More Population Ecology

Jasper National Park – August 2007

Predator-Prey Relationships

Predation

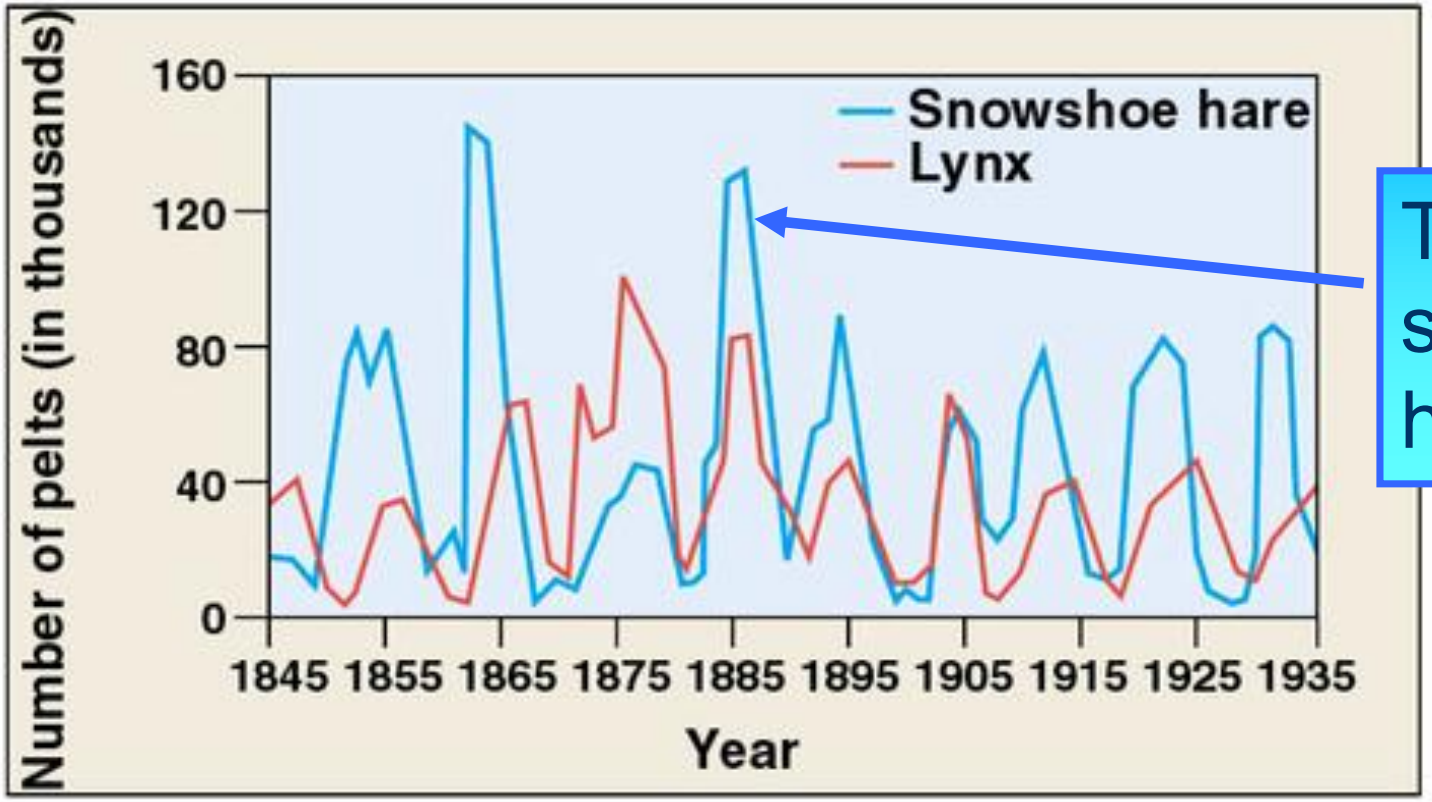
- The most obvious population interaction in a community are those in which a predator eats its prey
- Predators that specialize in eating only one prey species play an important role in controlling the population size of the prey species
  - Eg. Canada lynx and snowshoe hare
- The terms predator and prey apply not only to animals that eat other animals, but to any type of **producer and consumer relationship**
  - Eg. Plants and Herbivores

Predation

Plant defense mechanisms against herbivores:

- Thorns
- Microscopic crystals in their tissues
- Spines or hooks on leaves
- Distasteful or harmful chemicals
  - Some well-known poisons and drugs are secondary compounds produced by plants:
    - Strychnine
    - Morphine
    - Nicotine
    - Mescaline

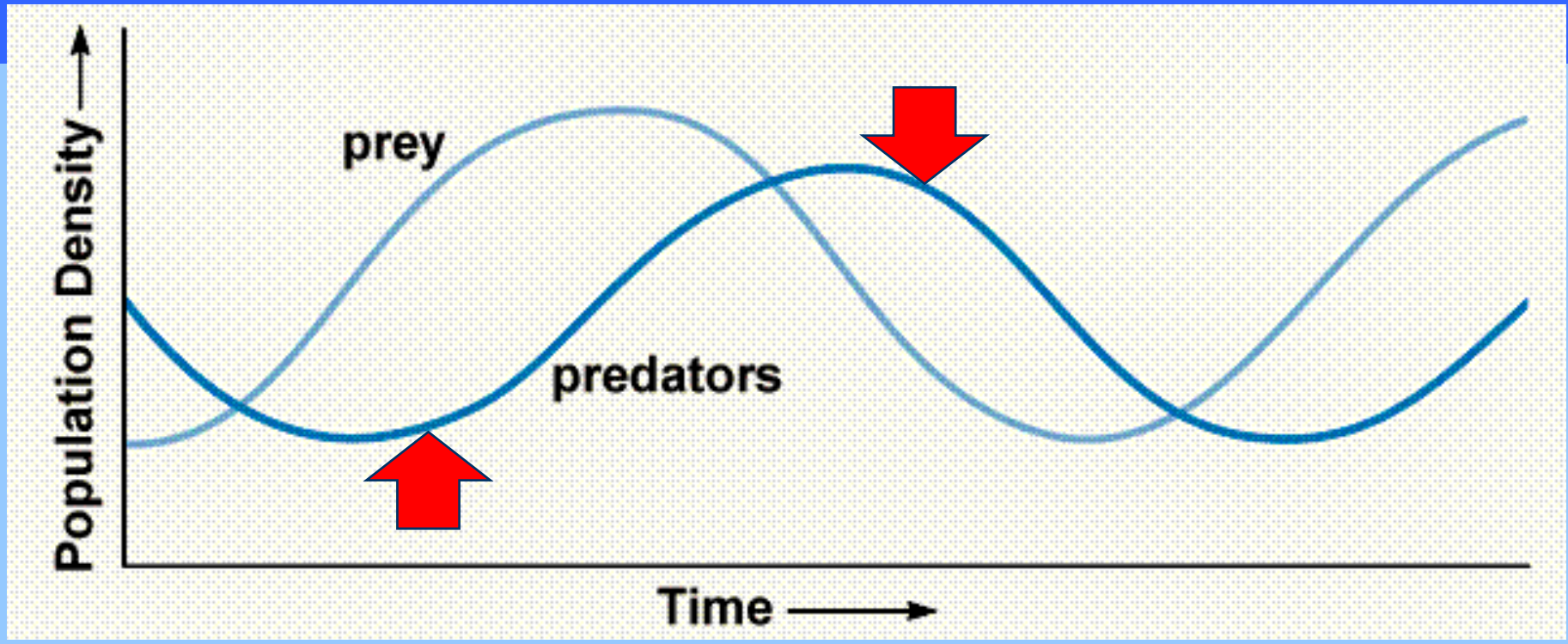
Predator-Prey Cycle



The prey is the species with the higher numbers.

The population of the **PREDATOR** must always be **smaller than the population of the PREY otherwise the cycle will BUST!**

Predator and Prey



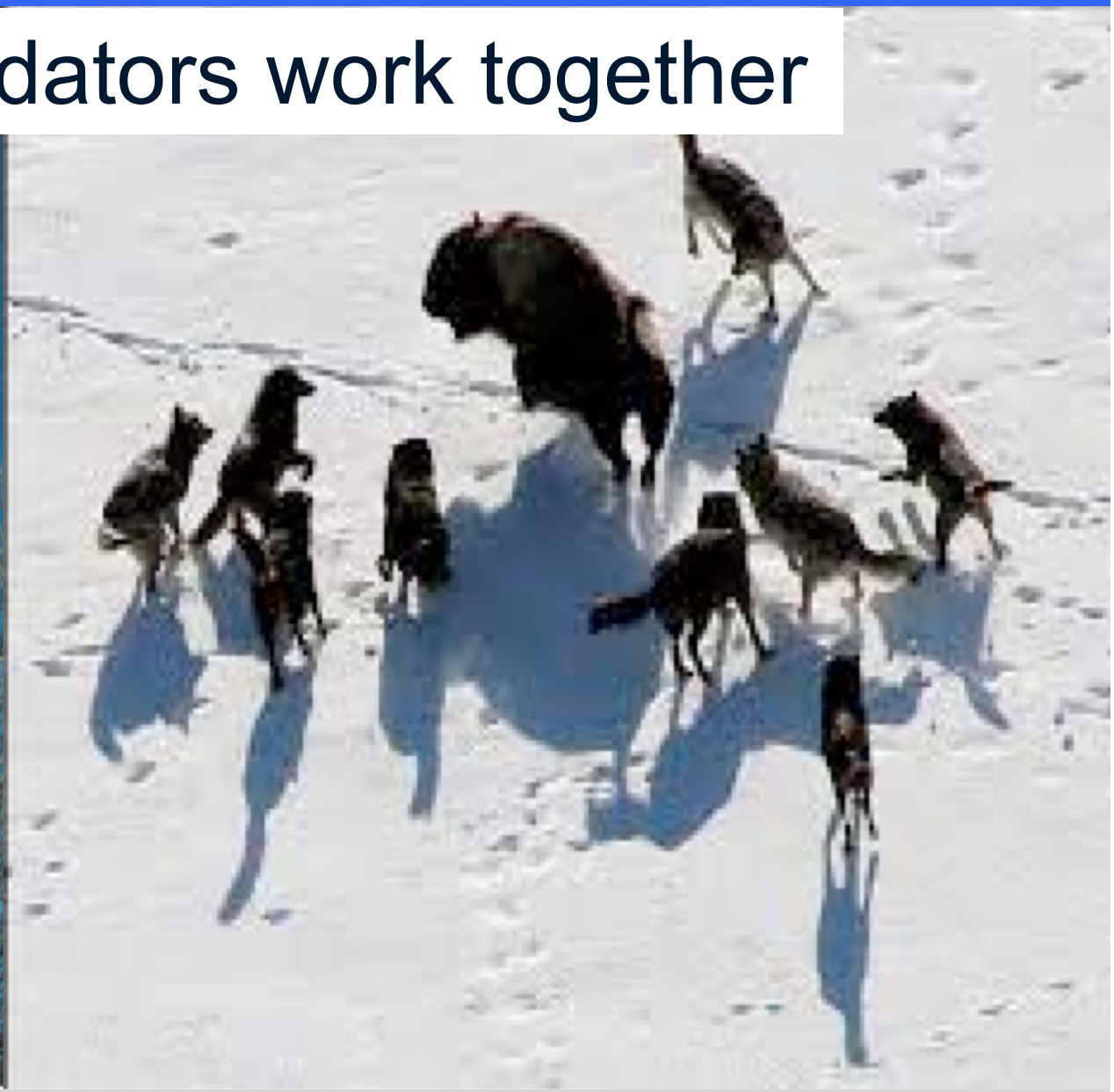
Pick point on the predator graph(ARROWS)…what is happening to the number of prey

Prey # increases, then the predator numbers increase

Prey # decrease then the predator numbers decrease

Predator Interaction

Some predators work together



Avoiding Predators

- Prey have counter strategies to avoid being detected, subdued, and eaten:

1. Mechanical Defenses
2. Visual Deception & Camouflage
3. Group Defense
4. Chemical Defense
5. Warning Colouration
6. Mimicry

Group vigilance and alarms in meerkats

Hiding is a common strategy of fawns

Structural / Mechanical Defenses

Webbed burrfish

Spiny sea urchin

Elk (male)

Armor / Quills

Stag beetle

Pill millipede

Tortoise

Visual Deception

- Markings, such as fake eyes, may deceive predators allowing prey to escape.
- **Camouflage** is used to avoid detection.

Shape shifting/ camouflage octopus:
http://www.youtube.com/watch?v=PmDTtkZIMwM&safety_mode=true&persist_safety_mode=1


Owl butterfly


Leaf insect


Butterfly fish

Group Defense

- Large groups are each less vulnerable to attack… *(more intimidating for predators)*
- Large flocks of birds and schools of fish move together as one mass to confuse predators and make it hard to isolate individuals.
- Large groups also provide greater surveillance.

Zebra Stripes
http://www.animalplanet.com/tv-shows/other/videos/fooled-by-nature-zebras-stripes/

Flamingoes congregate in large flocks

Large schools confuse predators

Chemical Defense

- **Chemical defenses** may include noxious fluids or venoms.

A scorpion's defensive posture warns potential attackers of its venomous sting.

Rattlesnakes have a venomous bite, but rely first on camouflage and a warning rattle.

Pentatomid (stink) bug

North American skunk

Toxin Example: monarch butterfly

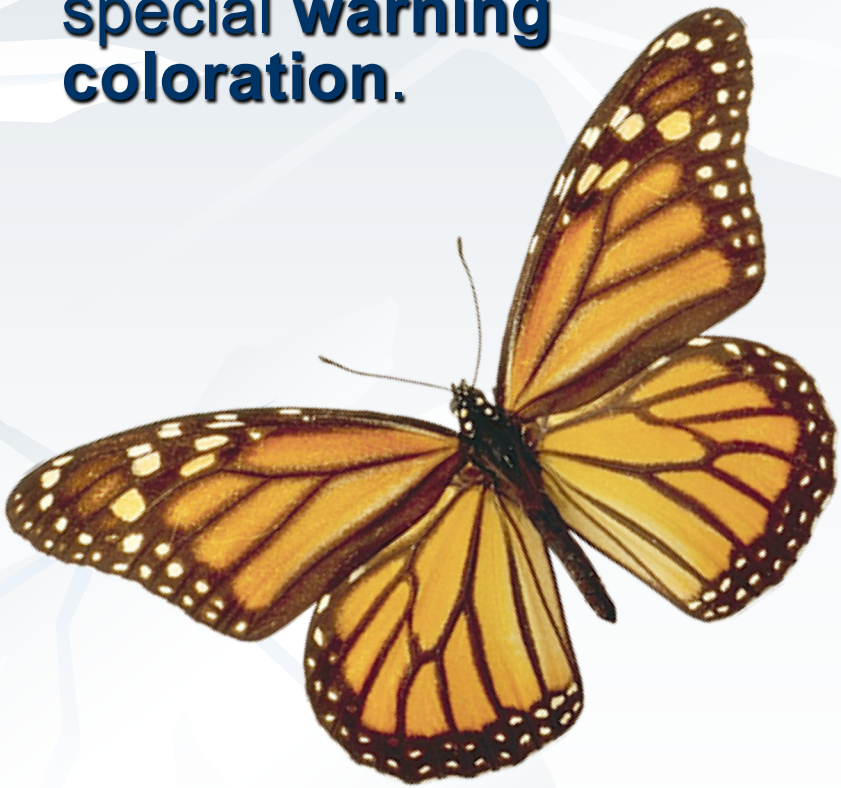
The monarch larvae feeds upon the milkweed plant and stores the toxins in its fatty tissue.

This makes both the larvae and the adult butterfly unpalatable to predators

Blue jays will actually regurgitate a swallowed prey because of it being unpalatable.

Warning Colors

- Many prey species that taste bad, are toxic, or inflict pain on attackers have a special **warning coloration**.



Monarch butterfly

Example: the poison-arrow frog

Mimicry

- Occurs when a harmless, palatable species resembles a toxic or dangerous species.

- OR several unpalatable species may resemble each other.
  - *ex Orange and black, or yellow and black are common warning colors in insects.*

The dangerous common wasp

Monarch butterfly

…and its harmless mimic, the wasp beetle

Watch this baby bird perfectly mimic a toxic caterpillar.

https://www.youtube.com/watch?v=FwSGk1_Y4rY

- Example: viceroy butterfly
- looks similar to the monarch butterfly, but does not contain toxins in its fatty tissues.


Viceroy at Singing Meadows by Joe Constanza

Mimicry

The mimic octopus takes on the shape and behavior of a flounder, a lionfish and a sea snake. By doing this, it is **protected from predators.**

Mimic octopus video:
http://www.youtube.com/watch?v=H8oQBYw6xxc&safety_mode=true&persist_safety_mode=1

Octopus video 2

Mimicry ..only one dangerous!!

Unpalatable

Palatable

- This hawkmoth larva puffs up its head to mimic the head of a snake

Competition

1. Inter-specific Competition:

- Competition between 2 members of different species in same community
- The more similar the niches of a species, the greater the competition
- Niche- the role that an organism takes in an environment

2. Intra-specific competition:

- between 2 members of same species

Competition can be for food, space, mates, oxygen, water or sunlight

Competition

INTERSPECIFIC - DIFFERENT

between 2 members of different species

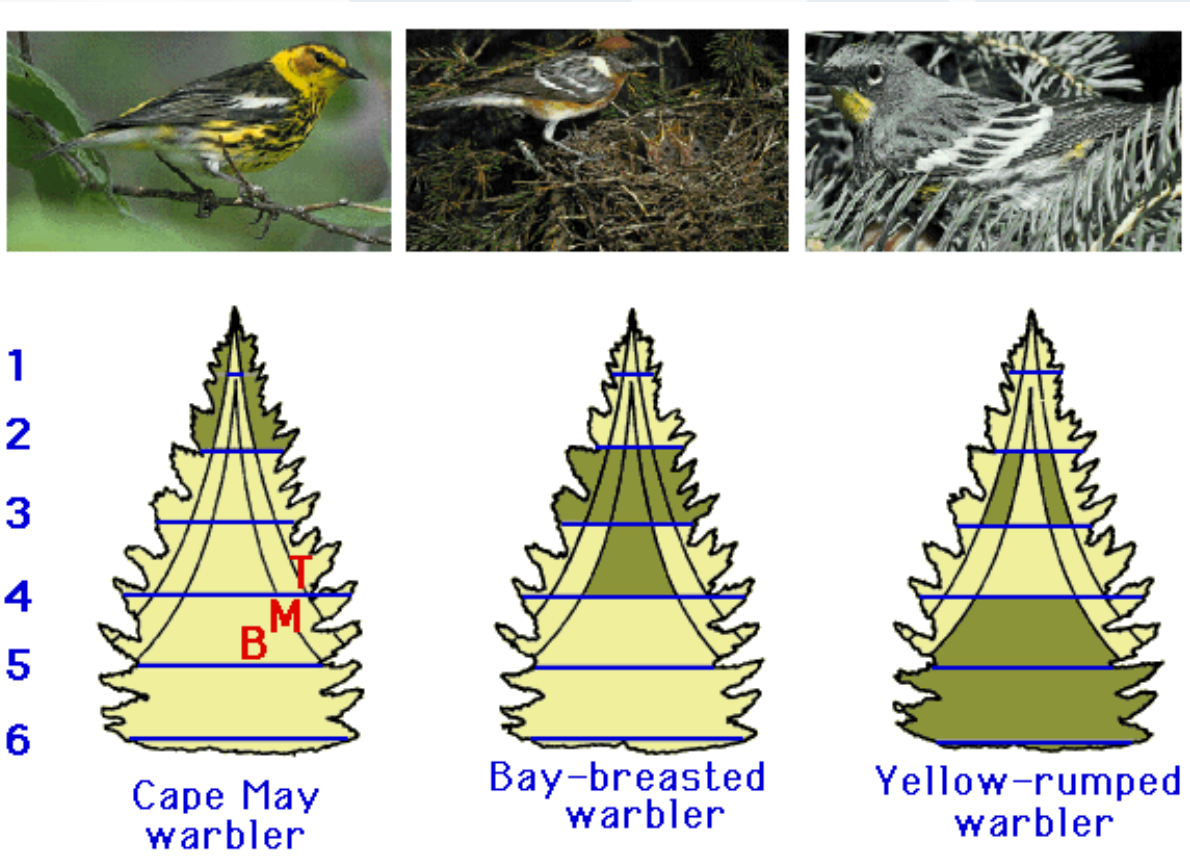
INTRASPECIFIC - SAME

between members of same species

Inter-specific Competition

Competition is less fierce, when populations have slightly different niches (resource partitioning)

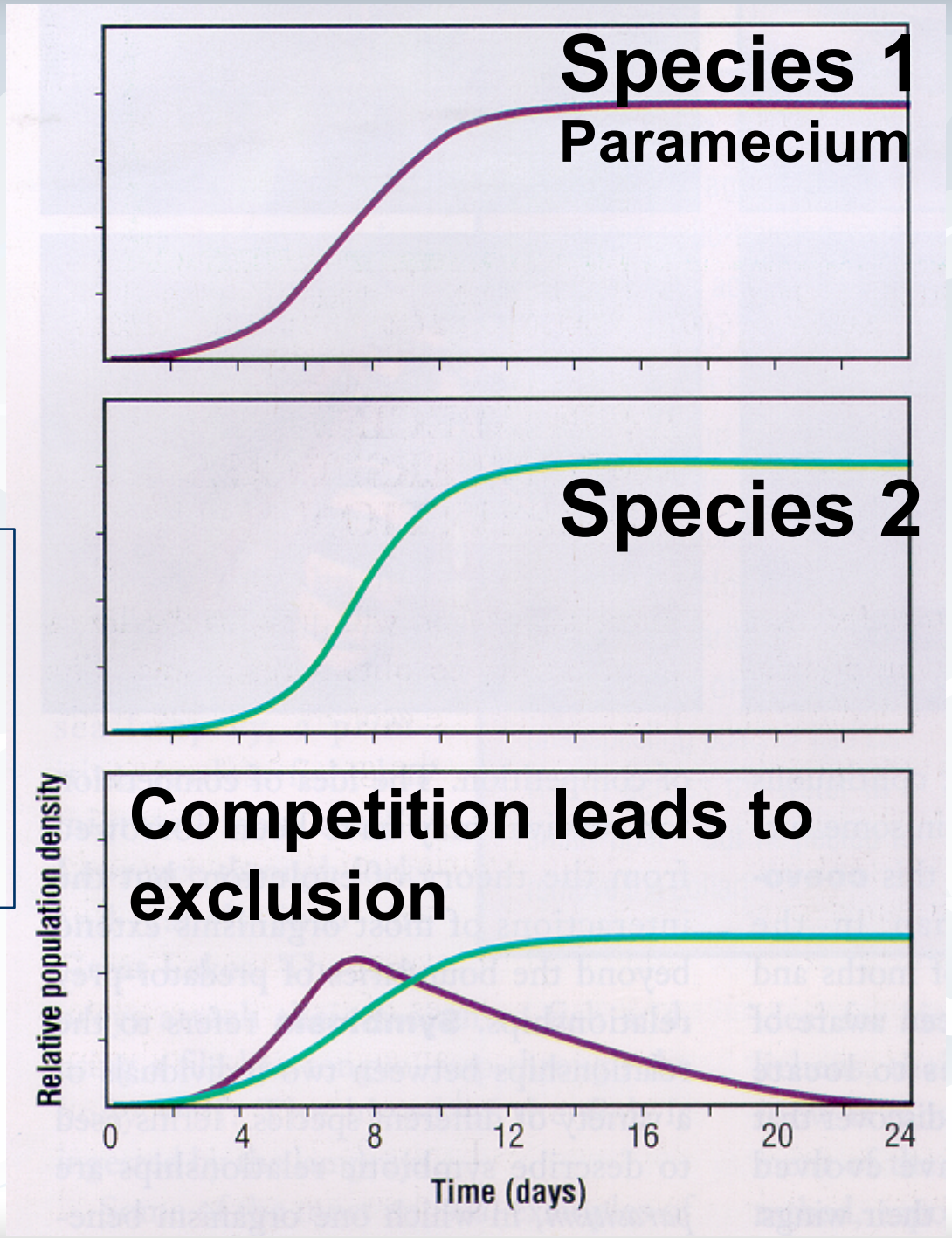
- Example – 5 species of warblers can feed on insects on a spruce tree – eat insects on different areas of tree



Gause's Principle or Competitive Exclusion

No two species can occupy the same ecological niche **without one being reduced in number or eliminated**

-One species will always have an advantage over the other

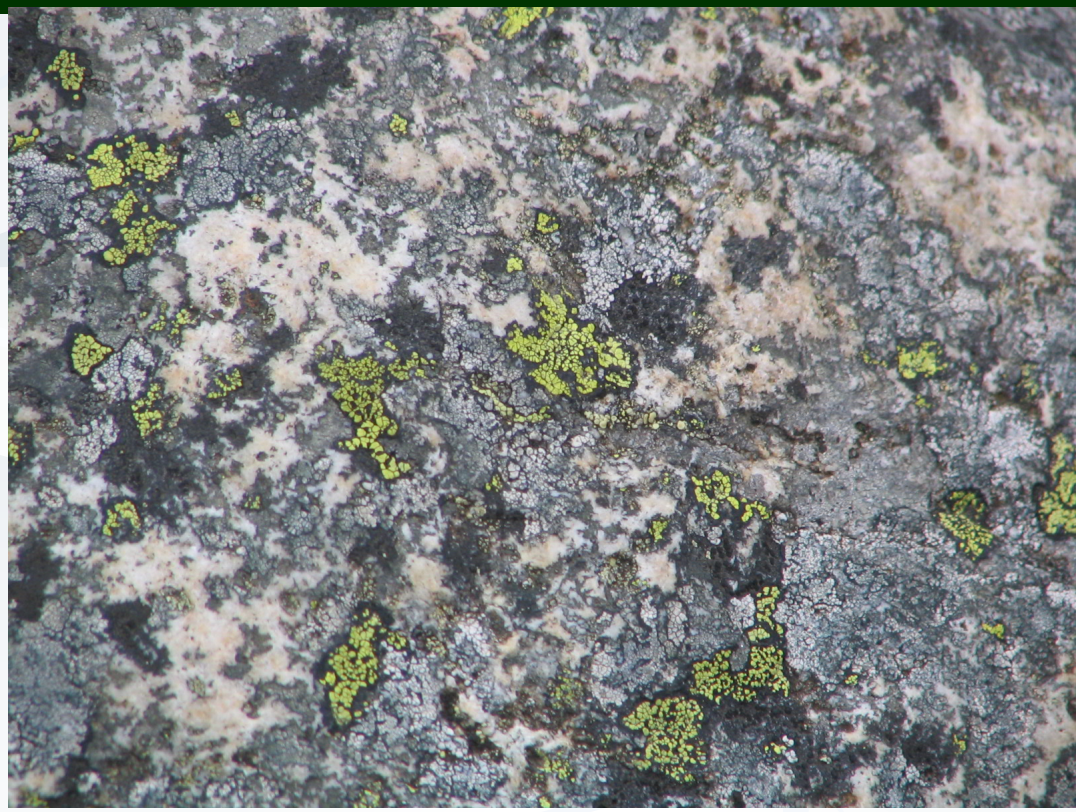


Symbiotic Relationships

		Organism 1	Organism 2
1. Mutualism	Both benefit **Ex.** cleaner wrasses and whale sharks, e.coli and humans, bees and flowers	+	+
2. Parasitism	One benefits, other harmed Parasites get nutrients from host, and do not usually kill host. **Parasites:** Mosquitoes, lice, mites, round worms, tapeworms. **Hosts:** many animals	+	-
3. Commensalism	One species obtains food or shelter from another species. Does not harm or help the other species. **Ex.** Shark and ramora, buffalo and birds	+	0

1. Mutualism

- **Two organisms living together - both benefit**



eg. Lichen (fungus + algae)

-fungus provides rooted structure and algae provides nutrients

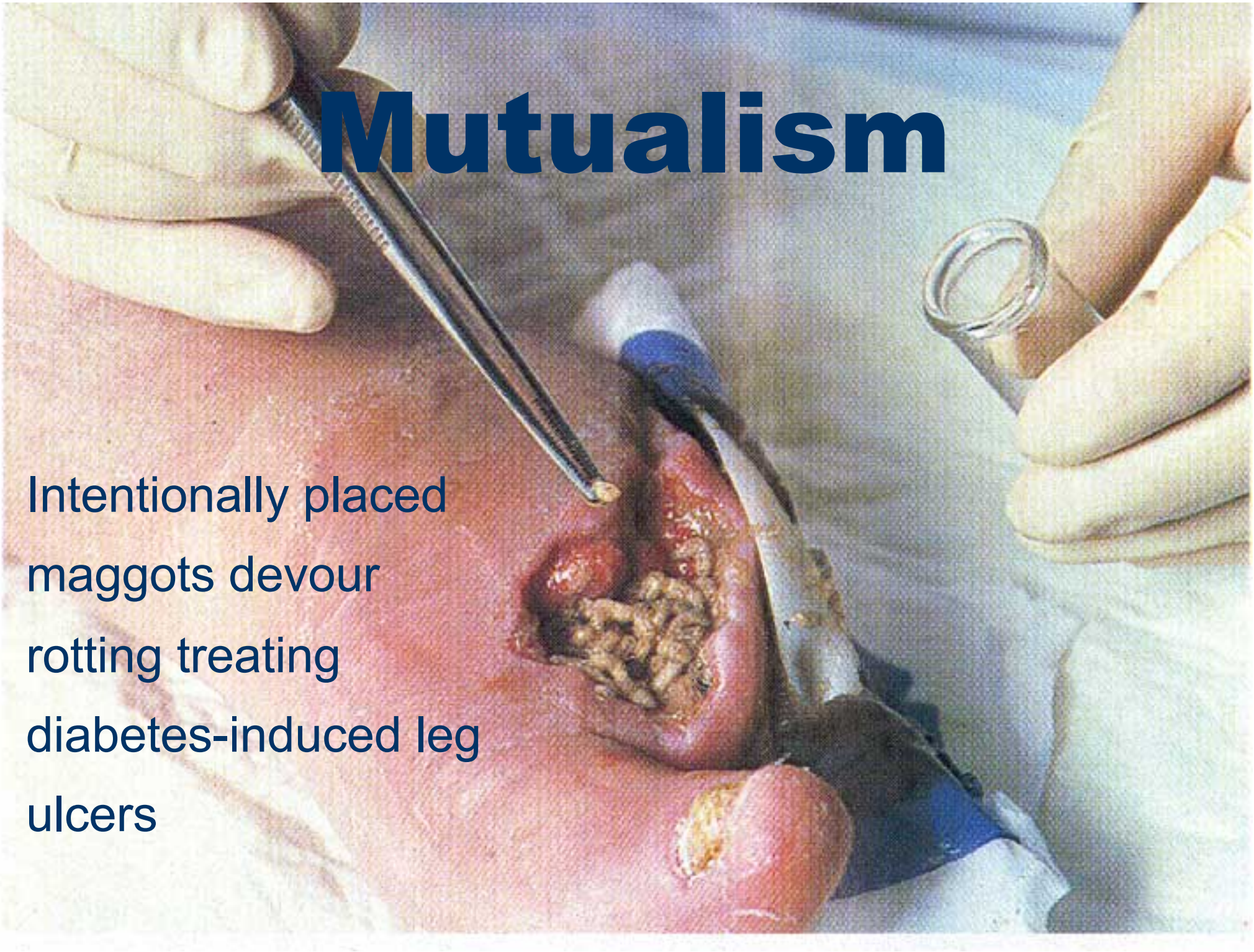
Together they eventually break down rock, creating soil

1. Mutualism

Clownfish and anemones
https://www.youtube.com/watch?v=vNhORnwcQcU

As far as is known, the fish is able to produce a special mucus that causes the anemone not to release its stings. It is also believed that the movements of the fish inform the anemone of its identity. In return for the anemone's protection, the fish brings scraps to it, and lures larger fish into the anemone's tentacles.

Mutualism

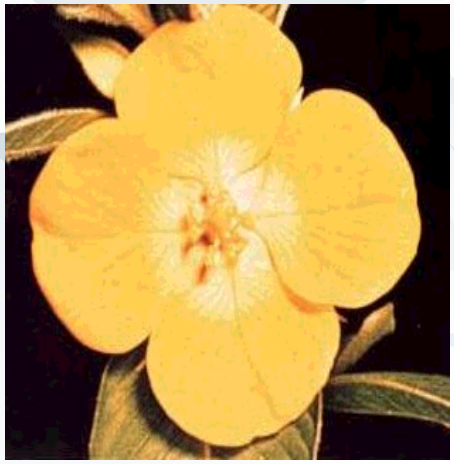


Intentionally placed maggots devour rotting treating diabetes-induced leg ulcers

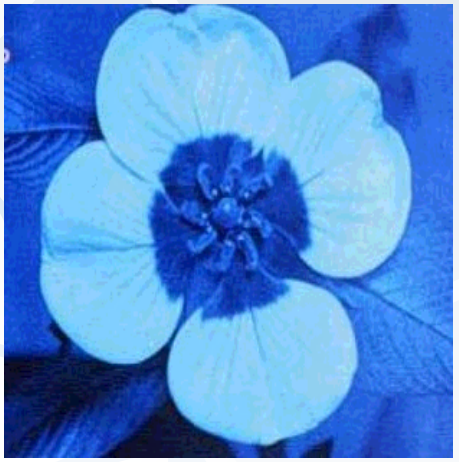
Mutualism

Honeybee & flowering plant

Interesting fact!



How we see the flower



How a bee sees the flower

They can see into the ultraviolet spectrum which helps then locate flowers and specifically the centers of them for nectar.

2. Parasitism

- One species benefits, other is harmed
- Parasite receives nourishment from host
- Parasites don’t normally kill host

Parasitism

52.5 Most Parasites Are Smaller Than their Hosts This Caribbean soldierfish is host to the parasitic isopod attached to its head between its eyes. The fish has no way to remove the isopod, which feeds on its body tissues.

Parasitic Wasp

https://www.youtube.com/watch?v=vMG-LWyNcAs

then there is the…

Tonguefish

https://www.youtube.com/watch?v=XBMK7C_HwI4

Lymphatic Filariasis (Elephantiasis)

- **The disease is caused by parasitic worms, all transmitted by mosquitoes.**

Parasitism

Tapeworm reaches maturity in intestine of mammals

Heartworm of dogs, whose adults reside in the right side of the heart.

3. Commensalism

Shark & Ramora
One benefits.
Other unaffected.

Ramora gets free ride + food

3. Commensalism

Shell fish and barnacles

The barnacles have a substrate...place to live

Buffalo and cowbirds

Birds feed on insects kicked up by buffalo

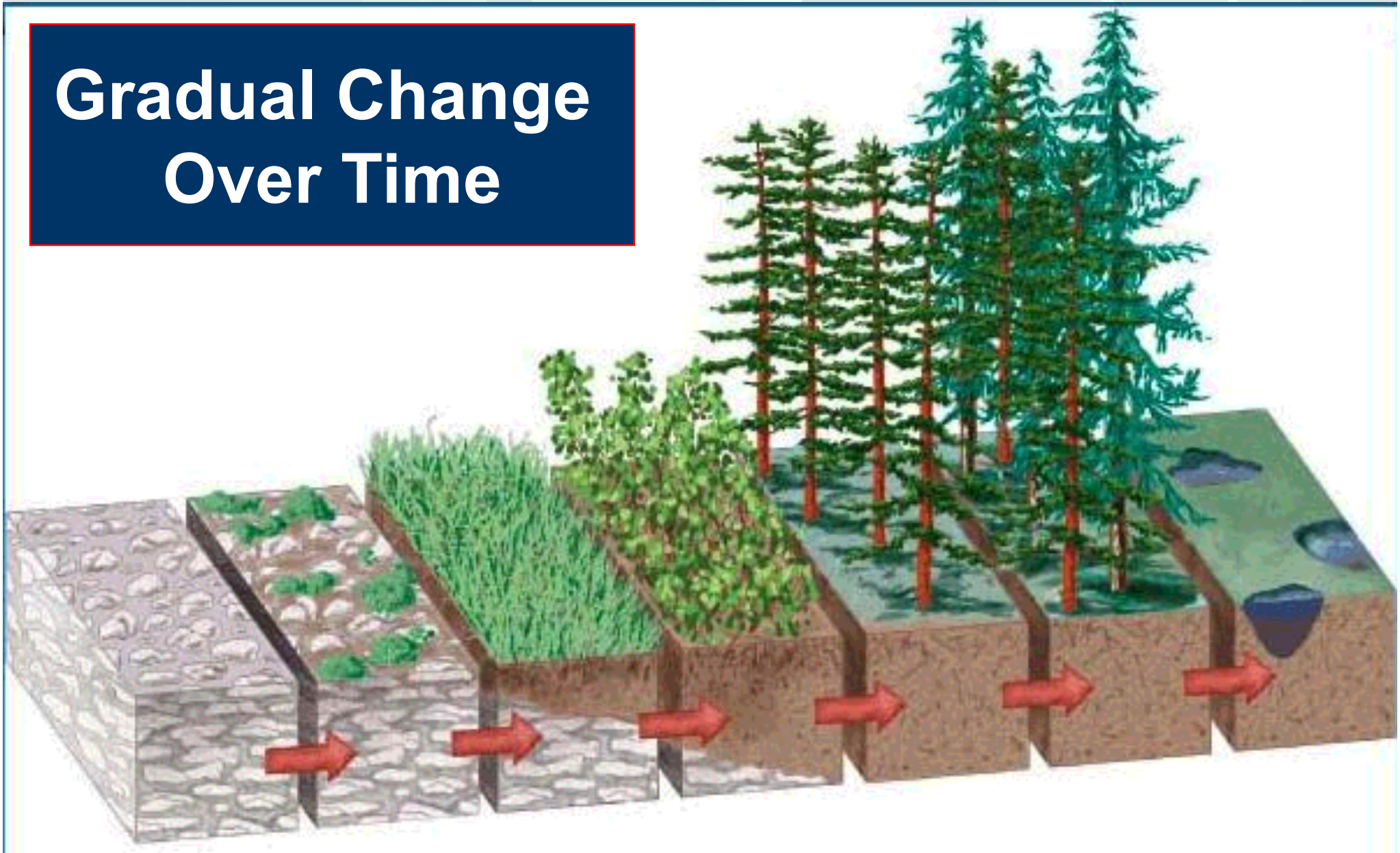
Commensalism

Orchid on tree

Nest in tree

Ecological Succession

Gradual Change Over Time



Succession

- **Gradual process of community replacement**
  - **Succession is the progression through these 3 types of communities**

Ecological Succession occurs in STAGES

1) Pioneer Communities

GROW on BARE ROCK

-Lichens (fungus & algae) digest rock turning it to soil

2) Seral stages

-Grass

-Shrubs

-Small trees

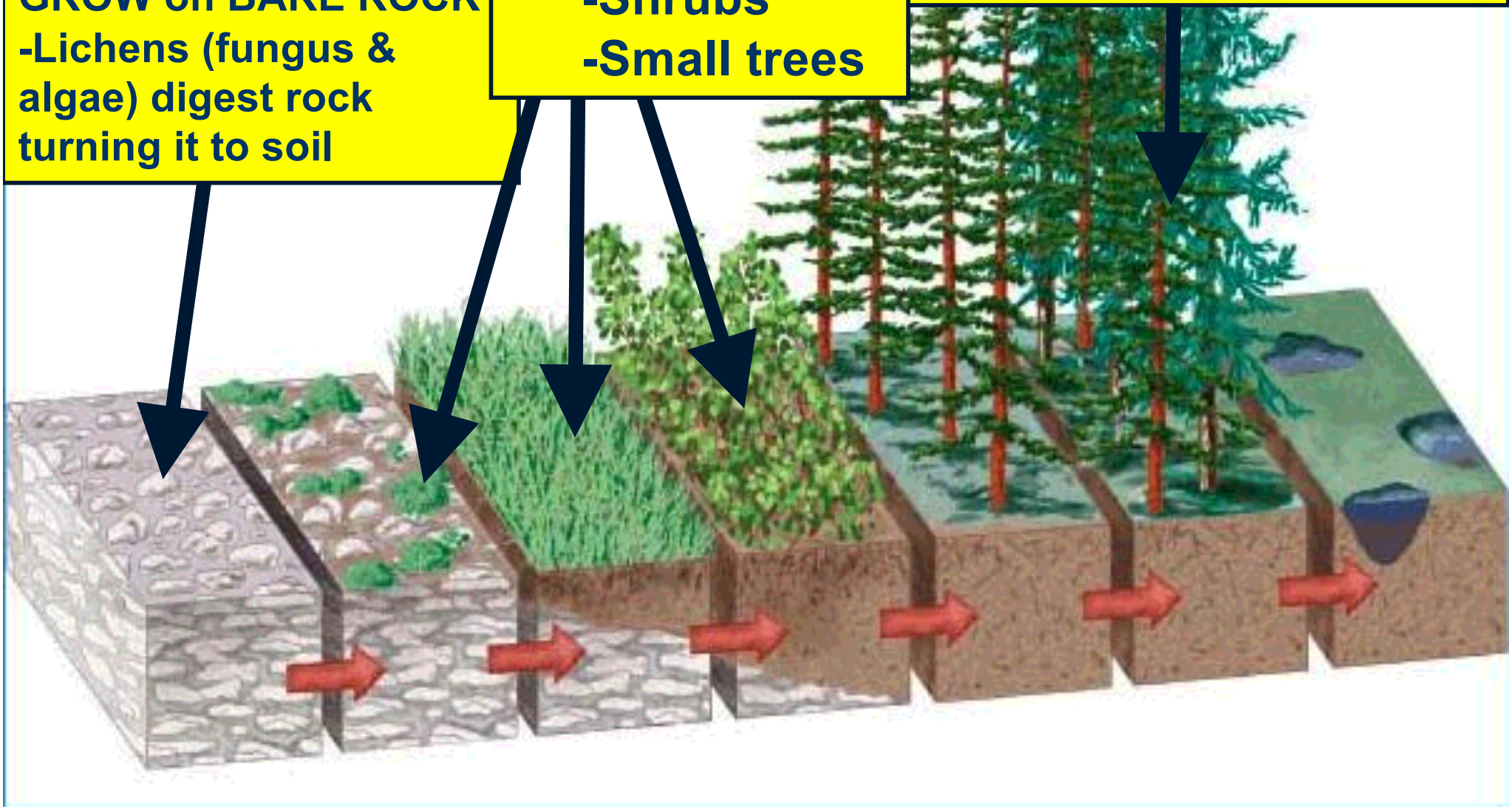
3) Climax Communities

most stable

most biodiversity

-conifers(evergreen)

-maples, oaks, poplars



CLIMAX COMMUNITY

CLIMAX XOMMUNITY: Stable or "final" form of the ecosystem

-Type of Climax community depends on ecosystem

- A climax community is one that has reached the **stable stage.**
- Examples are tundra , grassland, desert , and the deciduous, coniferous, and tropical rain forests .

Types of Succession

Primary

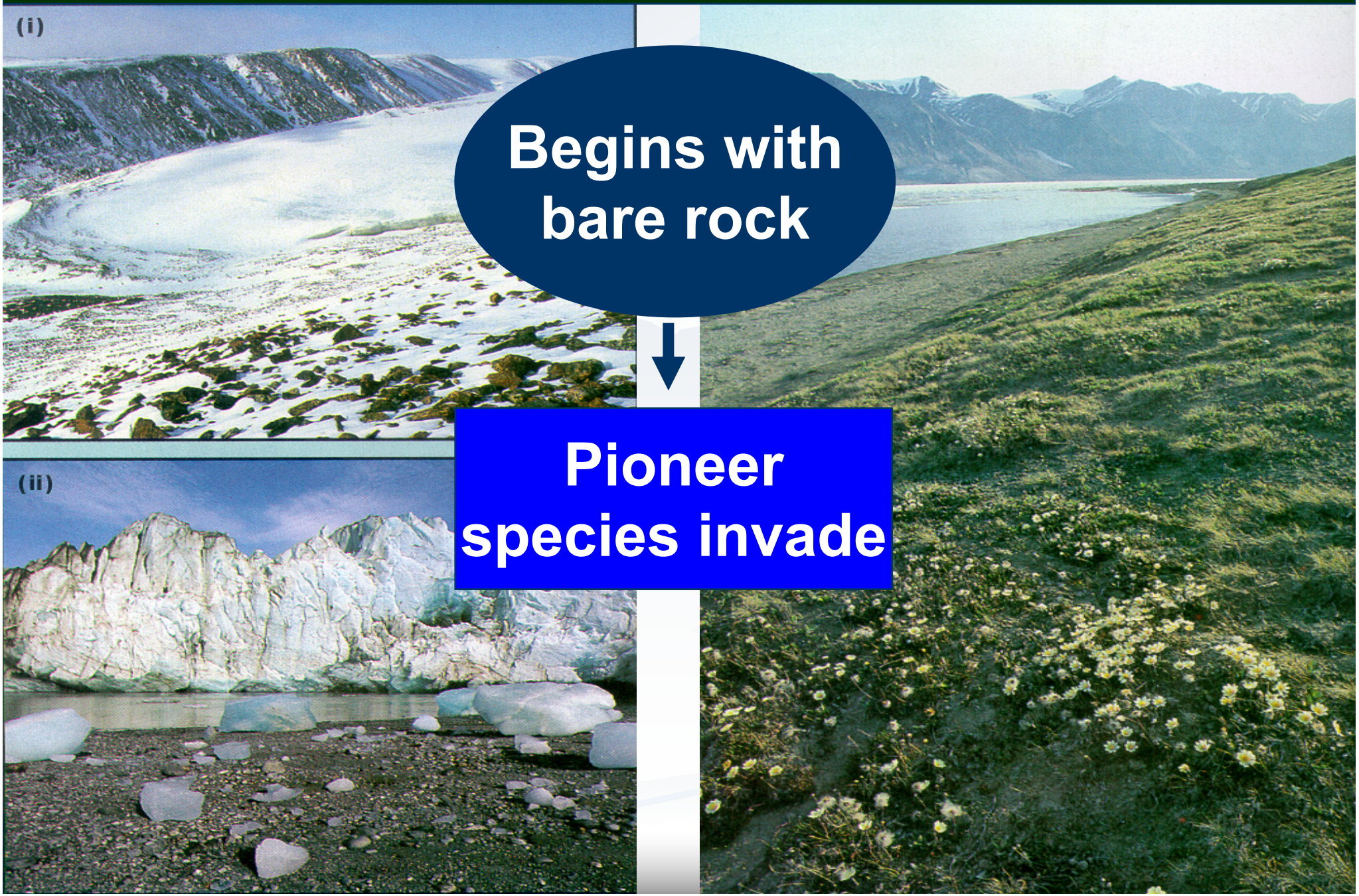
1. Begins with **bare rock**
   after a glacier recedes or volcano erupts
2. Pioneer species invade (Lichens)
3. Grasses, shrubs, trees (seral stages)
4. Climax community is reached

-is much slower than secondary succession because soil must be made from bare rock

Secondary

- **soil is already present**
- Occurs **after destruction of climax community**
  - Ex. Fire, flood

Primary Succession



Primary Succession

(a) Retreating Glacier

(b) Barren Moraine

(c) Pioneering Mosses

(d) Invading Alders

Primary Succession in Hawaii after a volcano Eruption

Primary Succession in Hawaii after a volcano Eruption

Secondary succession

-trees are colonizing uncultivated fields and meadows.

Secondary Succession

1)Occurs after destruction (flood, fire, avalanche etc.)

2)Does not start with bare rock.

-Soil already present.

Secondary Succession

Fireweed(pink flowers) are among the first plants to grow after a forest fire in secondary succession.

- **What is the difference between primary and secondary succession?**

(c)

(d)

(e)

(f)

- BOZEMAN and succession

- Workbook page 10 and 11

Ohhh…And one more thing…