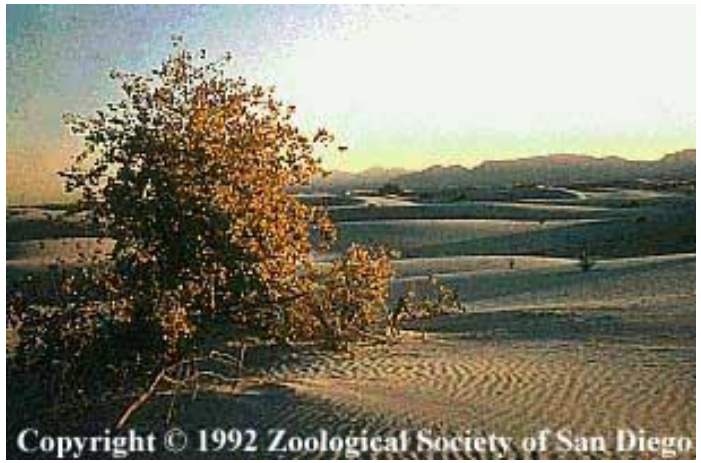
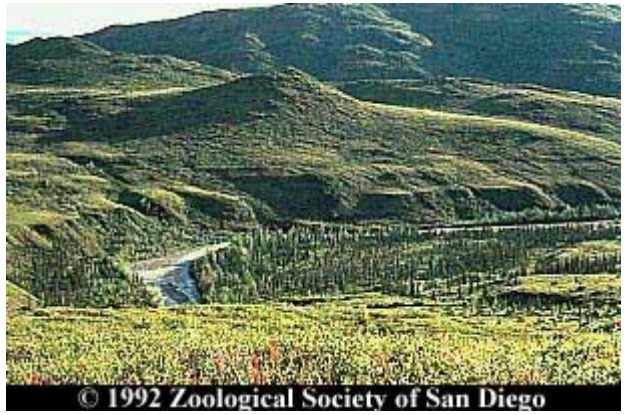
UNIT III ECOSYSTEMS

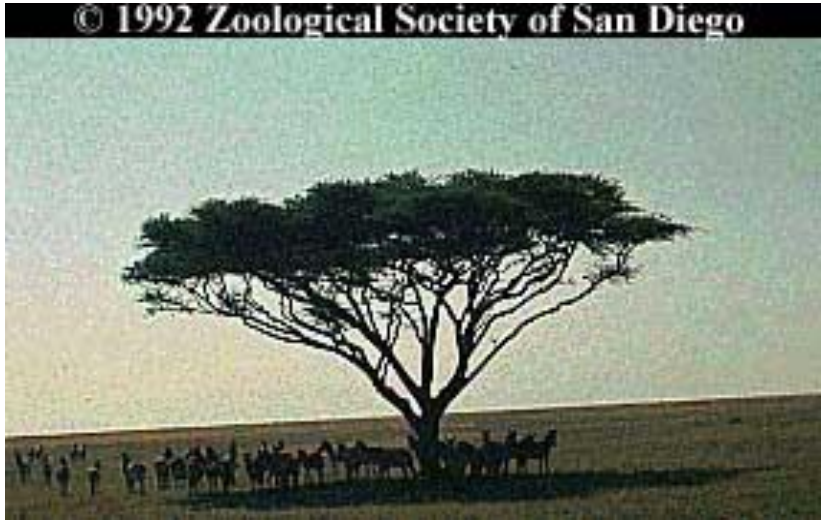




Ecosystem Basics

- **Ecosystem**: the network of relationships among plants, animals and the non-living things in an environment.

Savannah- Africa



Organisms in an Ecosystem

- PRODUCERS
- CONSUMERS
- DECOMPOSERS

Producers and Consumers

- A **producer** is a plant which can make carbohydrates using carbon dioxide and the sun's energy.
- Producers are so named because they actually produce the food for the ecosystem.
- EXAMPLES: Grass, trees, flowers, etc.

- **Consumers** are so named because they have to eat or consume their food.
  - **Primary consumers** eat producers.
  - **Secondary consumers** eat primary consumers.
  - **Tertiary consumers** eat secondary consumers.

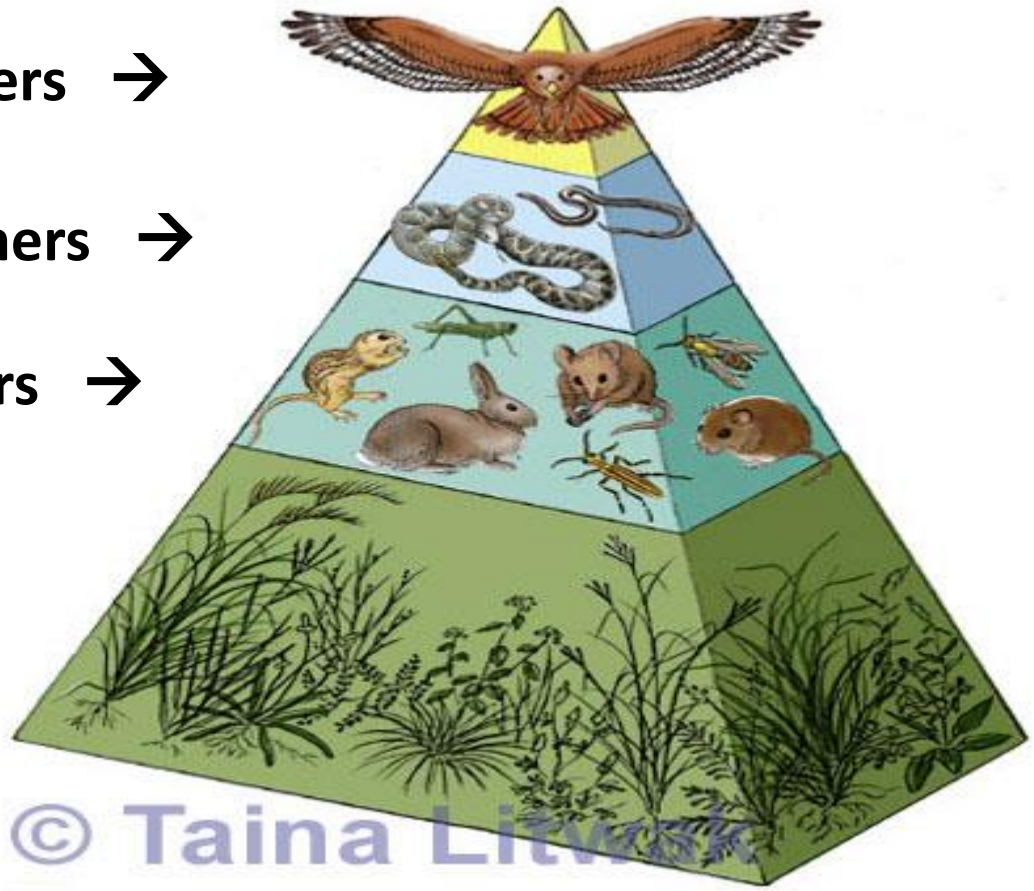
A Food Pyramid Showing Producers and Consumers

Tertiary Consumers →

Secondary Consumers →

Primary Consumers →

Producers →



Decomposers

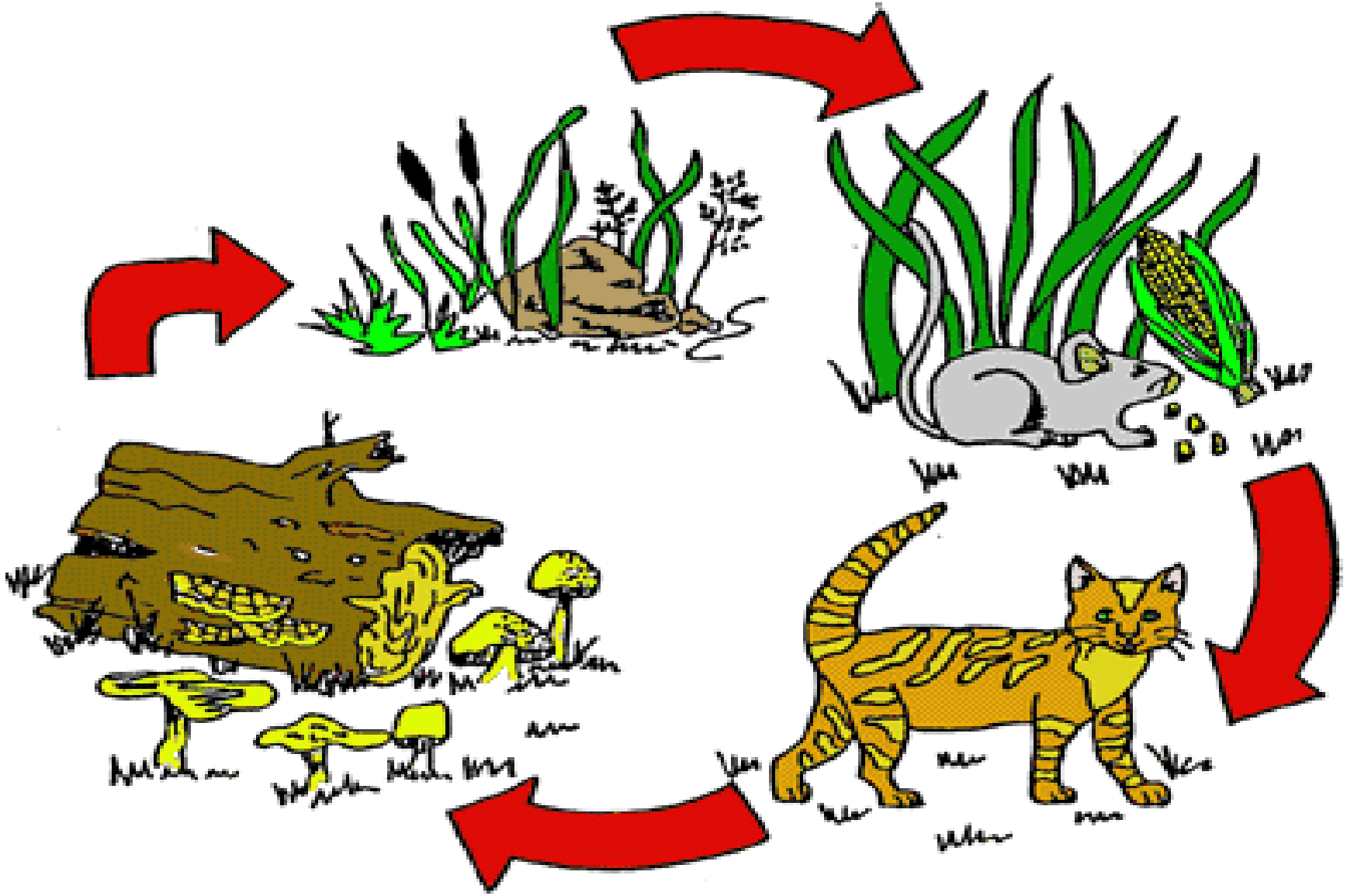
- **DEFINITION:** Simple organisms that get their food from dead organisms and wastes.

- In any ecosystem, the job of decomposers is to break down dead materials and help them to compost.

- EXAMPLES: Worms, insects, bacteria.

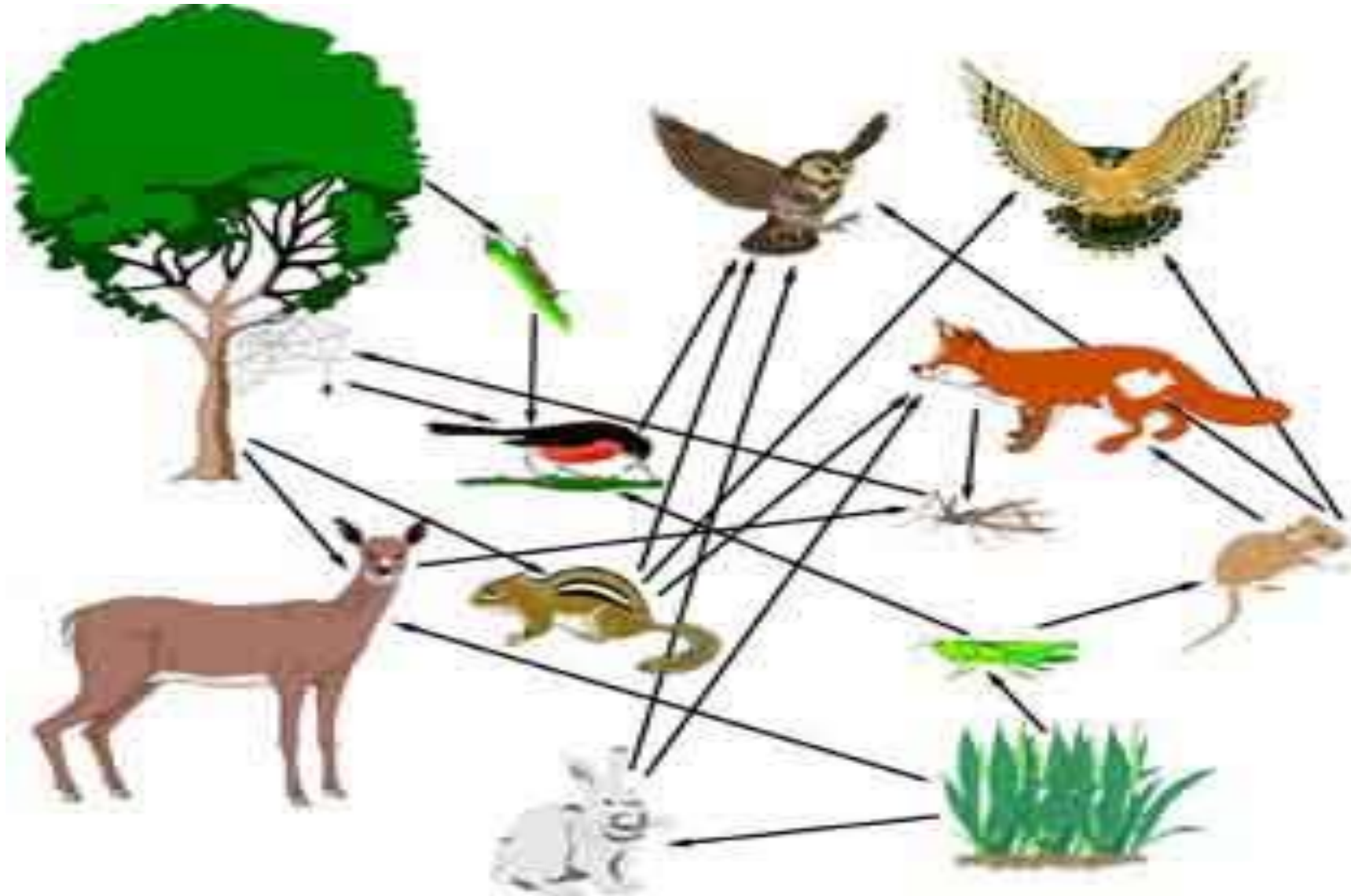
Food Chains & Food Webs

- **Food chain**: A set of steps showing the flow of energy & nutrients from the simplest plant to the top carnivore.
- **EXAMPLE:**
  - Grass → Rabbit → Fox→ Hawk
    - Producer: Grass
    - Primary consumer: Rabbit
    - Secondary consumer: Fox
    - Tertiary consumer: Hawk



Food Chains & Food Webs

- **Food web**: a series of interconnecting food chains in an ecosystem.
- Figure 6.4 on page 95 of your text book depicts a food web in a temperate deciduous forest.
- **Similarity**—both food chains and food webs show the flow of nutrients and energy in an ecosystem.
- **Differences**—Food webs are:
  - more complex
  - made up of several food chains
  - a more realistic picture of an ecosystem.



Energy Flow in an Ecosystem

- Using figure 6.5 on page 95 you can summarize the main energy flows in an ecosystem:
  - the Sun is the source of all ecosystem energy;
  - producers make food via photosynthesis;
  - consumers eat plants and other consumers to get energy;
  - each time energy moves from one organism to another, energy leaves the system in the form of heat;
  - decomposers return nutrients to the soil but energy is not recycled.

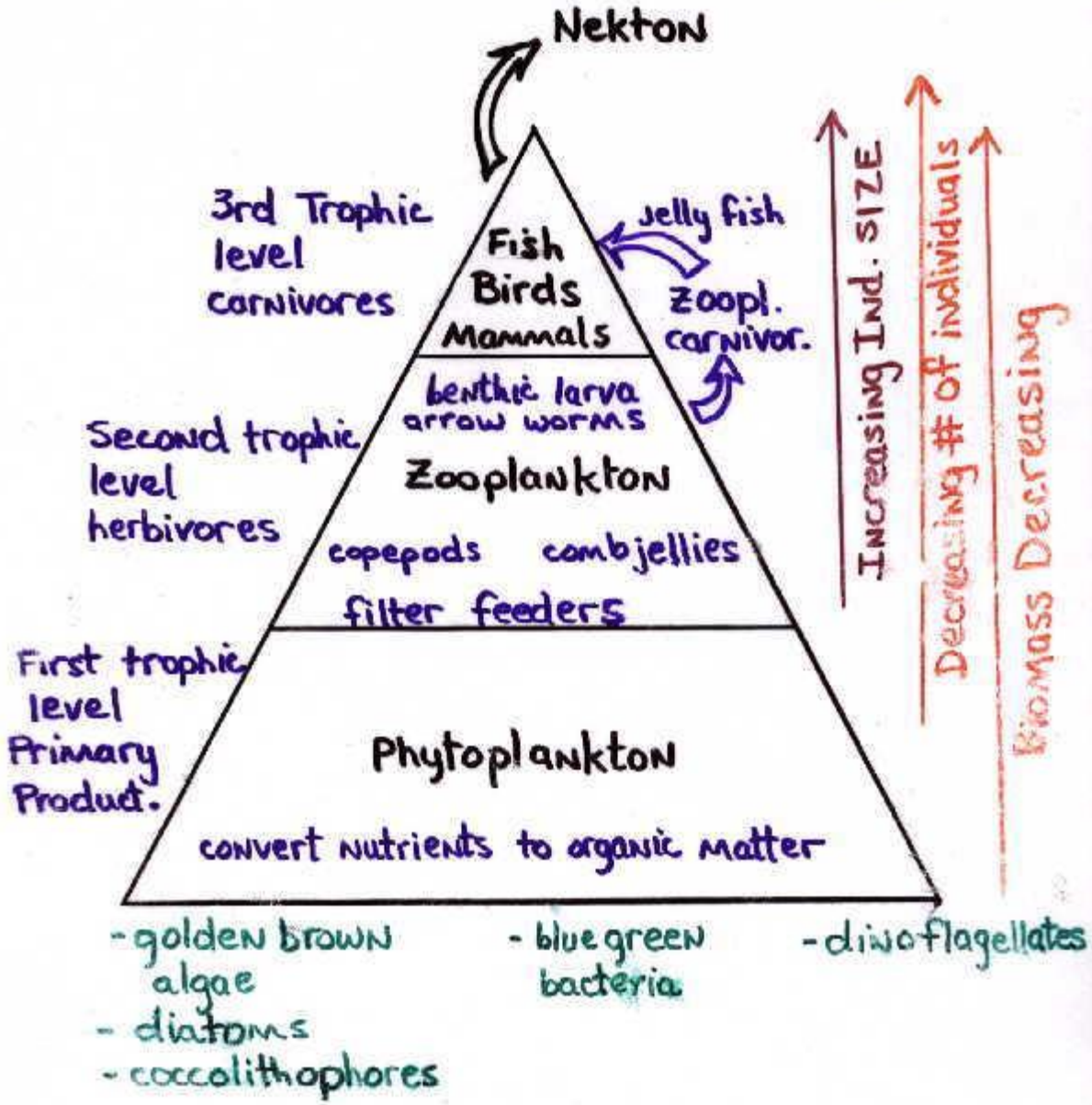
Ecosystem Balance & Food Pyramids

- You will need to understand the following concepts:
  - 3.2.1 Define the term biological amplification. (k)
  - 3.2.2 Explain why there are fewer organisms at each trophic level. (k)
  - 3.2.3 With reference to a food pyramid, explain how pesticides can reach toxic levels for organisms at a higher trophic level.
  - 3.2.4 Predict the effect on an ecosystem of the introduction of a new organism. (i)

Food Pyramids

- Diagrams showing each **trophic level (levels of producers and consumers)**
- Producers are located on the bottom at the widest part because there will be more of them.
- As you move up the pyramid, the numbers of consumers at each level decreases.

Oceanic Food Chain



Pyramid of Numbers

- There are fewer organisms at each increasing trophic level:
  - **less energy available** at each increasing level;
  - fewer organisms can obtain energy to live;
  - therefore fewer organisms at increasing levels.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Pyramid of Energy

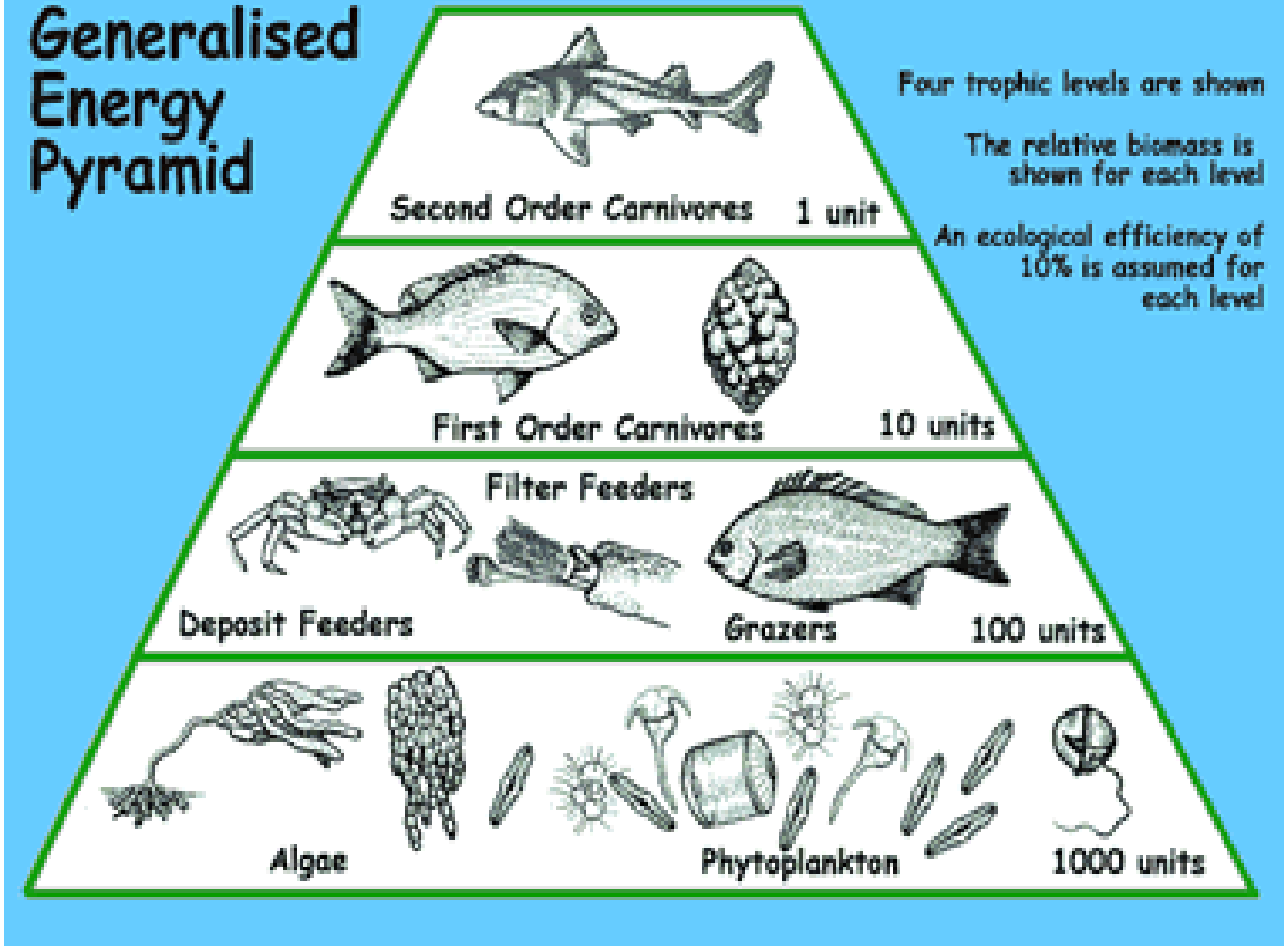
- There is a **high degree of energy loss** at each trophic level.
  - The producers only store **1% of the sun's energy** as food energy.
- Each consumer level loses energy AS YOU GO UP the pyramid.

- **Every consumer level loses energy for several reasons:**
  - much of the energy is **lost as heat**
  - most of the energy is **used to carry out life functions**. EX: we burn many calories of energy each day…so do all organisms
  - if an organism dies without being eaten, the energy goes to the decomposers and not up the trophic levels;
  - so only about **10-15%** of the energy is stored as usable food energy at each level.

Ex: Start with 1000 units of energy

- Producer: Stores 100-150 units of food energy- gets eaten by a primary consumer.
- Primary consumer: Stores 10-15 units- gets eaten by a secondary consumer.
- Secondary consumer: Stores 1-1.5 units- gets eaten by the a tertiary consumer.
- Tertiary consumer: Usually on top of the pyramid because they wouldn’t store enough energy for another consumer.

Generalised Energy Pyramid



Four trophic levels are shown

The relative biomass is shown for each level

An ecological efficiency of 10% is assumed for each level

Magnification of Toxin Levels

- When it comes to toxins/poisons, the opposite effect is true.
- **Biological Amplification:** higher trophic levels receive a higher dose of food chain toxins.

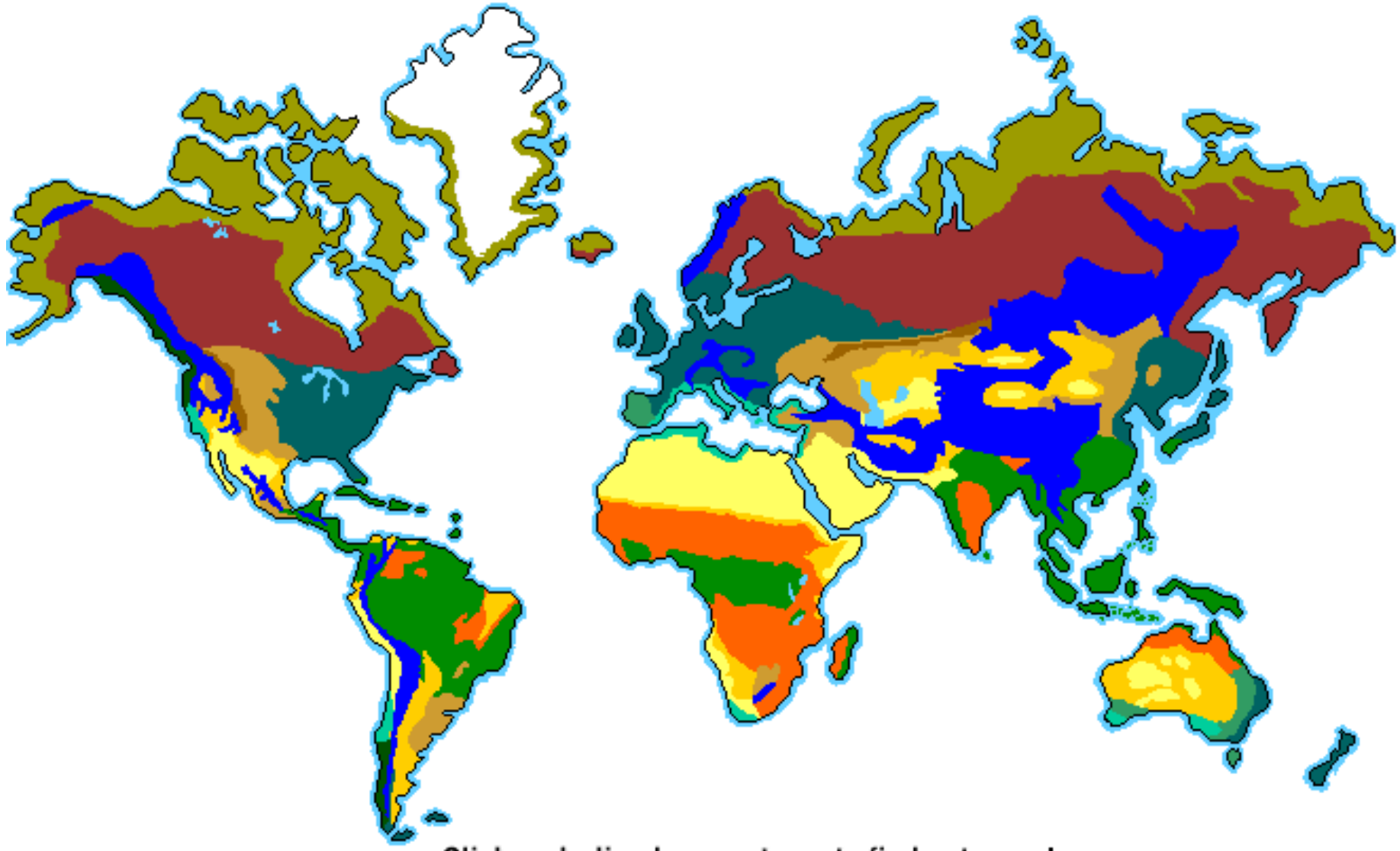
Upsetting the Balance

- Ecosystems are in a very delicate balance. Changing one thing in the ecosystem will have effects through the system because of the relationships that exist.

    - Question #13 on page 98 is about a pond ecosystem with blue gill sunfish. This is a sample question.

Any question could be asked where we have to predict possible outcomes. Question #14, 15 & #16 p. 98 make perfect review questions for the test.)

"Balance in the Ecosystem" Lab



Click underlined ecosystems to find out more!

- Tropical Rainforest
- Grasslands
- Desert
- Deciduous
- Tundra
- Coniferous Forest (Taiga)
- Chaparral
- Savanna
- Alpine

Climax Vegetation and Biomes

- This is the **most dominant vegetation in an ecosystem.**
  - Is **fits in with the climatic conditions**.
  - It should **change very little if left undisturbed**.
- You can usually tell an ecosystem by the climax vegetation found there.
- Climax vegetation depends on the climate of an ecosystem.
- **What is a biome?**
  - A biome is **a very large ecosystem** e.g. Tropical Rainforest.

World Ecosystems
3 systems we will look at:

- **High Latitude…furthest from the equator.**
- **Mid Latitude Ecosystems**
- **Low Latitude…closest to the equator.**

- **In each we will discuss:**
  - **climax vegetation**
  - **location**
  - **adaptations (plants & animals)**
  - **climate.**

High Latitude Ecosystems

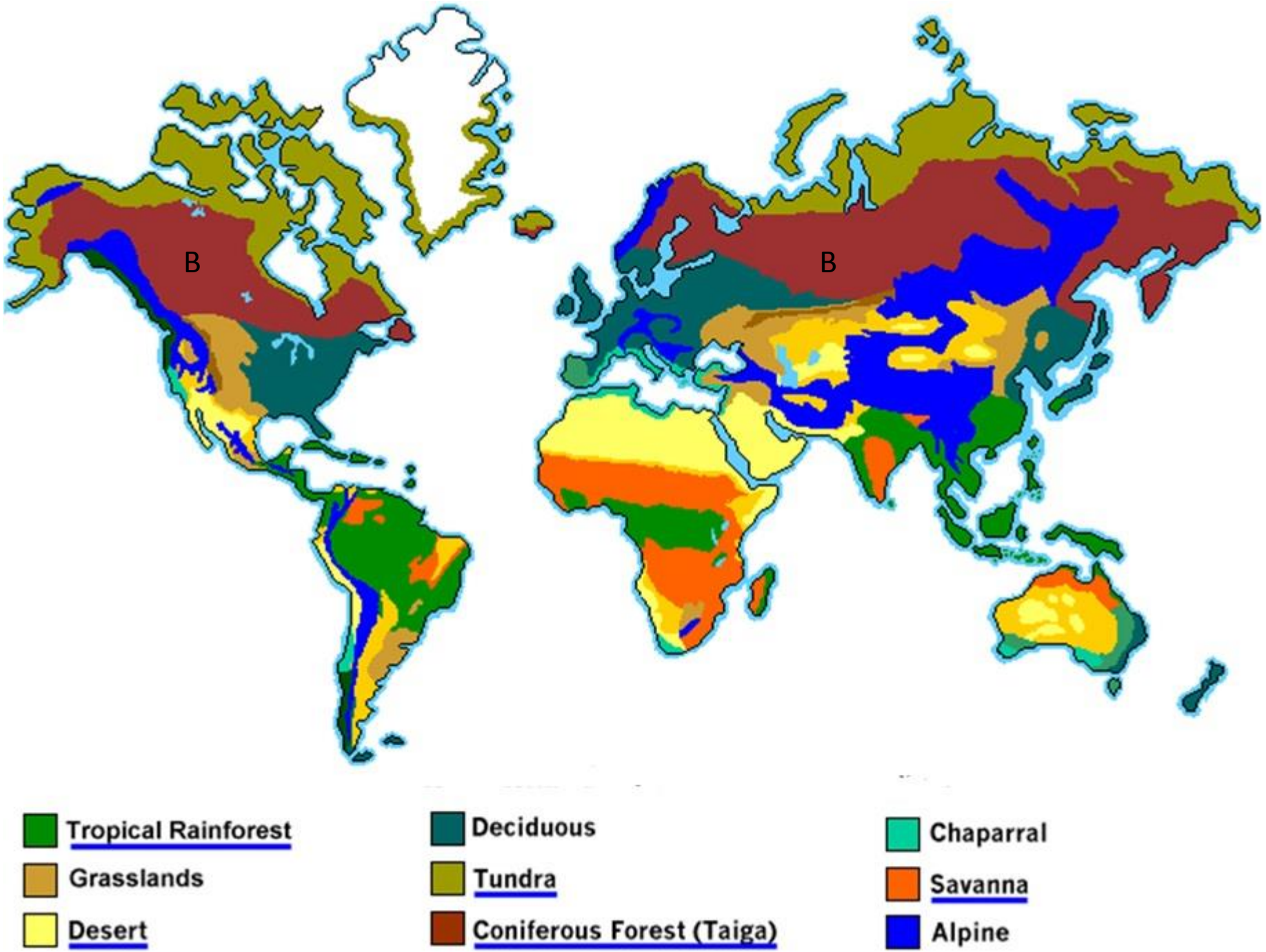
- three major type of ecosystems found in **high latitude regions**:
  - **Coniferous (Boreal) Forests**
  - **Tundra**
  - **Polar Ice Caps**

Coniferous (Boreal) Forests

- ***Climax vegetation…*****evergreen trees** with:
  - needle-like leaves
  - thick bark
  - conical shape
  - dense growing (close together) which blocks sun.

Coniferous (Boreal) Forests

- ***Location***:
  - **Northern Hemisphere only**
  - located in a broad band **across Northern North America and Northern Europe**.
    - Shown in the following map as **dark red and 'B'.**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Grasslands
Desert
Deciduous
Tundra
Coniferous Forest (Taiga)
Chaparral
Savanna
Alpine

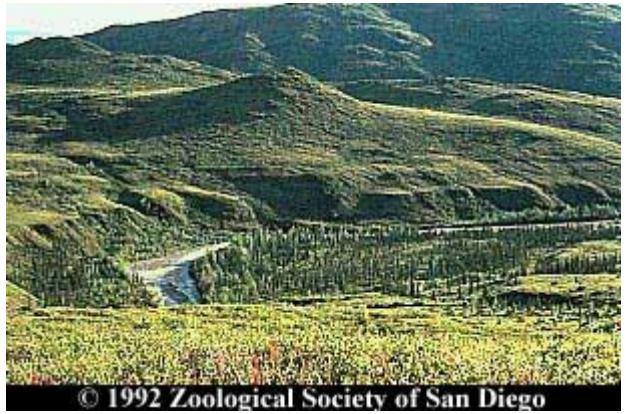
Coniferous (Boreal) Forests

- Coniferous trees are well ***adapted*** **to lack of water in winter** (it is all frozen):
  - **needle leaves:** protect the tree and help keep from losing water.
  - **drooping branches** and **conical shape** allow heavy snow to fall off
  - **thick bark** reduces water loss.

- ***Climate***: **temperate cold winter**.
  - Warm summers, winters below -3˚C.

Tundra

- ***Climax vegetation*…grasses, shrubs and low plants** with shallow roots.
- Because the summers are short, plants need to use the sunshine they get to grow quickly.
- ***Location:***
  - **Northern Hemisphere only**
  - located **north of the Boreal forest. (marked ‘T’ on the map that follows)**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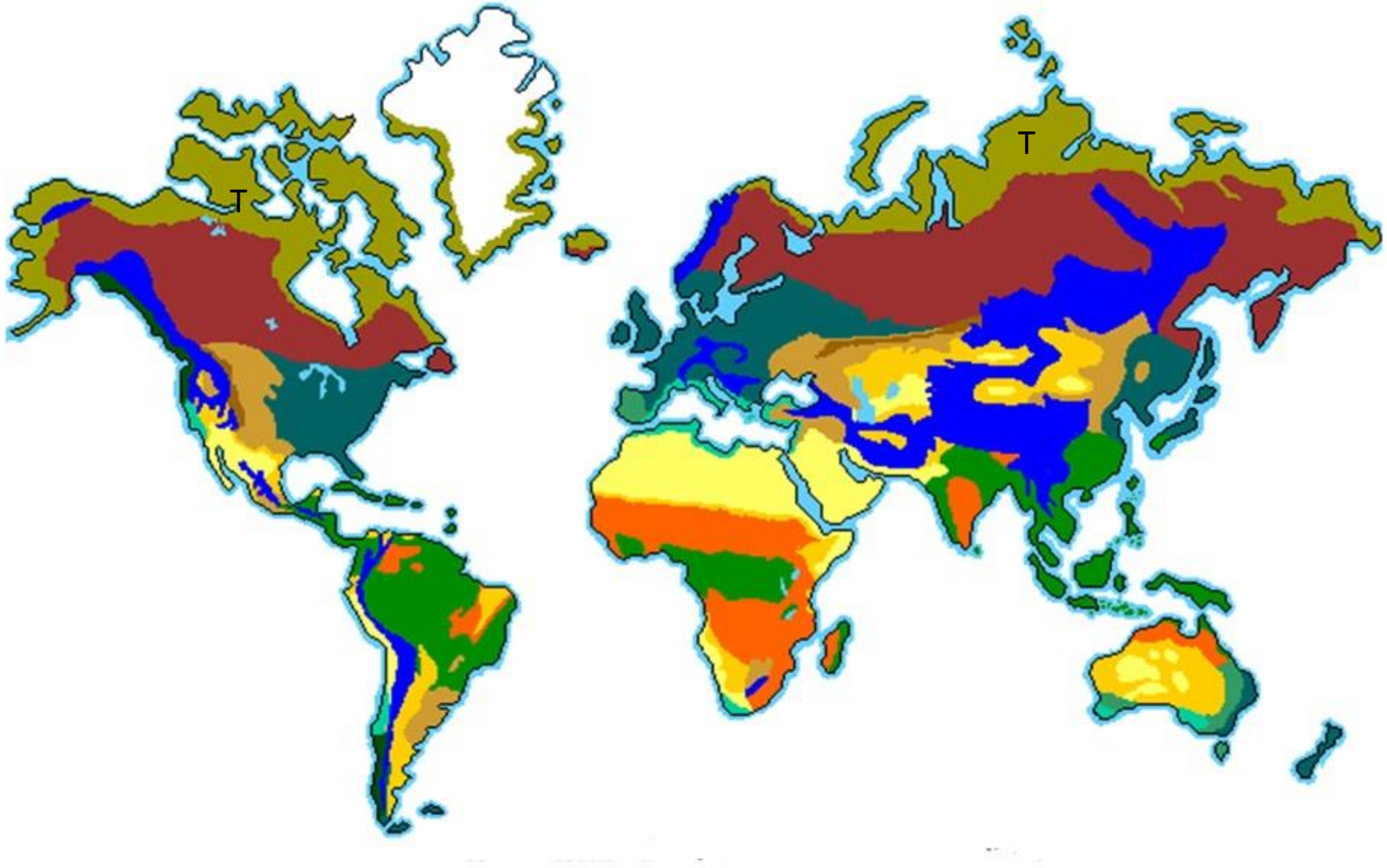
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Tropical Rainforest
Grasslands
Desert
Deciduous
Tundra
Coniferous Forest (Taiga)
Chaparral
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Alpine

Tundra

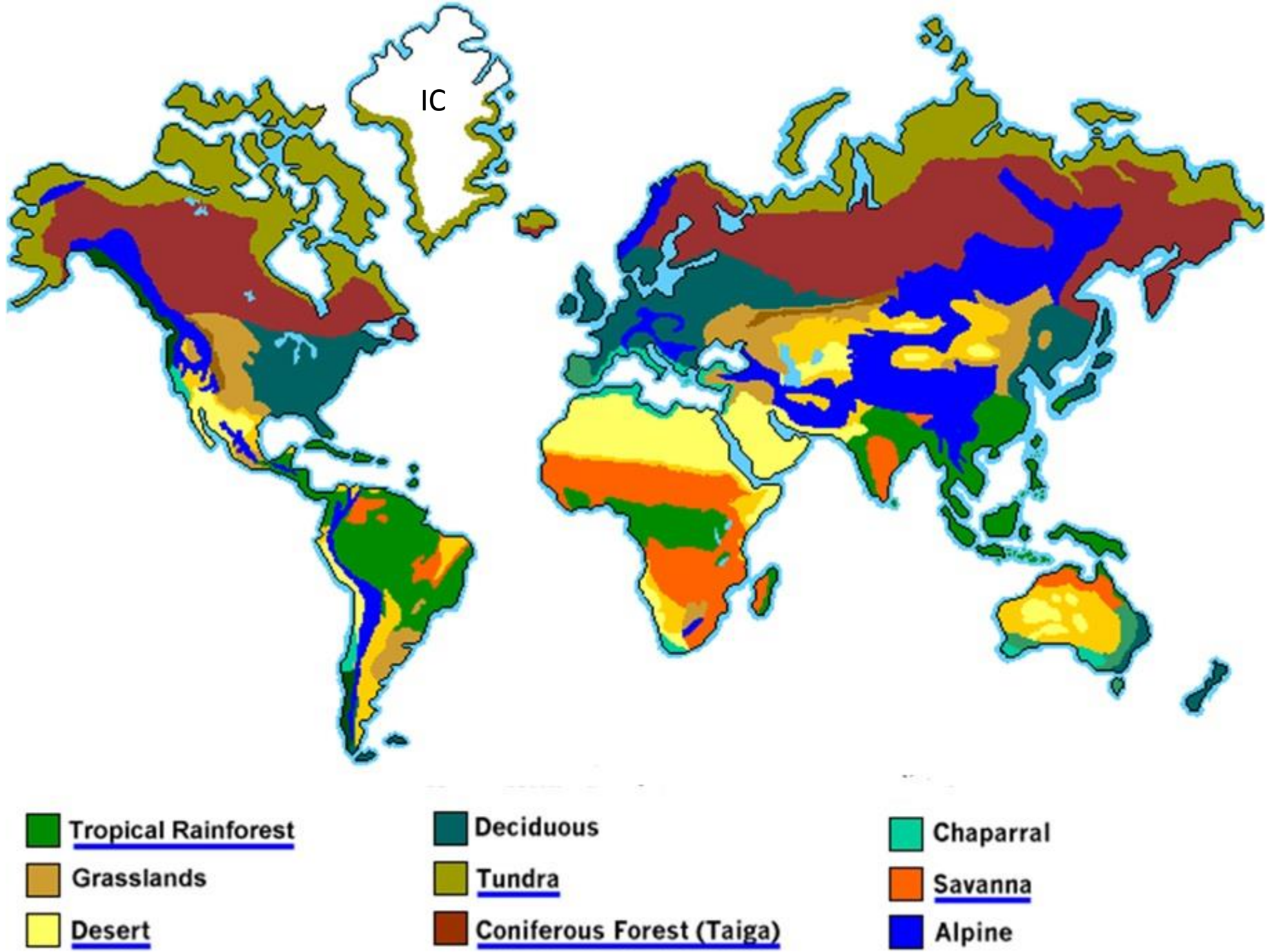
- Plants are well ***adapted*** to the long winters and short summers:
  - **shallow roots** are needed because **1-3 meters below the surface the soil is completely frozen** (Permafrost)
  - the **fast growing cycle** is needed: growing season is only 1-2 months.

- Animals have developed ***adaptations*** to the harsh Tundra climate:
  - **Hibernation** from the cold winter
  - **Migration:** Animals like caribou and birds move south for the winter for food and warmth.
  - **Thick fur and fat insulation**: For polar bears and other mammals
  - **White fur/feathers** to help with camouflage.

- **Climate**: found only in the tundra that it is called **Tundra climate**.

Polar Ice Caps

- **Climax Vegetation: Phytoplankton** beneath the ice.
  - There is no land for plants, so these creatures become the producers for the food pyramid.
- ***Location***: in **both hemispheres** in places like Northern Canada and Antarctica.
- **Adaptations:** same as for the Tundra.
- **Climate:** Polar climate…always below 0˚C.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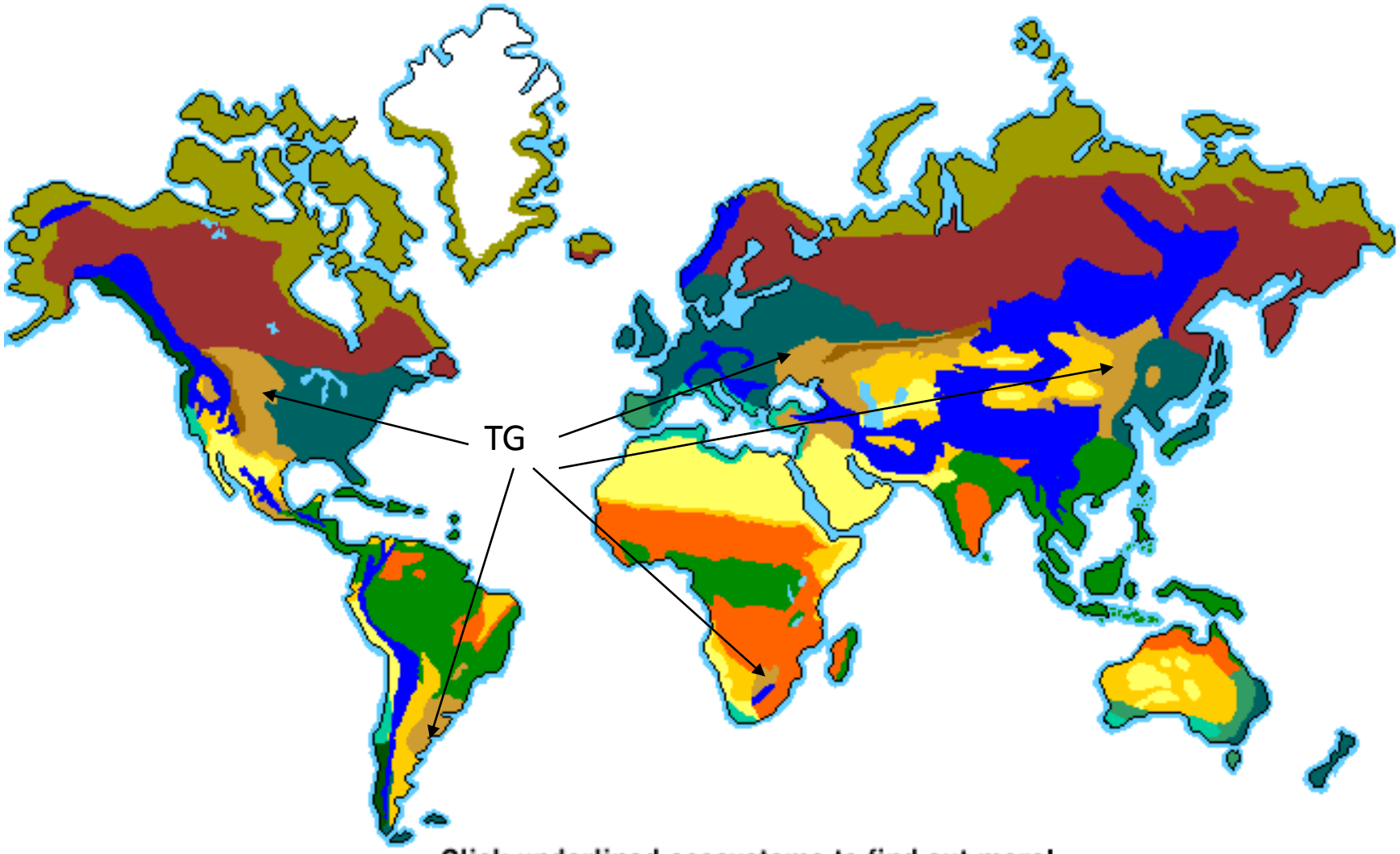
Alpine

Mid Latitude Ecosystems

- **Temperate Grasslands**
- **Temperate Deciduous Forests**

Temperate Grasslands

- ***Climax vegetation…*grass** that:
  - **Has shallow roots**
  - **Doesn't need much water.**
- ***Locations***: North America, South America, Australia and Europe/Asia (noted on next slide)
- ***Adaptation:*** Grasses use less water because they are small in size so they don't need much.
- ***Climate***:
  - **semi-arid** in most locations (closer to the equator)
  - **temperate cold winter** in some locations (further from the equator)



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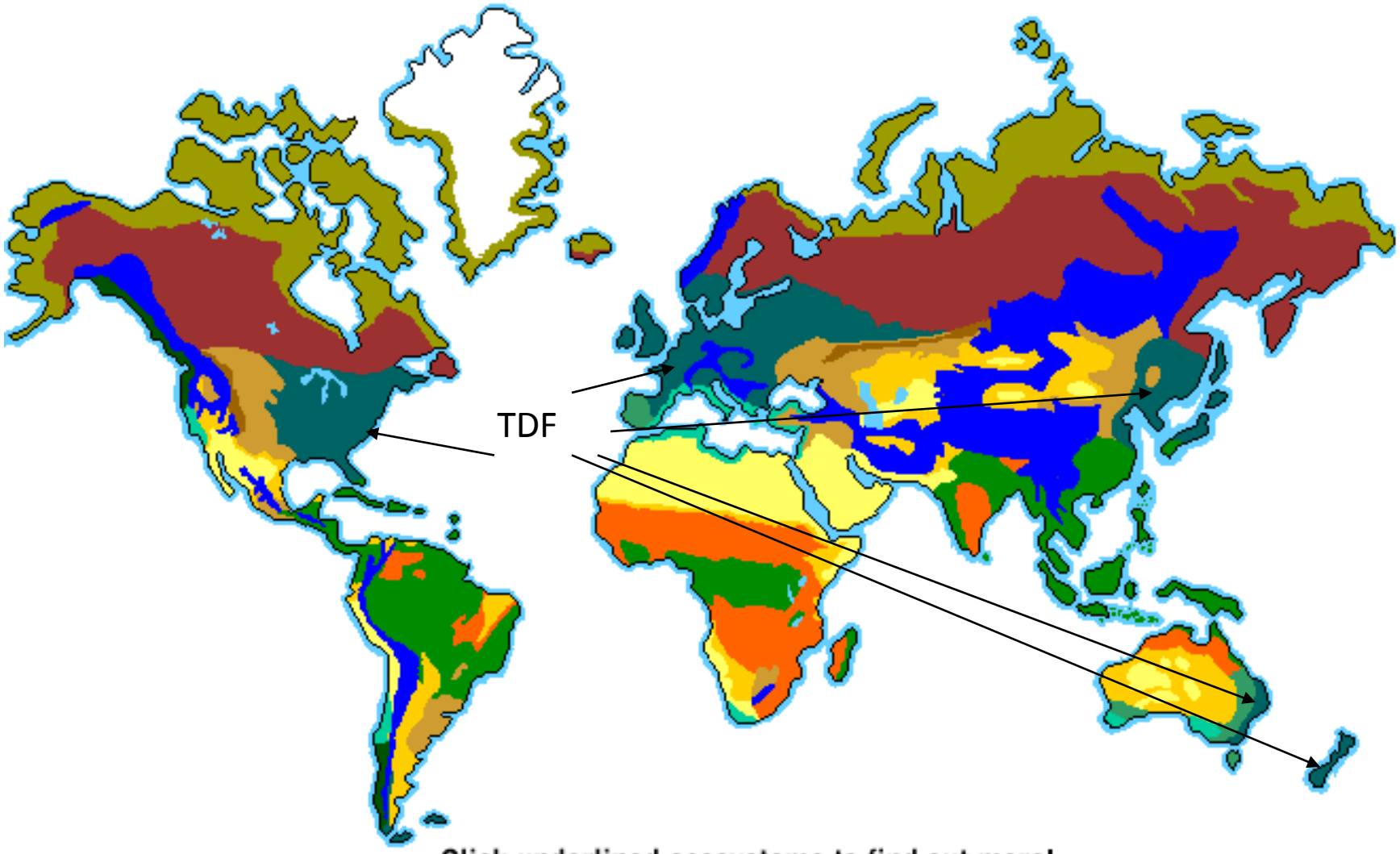
U.S. Fish and Wildlife

Temperate Deciduous Forests

- ***Climax vegetation:*** deciduous trees like **oak, birch and maple** which lose leaves in fall/winter.
- ***Location:*** mainly in North America and South America but is present in Australia and Europe and Asia.
- ***Adaptation:*** Deciduous trees lose their leaves in winter and this helps them reduce water loss because they lose most of their water through their leaves.
- ***Climate***: **temperate mild winter.**
  - Warm summers, winters warmer than -3˚C.



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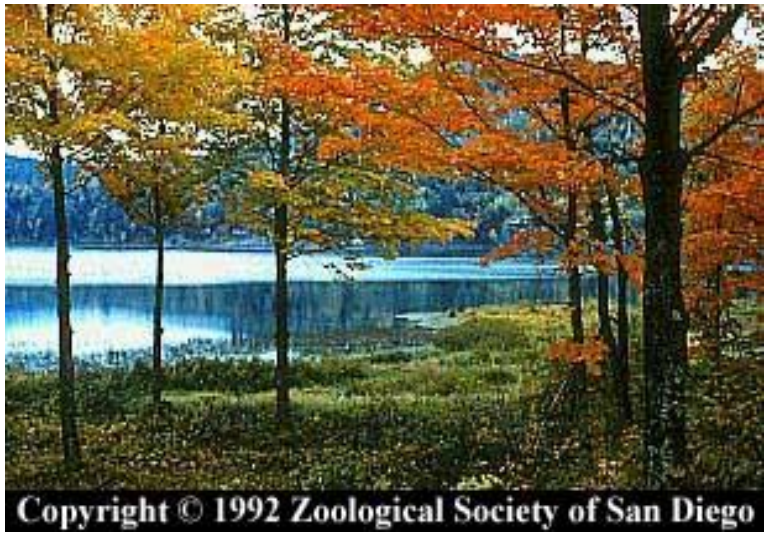
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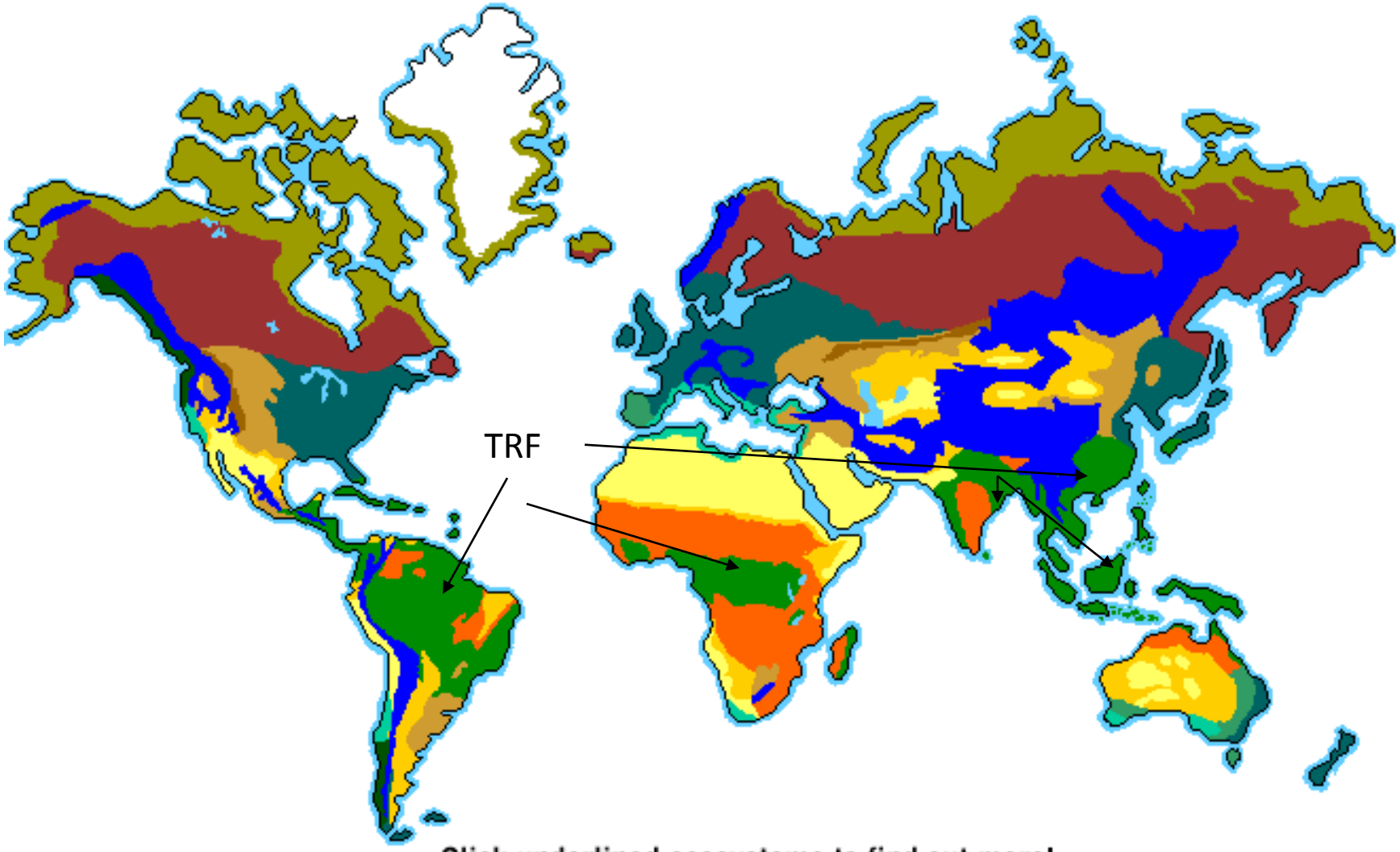
Low Latitude Ecosystems

- **Four ecosystems in this section:**
  - **Tropical Rain Forests**
  - **Savanna Grasslands**
  - **Deserts**
  - **Mountain Ecosystems**

Tropical Rain Forests

- ***Climax vegetation***: **tall evergreen broadleaf trees** with:
  - **Buttress roots** (also called stilt or prop roots)
- ***Location:*** South America, Africa, Australia and Southeast Asia and is **contained within the tropics**.

- ***Adaptations:***
  - The soil here is thin, so the **buttress roots** on the tall trees help keep them steady.
  - Some plants called **epiphytes** grow on top of taller trees and let their roots hang down to get water from rain.
  - Some animals live in the trees all the time.
- ***Climate:***
  - **Tropical wet** in most locations (rain all year)
  - **Tropical wet and dry** in some places (wet monsoon season with dry months)



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Grasslands
Desert
Deciduous
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Chaparral
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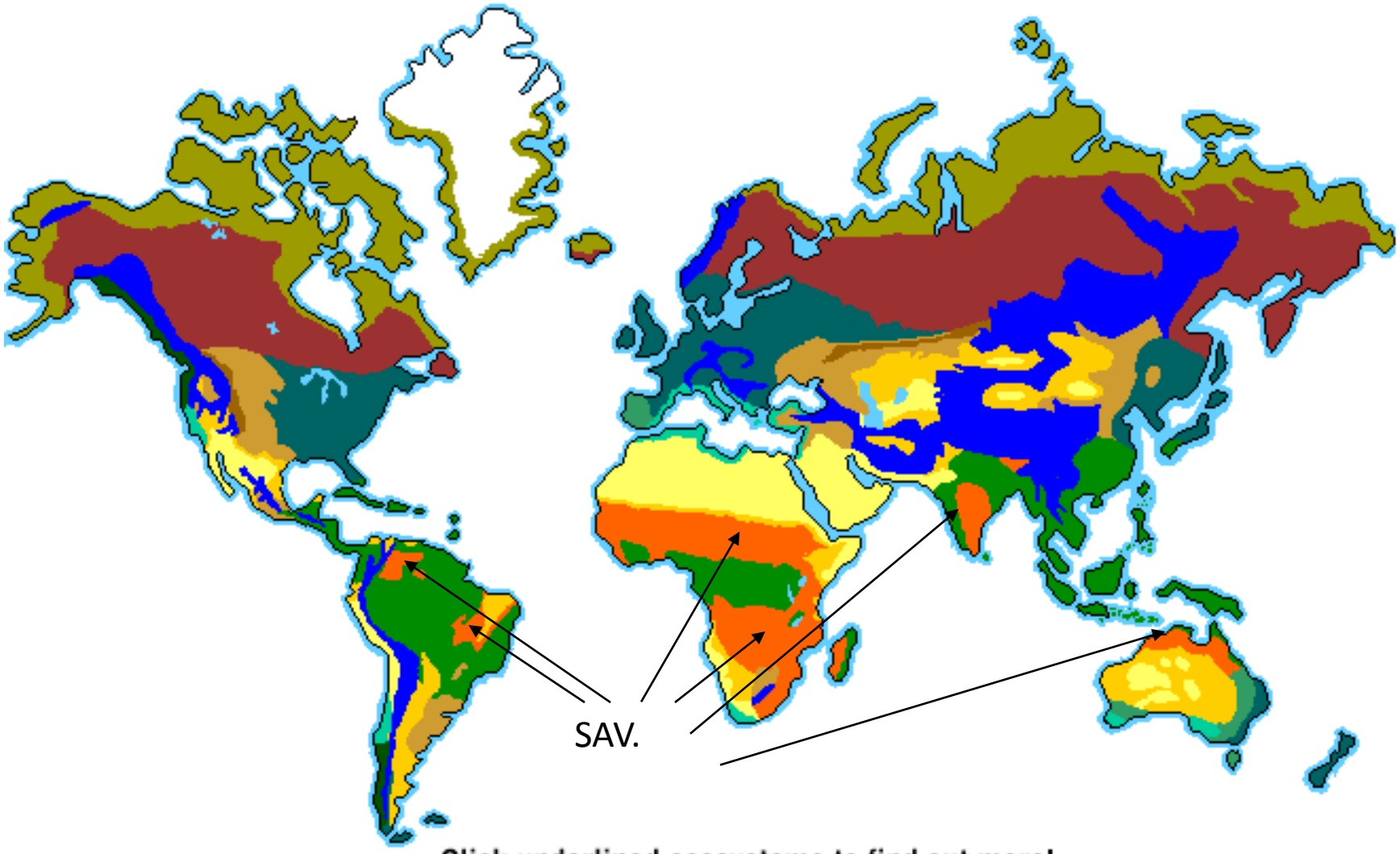
Alpine

Savanna Grasslands

- ***Climax vegetation***…grass with shallow roots that don't need much water.
  - Same as the **temperate grasslands** we saw earlier.
- ***Location***: South America, Australia, Africa and Southeast Asia.
- ***Adaptation:*** Grasses use less water because they are small in size so they don't need much.
- ***Climate***:
  - **tropical wet & dry** in most locations
  - **semi-arid** in some places.



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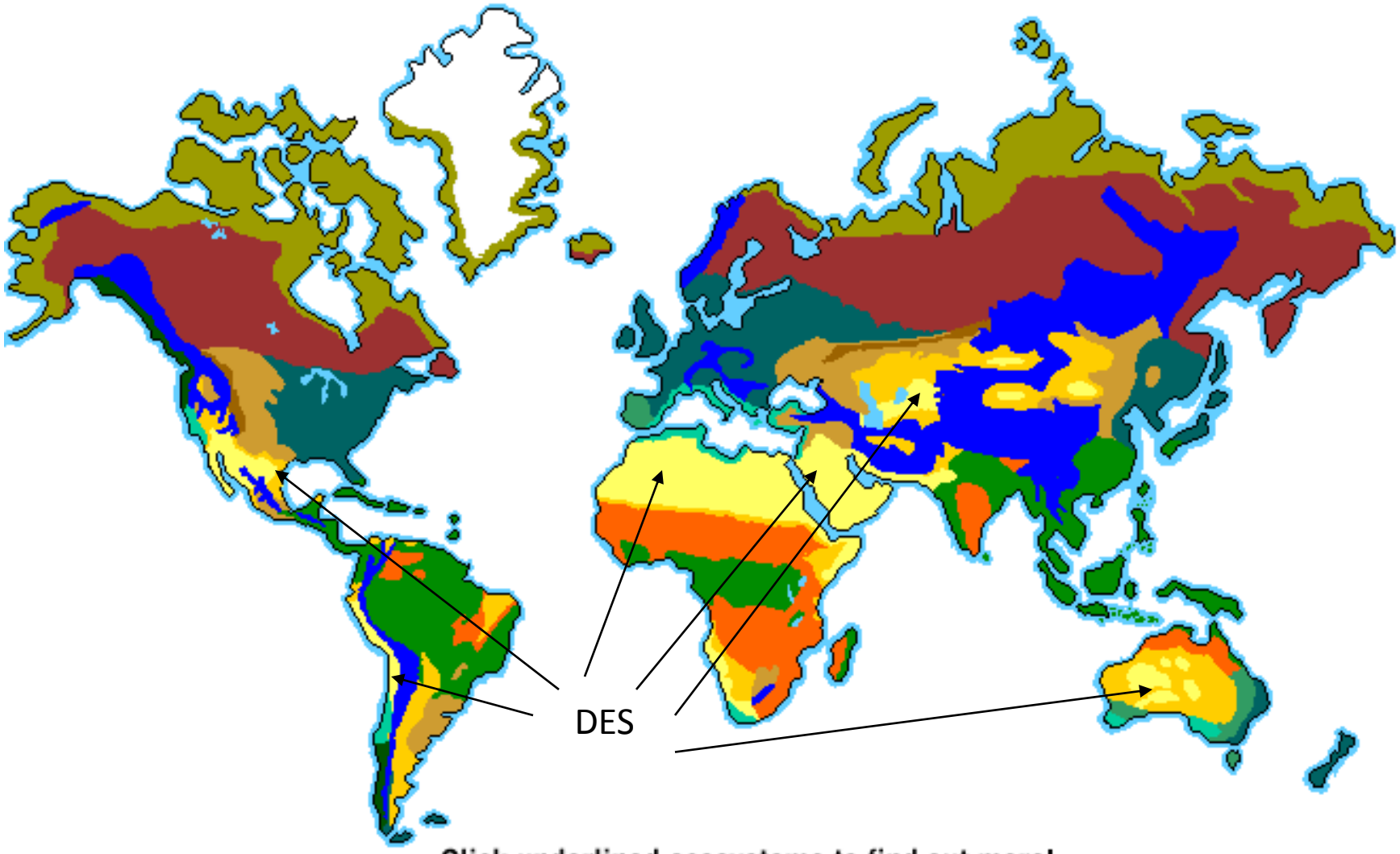
Deserts

- ***Climax vegetation***: **cacti** and fleshy plants with:
  - long roots
  - water storage capability
  - leaves modified as needles.
- ***Location***: North America, South America, Australia, Africa and Asia.
- Deserts are mostly concentrated in two bands around the earth **10-30˚ North and South of the equator**.



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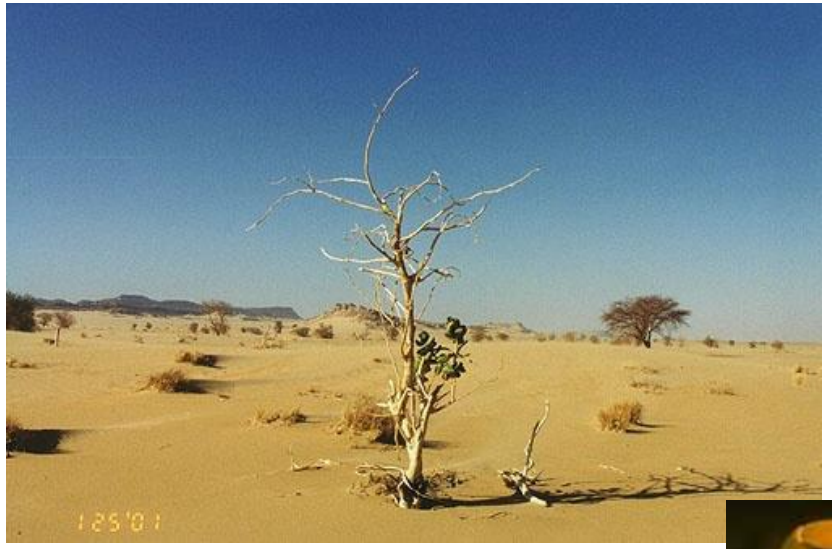
Deserts

- Cacti are well ***adapted*** to lack of water. They are often referred to as **Xerophytes**:
  - **Long roots** help them get water deep in the **water table** (water stored underground)
  - **Water storage:** A cactus can go long periods without rain.
  - **Leaves modified as needles:** Helps protect against grazing animals and keep water in.



Deserts

- ***Animal adaptations***:
  - **Deer mice:** Can get all the water they need from the food they eat.
  - **Toads:** Hibernate through the driest seasons;
  - Some **mammals** are **nocturnal**, so they are active during the night when it's cooler.

- ***Climate:*** **Arid**…less than **250 mm** of rain per year.

Mountain Ecosystems

- Mountains ecosystems happen all over the planet, but they have similar features.
- As we move from the equator to the poles, we see a pattern…**vegetation gets smaller until it disappears and there are less species of animals**.
- **The same changes in ecosystem can be seen as you move up a tropical mountain**.
- As you move up a mountain, the vegetation gets smaller and thinner and there are less kinds of animals.
- The kinds of plants and animals in a mountain ecosystem depends on where the mountain is located on Earth.

World View

- Two contrasting World Views:

  1) The natural world exists to meet human needs/wants and is to be used to the fullest.

  OR…

  2) Humans are a part of the larger web of life having the same rights as any other being…**no more, no less.**

  QUESTION: Which do YOU believe? One or the other? A bit of both?

Earth's Soil

- **Soil** is one of the world's most important **natural resources**.
- Its **composition** (what it's made of) has a large impact on human activities such as farming, forestry and food production.
  - Certain soils allow different types of plants to grow

- The key factor in the development of soil is **climate.**
- Climate provides moisture needed to determine if the soil will be **"good."**

World Soils

- **Soil**- The surface layer of the earth.
- True soil must have the following:

1. Mineral material
2. Organic materials
3. Air
4. Moisture
5. Soil texture

1. Mineral Materials

- **Mineral Materials**- are rock particles that have been broken down into sand, silt ,and clay . **These particles give the soil its structure** .
  - Many of the minerals (eg. Calcium, phosphorous , and potassium) provide nutrients to plants.
  - The more rain a place gets, the more minerals that get washed out of the soil.

2. Organic Materials

- **Organic Materials**- are decaying plant and animal remains that form **humus**.
- The humus:
  - **adds soil structure** and **provides nutrients** for plant growth.
  - gives the soil its dark colour.
- The more organic material in the soil, the more **fertile** it will be.

3. Air

- Air is **needed for chemical and biological processes** in the soil.
- To work properly, plants need air around their roots . Organisms and humus add air to the soil.

4. Moisture

- Moisture is **needed for plants to survive** and for the **chemical and physical processes** that weather rock and decay organic materials.
  - Too little/too much moisture isn't good for plant life.

5. Soil Texture

- Refers to the mixture of:
  - fine particles (**sand**)
  - very fine particles (**silt**)
  - extra fine particles (**clay**)

IMPORTANT POINT: **The best texture for agriculture is an even mixture of each**.

Environmental Factors Affecting Soil

1) Leeching

- Happens when water runs down through soil, dissolves the nutrients and carries them away.
  - Found in areas with **high precipitation** and has a **poor, often thin topsoil layer.**

2) Calcification:

- Water evaporates up through the surface of the soil. As the water moves up it **leaves behind the minerals**.
  - Happens in areas of **dry climates** and creates a **thick topsoil layer rich in minerals.**

3) Temperature: affects the development of humus.

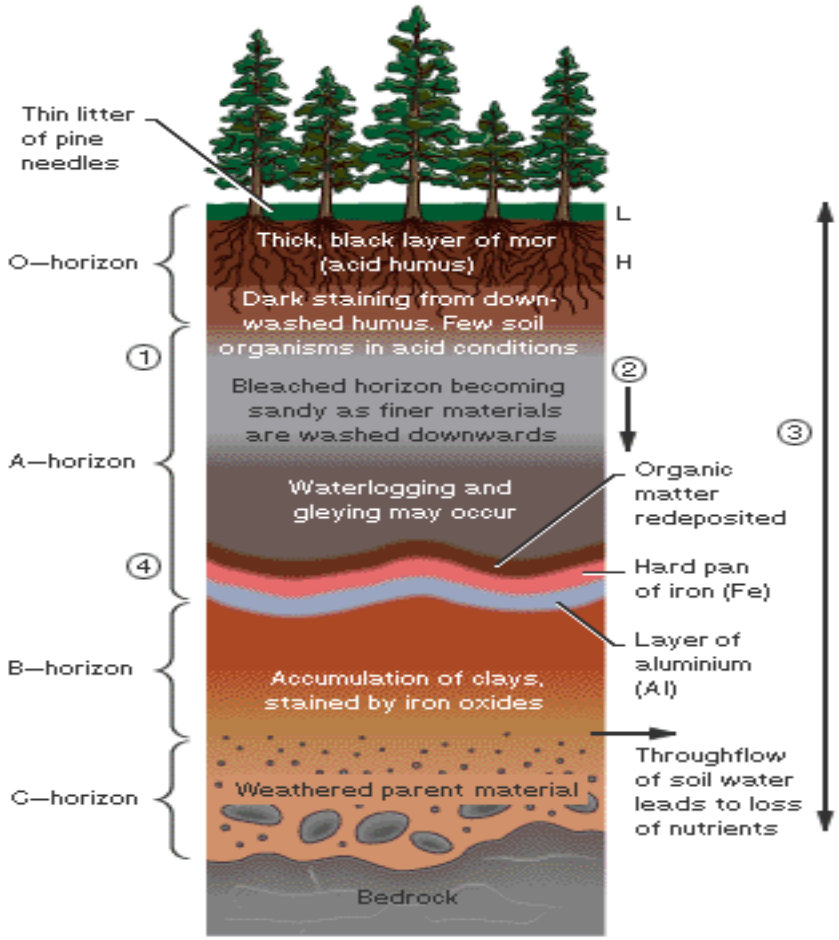
  - Too cold and the decay of organic matter is slowed considerably.

Three Types of Soil

1) Podzol

2) Chernozem

3) Latosol



1) Podzol

- These are soils which:
  - widely found in the **boreal forest**
  - tend to be **somewhat acidic**.

2) Chernozem

- These are soils which:
  - tend to be the **best for agriculture**
  - **found in grasslands** which are **semi-arid** resulting in **less leeching** and a **mineral rich soil**.

3) Latasol

- These are soils which:
- are **very infertile** due to the **high amount of leeching**.
- They are **found in tropical rain forests** with high amounts of rain…mineral-poor soil

Soil Texture

- The ***texture*** of soil determines its “value”.
    - Texture also **affects how well water and air flow**.
- The 3 smallest particle types *(**sand, silt, & clay**)* are the main ingredients of soil.
- Too much sand or clay makes soil too dry or too wet for plants to grow.
- The best combination of sand, silt and clay makes a soil called **loam**.

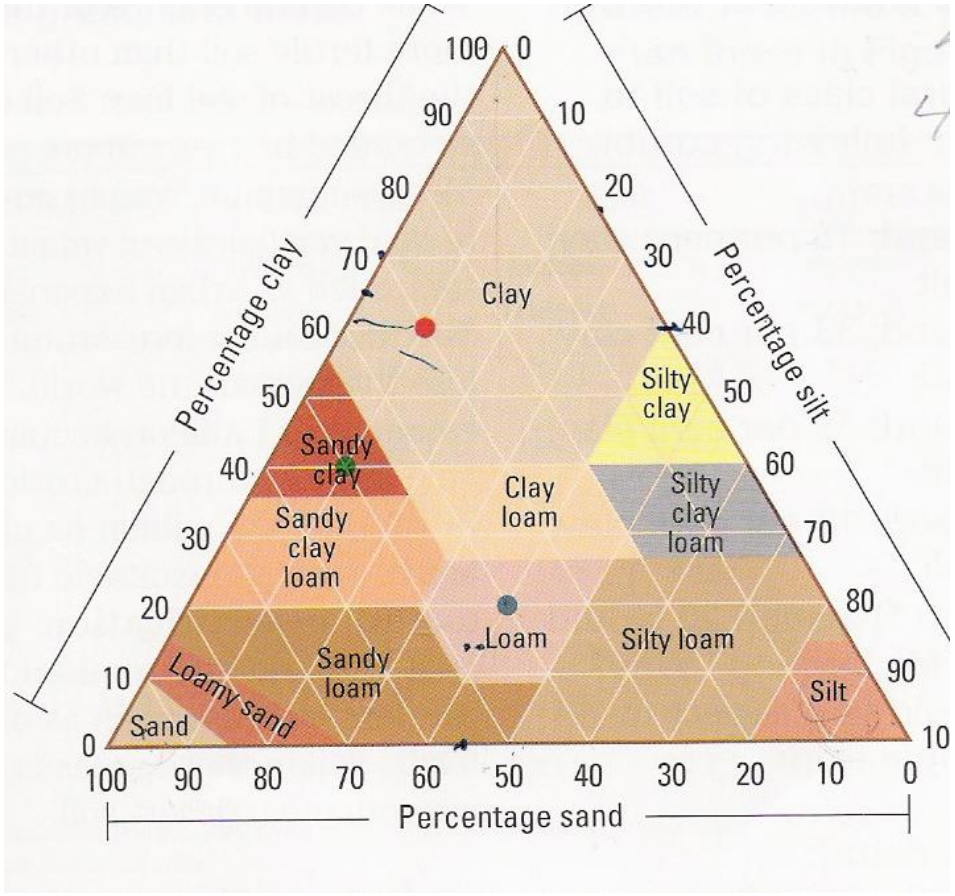
See. P. 139

Green Dot:

- Clay = 40%
-Silt = 10%
- Sand = 50%

Red Dot:

- Clay = 60%
-Silt = 10%
- Sand = 30%



Blue Dot:

- Clay = 20%
-Silt = 40%
- Sand = 40%