

Dynamics of Ecosystems



Introduction

Ecology Introduction...

ECOLOGY is the branch of biology that deals with the study of the **INTERACTIONS AMONG ORGANISMS AND THEIR ENVIRONMENT.**

→ The prefix “**ECO**” comes from the Greek word “**OIKOS**” which means **HOUSE**.



Scientists who study **ECOLOGY** are called **ECOLOGISTS**.

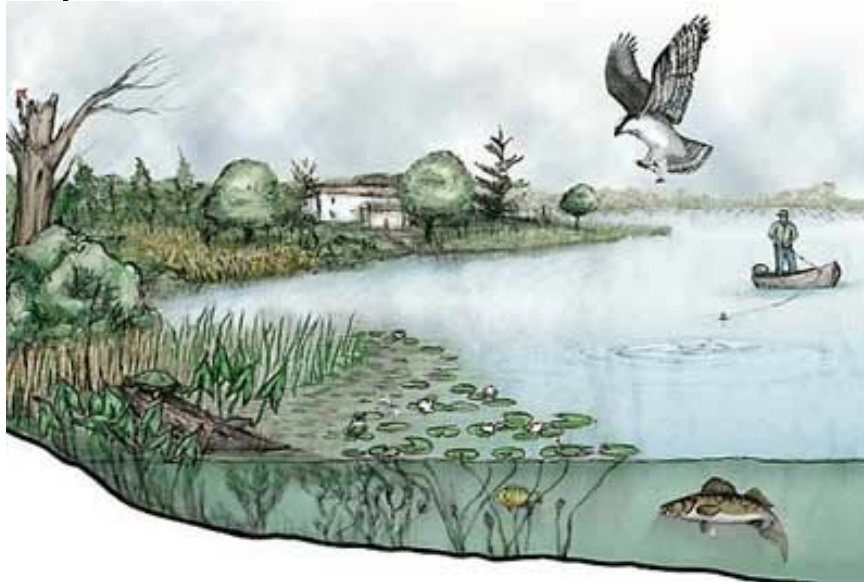
Because our planet has many diverse plants, animals and environments, **ECOLOGISTS** tend to study **SMALLER AREAS** called **ECOSYSTEMS**.

Ecosystems...

An ecosystem consists of the

- The **PHYSICAL ENVIRONMENT** or **ABIOTIC** factors.
- The **LIVING THINGS** or **BIOTIC** factors within it

At first glance an ecosystem may appear simple, even boring. Upon closer examination, you will notice the wide variety of living things present in the ecosystem.



Abiotic and Biotic Factors

Examples of **ABIOTIC** factors include:

- **WATER**
- **SUNLIGHT**
- **OXYGEN**
- **SOIL**
- **NUTRIENTS**
- **TEMPERATURE**



illustration by Jeff Grader / property of Delta Education

Examples of **BIOTIC** factors include:

- **PLANTS**
- **ANIMALS**
- **FUNGI**
- **BACTERIA**

Habitat vs. Niche

Each type of **LIVING** thing in an ecosystem has a **PLACE** in which it **LIVES**. This is known as its **HABITAT**.

The **FUNCTION** or **JOB** an organism performs in its habitat is called its **NICHE**.

*What are some **NICHES** (jobs) that organisms have?*

- Plants and algae trap the energy in sunlight and produce their own food. → **PRODUCERS**.
- Animals are **CONSUMERS** since they cannot make their own food and must obtain their food from producers.
- Bacteria and fungi are **DECOMPOSERS**. They eat dead plant and animal remains and convert them into substances that can be reused. They are the **RECYCLERS** of the ecosystem.

Energy Flow

All organisms need **ENERGY** to carry out the activities of life such as:

- **MOVING**
 - **FEEDING**
 - **REPRODUCING**
 - **GROWING**
-
- Only **PLANTS** are able to take **ENERGY FROM THE SUN** and use it to drive their activities (**PRODUCERS**).
 - Most organisms cannot take the energy from the sun and use it directly for their own purposes. Instead, they **EAT OTHER ORGANISMS** to obtain their energy (**CONSUMERS**).
 - Since organisms only eat certain other types of organisms, the trail of the **ENERGY** can be traced as it flows along from organism to organism – this can be shown through a **FOOD CHAIN**

Note: all energy in an ecosystem originates from the **SUN!**

Food Chains

A food chain shows the transfer of energy from the sun through a series of organisms.

Vocabulary Review:

TROPHIC LEVELS:

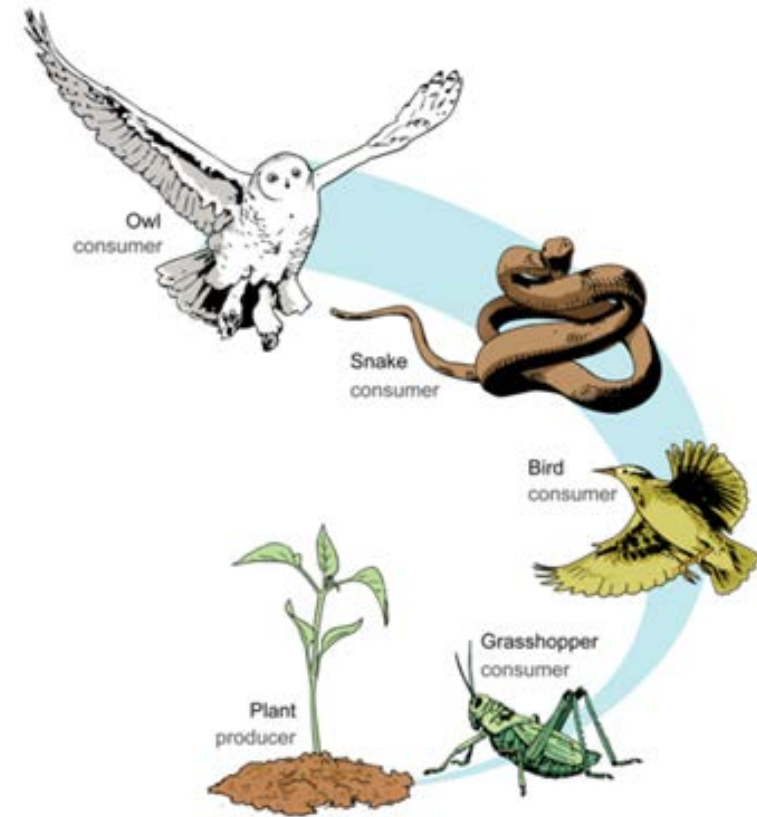
- The “**FEEDING LEVEL**” of an organism
- **CLASSIFIES** where an organism gets its **ENERGY**
- Trophic levels can be split into two categories:

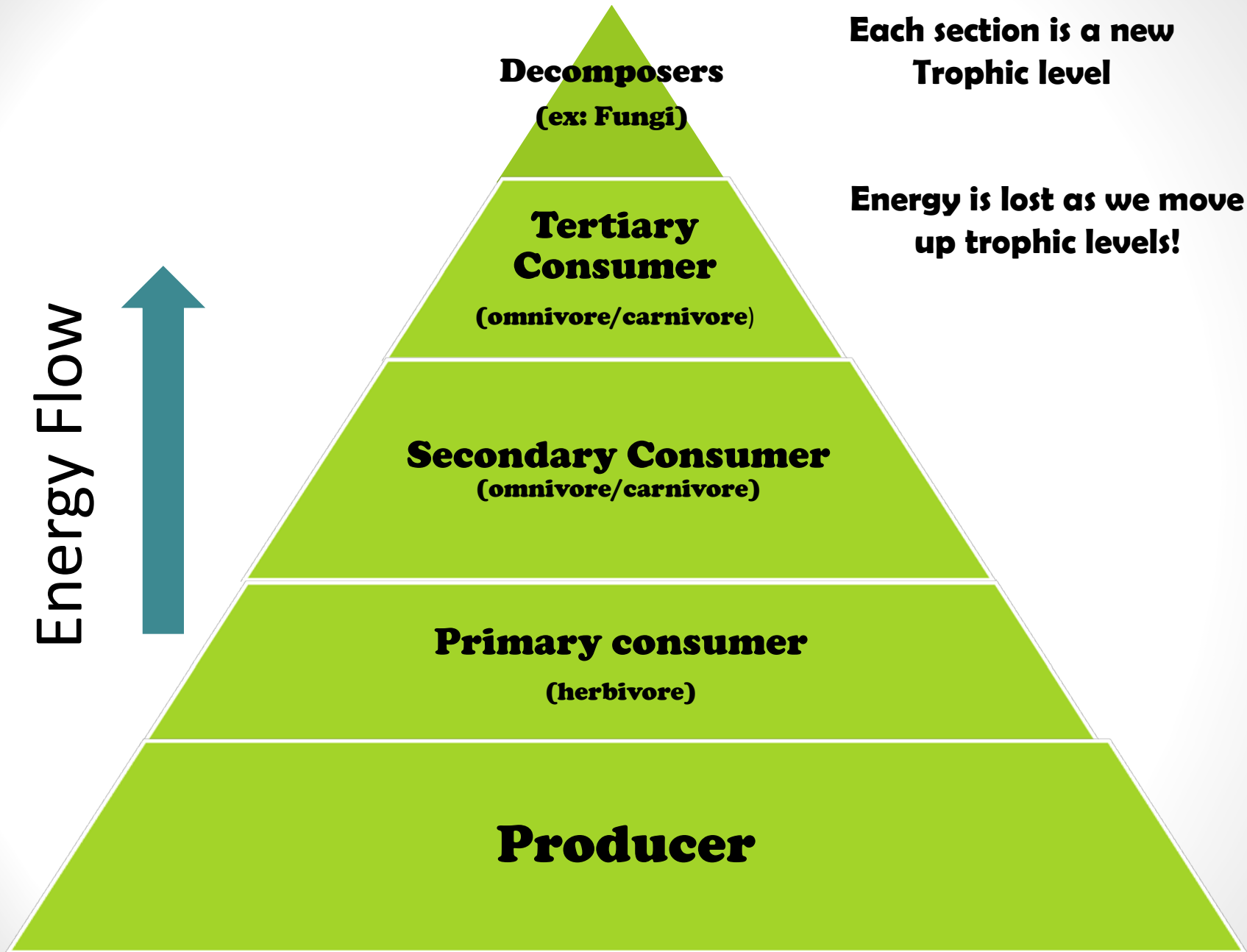
AUTOTROPHS:

- Organisms that **PRODUCE** their **OWN FOOD**
- AKA **PRODUCERS**

HETEROTROPHS:

- Organisms that **CANNOT** produce their own **FOOD** → they must **FEED** on **OTHERS**
- AKA **CONSUMERS**



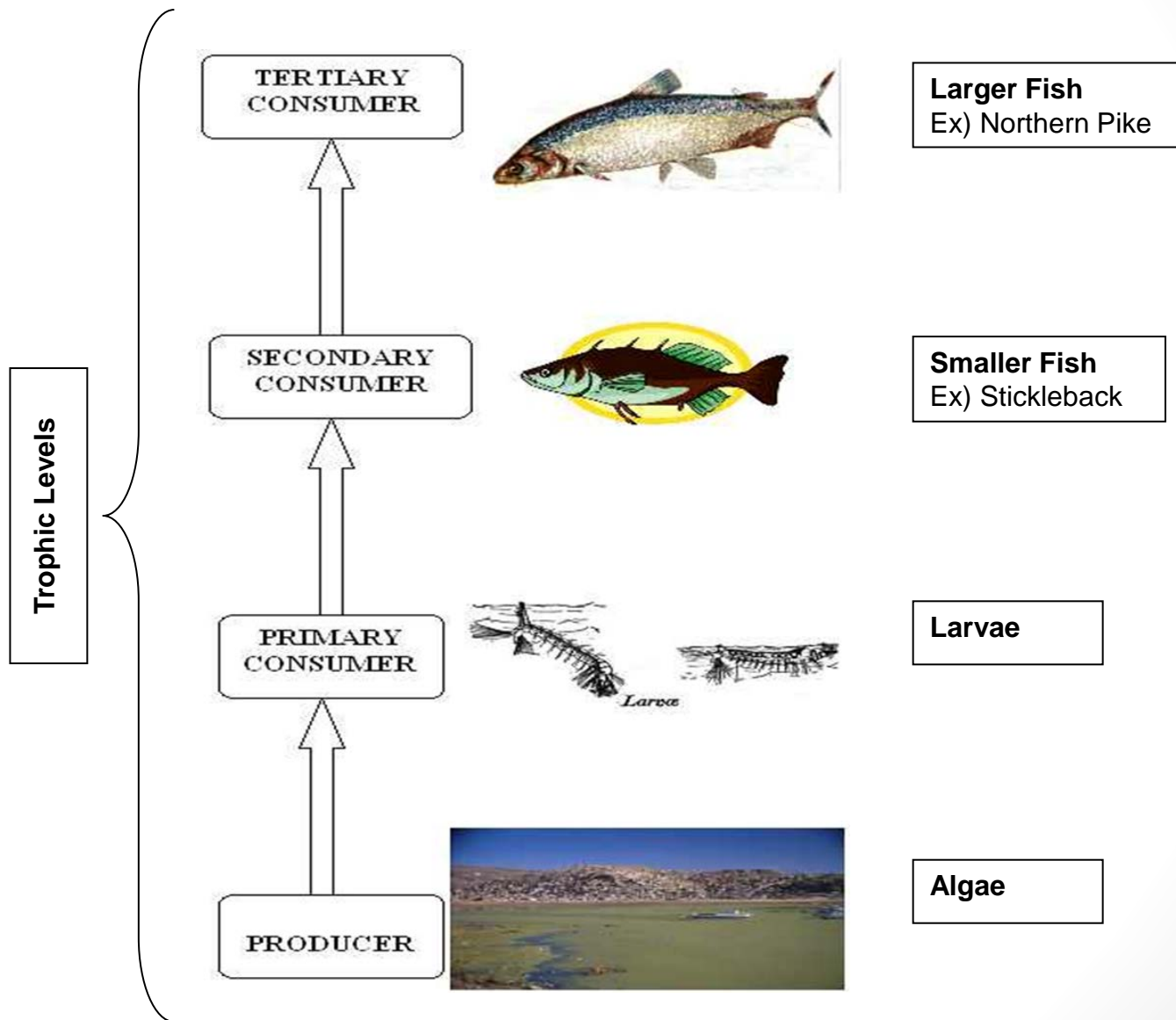


Food Chains

Unlike producers, **CONSUMERS** are unable to directly transform sunlight into organic compounds.

- **PRIMARY** (1°) consumers (also called **HERBIVORES**) feed directly on plants.
 - Examples of herbivores include **MOOSE**, **CATTLE**, **GRASSHOPPERS**, **RABBITS** and **APHIDS**.
- **SECONDARY** (2°) consumers feed on primary consumers, and **TERTIARY** (3°) consumers feed on secondary consumers.
 - These higher-level consumers (2° & 3°) are also known as **CARNIVORES**
 - Examples of carnivores include **WOLVES**, **NORTHERN PIKE**, **EAGLES**, **POLAR BEARS**, **LADYBUGS** and **SNAPPING TURTLES**.
- **SCAVENGERS** are **CARNIVORES** that feed on **DEAD** animals
 - Examples of scavengers include **BLOWFLIES**, **TURKEY VULTURES**, **EAGLES**, **SEAGULLS** and **RAVENS**.

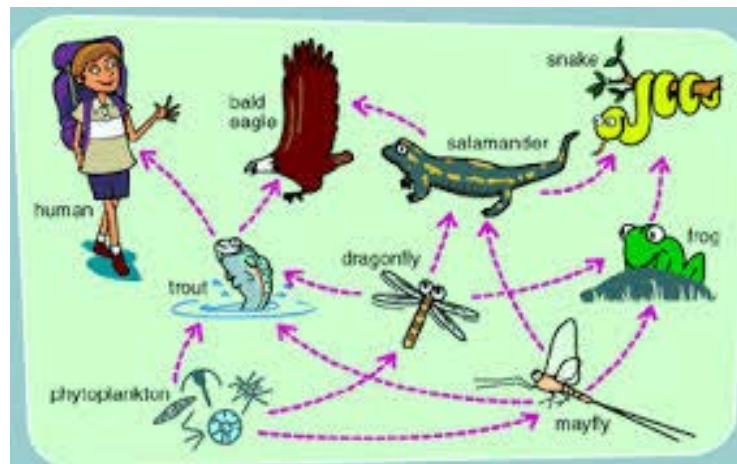
Example Food Chain



Food Webs

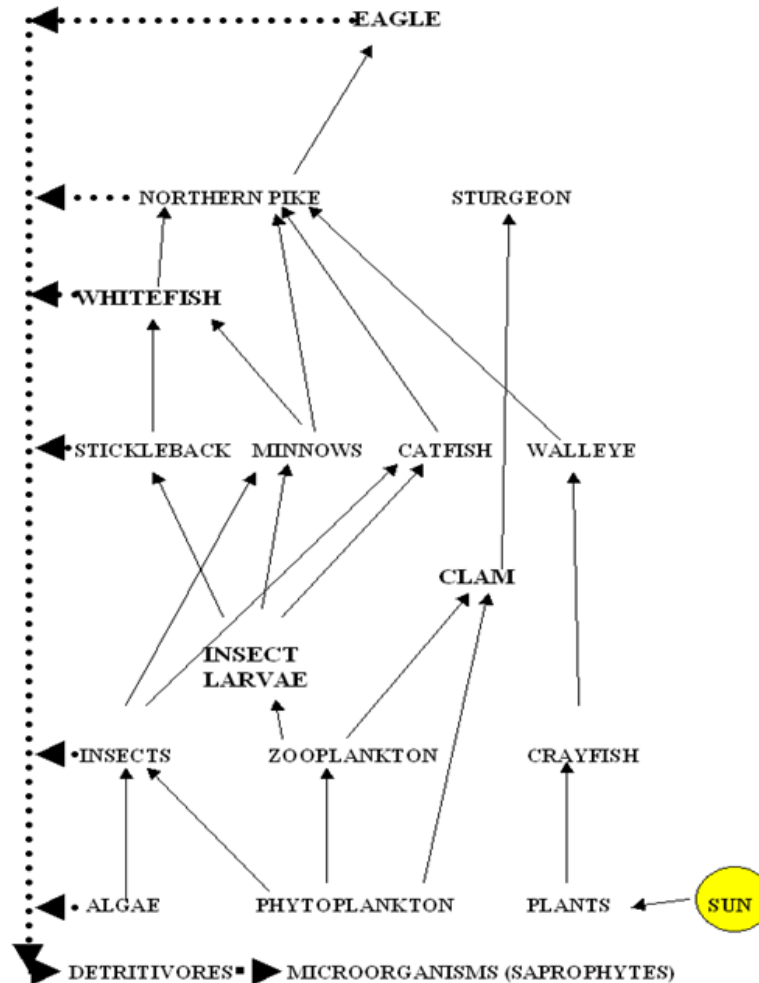
Because animals typically feed on more than one type of organism, food chains become **CONNECTED** in a **COMPLEX** relationship known as a **FOOD WEB**. (A food web is many food chains that are connected together).

- Food Webs are **MORE REALISTIC** than food chains.
- The **ARROWS** show how the sun's **ENERGY FLOWS** through an ecosystem from the sun, to producers, to consumers, and to decomposers.
- Because plants and animals **DIE AT ALL POINTS** in food chains, **DECOMPOSERS** are found at **ALL** trophic levels in ecosystems.

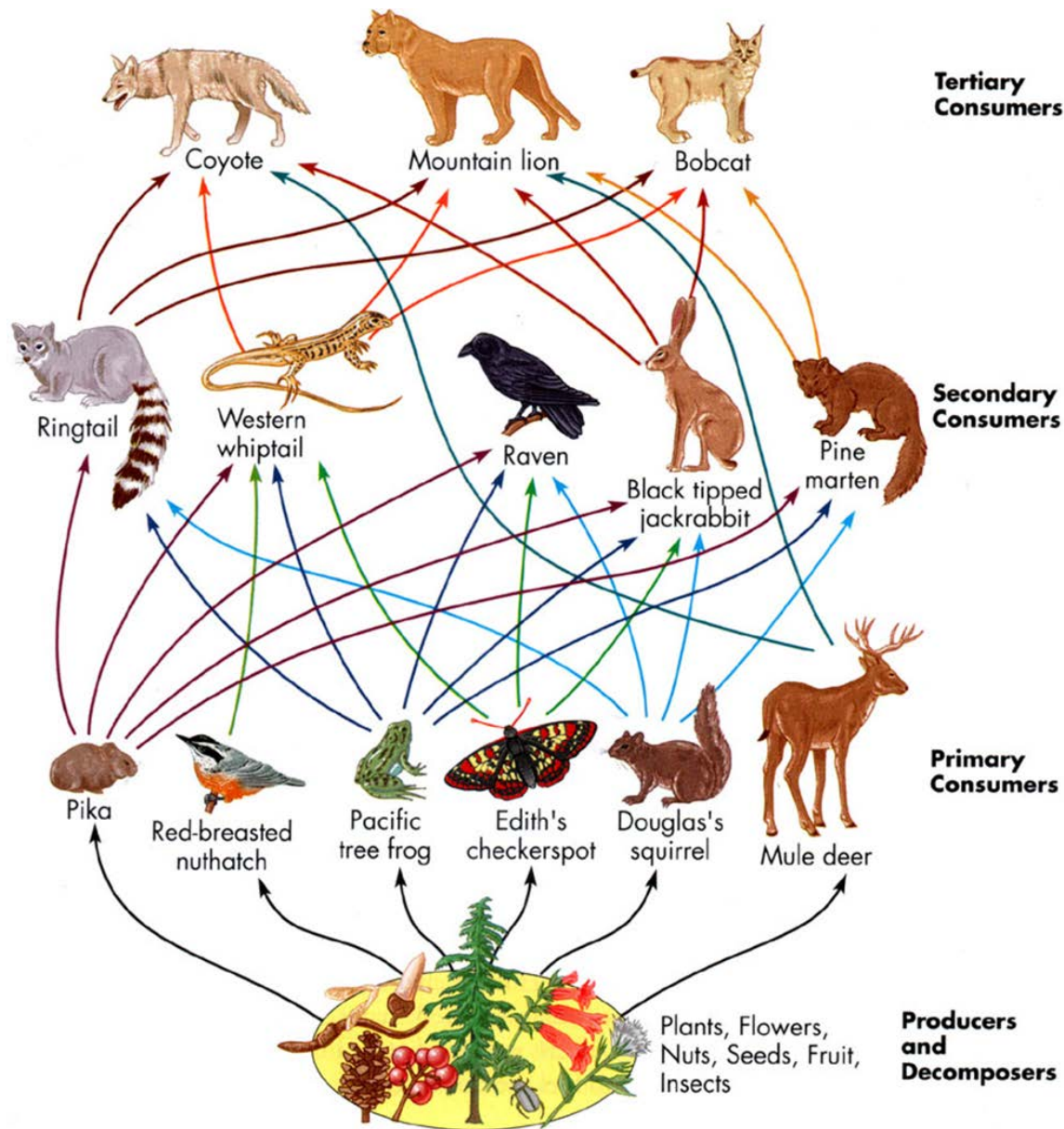


Food Webs

The diagram below shows the food web of the Lake Winnipeg ecosystem.

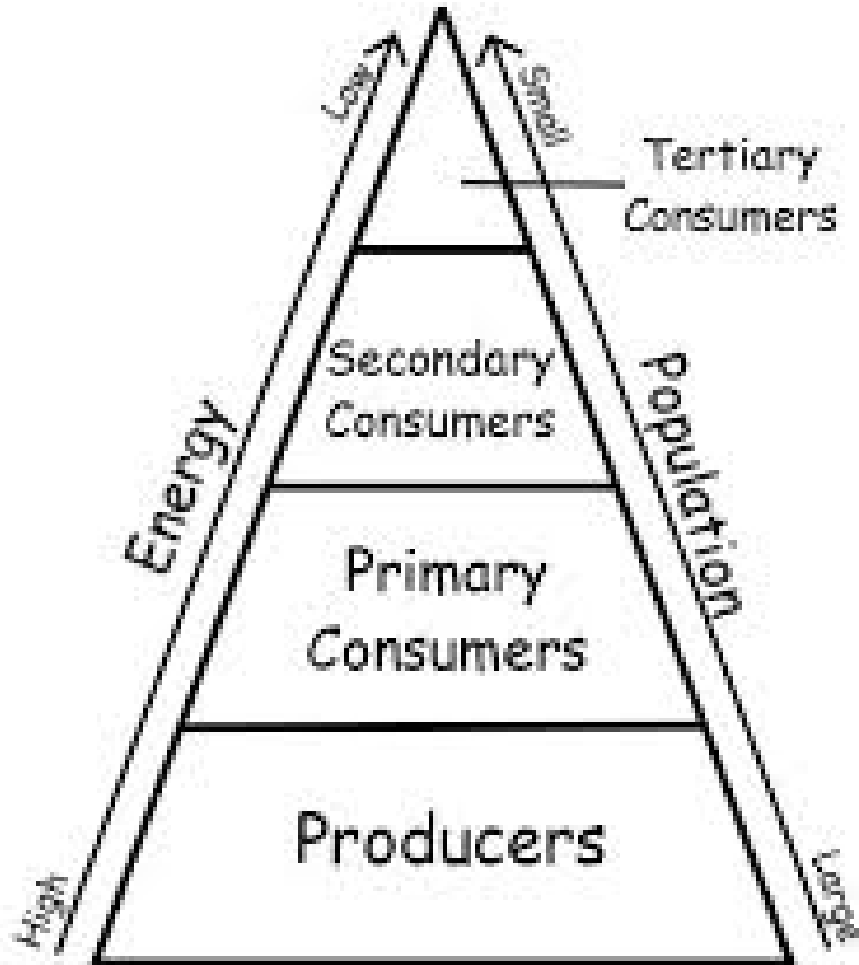


Food Webs



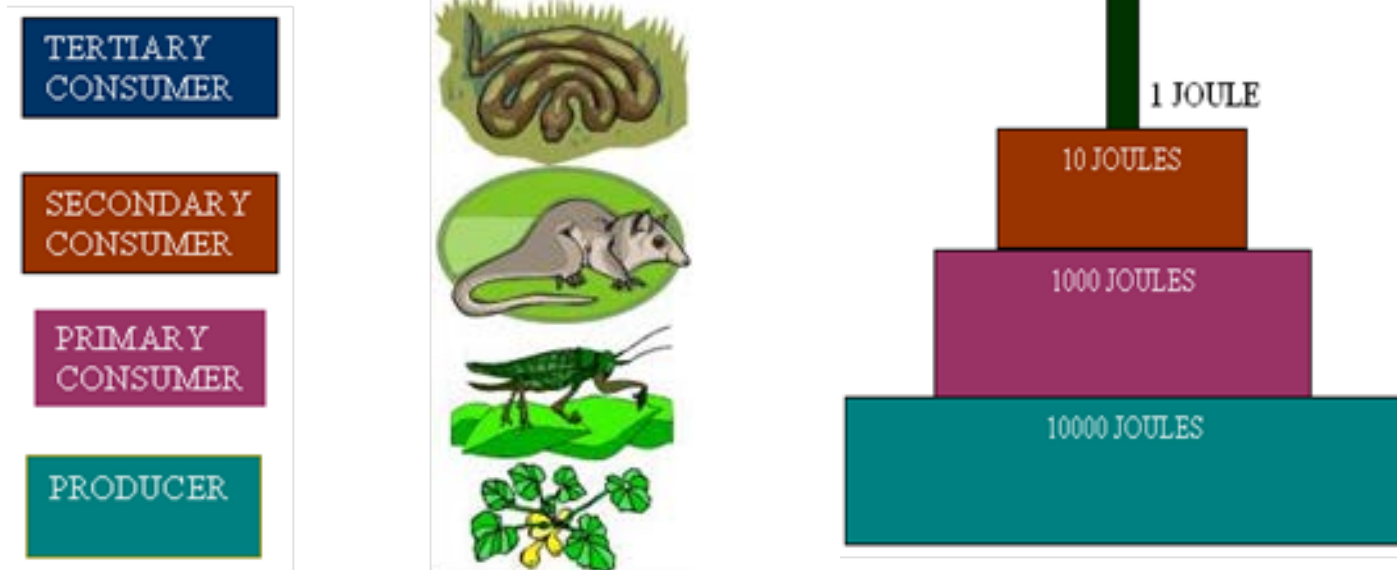
Ecological Pyramids

- Ecologists use **ECOLOGICAL PYRAMIDS** to describe the **ENERGY FLOW** and **BIOMASS** among the trophic levels.



Energy Pyramids

- This pyramid shows the relative **AMOUNTS** of **ENERGY PASSED ON** from level to level.



- Only **10%** of the **ENERGY** is **PASSED ON** from one **TROPHIC LEVEL** to another.
- This is because **NOT ALL** of the **ENERGY** that an organism takes in is transformed into **FOOD**. Energy is used by the organism for a variety of life processes such as:
 - BREATHING**
 - TRANSPORTING MATERIALS**
 - MOVEMENT**
 - REPRODUCTION**

Pyramid of Biomass

This pyramid shows the **TOTAL AMOUNT** of **LIVING MATERIAL** available at each trophic level.



- The area at the **BOTTOM** of the biomass pyramid corresponds to the **PRODUCER** level. This represents the **GREATEST** amount of living material.
- You should note that a pyramid of biomass does **NOT** follow the 10% rule that a pyramid of energy does.

Pyramid of Biomass

For example, in an ecosystem it takes a **LARGE** amount of producers such as plants to support a **SMALL** number of herbivores such as moose. The number of carnivores such as wolves that can be supported by the moose is even **SMALLER** yet.

