

Three types of food pyramid are normally used:

- **pyramid of _____**
  - shows _____ of organisms at each trophic level in the food chain
- **pyramid of _____**
  - shows _____ (dry weight) of organisms at each trophic level in the food chain
- **pyramid of _____**
  - shows _____ available at each trophic level in the food chain

1) **Pyramid of Numbers:**

- Each level in a pyramid of numbers shows the _____ in that trophic level.
- This pyramid can be _____ if an organism at a lower level is large enough to support many organisms in a higher level, e.g. trees

Pyramid of Numbers Diagrams

2) **Pyramid of Biomass:**

- A pyramid of biomass _____ all the organisms have_____ _____.
- It is usually calculated using the dry mass of organisms.
- This pyramid can also be _____.

Pyramid of Biomass Diagram

Inverted Pyramid of Biomass:

- The bottom trophic level is smallest because the **organisms are being eaten as quickly as they are reproducing**.
- This means there is very little mass at any given time in this level.
- This occurs in ocean food chains where the phytoplankton (like algae) is quickly eaten by the zooplankton (tiny little animals).

3) **Pyramid of Energy Flow:**

- A pyramid of energy flow displays how energy is distributed within a food chain
- Producers have the most energy available to them
    - The _____of the pyramid will _____
- As you move up each trophic level less energy becomes available
    - This is because _____of the energy received by the organisms in a trophic level is used up for movement and heat
    - This means only _____ of the energy is passed on to each successive trophic level.

Pyramid of Energy Flow Diagram

Do Page 39 #10-14

- ***Handout: "Ecology Terms" 1-8***
- ***Handout: "Interaction Pyramids"***

Cycles

_____ does not cycle.

The energy lost as heat does not _____ to refuel the _____.

_____ cycles.

The 3 most important types of matter which living things require are _____, _____, and _____.

These elements are also known as _____.

These and other nutrients are freed from wastes and dead organisms by decomposers which _____ them through the "_____", and the "_____."

PREPARE FOR QUIZ

CHAPTER 1
REINFORCEMENT

Interaction Pyramids

BLM 1-11

Goal • Increase your understanding of feeding relationships in pyramids.

What to Do

Answer each question in the space provided.

1. Create a pyramid of numbers, given the following information: 75 000 blades of grass, 7500 beetles, 750 sparrows, 75 snakes, 7 hawks.

2. Create a pyramid of biomass, given the following information: 50 000 kg of roots, 5000 kg of mouse, 500 kg of snake, 5 kg of hawk.

3. Create a pyramid of energy based on the following information: Grass captures 67 000 kJ of energy from the Sun. Rabbits eat the grass, and snakes eat the rabbits. The wolf, which preys on rabbits and snakes, is the top carnivore.

Do Ecology Word Cycle – For marks

The Carbon Cycle

Photosynthesis

All _____ originates from the _____. The sun's energy is captured through a process called _____.

Through photosynthesis, primary _____ (i.e. _____) convert light energy from the sun into _____ – stored as carbohydrates (i.e. _____ and starch).

Plants are able to capture the energy from the sun through _____ called _____.

Chlorophyll is found in organelles called _____.

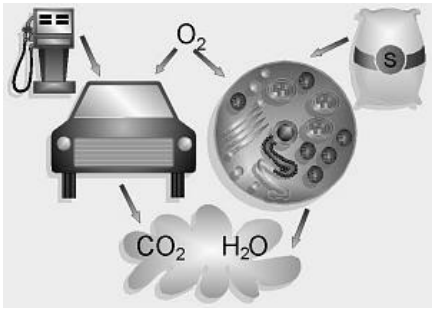
Reactants			**Products**
_____			_____
_____			_____
_____			
+	+	→	+
+	+	→	+

Cellular Respiration

An analogy can be drawn between the process of _____ in our cells and a _____.

The _____ are the engines of our cells where _____ is burned for fuel and the exhaust is _____ and _____.

**Note that in a car that burns fuel perfectly, the only exhaust should theoretically be CO_2 and H_2O also.



_____ is the cellular organelle that produces energy. _____ occurs on the cristae of the mitochondria.

A carbohydrate (a sugar or a starch) and oxygen combine to produce carbon dioxide, water, and energy.

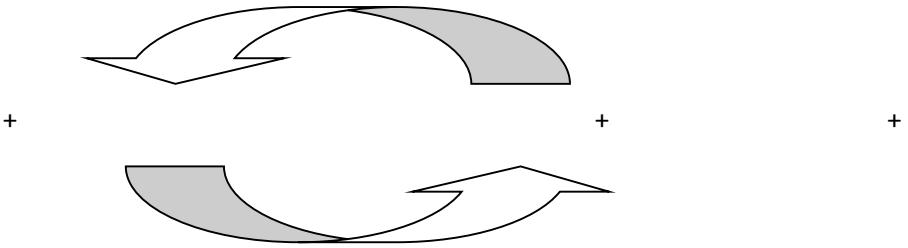
Reactants		**Products**	
_____		_____	
_____		_____	
		_____	
+	→	+	+
+	→	+	+

_____ producers carry out photosynthesis, but _____ organisms, including _____ (plants), carry out cellular respiration.

They Need Each Other: The Carbon Cycle

Respiration and Photosynthesis occur _____. They are _____ happening.

Together they form a natural cycle called _____.



_____ and oxygen move back and forth between living things and their surrounding _____.

Producers remove carbon from the atmosphere (as CO_2) during _____.

When _____ eat plants, the carbon compounds pass through the _____ from organism to organism. Carbon is found in the _____ and _____ that is released by animals.

_____ use this waste as food.

Carbon is released to the atmosphere as _____ at each stage in the food chain through _____.

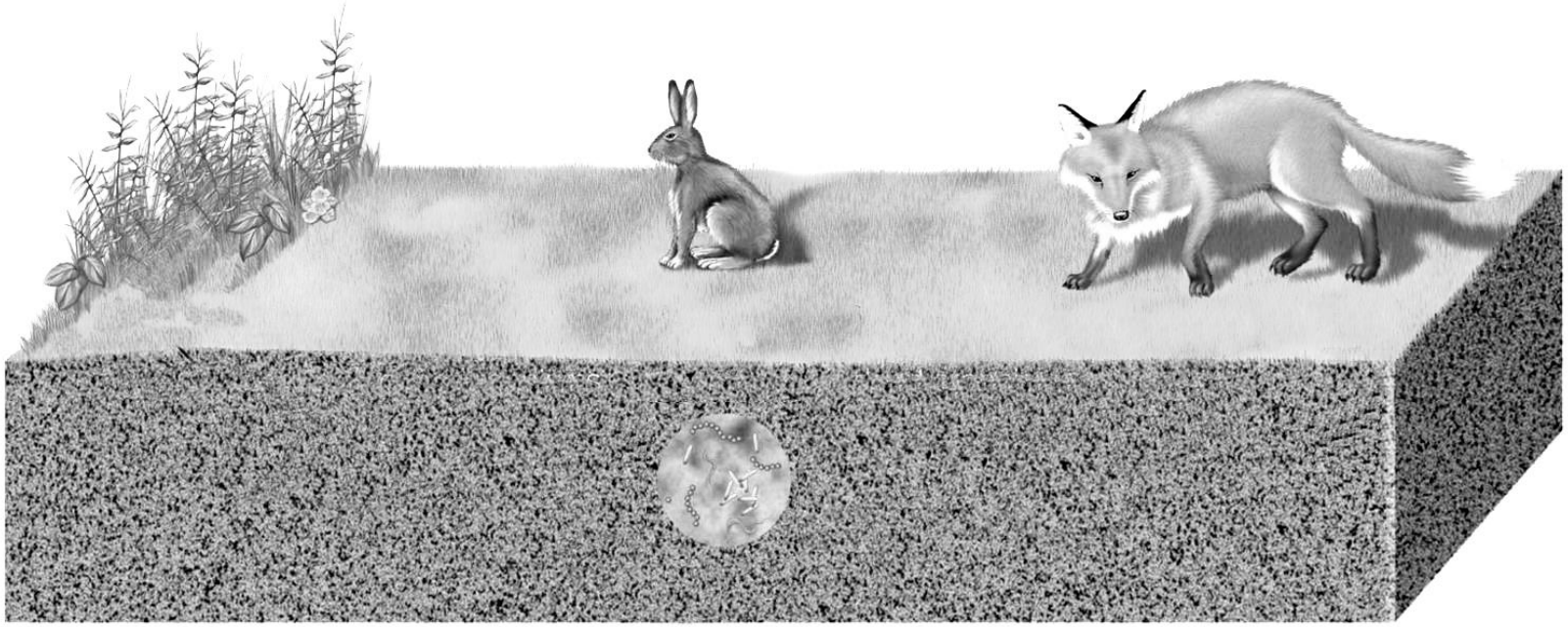
Another major exchange of CO_2 occurs between the _____ and the _____.

Oceans and lakes hold over _____ times as much CO_2 as the atmosphere.

Assignment 1:

Use arrows to indicate the direction of movement of **carbon** in each part of the cycle.

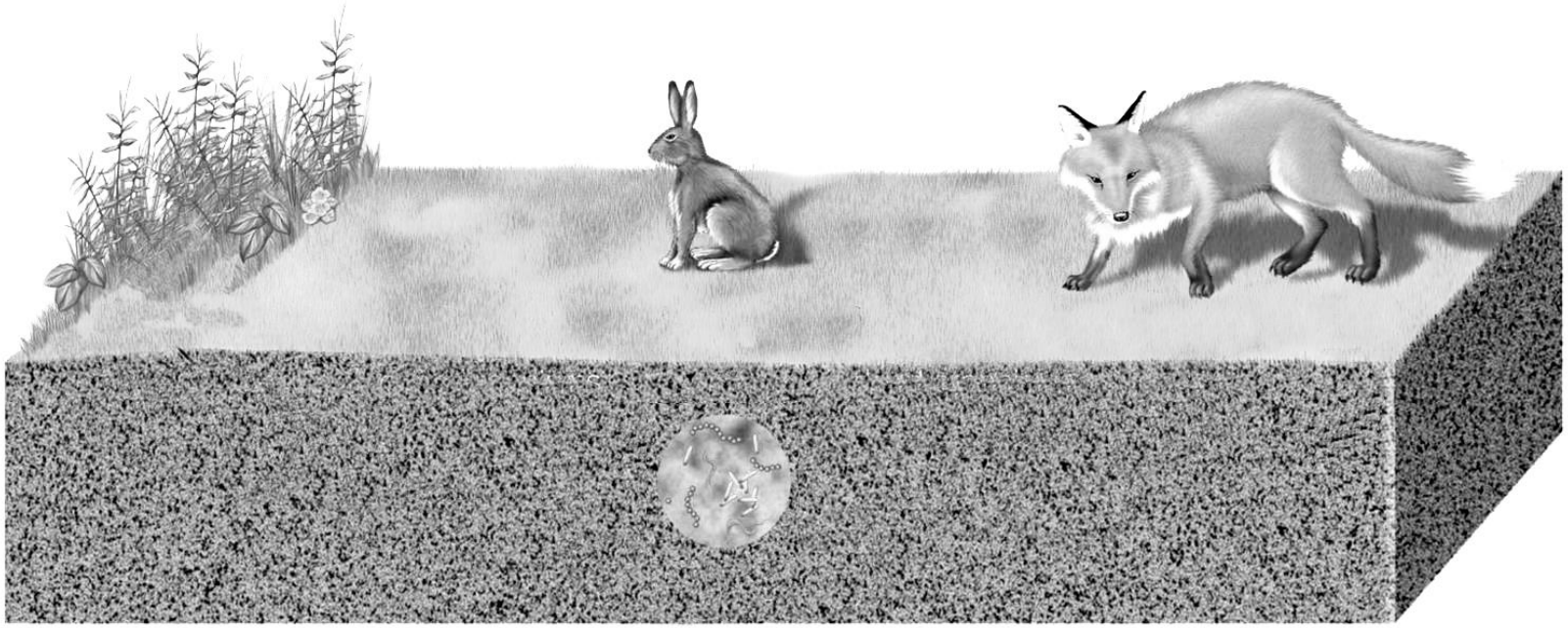
Include the following terms: photosynthesis, cellular respiration, producers, primary consumers, secondary consumers, decomposers, atmospheric carbon dioxide, and carbon in tissues.



Assignment 2:

Use arrows to indicate the direction of movement of **oxygen** in each part of the cycle.

Include the following terms: photosynthesis, cellular respiration, producers, primary consumers, secondary consumers, decomposers and atmospheric oxygen.



Disrupting the Carbon Cycle

The carbon produced by cellular respiration _____the amount of carbon absorbed by photosynthesis. They are _____.

However, this balance can be _____.

The Carboniferous Period

Over 300 million years ago (_____), large amounts of carbon, from decaying plants, accumulated in carbon sinks as _____, _____ and _____.

Fossil Fuels

Coal, oil and natural gas are _____. It took _____ of years to make these fuels. We are burning them all up in a few _____ years.

_____ activity has "unlocked" much of this unavailable carbon by _____ coal and _____ oil and gas. Burning fossil fuels releases _____ into the atmosphere.

Assignment 3: The Carbon Cycle and Climate (textbook pg. 48)

The Greenhouse Effect and Global Warming

How does an increase in carbon dioxide increase global temperatures?

Carbon dioxide is _____ to light but rather _____ (not clear) to heat rays.

Therefore, CO_2 in the atmosphere _____ the radiation of heat from the earth and _____ the atmosphere — the "_____".

Do – Testing Leaves for Starch Lab

Assignment 4: Exit Slip Journal – For marks

CHAPTER 2
INFORMATION HANDOUT

Equation for Respiration

BLM 2-2

Goal • Review energy flow in cellular respiration.

Introduction

From previous studies, you know that cells are the basic structural and functional units of living organisms. Cells require energy to perform the functions that are vital to life. How do cells obtain this energy?

Cellular Respiration

Energy is produced during cellular respiration by an organelle called a mitochondrion. The diagram below shows the internal structure of a mitochondrion. It is made up of folds called *cristae*. Cellular respiration occurs on these cristae.

In cellular respiration, a carbohydrate (a sugar or a starch) and oxygen combine to produce carbon dioxide, water, and energy. This process can be summarized by the equation below:

carbohydrate + oxygen → carbon dioxide + water + energy

The components to the left of the arrow — carbohydrate and oxygen — are the reactants.

The components to the right of the arrow — carbon dioxide, water, and energy — are the products.

CHAPTER 2
REINFORCEMENT

Follow That Carbon Molecule

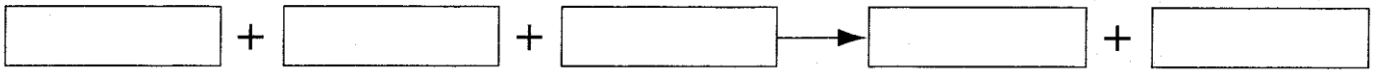
BLM 2-8

Goal • Review the movement of carbon within the nutrient cycle.

What to Do

Answer each question in the space provided. If you need help, refer to pages 46 to 50 of your textbook.

1. Fill in each box to write the equation for photosynthesis.



2. In what kind of organism does photosynthesis occur?

_____

3. (a) In photosynthesis, what are the reactants?

_____

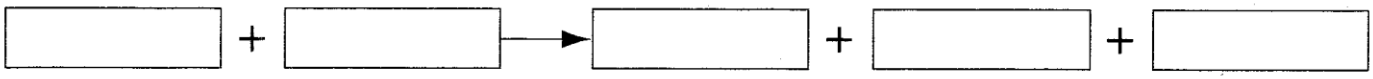
(b) What are the products?

_____

4. What is the origin of the energy needed to drive photosynthesis?

_____

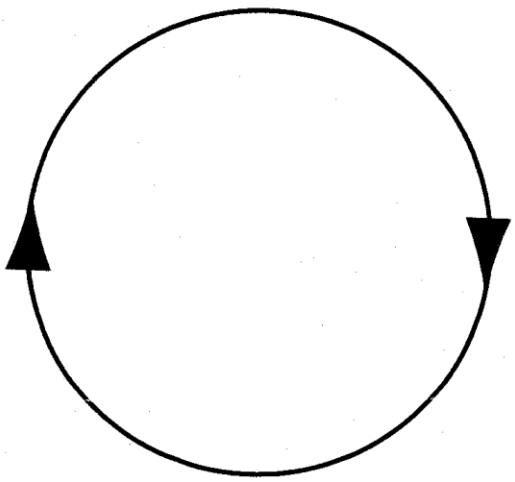
5. Fill in each box to write the equation for respiration.



6. Where does respiration occur?

_____

7. Complete the diagram at the right to show the relationship between photosynthesis and respiration as a cycle. You may draw sketches to illustrate stages of this cycle. Give your diagram a title.



CHAPTER 2
ASSESSMENT

Matching Carbon Terms

BLM 2-

Goal • Review terms related to the carbon cycle.

What to Do

Match each description in column A with the correct term in column B. Place the letter for the term on the line beside the description. If you need help, refer to pages 46 to 50 of your textbook. Some answers may be used mo than once.

A	B
____ 1. period of time in which the level of carbon in the atmosphere decreased	(a) greenhouse effect
____ 2. process that occurs in a cell's mitochondrion	(b) products of photosynthesis
____ 3. carbohydrates and oxygen	(c) products of respiration
____ 4. water, carbon dioxide, and energy	(d) respiration
____ 5. process that occurs in the chloroplasts of plant cells	(e) Carboniferous Period
____ 6. process in which a plant captures carbon from its environment	(f) photosynthesis
____ 7. main cause of increased global temperatures	(g) CO_2
	(h) energy
	(i) equation for respiration

The Nitrogen Cycle:

What do you know?

- What happens to the bodies of dead organisms?

- How are the bodies of dead organisms reused and recycled in the environment?

- What is fertilizer?

- Where is nitrogen found on Earth? Does it move from place to place or stay still? Why is it important?

***** Nitrogen Cycle Game***

The Nitrogen Cycle

The movement of _____, in its many forms, between the biosphere, atmosphere, and animals, is described by the _____.

All living things need _____ to make proteins.

Almost _____ of the atmosphere is nitrogen, however, nitrogen _____ be used directly by living things.

Nitrogen must be _____ or "_____" into a form that plants and animals can use.

Nitrogen Fixation

Definition: The _____ of nitrogen gas (N_2) in the atmosphere to:

- _____ (NH_4^+) / _____ (NH_3)
- _____ (NO_3^-)
- _____ (NO_2^-)

which can be used by plants and animals

Nitrogen is fixed in 3 ways:

1. By nitrogen-fixing bacteria in _____ or water

2. By nitrogen-fixing bacteria living in _____/legume roots (fertilizers)
3. By _____

Legumes are plants that include _____, _____, and _____. These plants have special swellings on their roots called _____. These swellings hold and feed _____, which fix nitrogen into the soil.

The Nitrogen Cycle

The nitrogen cycle has three main components:

1. _____ - produces ammonium (NH_4^+)
2. _____ - produces nitrates (NO_3^-)
3. _____ - produces gaseous nitrogen (N_2)

Ammonification

The nitrogen compounds that enter plants move through the _____.

_____ is produced when nitrogen in animal waste and dead organisms decompose.

This is done by special ammonifying _____ in soil and water.

Nitrification

Ammonia is _____ into nitrates by _____. This is called _____.

Nitrate is the form of nitrogen that is easiest for _____ to use. Plants absorb it from the _____.

The _____ are then eaten by _____ and the nitrogen is _____ to the consumer.

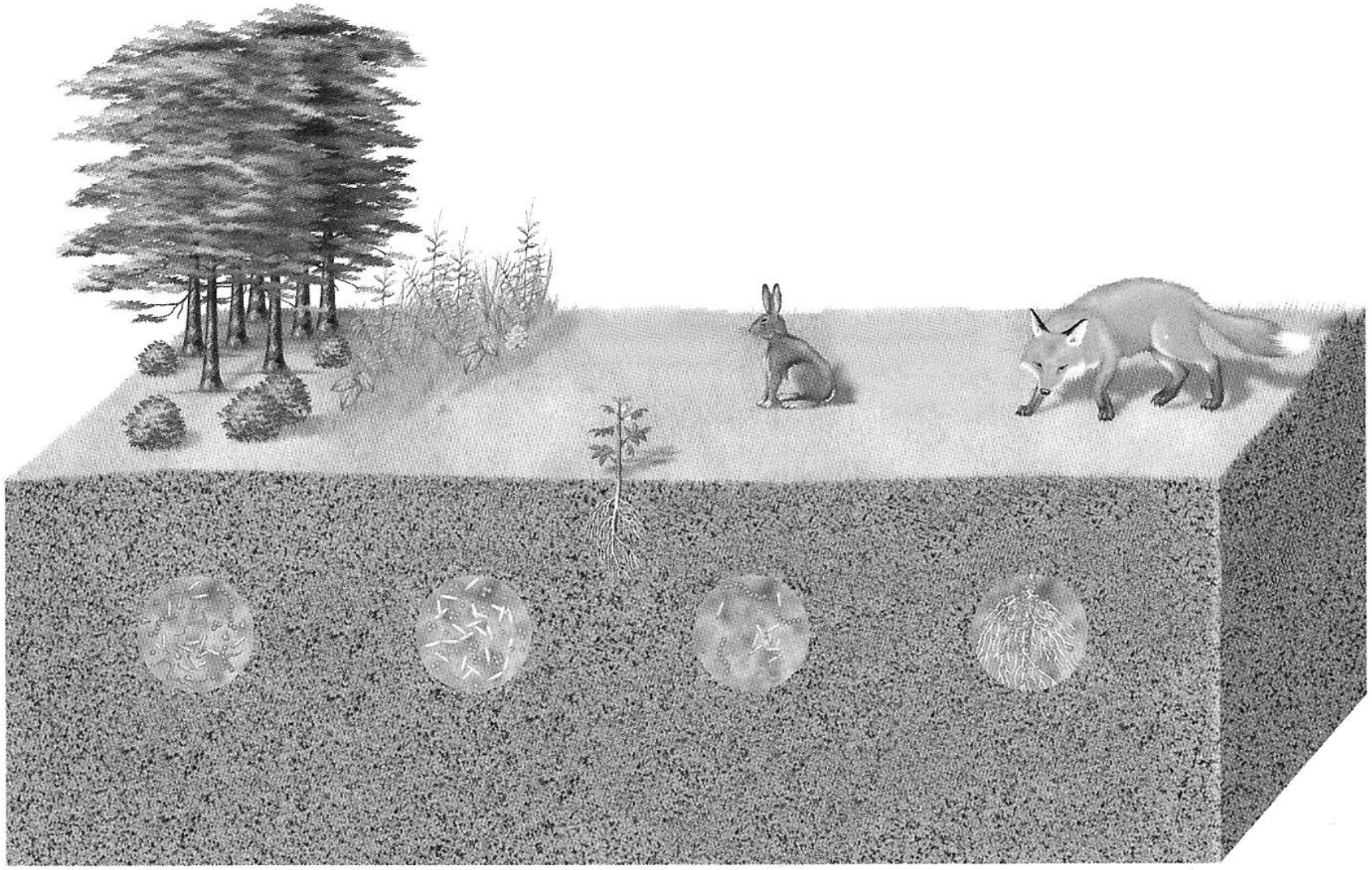
Denitrification

Denitrification occurs when _____ converts ammonia, nitrite, or nitrate back to _____.

Nitrogen gas is release into the _____.

Assignment 1: Use arrows to indicate the direction of movement of **nitrogen** in each part of the cycle.

Include the following terms: nitrogen in the atmosphere, nitrogen gas, nitrogen fixing bacteria, decomposers, animal wastes and dead organisms, nitrifying bacteria, nitrates, denitrifying bacteria and nitrogen in tissues. (pg. 54)



Altering the Balance

In a normal cycle, the rates of _____ from one part of the cycle to another are _____.

What might happen if an outside influence altered part of the cycle?

Human Impacts on the Nitrogen Cycle

Farming:

- _____ fertilizers
- Grow _____ crops

Burning fossil fuels:

- _____ released into air

Nitrogen _____!!!

More nitrogen is being _____ to the environment than ecosystems can _____.

Assignment 2: Group Jigsaw

Do Carbon Cycle and Nitrogen Cycle Cut-out handouts

Human Impacts on the Nitrogen Cycle

Effects on Soil (pg. 57-58)

1. What is “nitrogen saturation”?
2. Where is nitrogen saturation a problem? What effect does it have on forests?

Effects on the Atmosphere (pg. 58-59)

1. What nitrogen containing gases spew into the air, what do they form?
2. What is this a component of?
3. What does acid in the water of a lake do?
4. How does acid rain affect forests?
5. What are we doing to prevent this problem from getting worse?
6. What can we do to acidified lakes to “fix” them? How does this work?

Effects on Fresh-Water Ecosystems (pg. 59-60)

1. What is the build-up of nutrients in an aquatic ecosystem called?
2. How does the increase in the population of producers disrupt an aquatic ecosystem? (3 ways)

Effects on Marine Ecosystems (pg. 60)

1. What is an “algal bloom”?
2. How does this affect the organisms that live deep in the sea?

Effects on Biodiversity (pg. 63)

1. What is “biodiversity”?
2. How is the biodiversity of an ecosystem decreased?
3. How has biodiversity of lakes been affected by an increase of nitrogen in the ecosystem?

CHAPTER 2
REINFORCEMENT

BLM 2-11

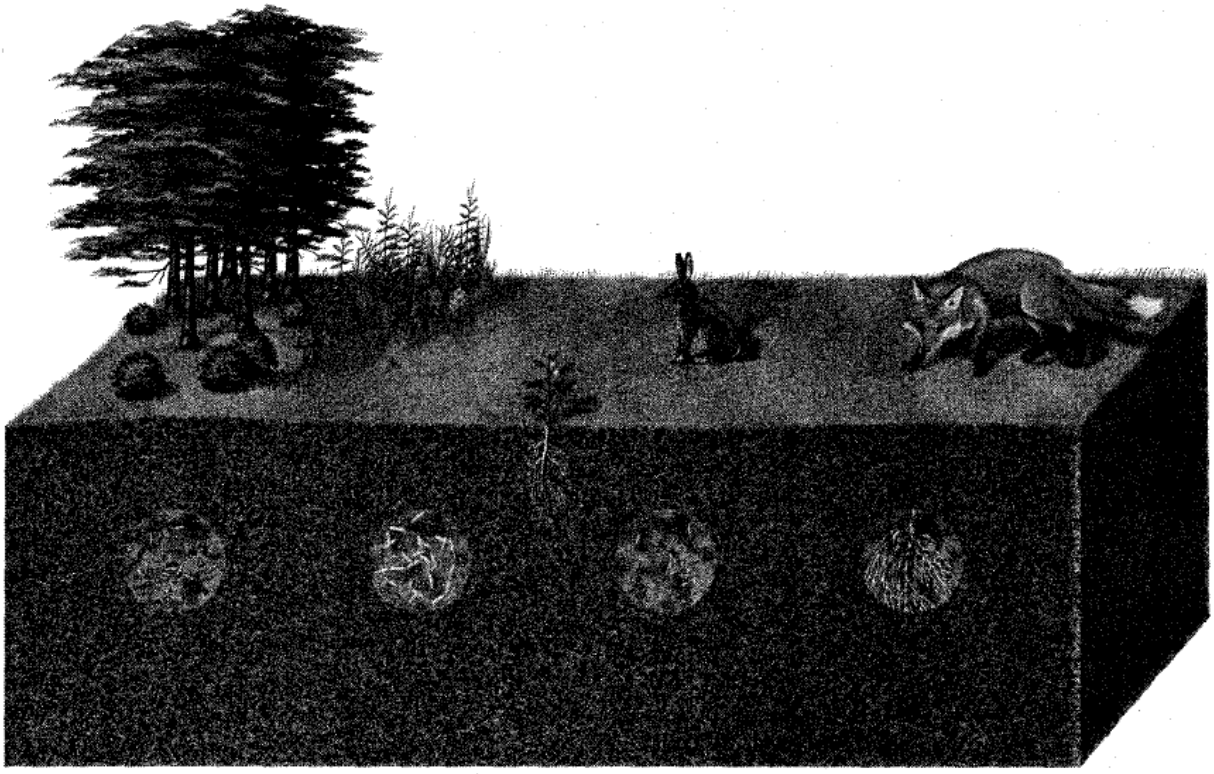
Fixed on Nitrogen

Goal • Review the movement of nitrogen within the nutrient cycle.

What to Do

Answer each question in the space provided. If you need help, refer to pages 52 to 55 of your textbook.

1. Label the following diagram of the nitrogen cycle.



2. What percentage of the air around us is nitrogen?

_____

3. (a) Describe the process of nitrogen fixation.

_____

(b) State an example of a nitrogen-fixing bacterium.

_____

(c) Where does nitrogen fixation occur?

_____

4. How does nitrogen gas return to the environment after it is used?

_____

_____

5. What contribution do denitrifying bacteria make to the nitrogen cycle?

_____

_____

CHAPTER 2 ASSESSMENT

Matching Nutrient Terms

BLM 2-13

Goal • Assess your knowledge of terms related to the carbon and nitrogen cycles.

What to Do

Match each description in column A with the correct term in column B. Place the letter for the term on the line beside the description.

A	B
____ 1. process in which carbon dioxide, water, and energy from the Sun are converted into carbohydrates and oxygen	(a) denitrification
____ 2. term that describes the living components of an ecosystem	(b) nitrogen fixation
____ 3. mixture of elements, such as N, P, and K, that can help to enrich soil	(c) biotic
____ 4. process in which an environment is maintained and the negative effects of human activities are reduced	(d) photosynthesis
____ 5. term that describes the non-living components of an ecosystem	(e) abiotic
____ 6. explosion of an aquatic population resulting from high levels of nitrogen	(f) respiration
____ 7. time when large amounts of carbon were deposited beneath sediment that later became rock	(g) fertilizer
____ 8. process in which nitrogen gas is converted into a form that organisms are able to absorb	(h) acid precipitation
____ 9. process in which nitrates are converted into nitrogen gas	(i) eutrophication
____ 10. buildup of nutrients that threaten the health of an aquatic ecosystem	(j) algal bloom
____ 11. substance that is formed when nitrogen-containing gases, from industrial smokestacks and car exhausts, mix with water	(k) sustainability
____ 12. process that occurs in a cell's mitochondrion and breaks down carbohydrates into useful energy	(l) Carboniferous Period

What happens when non-biodegradable substances enter ecosystems?

DDT:

Biological Magnification/Bioaccumulation

Listen to:
Big Yellow Taxi
By: Counting Crows

In groups, read Bioaccumulation articles and present to the class*

STUDY FOR QUIZ*

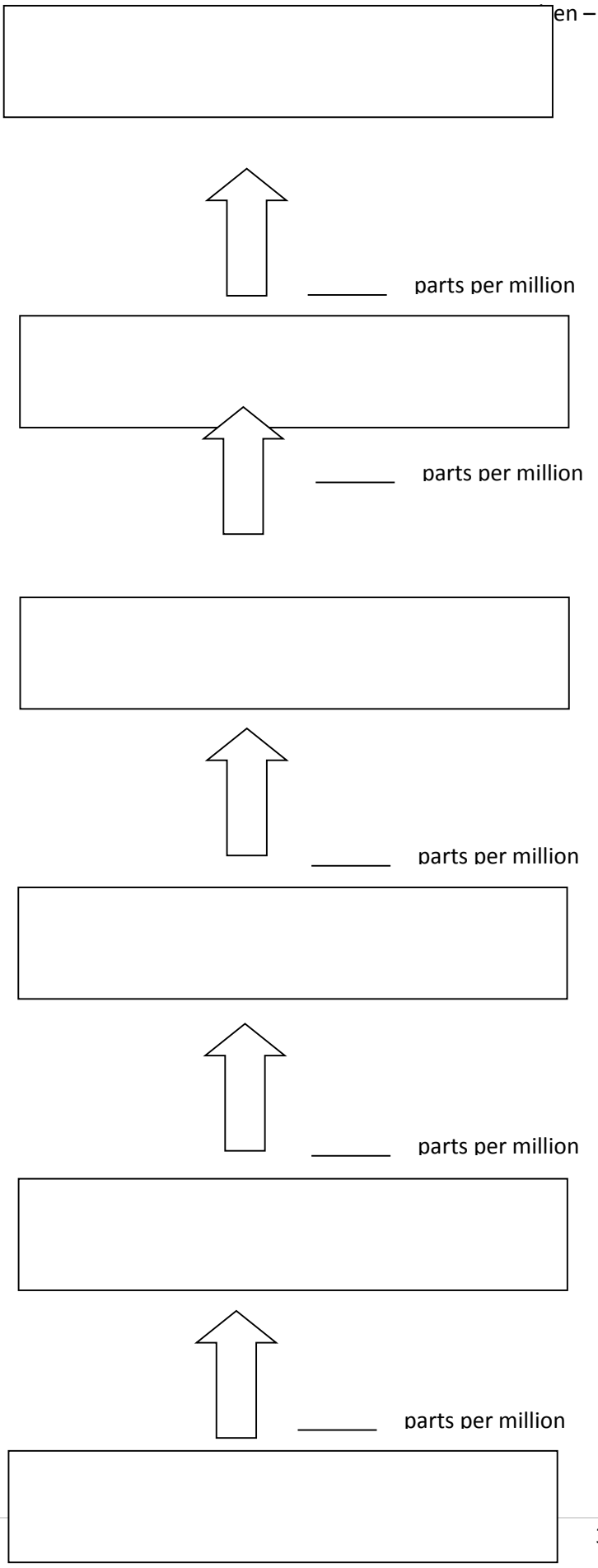
<u>BIOLOGICAL MAGNIFICATION</u> (A.K.A. bioaccumulation and biomagnification) occurs when toxic substances accumulate in the bodies of organisms as they pass up through trophic levels. The concentrations of the toxins increase as they pass higher up the food chain.

<u>Directions:</u> Order the following statements and numbers in a way that illustrates the process of bioamplification.

1. Tiny insects feed off the water plants and take DDT into their body tissues.
2. Bigger fish, such as trout and bass, eat the smaller fish. They accumulate DDT in their body tissues.
3. Some DDT is taken in by water plants.
4. An aquatic ecosystem is sprayed with low levels of DDT.
5. Humans eat trout and bass. They accumulate toxic DDT in their body tissues.
6. Small fish eat the insects and accumulate DDT in their body tissues.

A. 0.01 B. 500 C.4.3

D.2.0 E.200 F.0.2



Contaminants in Fish

Chemicals in Our Water

In the mid-20th century, the increasing worldwide use of chemicals and resulting health problems brought attention to the possible environmental impacts associated with toxic chemicals. Thanks to scientific research linking environmental contamination and deformities in aquatic life, and increasing public pressure, much has since been done to eliminate many of these harmful chemicals from reaching aquatic environments.

Mercury is a naturally occurring element that is generally found in low concentrations in air, water, and soil. Consequently, mercury residues are naturally present to some degree in plant, fish, animal, and human tissues.

Mercury in Fish

In Minimata Bay, Japan, in the 1950s, high levels of mercury in fish were identified as a problem when many people developed serious disorders of the brain and nervous system. Symptoms of mercury poisoning in humans include tremors, dizziness, joint stiffness and pain, as well as memory loss and mental decline. Some people eventually died from mercury poisoning after eating contaminated fish. In 1969, contaminants in fish became a concern in Manitoba with the discovery of high mercury levels in fish from the English-Wabigoon river system in Ontario and in fish from the south basin of Lake Winnipeg. Athe same time, mercury contamination was discovered in fish from the Saskatchewan River. This led to the closure of commercial fishing on the Saskatchewan River in Manitoba, including Cedar Lake. Studies attributed the mercury contamination mainly to discharges from some pulp and paper mills. Controls on the use and release of mercury from industry during the 1970s helped reduce the level of mercury pollution in these areas.

Increased mercury levels were also discovered in fish from lakes flooded by the Churchill River hydroelectric dams in northern Manitoba during the late 1970s and early 1980s. In the newly flooded land, bacteria altered the form of naturally occurring mercury, making it more readily taken-up by fish and other aquatic organisms. This resulted in elevated levels of mercury found in some fish species caught in flooded lakes.

Fish Consumption Guidelines Developed

During the late 1970s, Manitoba Environment began collecting samples of fish tissue from some of the major river systems in southern Manitoba to determine if there was a problem with the accumulation of mercury or other chemicals in fish. Mercury was the only substance found at higher levels in some fish species from a few of Manitoba's lakes and rivers. Predatory fish, such as walleye and northern pike, will usually have higher mercury residues than bottom-feeding species, such as whitefish or suckers. Lower mercury residues usually occur in the smaller and younger fish of a species.

Consequently, a sport fish consumption guideline – recommending consumption limits for certain sizes and types of fish - was prepared in 1995 by the provincial departments of Environment, Natural Resources, and Health. Contact Manitoba Environment for consumption guidelines for fish caught in the Saskatchewan, Souris, Assiniboine, Red, and Winnipeg river systems. For example, according to the guide, you can eat any fish you catch in the Red River system. However, there are some consumption restrictions on larger fish from the Winnipeg River system and the Assiniboine River system. Information on mercury residues in fish from northern lakes on the Rat, Burntwood, and Nelson rivers may be obtained from Manitoba Natural Resources, Fisheries Branch.

What You Can Do!

- Limit your use of pesticides as much as possible. Follow the label instructions carefully and dispose of used containers in a safe manner.
- Do not flush chemicals down sinks or storm drains. Take unwanted or unused chemicals to a hazardous waste disposal facility.
- When fishing in Manitoba, refer to the sport fish consumption guide to determine which species are restricted for eating due to mercury. Those fish not recommended for consumption should be released unharmed.

What will be on my Ecology quiz?

Introduction to Ecology/Review:

- Know the differences of the three types of ecological pyramids: Pyramid of Biomass, Pyramid of Energy, and Pyramid of Numbers. Know how to draw them.
- Know the difference between a food web and a food chain
- Know the different trophic levels
- Define and describe the following terms:
    - Detritivore
    - Decomposer
    - Trophic Level
    - Consumer
    - Tertiary consumer
    - Producer
    - Top Carnivore
    - Carnivore
    - Herbivore
    - Autotroph
    - Heterotroph
    - Omnivore
    - Abiotic
    - Biotic
    - Energy flow

Biogeochemical cycles (Carbon and Nitrogen)

- Define and describe photosynthesis and cellular respiration. Know where each occurs and the chemical formula of each **
- What is a reactant and product in a chemical formula?
- Know how the following terms relate to the Carbon and/or Nitrogen cycles:
    - Fossil fuels
    - Greenhouse gases
    - Global warming
    - Eutrophication
    - Fertilizers
    - Legumes
    - Denitrification/ Nitrification/ Ammonification
    - Carbon Dioxide (CO_2), Oxygen (O_2), and Carbohydrates ($C_6H_{12}O_6$)
    - Decomposers
    - Bacteria
    - Carboniferous period
    - Nitrates/Nitrates
    - Ammonia
    - Cristae
    - Chlorophyll
    - Chloroplast
    - Mitochondria
    - Nitrogen fixation
    - Acid precipitation

Bioaccumulation/ Biomagnification

- What was DDT used for and how did it have a negative effect on the ecosystem?
- How do toxins get passed up the food chain?
- Why are top carnivores more severely affected?
- Know these terms:
    - DDT
    - Toxins
    - Non-biodegradable
    - Bioaccumulations

Attachment 9.2

Knowledge Chart

Course _____ Unit _____

What do you know about populations **?**

Know now (draw):	**Know now (list):**

Need to know:

List what you have learned:	**Final concept map or drawing:**

Knowledge Chart: Used by permission of Lynda Matchullis and Bette Mueller, Nellie McClung Collegiate, Pembina Valley S.D. No. 27, Manitoba.

Exploration: Food Chain

Vocabulary: consumer, ecosystem, equilibrium, food chain, population, predator, prey, producer

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
The *Food Chain* Gizmo™ shows a **food chain** with hawks, snakes, rabbits, and grass. In this simulation, the hawks eat snakes, the snakes eat rabbits, and the rabbits eat grass.

1. **Producers** are organisms that do not need to eat other organisms to obtain energy.

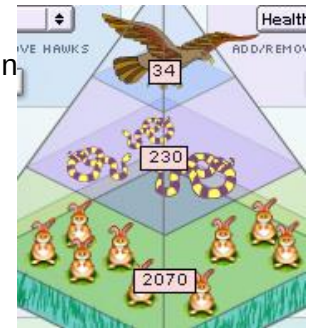
   A. Which organism is a producer in this food chain? _____

   B. Where does the producer get its energy? _____

2. **Consumers** must eat other organisms for energy. Which organisms are consumers in this food chain?

   _____

Gizmo Warm-up
The SIMULATION pane of the Gizmo shows the current **population**, or n each organism in the food chain.



1. What are the current populations of each organism?

   Hawks: _____ Snakes: _____ Rabbits: _____ Grass: _____

2. Select the BAR CHART tab, and click **Play** ( ). What do you notice about each population as time goes by?

   _____

   If populations don't change very much over time, the ecosystem is in **equilibrium**.

3. Compare the equilibrium populations of the four organisms. Why do you think populations decrease at higher levels of the food chain? _____

   _____

Activity A: **Predator-prey relationships**	Get the Gizmo ready: • Click **Reset** ( ). • Check that the BAR CHART tab is selected.	

Question: Predators are animals that hunt other animals, called prey. How do predator and prey populations affect one another?

1. Observe: Run the Gizmo with several different starting conditions. Use the **+** or **–** buttons to add or remove organisms, or you can choose **Diseased** from the dropdown lists.

2. Form hypothesis: How do you think predator and prey populations affect one another?

   _____

   _____

3. Predict: Based on your hypothesis, predict how changing the rabbit population will affect the other organisms at first. Write "Increase" or "Decrease" next to each "Prediction" in the table.

Change	Grass	Snakes	Hawks
Doubling rabbit population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving rabbit population	Prediction: Result:	Prediction: Result:	Prediction: Result:

4. Test: Add rabbits until the population is about twice as large as it was (200% of balance). Click **Play**, and then **Pause** ( ) after ONE month. Next to each "Result" line in the table, write "Increase" or "Decrease." Click **Reset** and then halve the rabbit population (50% of balance). Record the results for this experiment in the table as well.

   A. How did doubling the rabbit population affect the grass, snakes, and hawks at first?

      _____

      _____

   B. How did halving the rabbit population affect the grass, snakes, and hawks at first?

      _____

5. Predict: Predict how changing the snake and hawk populations will affect the other organisms within the first month. In the tables below, write your predictions.

Change	Grass	Rabbits	Hawks
Doubling snake population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving snake population	Prediction: Result:	Prediction: Result:	Prediction: Result:

Change	Grass	Rabbits	Snakes
Doubling hawk population	Prediction: Result:	Prediction: Result:	Prediction: Result:
Halving hawk population	Prediction: Result:	Prediction: Result:	Prediction: Result:

6. Test: Click **Reset**. Try each experiment with the Gizmo. Record each result after one month.

   A. How did increasing the snakes affect the grass? _____

   Explain why: _____

   _____

   B. How did increasing the hawks affect the rabbits? _____

   Explain why: _____

   _____

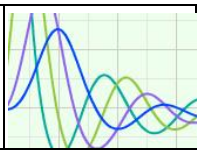
7. Draw conclusions: In general, what effect did removing prey have on predators? _____

   _____

   What effect did removing predators have on prey? _____

   _____

Extend your thinking: In North America, many top predators, such as wolves, have been driven nearly to extinction. What effect do you think this has on their main prey, deer? Write your answer on a separate sheet, and/or discuss with your classmates and teacher.

Activity B: **Long-term changes**	Get the Gizmo ready: • Click **Reset**. • Select the GRAPH tab.	

Question: An ecosystem is a group of living things and their physical environment. How do ecosystems react to major disturbances?

1. Observe: Kill off most of the hawks using the **–** button, and then click **Play**. Observe the GRAPH for about 12 months, and then click **Pause**. What happens?

_____

_____

2. Analyze: Explain why you think the population of each organism changed the way it did. (Use extra paper if necessary.)

_____

_____

_____

3. Summarize: Give at least one example of each of the following:

   A. A major disturbance that the ecosystem was able to recover completely from.

   _____

   B. A major disturbance that caused the ecosystem to stabilize at a new equilibrium.

   _____

   C. A major disturbance that caused the ecosystem to completely collapse.

   _____

D. (Challenge) A major disturbance that *almost* caused a total collapse, but that the ecosystem was able to recover from eventually.

_____

Populations

Think:

What affects the size of a population? (ppt discussion)

Do Appendix 1.1

Use the textbook (pg. 18-20) to fill in the notes:

Carrying capacity is _____

_____

Definitions:

population**:** the total number of animals/plants/things of one type in a particular area

Examples:

1.

2.

3.

There are four main factors that affect the carrying capacity of an ecosystem.

1. **Materials and Energy:** All populations are affected by the amount of _____ (which could be in the form of animals or plants) as well as water and carbon supply.

2. **Food Chains:** Populations at one trophic level are affected by the numbers in all levels above and below it.

i.e: Populations are affected by their _____. (The animals/plants below it in a food web.)

Populations are also limited by their _____. (The animals above them on a food web.)

3. **Competition:** The demand for resources such as _____ _____. This also affects the carrying capacity of an ecosystem.

There are two types of competition:

intraspecific competition: competition among _____
Example:

interspecific competition: competition among _____
Example:

4. **Density:** Depending on an animal's need for space this determines their **population density**. (Population density is _____ _____)

There are two types of factors that affect population density:

density-dependent factors: These are factors that _____ as population grows. These things are influenced by an _____ in population.
Examples:

density-independent factors: These are factors that affect populations regardless of their size to begin with. These factors will take place _____ of an increase or decrease in population.
Examples:

Spread of Disease Gizmo

http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=379

Class Review

Assignment: page 24 (1-6)

***Do – Animal Crackers Activity**

CHAPTER 1
VOCABULARY CHECK

Population Terms

BLM 1-17

Goal • Become familiar with terms related to populations.

What to Do

Carefully read the instructions before answering each set of questions. If you need help, refer to your textbook, Chapter 3, section 1.3.

Fill in the Blanks

Use the terms below to complete the sentences that follow.

density-independent factors	population density	carrying capacity
density-dependent factors	intraspecific competition	
interspecific competition	competition	

1. When two organisms from the same species are after the same resources and food, they are in _____.
2. When a population has reached an amount where growth can no longer occur, it has reached its _____.
3. The number of organisms that live in a given area can be referred to as _____.
4. The relationship between two different organisms (either from the same species or from different species) after a common goal can be called _____.
5. When two organisms from different species are after the same resources and food, they are in _____.
6. Factors that increase in significance as a population grows are called _____.
7. Factors, such as forest fires, that can limit a population regardless of its size are referred to as _____.

Short Answer

Answer each question in the space provided.

8. Give a concrete example to show that you understand each term below.

   (a) interspecific competition

   _____

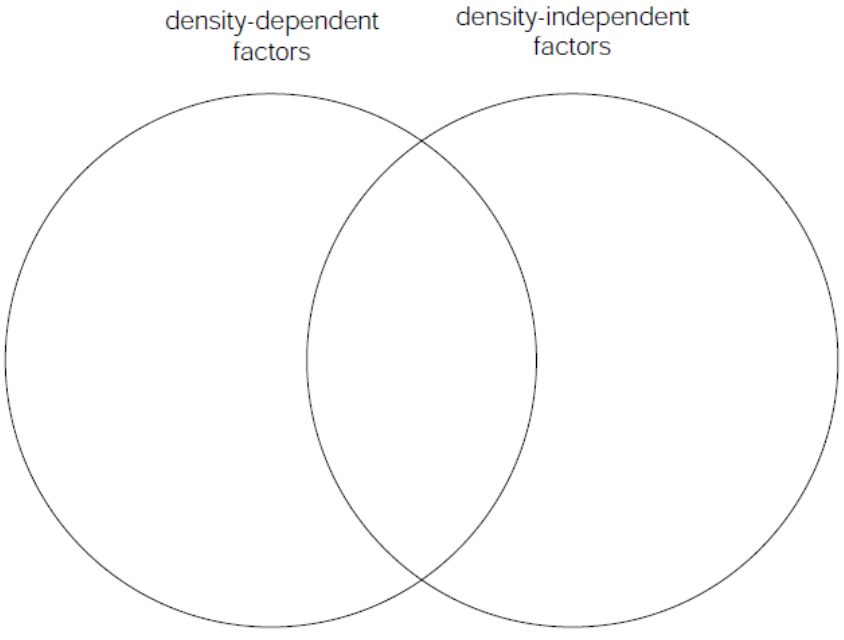
   _____

   (b) intraspecific competition

   _____

   _____

9. Compare and contrast density-dependent and density-independent factors. Write words that show similarities where the circles overlap. Write words that show contrasts inside the circles.



SLA Student Learning Activity

Limiting Factors

1. Explain the difference between density-dependent and density-independent limiting factors.

2. Each of the statements below involves a situation that will affect the growth of a population. Classify each of the statements as DD (density-dependent) or DI (density-independent) and give a reason for your choice.

   a. A lion and a cheetah attempt to occupy the same niche. The more aggressive lion survives; the cheetah does not.

   b. Coyotes cross the winter pack ice and enter Newfoundland. The moose population starts to decline.

   c. A severe frost wipes out fifty percent of the coffee crop in Brazil.

   d. A forest fire destroys much of the wildlife in an area of northern Manitoba.

   e. Due to severe overcrowding in an Asian village, many children do not survive to reach adulthood.

f. Since lynx prey on hares, an increase in the hare population causes an increase in the lynx population.

g. A severe flood in the Red River valley causes a decline in the deer population.

h. Due to stress, large numbers of female lemmings miscarry their young and fail to reproduce.

i. Travelers who visit a crowded African village become infected with a disease caused by parasites.

j. Many fish die due to a change in the winds and the appearance of the El Niño ocean current off the coast of Peru and Chile.

k. Because rabbits in Australia have no natural enemies, their population increases rapidly.

l. Fish on a coral reef stake out their territory and chase away any younger fish that try to live there.

m. An extensive drought on the Serengeti Plain threatens wildebeest, giraffe, zebra and springbok populations.

Population Growth: Carrying Capacity

Think back to the housefly problem. Over the months the number of flies increased from 900 flies in January. 400 000 flies by late February. 180 000 000 flies in March. The number of flies increased slowly at first and then very rapidly. However; having a few hundred million flies in your home in March is highly unlikely. Why is this so?

To answer questions such as this, ecologists study _____.
A _____ is a group of organisms that belong to the same species living in a _____. For example, all the flies that live in your house are a population, as are all the people who live in the town of Gimli, Manitoba.

When conditions are _____ for growth and reproduction, a population will experience a rapid _____ in size. Initially the population grows _____, but the larger the population gets, the faster it grows. As more offspring survive and reproduce, even more offspring are born.

If things were _____ for a population and all the individuals survived and reproduced at the _____ rate, that growth rate is called the _____.

The graph below is called an _____ population growth curve, or a _____ curve.

Draw the graph:

Can a population continue to grow at this rate forever? The answer, of course, is _____. The environment becomes _____. Resources such as food and water become scarcer and the rate of population increase begins to _____. The graph below illustrates a population growth curve of this nature.

The graph below is called a _____ population growth curve, or a _____ curve.

Draw the graph:

Assignment: Compare and Contrast

The formula for determining population growth is as follows:

If population growth is _____ than zero, there are _____ deaths and emigrants in the population than there are births and immigrants. The size of the population begins to _____.

The largest population of a species that a particular environment can support is known as the _____.

The carrying capacity of the environment is different at different times.
At some times, when resources such as food and water are more abundant, a population can _____ in size. At other times, resources may be scarcer, causing the population to _____.
These population _____ occur over time, but the carrying capacity represents an _____ of a series of ups and downs.

Draw the graph:

If you draw a _____ through the _____ of the population fluctuations, that line represents the carrying capacity of that environment for that species.

Do – Conduct an Investigation Activity on Deer Populations

&

Predator-Prey Interactions Appendix 1.5

&

Populations Study Activity

Compare and Contrast Frame 1

How are J-Shaped Growth and S-Shaped Growth **alike**?

How are J-Shaped Growth and S-Shaped Growth **different**?	

Write a statement to compare and contrast J-Shaped versus S-Shaped growth.

Population Growth: Histograms

As well as showing how population changes with time, (which is the purpose of a growth curve), it is also useful to consider how many organisms there are of a _____ within a population.

Age structure is usually shown as a graph called a population _____.

The histogram can be used to predict _____ changes in population size and provide governments with information on the types of _____ that might be required.

Ex.

These histograms only represent a particular moment or _____ in time.

The shapes of histograms can often tell you whether a population is _____, _____ or _____.

About the Graph

The _____ is along the _____ axis.

The _____ is along the _____ axis.

The graph is drawn with _____ bars.

Each bar represents the _____ of organisms of a certain _____ group. There are as many bars as age groups. There is one bar for _____ and one bar for _____.

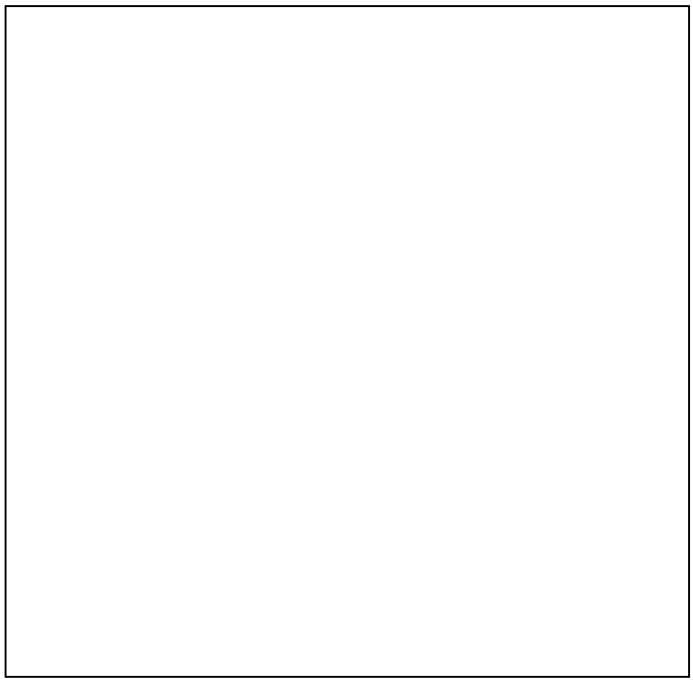
Increasing Population

In this histogram _____ offspring are being produced.

As the population ages, the young replace the current parents and have offspring of their own.

The histogram is shaped like a _____ with a wide base. The wide base means there are lots of young organisms and few older ones.

The population _____ since there are fewer older organisms dying and many more organisms being born.



Steady/Stable Population

In this histogram organisms of reproductive age are having _____ offspring to replace themselves.

As the population ages, there will be enough young organisms to replace the current parents and have offspring of their own.

Since there are as many organisms being born as are dying, the population remains _____.

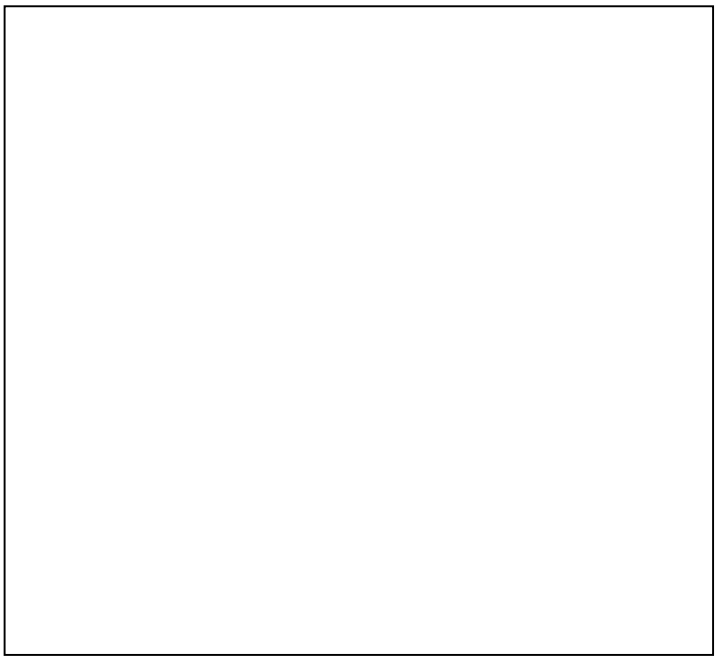
Decreasing Population

In this histogram there are many organisms of reproductive age but they are having _____ offspring.

As the population ages, there will be fewer young organisms to replace the current parents.

This histogram has the widest part in the _____ section because there are more parents than young.

The population _____ since there will be fewer organisms to reproduce and replace the young.



Summary of Population Growth

Population Growth Curves

The _____ show how population _____.

These graphs show that populations grow differently depending on whether the conditions for growth are _____ (_____) or if there are _____ (_____).

Populations in real life _____ around the _____ number of organisms which the ecosystem can support called the _____.

Histograms

An age-population _____ shows a snapshot of the organisms, both male and female, that fall into _____.

While the data represented is for only a particular instant in time, the shape of the distribution allows us to _____ if the population is _____, _____ or _____.

Wildlife Management

In some cultures, wolves have been admired for their ability to work tirelessly together in packs to capture their prey. In other cultures, they have been viewed as dangerous predators whose victims included livestock and humans. Early European settlers to Manitoba attempted to kill off the wolf population to protect their children, cattle, and sheep from predation. What impact did the extermination of wolves have on the ecosystem?

Prior to the introduction of cattle and sheep, wolves preyed on deer and elk in Manitoba's grasslands and forests. When the wolf population went into decline due to human attempts at extermination, deer and elk populations began to increase. The lack of predators in the ecosystem led to a population increase in the prey population. The large numbers of deer and elk began to cause problems for farmers. The deer and elk began to eat crops, and the large herds began to damage farmland. Diseases infected the herds. As a result, the deer and elk populations had to be controlled.

To the day, deer and elk populations are managed by hunting. Deer population estimates remain between 150 000 and 160 000. An historic peak of about 250 000 occurred in the summer of 1995, in contrast to a low of 60 000 in 1974. The number of deer and elk is carefully monitored and this information is used to set bag limits for licensed hunters. When populations are high, limits are increased. High deer populations may contribute to greater numbers of deer-vehicle collisions. Deer and elk grazing continue to damage crops and trees. In an attempt to reduce the damage, feeding programs have been established in some parts of Manitoba.

Today, timber wolves are primarily restricted to our boreal forests and tundra with small populations in southern Manitoba. Manitoba's wolf population numbers approximately
4000 and appears to be stable. An exception is the Riding Mountain population, which decreased during the 1990s. In response to this decline, wolf hunting has been reduced in the Riding Mountain area.

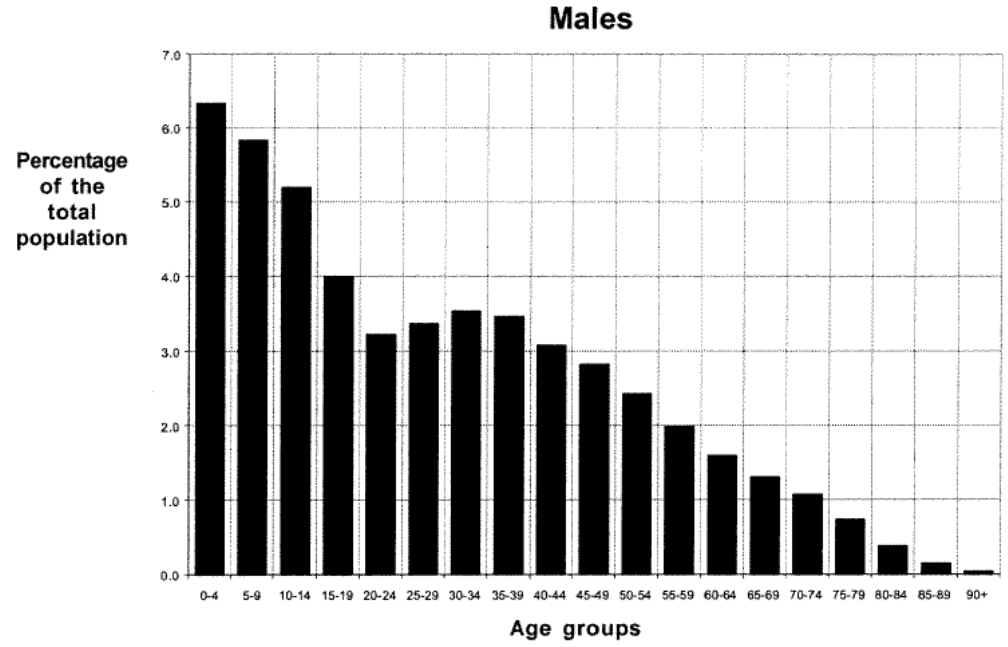
Generally, timber wolves are left alone in the vast majority of their range in the boreal forest and tundra. Some trapping and hunting of wolves is permitted in areas where wolf populations are stable. Where wolves intrude in agricultural areas and prey on cattle and sheep, or where wolves venture into northern communities, measures to control offending animals are implemented.

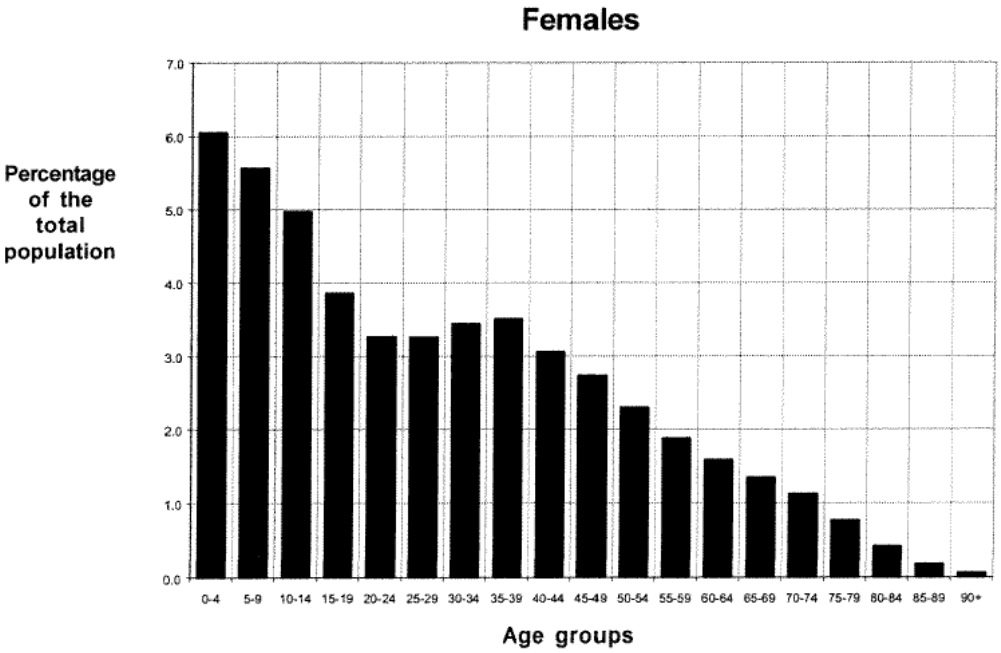
Some controversy over the control of the wolf population remains to this day. Old prejudices still linger, even though the myths of wolves eating children have been shown to be false.
Ranchers lose money when wolves prey on their cattle and sheep. However, their losses must be balanced with the losses suffered by farmers whose crops are eaten, or drivers whose vehicles are damaged in collisions with wildlife.

Gray (Timber) Wolf and White-tailed Deer Fact Sheets: Adapted from material located on the Manitoba Conservation website at:
<http://www.gov.mb.ca/conservation/wildlife/managing/fs_gray_wolf.html> and
<http://www.gov.mb.ca/conservation/wildlife/managing/fs_whitetailed_deer.html>.

Handout 1 The Population Pyramid—what it is and how it works

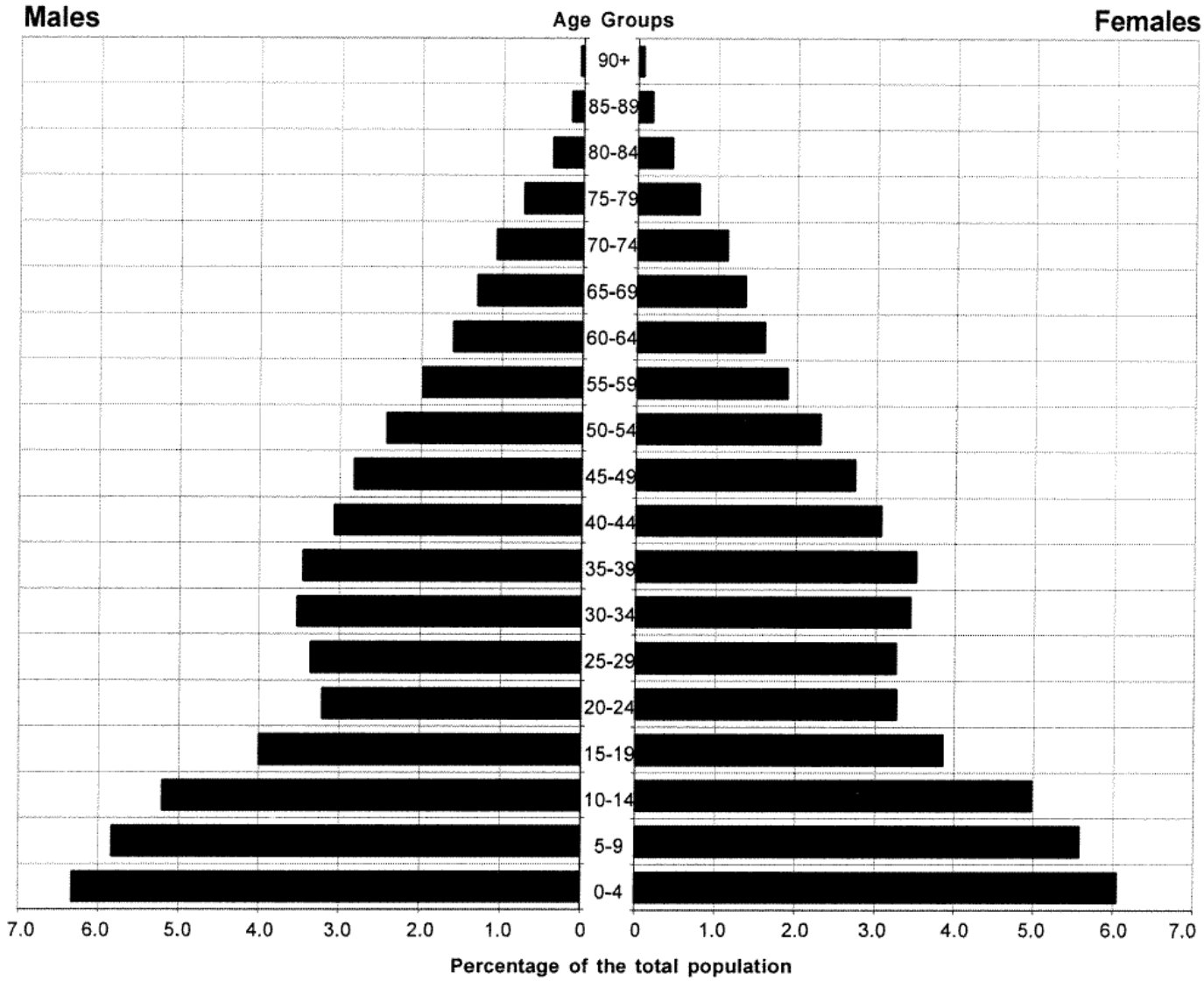
Bar graphs are a handy way to illustrate numbers. For example, if we were to graph the number of males and females in Canada for various age groups according to the 1961 Census, the result would b the illustrations below.





If we were to display these graphs horizontally, make a mirror image of the one for women, and then join them together, we would have a **population pyramid**—exactly as you see on the next page.

Population Pyramid, 1961



This population pyramid shows at a glance the distribution of the Canadian population in 1961.

You can see that the pyramid narrows toward the top. This is because the death rate is higher among older people than among younger people.

There are also a few bulges and narrower parts in the middle part of the pyramid. For example, there are not as many people in their 20s as in their 30s in Canada in 1961. The people in their 20s in 1961 were born during the Depression, a time of economic hardship in Canada when people were having fewer children.

In 1961 the pyramid had a wide base. In fact, when we add the percentages for the three lowest age groups, we find that 35% of the population was under 15. These are the "baby boomers," a large group of people born between 1947 and 1966 when the economy was growing and prospering.

By analyzing population pyramids and identifying trends, we can learn a lot about our society. These statistics give governments and others one of the tools they need to make informed decisions that will affect our lives today and in the future.

Handout 2 1996 Population Pyramid

Now let's turn to the 1996 Census. Below are the data from the 1996 Census of Population givir the population by five-year age groups and sex. Using these data, complete the 1996 population pyramid on the following page.

Canada's population by age group and sex, 1996 Census of Population *

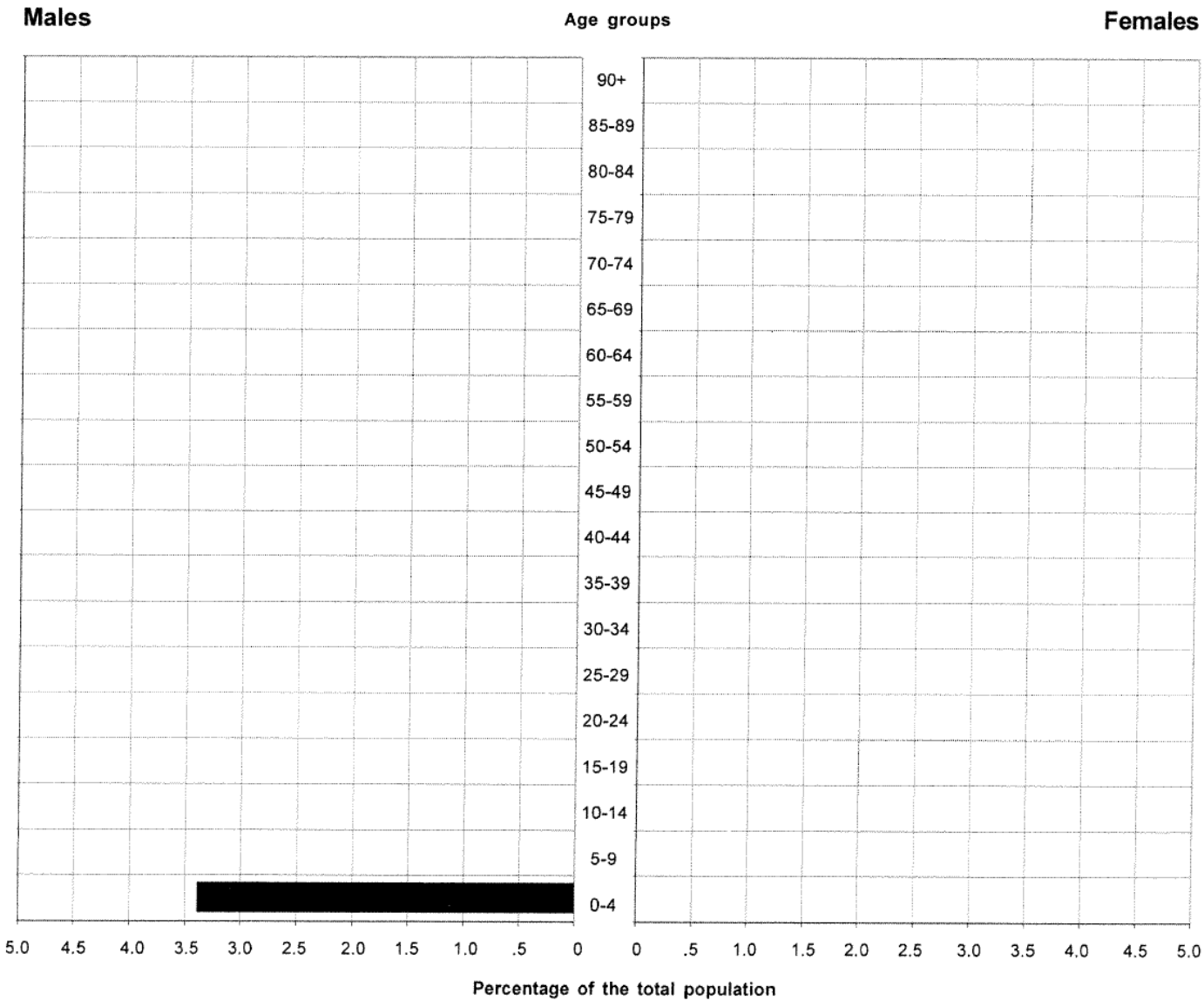
Age group	% men	% women
0-4	3.4	3.2
5-9	3.5	3.4
10-14	3.5	3.4
15-19	3.5	3.3
20-24	3.3	3.3
25-29	3.5	3.6
30-34	4.2	4.3
35-39	4.4	4.5
40-44	4.0	4.1
45-49	3.6	3.7
50-54	2.8	2.8
55-59	2.2	2.3
60-64	2.0	2.1
65-69	1.8	2.0
70-74	1.5	1.9
75-79	1.0	1.4
80-84	0.6	1.0
85-89	0.3	0.5
90+	0.1	0.3

* Percentages have been rounded to the nearest tenth of a decimal point and do not necessarily add up to 100.

Handout 2
(continued)

Use the structure below to create your pyramid. To get you started, the 0-4 category for males has already been drawn in. Highlight the bar that represents your age group and sex by shading it in a particular colour. Use different colours to shade in other bars that represent some of your relatives or friends.

1996 Population Pyramid



Invasive Species and Extinction

Definitions:

Think-pair-share:

Based on what you know about ecosystems, what are the potential problems of introducing a new species to an ecosystem? (These will be your notes)

Extinction:

Species Extinction in Manitoba

Read the articles:

- *Manitoba's Species at Risk: An Overview*
- *Manitoba's Species at Risk: The Piping Plover*

Answer the following questions:

1. In your own words define the following terms and provide a Manitoba example for each.
    a) extirpated species
    b) endangered species
    c) threatened species

2. Describe how Manitoba's Endangered Species Act is designed to ensure the survival of species at risk.

3. Identify possible natural occurrences that have led to the decline of the piping plover population.

4. Identify possible human activities that have led to the decline of the piping plover population.

Species Introduction

Read the information bulletin "Zebra Mussels in North America" and answer the following questions:

1. Describe some of the economic problems that have been created by the introduction of zebra mussels to North America.

2. What are the characteristics of zebra mussels that have allowed them to spread so quickly?

3. Why are zebra mussels so abundant in the areas to where they have spread?

4. How do zebra mussels affect an ecosystem?

5. Why is Manitoba a likely target for zebra mussel invasion?

6. What can you do to help prevent the spread of zebra mussels?

Extension: RAFT

Choose an at-risk species of Manitoba of your choice.

The species may be found at http://www.manitoba.ca/conservation/wildlife/managing/sar_facts.html

As a species at-risk, make an appeal to the humans in your area outlining the effects your extinction will have on the ecosystem.

To do: Exit Slip (on PPT)

Biodiversity

Sustainability

Stable and healthy ecosystems are **sustainable**; they are renewable and can continue without the addition of new materials. They rely on the undisturbed cycling of nutrients and the natural biodiversity of the area to maintain predator-prey relationships.

Compare the sustainability of a natural prairie grassland to that of a homeowner's lawn.

The biodiversity of the grassland is much greater than that of the lawn. Different plants, including those that can "fix" nitrogen, are present. In contrast, a lawn is a **monoculture**. Only one type of plant (grass) is present. As grasses cannot "fix" nitrogen, the lawn ecosystem can only be sustained with the addition of fertilizer on a regular basis.

The biodiversity of a natural prairie grassland helps protect it from predators. While grasshoppers consume grasses, their population is kept in check by predators such as red-wing blackbirds. Other plant species may not be harmed by grasshoppers, and will continue to grow.

In contrast, monocultures are more susceptible to pests. Because monocultures are a large concentration of a small number of species, they are more vulnerable to attack. A lawn requires the addition of herbicides to keep it weed-free, and the addition of insecticides to reduce the damage caused by insects.

Effects of Extinction

As you recall from previous lessons, organisms are linked together in complex food webs. Should one species in an ecosystem go **extinct**, the entire food web may be jeopardized. A species is considered to be extinct when it is no longer found anywhere on our planet. Extinction disturbs predator-prey relationships.

Review the food web diagram in Module 1, Lesson 2: Energy Flow. How would the removal of wild rice affect the Lake Winnipeg ecosystem? As you can see from the diagram, wild rice is a producer. It is an important food source for primary consumers such as minnows and red-wing blackbirds. A lack of wild rice could result in a shortage of food for these primary consumers. The red-wing blackbird and minnow populations will begin to decline.

This, in turn, would affect the populations of secondary consumers that prey upon them. The number of loons, bullfrogs, snapping turtles, and northern pike would be reduced. Finally, the number of tertiary consumer populations (e.g., eagles) would begin to fall as well. You can see how the removal of one species can have a large impact on an ecosystem. It can lead to a domino effect: one event can cause a large chain reaction.

Summary

In the past, we often did not concern ourselves with the importance of biodiversity to our planet. As our knowledge of ecology has grown, we have become more aware of the need for biodiversity in maintaining and preserving ecosystems, including the survival of our species.

Learning Activity

1. A homeowner's lawn is an example of a monoculture. Can you think of other examples of monocultures?

2. If monocultures are not sustainable, why do we rely on them for much of our food production?

3. Complete the Concept Overview on the following page for the term "biodiversity."

Concept Overview

Key word or concept.

Biodiversity

Write an explanation or definition in your own words. You will be paraphrasing.

Draw a figurative representation.

List facts (at least five).

Create your own questions about the concept.

Create an analogy.

Debate an Issue!

You will choose one of these two issues to debate in assigned small groups during class time:

i) Should hunting be permitted in Manitoba's provincial/national parks?

ii) Should hog barn operations in Manitoba be allowed to expand?

You will be assigned to argue either "for" or "against" the ***STSE (Science Technology Society Environment) issue.***

Preparation:

You will research the issue. Be sure to record your sources and come up with at least 5 expanded points to prove your side of the debate. This information will be used for your report, so remember where you found it.

Identify the different groups you would be using your arguments (eg: hunters, conservation officers, hog barn owners, etc.)

You will receive marks for preparation of the debate. Be sure to come to class prepared to debate your side!

The DEBATE!

- Be sure to be respectful of each other.
- Remember that a conclusion may not be reached. Be sure to take your time to fully understand the point being made by the other side.

The Decision-Making Report

** Be sure to refer to the rubric so that you know you have included all of the needed information. In blue pen, check off how you think you did in each section of the rubric

The Task

- You will write a report that uses the decision-making cycle to resolve the STSE issue of your choice (most likely the one you debated).

These are the elements you need to include:

i) *Identification of STSE Issue* – State which issue you are investigating and what the problem is

ii) *Evaluation of Current Research on the Issue* – Use current, applicable research from a variety of perspectives. (From at least 4 sources)

iii) *Formulates Possible Options* – Present options that demonstrate a reasonable chance of succeeding in being chosen. It must satisfy the needs of as many groups as possible

iv) *Identifies Projected Impacts* – Identifies the positive and negative impacts of each solution (*NOTE – you do not have to make a report)

v) *Selects an Option and Makes a Decision* – Selects the best solution

vi) *Implementation* – State how the solution will be implemented

vii) *Identifies and Evaluates Actual Impacts of Decision* – foresees outcomes for all involved groups

viii) *Reflection on the Decision* – Evaluate your decision

Due Date: _____