UNIT OUTLINE

Day	Topics	Activities & Evaluations
1	Introduction to Ecology • What Do You Already Know? • Peel TV – "Bill Nye – Biodiversity" • ecology terminology	Q p 23 #1-6 R pp 27-31, Q p 31 #1-7
2	Ecosystems • ecology terminology (continued) • Intro to brochure assignment	R pp 32-35, Q p35 #1-7 **C: Species of concern brochure** choose and research two species
3	Energy Flow and Food Relationships • Photosynthesis and producers • food chains and pyramids	R pp 38-41, Q p 41 #2-4 R pp 42-47, Q p 47 #1-8 food chain activity
4	Cycling of Matter • Water cycle, carbon cycle, nitrogen cycle • Peel TV – "Carbon Cycle"	R pp 48-51, Q p 51 #1-5 biogeochemical cycle diagrams
5	Biotic and Abiotic influences on Ecosystems • Tolerance ranges • Human effects on ecosystems • Symbiosis	R pp 52-55, Q p 55 #1-4, 8 **A: predator prey graph assignment**
6	Terrestrial and Aquatic Ecosystems • Canadian biomes • Freshwater and marine ecosystems • Peel TV – "Biomes: Coniferous Forests"	R pp 56-62 Q p 59 #1-4, p 62 #1-6
7	Ecosystems and Stewardship • review of terrestrial and aquatic ecosystems • Value of ecosystems • Ecological succession	R pp 77-79, Q p 79 #1,4,5 R pp 80-82 Q p 82 #1, 3-9
8	Biodiversity • Peel TV – "Ecosystems Dynamics" • biodiversity and species at risk • habitat loss and fragmentation	R pp 83-85 define bold print terms Q p 86 #3,4,6 R pp 87-95, Q p 90 #1,4,5 p 94 #1,6,7
9	Ecosystems by design • natural vs. agro ecosystems	R pp 119-122, Q p 122 #5,6,8,10,11
10	Managing the soil • soil nutrients and water flow • Peel TV – "Shop Wisely, Shop Organic", "Soil, An Introduction", "Bill Nye - Farming"	R pp 123-128, Q p 128 #1-4,8
11	Pests and Poisons • Peel TV – "Wash Your Veggies" • types and characteristics • issues with pesticides	R pp 132-134, define bold print terms Q p 134 # 1-4,6,7 R pp 135-140, Q p 140 #1-4,6-8
12	Bioaccumulation	**I: Bioaccumulation assignment due lesson 14**
13	Urban ecosystems and Greener cities • Peel TV – "Ontario Ecology – It Is Easy Being Green"	R pp 142-145, Q p 145 #1-3,6,7
14	Unit Review	Unit review pp 158-165 (see text for answers)
15	**Unit Test**	

INTRODUCTION to ECOLOGY (text ref pp 29 – 35)

Define or Describe the following terms;

atmosphere

biosphere

Gaia Hypothesis

ecosystem

community

population

sustainability

abiotic factors

biotic factors

ENERGY FLOW in ECOSYSTEMS

The Sun supplies all the Earth's energy in the form of ______________________ energy. Approximately _____ % of this energy is absorbed by the **hydrosphere** and the **lithosphere** and converted into **thermal energy**.

define

a) hydrosphere

b) lithosphere

Only a small percentage (____ %) of the Sun's energy is absorbed by living organisms and used for **photosynthesis**. Organisms that can absorb light energy and combine carbon dioxide and water to make food are called ______________________. This process takes place in the **chloroplasts**.

Write the word equation for photosynthesis in the space below.

All organisms require food for their energy, whether they make the food or eat the food. Food has stored energy that is released to the cell in the process of _______________________________. This process takes place in the **mitochondria**.

Write the word equation for **cellular respiration** in the space below.

___________________________ are organisms that cannot make their own food and must eat other living things in order to survive.

We can organize consumers into categories according to what they eat.

1) ____________________ eat plants or other producers

2) ____________________ eat other animals

3) ____________________ eat both plants and animals

4) ____________________ eat remains of other organisms

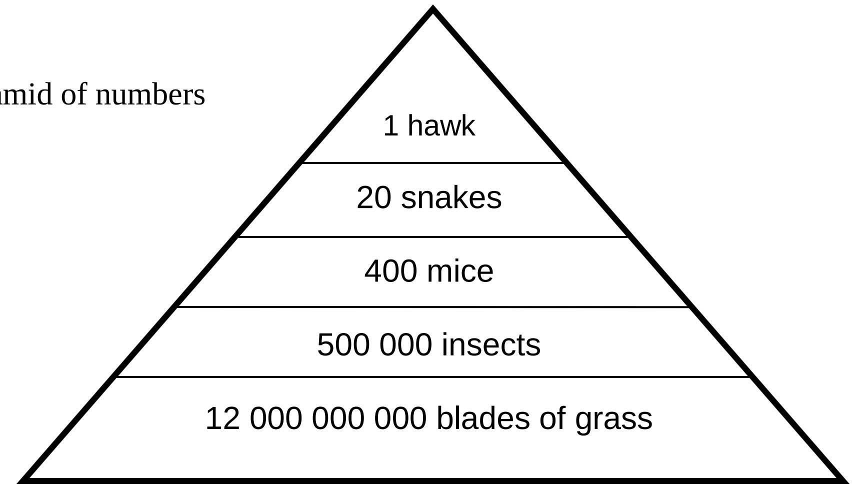
We can represent the movement of energy and nutrients through an ecosystem using **food chains** (simple) or **food webs** (more complex and realistic). (see p 43 of text)

Ecological pyramids also help represent the flow of energy through an ecosystem. (see p 45 of text)

PYRAMID ANALYSIS

Pyramid analysis allows us to study the flow of energy in a food chain/web using actual numbers. This allows us to predict the effects of different scenarios on ecosystems.

Pyramid of numbers



1. In the box below, develop a labeled biomass pyramid from the numbers pyramid shown above.

mass of one hawk: 2500 g
mass of one snake: 130 g
mass of one mouse: 50 g
mass of one insect: 0.5 g
mass of one blade of grass: 0.2 g

Biomass Pyramid

2. How much food in mass is available for the hawk to consume if it only eats snakes? Show your calculations.

3. How much food in mass is available for the hawk to consume if it eats snakes AND mice? Show your calculations.

4. If snakes require 75% of the mouse mass for food, how much is actually available for the hawk to consume? Show your calculations.

5. If 30% of the snake mass and 20% of the mouse mass is used for reproduction, how much food (mass) is now available for the hawk to eat? Show your calculations.

6. Suggest why hawks are solitary animals.

7. In the box below, develop a pyramid of energy flow for this ecosystem using the data shown.

   Energy:
   1 g grass = 2.0 J
   1 g insect = 10 J
   1 g meat (mouse or snake) = 16 J

CYCLING of MATTER

The matter that is part of every living thing has been cannot be created nor destroyed but must come from somewhere. In order to continue to supply the matter required, ecosystems must cycle this matter through the living and non-living components. These processes are called **biogeochemical cycles.**

examples of biogeochemical cycles are the ____________________, ____________________, and ____________________ cycles.

In the space below on this page show a labeled diagram of the water cycle. On 2 other blank pages, show similar diagrams for the carbon cycle and the nitrogen cycle.

BIOTIC and ABIOTIC INFLUENCES on the ECOSYSTEM

Tolerance range refers to

Optimal range means

Carrying capacity of an ecosystem is

POPULATION STUDY in an ECOSYSTEM

In 1981, a study of the elk population of an island forest was begun. The island was about 3150 km^2 in area and had excellent vegetation for feeding, although the food supply obviously had limits. The forest managers decided to bring in natural predators to control the elk population so that overgrazing would not cause mass starvation of the herd. Elimination of the weakest elk from the herd by culling would prevent overpopulation and improve the quality of the herd. In 1985, 10 wolves were placed on the island. The results of this experiment were then studied over a 21 year period. The table below displays the results.

YEAR	elk population	wolf population
1978	3209	0
1979	3190	0
1980	3260	0
1981	3215	0
1982	3180	0
1983	3110	0
1984	3230	0
1985	2960	10
1986	2910	12
1987	2880	14
1988	2740	15
1989	2330	18
1990	2190	24
1991	2140	32
1992	1815	29
1993	1790	22
1994	1895	24
1995	2160	24
1996	2147	23
1997	2200	25
1998	2186	24

Make a point and line graph of the above data on the same graph. The horizontal axis will start at 1981 and be the same for both sets of data. The vertical axis will have two scales (one for each population) and will not be compressed or have a break. Your graph should show the population levels of both elk and wolves.
Also answer the questions below.

1. What is the carrying capacity for elk from 1978 to 1985?
2. What is the carrying capacity for elk by 1998?
3. Is the wolf presence on the island a limiting factor on the elk population? Explain.
4. List 4 other factors that likely control the elk population.
5. How does the size of the elk population influence the number of wolves on the island? What natural mechanisms control the wolf population?

TERRESTRIAL ECOSYSTEMS

In your notebook, design and complete a tablet that describes Canada's 4 major biomes with the following headings: Biome, relative temperature, average annual precipitation, soil characteristics, typical flora, typical fauna.

On the map below, show the biomes of Canada. Include appropriate labels.

AQUATIC ECOSYSTEMS

In your notebook, design, draw, and label a flowchart-style graphic organizer that describes the different types of aquatic ecosystems and their features.

NATURAL ECOSYSTEMS and STEWARDSHIP

Key Concepts:

Concept: Natural ecosystems are of great value to humans.

Example:

Concept: Ecosystems are at equilibrium but can change over time.

Example:

Concept: Biodiversity describes the variety and abundance of life in an ecosystem.

Example:

Concept: Many human activities impact and threaten the sustainability of natural ecosystems.

Example:

Concept: water, land, and air pollution cause health problems and economic problems.

Example:

Concept: Plant and animal resources should be used in a sustainable manner.

Example:

EQUILIBRIUM and CHANGE

____________________ is when there is a situation where conditions stay relatively the same over time. An ecosystem in equilibrium will maintain a characteristic set of ____________________ over hundreds or thousands of years. If abiotic conditions change, there can be change to the ecosystem. The process of establishing and replacing the original ecosystem is called ____________________. If there is a drastic change (flood, fire, volcanic eruption), then this process of succession is initiated.

Primary succession:

Secondary succession:

BIODIVERSITY and SPECIES AT RISK

Explain, with the use of an example, the following terms.

a) biodiversity

b) species richness

c) extinct

d) extirpated

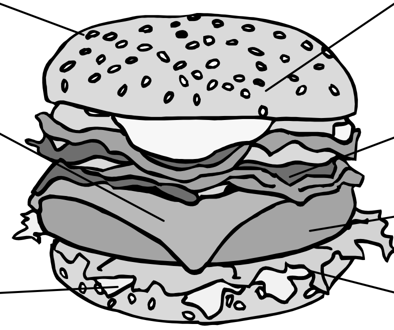
e) endangered

f) threatened

g) special concern

ECOSYSTEMS BY DESIGN

Research the components of the hamburger below and determine the geographical origin of the species indicated.



MANAGING THE SOIL

R pp 123-128, Q p128 #1-4, 8 (use the table below for the answer to #3)

	Synthetic Fertilizers	Natural Fertilizers
examples		
advantages		
disadvantages		

BIOACCUMULATION and FOODWEBS

Background Information

In the 1950's and early 1960's, a new chemical was sprayed on plants all over North America to control insects, particularly mosquitoes. This chemical was called DDT. It was considered a miracle because it only killed insects and had no apparent effect on any animals – or so it was thought. In fact, children would play outside even while planes were spraying DDT over them to control the insects in their neighbourhood! DDT was widely used in North America until an environmentalist named Rachel Carson wrote a book called *Silent Spring* in which she predicted the effects of DDT farther up the food chain from insects. She showed that DDT was accumulating in the fat cells of animals at an alarming rate and was causing all kinds of problems for the birds at the top of the food insect chain. Specifically, DDT in the bodies of female birds caused the eggs they laid to have such brittle, thin shells that they would crack under the weight of the mother sitting on the eggs. This accumulation of a toxin in the bodies of organisms as you move up the food chain is called **bioaccumulation** or **bioamplification**. DDT is now banned in Canada and the United States but it is used in other countries and may be carried in winds around the world to end up in foods you eat.

This activity shows how bioaccumulation might occur in a chaparral ecosystem. A chaparral ecosystem is one that contains low shrubs and bushes and has two distinct seasons; a moist season and a very dry season. This type of ecosystem is commonly found in the south-western United States.

Pre-Activity Questions

1. Define bioaccumulation.
2. Who was Rachel Carson?
3. Why was DDT first considered an excellent chemical pesticide?
4. Why is DDT harmful in ecosystems?

Materials for Activity

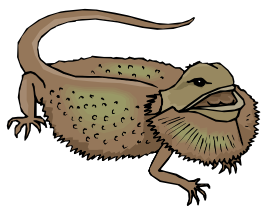
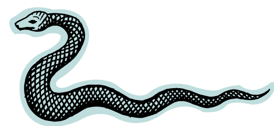
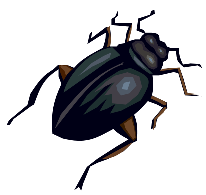
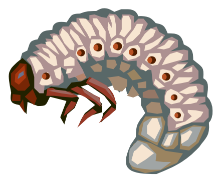
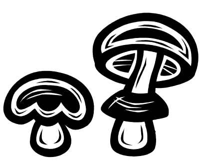
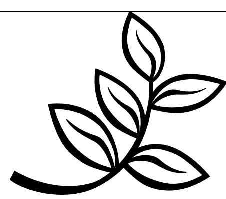
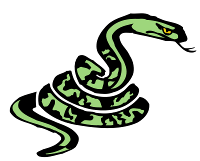
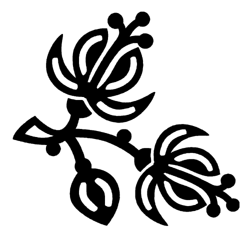
- one piece of ledger paper
- scissors, glue stick, coloured pencil crayons
- organism diagrams including feeding information

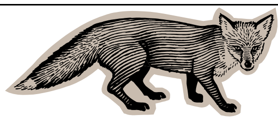
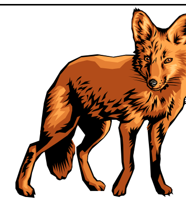
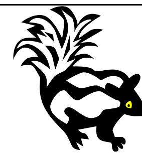
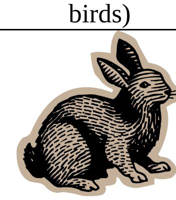
Procedure

1. Cut out the organism pictures.
2. Using the feeding information, sort the organisms into producers, 1st order consumers, 2nd order consumers, and 3rd order consumers, etc. Scavengers and decomposers may be placed in the same group separate from the others.
3. Shade each organism with a pencil crayon or marker. Use a common colour for each group and make a decision about scavengers and other omnivores. Choose a logical colour for the sun.
4. Arrange the pictures of the organisms on your ledger paper in the best and clearest way possible to show the feeding relationships. Space your organisms well. Keep in mind that you will be connecting them with lines that cannot go through another organism.
5. When you are satisfied with the arrangement of organisms, glue them to the ledger paper.
6. Draw arrows between the organisms to show how they are eaten. Remember that the arrow shows the direction of nutrient and energy flow.
7. With a black marker or pencil crayon, draw a dark black border around the producer Toyon. This black border is to indicate visually that the Toyon was sprayed with DDT.
8. Now draw a black border around each other organism in the food web that would end up with some DDT in their bodies.

Follow-up Questions

1. In general, will there always be more predators or more prey in any ecosystem? Explain your answer.
2. Why can't food chains go on forever? In other words, why aren't there any examples of 8th order consumers, 9th order, and so on?
3. Design a table with the following headings: "Organism" and "Population Change (+, -, or NA)". Fill in the "Organism" column with the name of each organism from your food web except the Western Rattlesnake. Assume a terrible disease has killed off all the rattlesnakes. Indicate in the second column whether the population of the other organisms will increase (+), decrease (-), or be unaffected (NA).
4. Why are 2nd order consumers more likely to be affected by the DDT than the 1st order consumers?
5. Pick a 4-organism food chain from your food web and write it out. Assume there are 3 units of toxin in your producer. If each organism in the food chain eats 4 organisms below it, how many units of the toxin will be in the top carnivore?

 WESTERN FENCE LIZARD (spiders)	 COAST HORNED TOAD (grubs & insect larvae, grasshoppers)	 GOPHER SNAKE (mice, rabbits, California quail, lizards, toads)	 GROUND SQUIRREL (Toyon leaves, Chamise seeds, Manzanita bulbs)
 CHAMISE (producer)	 BEETLES (plant material, bark from scrub)	 GRUBS & INSECT LARVAE (leaves & plant material from scrub)	 RED-TAILED HAWK (pocket mice, ground squirrels, brush rabbits, grubs & insect larvae, grasshoppers)
 BACTERIA/FUNGI/ MOULDS breaks down dead and decaying plant material)	 MANZANITA (producer)	 WESTERN RATTLESNAKE (pocket mice, ground squirrels, brush rabbits, California quails, western fence lizards, toads)	 BITTER CHERRY (producer)

 TOYON (producer)	 BUTTERFLIES (nectar from bitter cherry and Manzanita)	 SUN (source of energy for all producers)	 GRASSHOPPER (green vegetation from Chamise and Toyon)
 GREY FOX (berries of bitter cherry and Toyon, mice, rabbits, quail)	 SCRUB OAK (producer)	 CALIFORNIA QUAIL (seeds of scrub oak, leaves of Chamise, berries of Toyon, butterflies)	 MOUNTAIN COYOTE (squirrels, mice, rabbits, all birds)
 CALIFORNIA JAY (spiders, beetles, California quail, scrub oak)	 POCKET MOUSE (seeds of Chamise, Manzanita, and bitter cherry)	 SPOTTED SKUNK (beetles, butterflies, mice, quail, coyote carcasses)	 BRUSH RABBIT (seeds of scrub oak, leaves of Chamise, berries of Toyon)
 SPIDER (beetles, grubs and larvae)			