# COMMUNITY ECOLOGY

Lecture 2


Community Ecology
organism
population
community
ecosystem
biosphere

# Communities

- A community is a group of organisms of different species that live in a particular area

Multiple communities might be spread across an area.

An interesting question becomes, why do the communities not have the same numbers of species or the same abundances of species?

Comparisons can be made among communities using attributes such as **species richness, species diversity, and evenness.**

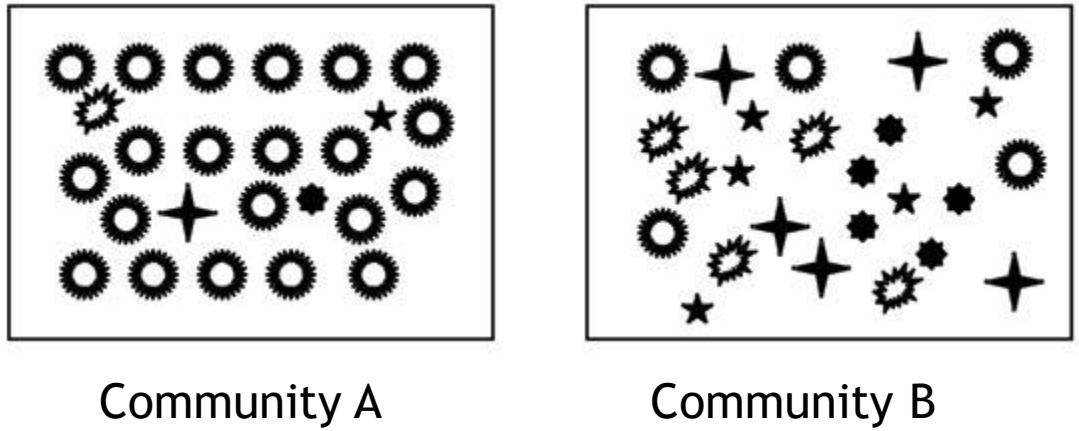
Species richness is simply the number of species in a community.

Species diversity is more complex, and includes a measure of the number of species in a community, and a measure of the abundance of each species.

Species diversity is usually described by an index, such as Shannon’s Index H'.

Species evenness is a description of the distribution of abundance across the species in a community.
Species evenness is highest when all species in a sample have the same abundance.

Figure below is a simple diagram to describe species richness and species evenness. Both communities contain five species of animalcules. Species richness is the same. The community on the left(A) is dominated by one of the species. The community on the right (B)has equal proportions of each species. Evenness is higher when species are present in similar proportions.



Community A



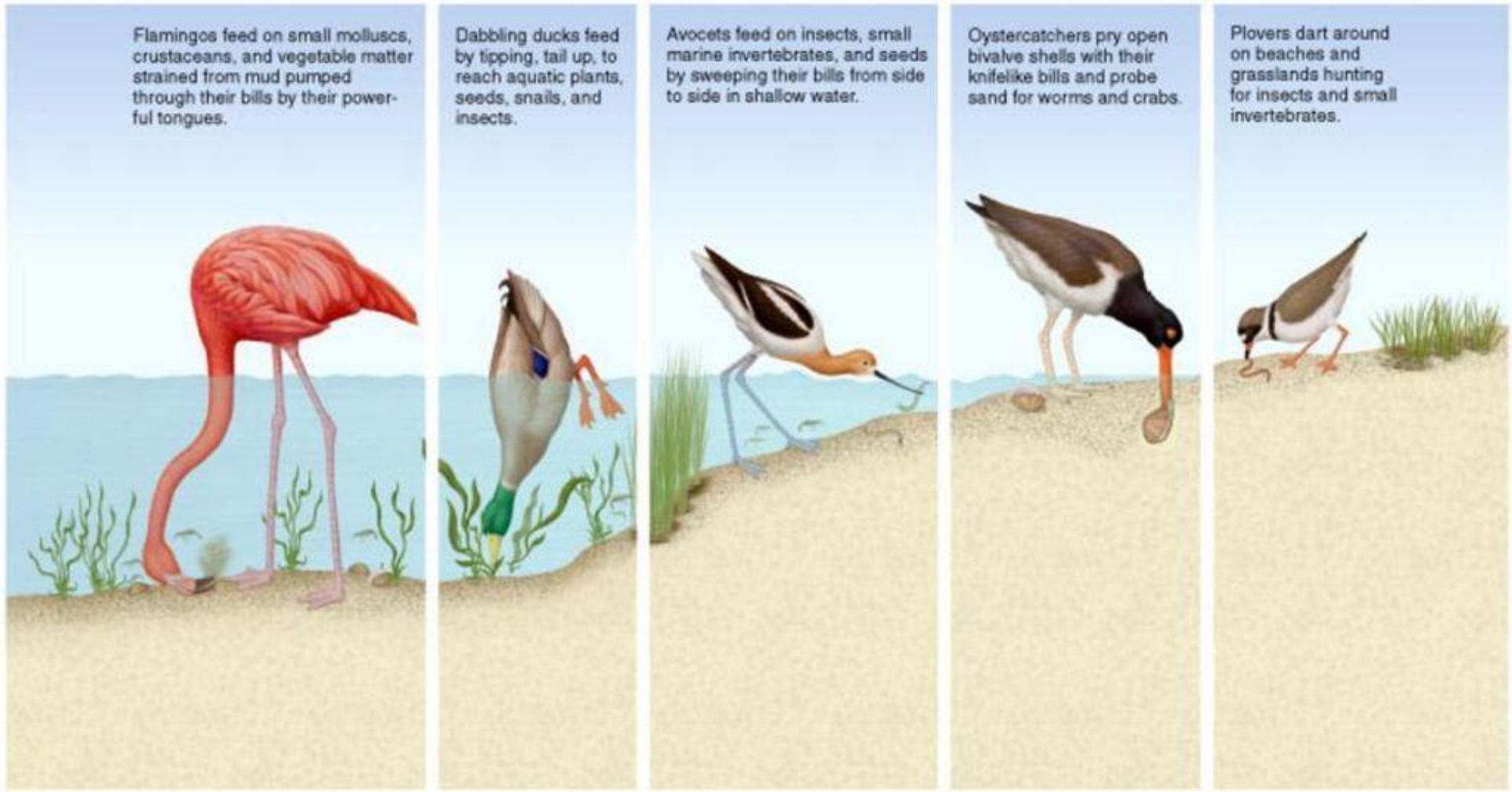
Community B

# What's the difference between a habitat and niche?

- Habitat: All of the biotic & abiotic factors in the area where an organism lives (i.e. grass, trees, watering hole)
- Niche: All of the physical, chemical, and biological factors that a species needs to survive, stay healthy, and reproduce (i.e. type of food species eats, temperature it can tolerate, time of day it is active)
- Habitat is **where** a species lives ("address"), niche is **how** it lives there ("job")

# Niche – each member of this community gathers food in a unique way



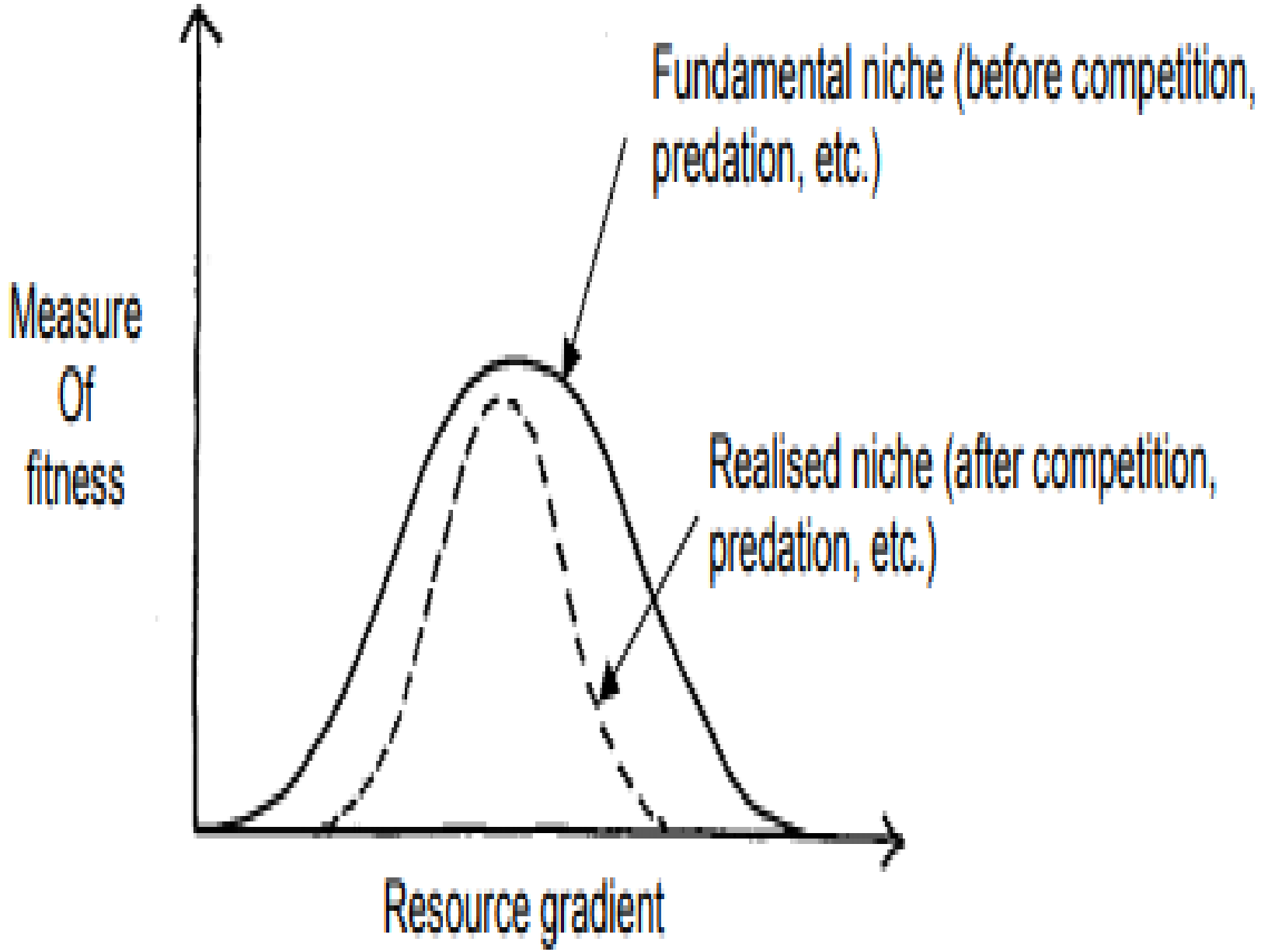


**The fundamental niche** is the potential set of conditions which a species can occupy.

It can be determined experimentally.

However, in nature due to the effects of competition, enemies and biogeography, species do not occupy the niche completely.

* What is observed is their **realised niche** .


Fundamental niche (before competition, predation, etc.)
Realised niche (after competition, predation, etc.)
Measure Of fitness
Resource gradient

Community structure can be investigated by grouping organisms at levels higher than the species. **Some common ways of grouping species are:**

***A.Guilds*:** A guild is a group of species which utilise resources in a similar way. **For example** a group of fruit eating birds in a rainforest, a guild of forest-floor dwelling herbs. Note that because species within a guild utilise the same resources, then we expect them to compete more strongly with each
other than with species from different guilds.

***B. Functional types:*** Functional types are groupings of organisms which respond similarly to a particular disturbance.The groupings can include species, or subspecies, or phenotypes which differentially respond to the disturbance, or even different stages in the life history of the same species.

***C. Trophic levels*:** Community structure can be described by the use of food webs. A food web is a graph of the various trophic levels in a community
(carnivores, herbivores, producers) and the links between them.
**Trophic structure** is the hierarchy of feeding. It describes who eats whom(a **trophic interaction** is a transfer of energy: i.e., eating, decomposing, obtaining energy via photosynthesis).
For every community, a diagram of **trophic interactions** called a **food web**.
Energy flows from the bottom to the top

# Emergent Properties of a Community

- Scale
- Spatial and Temporal Structure
- Species Richness
- Species Diversity
- Trophic structure
- Succession and Disturbance

- **Scale** is the size of a community.
- **Spatial Structure** is the way species are distributed relative to each other. Some species provide a framework that creates habitats for other species.
- Example: Trees in a rainforest are stratified into several different levels, including a canopy, several understoreys, a ground level, and roots. Each level is the habitat of a distinct collection of species.
- **Temporal structure** is the timing of the appearance and activity of species.
- Example: Many desert plants and animals are dormant most of the year. They emerge, or germinate, in response to seasonal rains. Other plants stick around year round, having evolved adaptations to resist drought.

- **Species Richness** - is the number of species in a community.

- **Species Diversity** is the variety of different species in the community, and their relative abundances.

## Succession, Disturbance and Change

- In terms of species and physical structure, communities change with time.
  - **Ecological succession**, the predictable change in species over time, as each new set of species modifies the environment to enable the establishment of other species.

# Some Agents of Disturbance

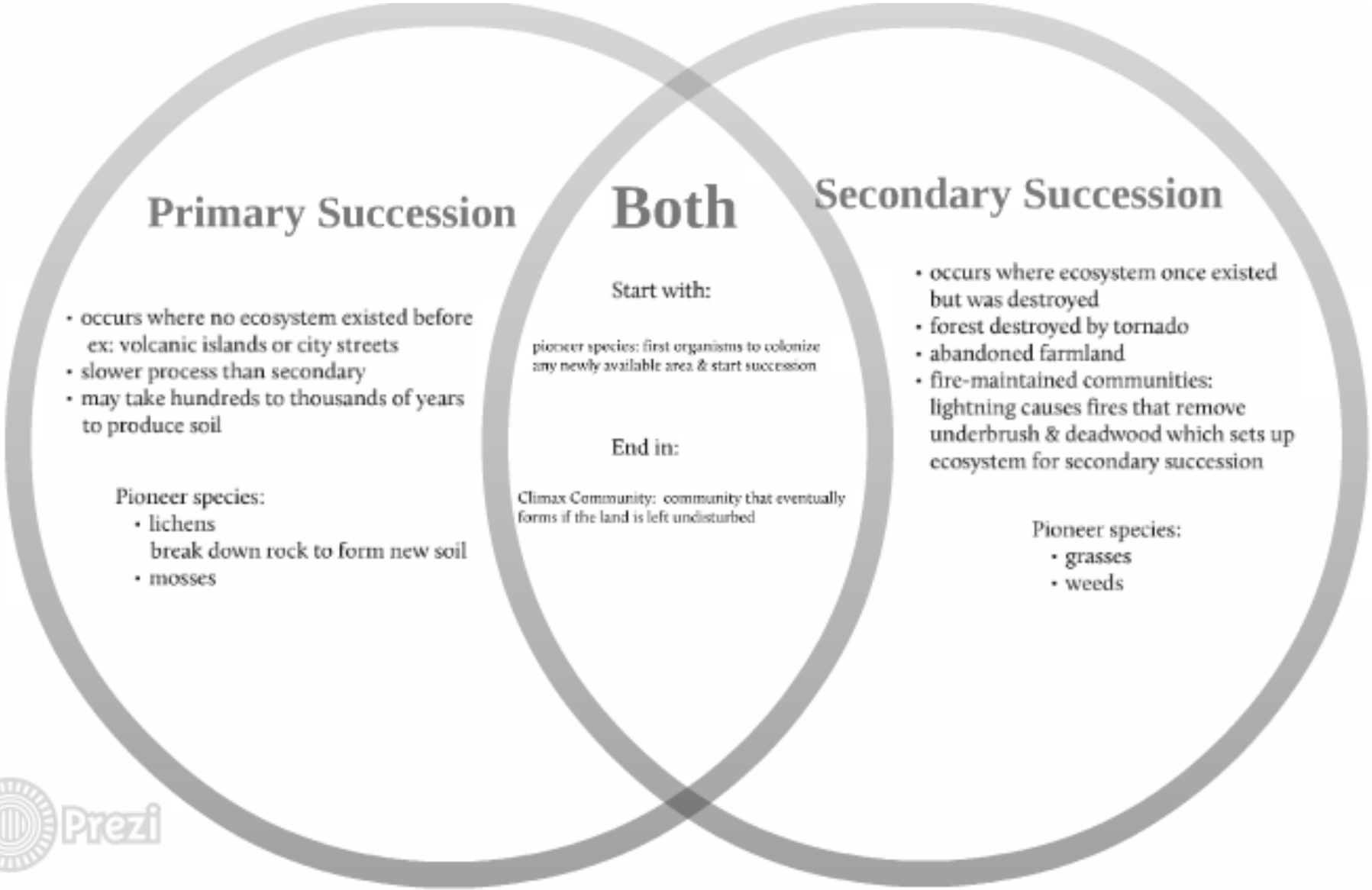
- Fire
- Floods
- Drought
- Large Herbivores
- Storms
- Volcanoes
- Human Activity

# Disturbance of a community is usually followed by recovery, called ecological succession.

The sequence of succession is driven by the interactions among dispersal, ecological tolerances, and competitive ability.

- **Primary succession-**the sequence of species on newly exposed landforms that have not previously been influenced by a community.
- **Secondary succession** occurs in cases which vegetation of an area has been partially or completely removed, but where soil, seeds, and spores remain.

Example: A forest fire may destroy a large area of trees, clearing the way for a meadow. Eventually, the trees take over and the meadow is replaced.


Primary Succession
• occurs where no ecosystem existed before
ex: volcanic islands or city streets
• slower process than secondary
• may take hundreds to thousands of years
to produce soil
Pioneer species:
• lichens
break down rock to form new soil
• mosses
Both
Start with:
pioneer species: first organisms to colonize
any newly available area & start succession
End in:
Climax Community: community that eventually
forms if the land is left undisturbed
Secondary Succession
• occurs where ecosystem once existed
but was destroyed
• forest destroyed by tornado
• abandoned farmland
• fire-maintained communities:
lightning causes fires that remove
underbrush & deadwood which sets up
ecosystem for secondary succession
Pioneer species:
• grasses
• weeds

# Primary terrestrial succession

1. 2. 3. 4. 5. Climax

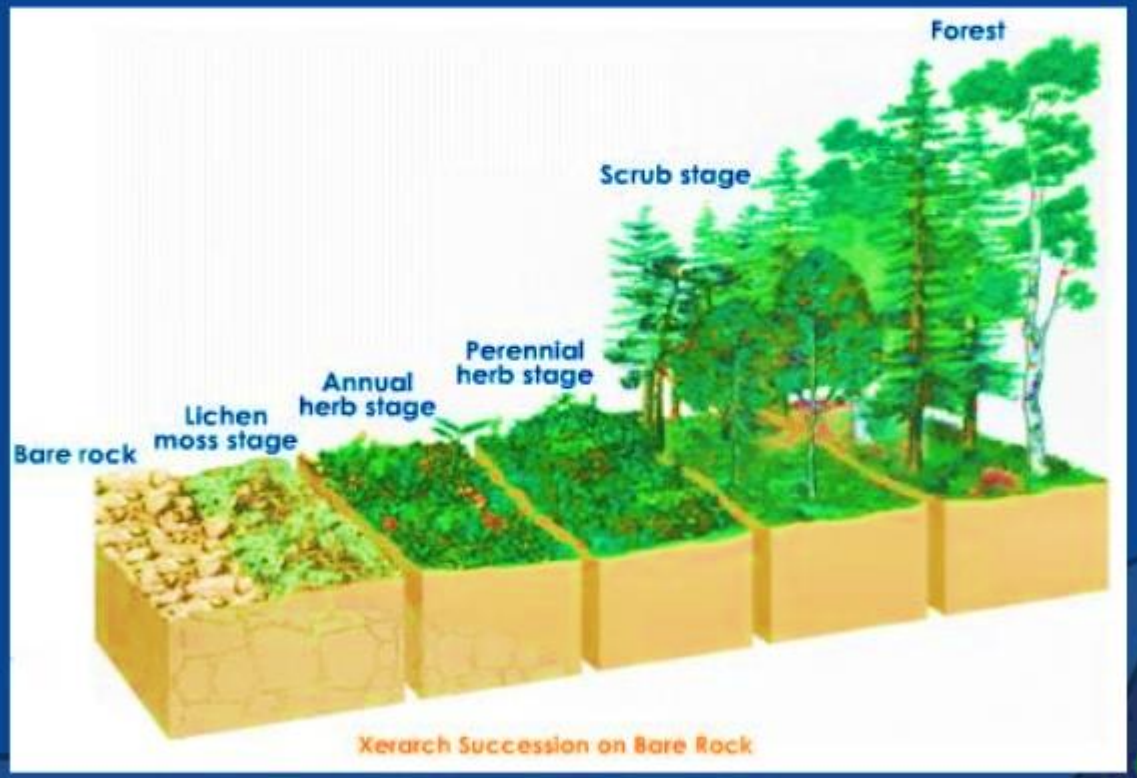
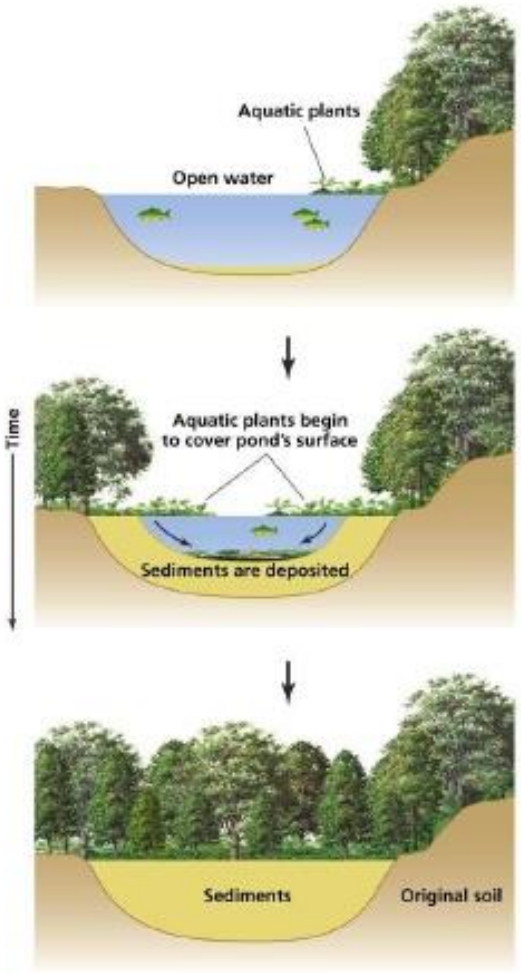


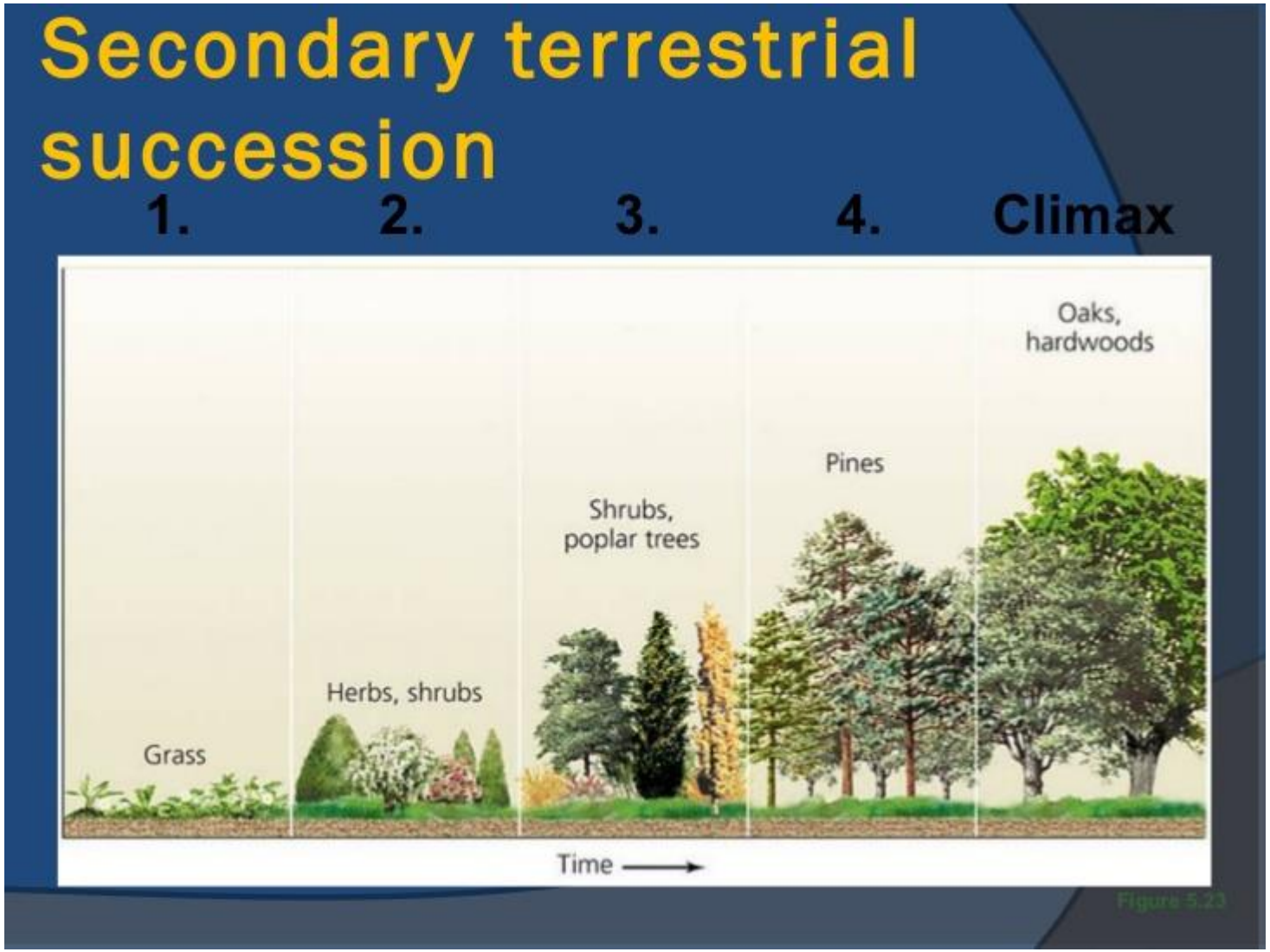

Figure 5.24

# Primary aquatic succession

1. Open pond
2. Plants begin to cover surface; sediment deposited
3. Pond filled by sediment; vegetation grows over site



# Secondary terrestrial succession

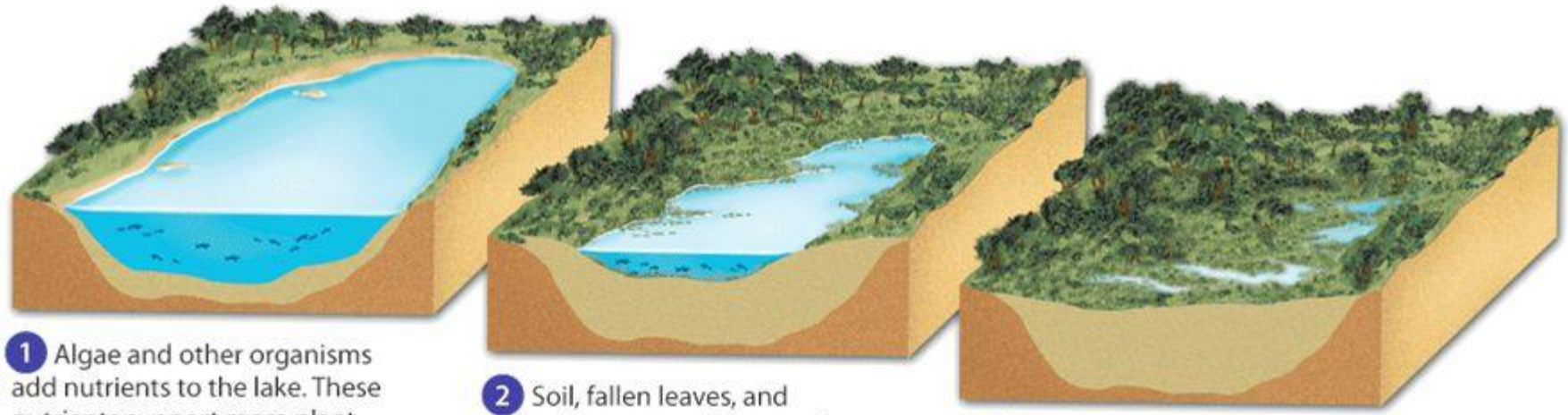


# Aquatic Succession

- Succession also occurs in aquatic ecosystems, especially lakes and ponds
- Primary: Lakes fill in for the first time
  - Ex: glacier retreats and melts, creating lake
- Secondary: Over time, lakes and ponds fill with runoff / sediment and decaying organisms

# Succession in Water

- Disturbances such as floods or excess nutrient runoff can lead to SECONDARY aquatic succession.
- As the aquatic community fills with algae, microbes and plants, it may eventually fill up and become a TERRESTRIAL environment.



1 Algae and other organisms add nutrients to the lake. These nutrients support more plant

2 Soil, fallen leaves, and decaying matter pile up on the

3 Eventually the lake fills in.

- **The first community which is inhabiting the area will be referred as 'pioneer community' . for example, algae that colonize bare rocks.**
- **The intermediate communities are called 'transitional or seral communities'.**

- **The last community occurring over a long period of time in the same area results in establishment of stable or climax community.**

**E.g.** Cacti in deserts

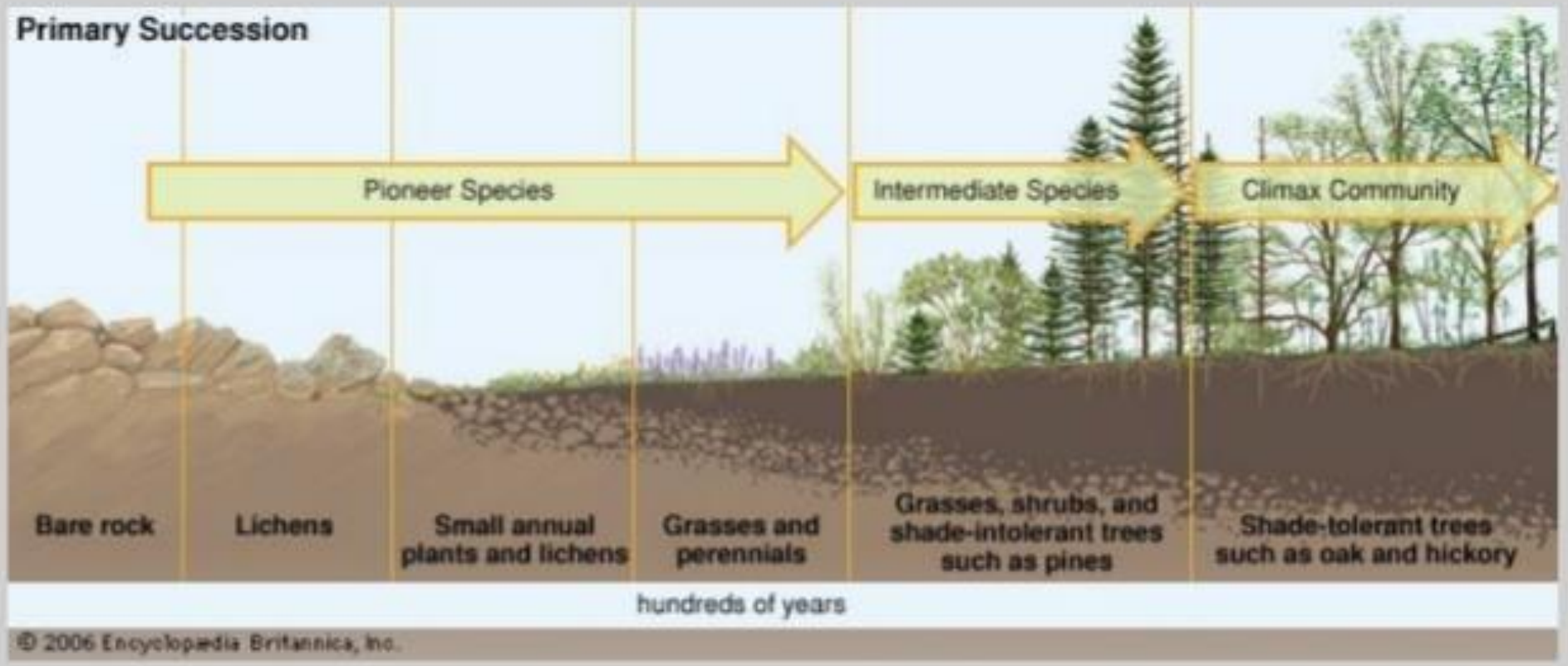
- **The whole series of changes in community characteristics from pioneer stage to climax stage constitute a 'sere' and the intermediate stages are the 'seral stages'.**

- **Pioneer Communities**

- Early in succession, species are generally excellent dispersers and good at tolerating harsh environments, but not the best interspecific competitors.
- As ecological succession progresses, they are replaced with species which are superior competitors,

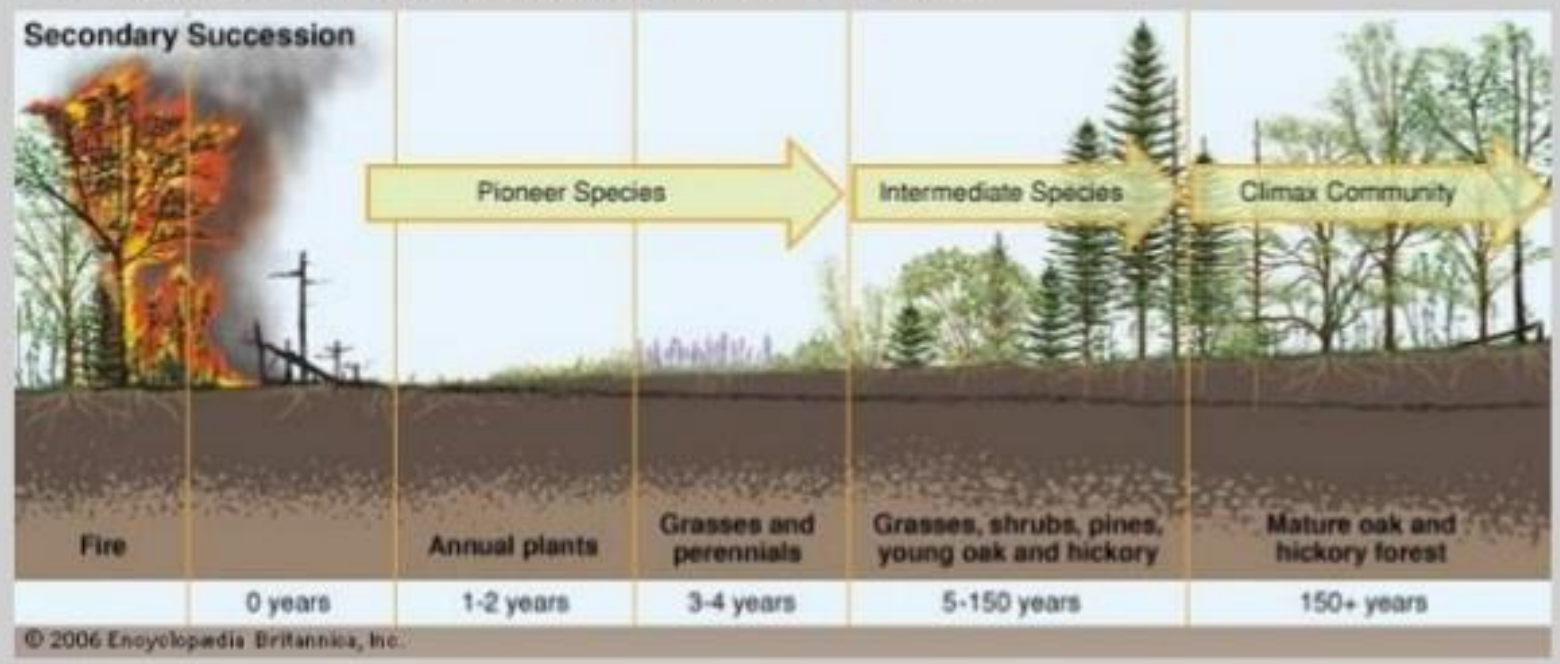
- A **climax community** is a more or less permanent and final stage of a particular succession, often characteristic of a restricted area.
- Climax communities are characterized by slow rates of change, compared with more dynamic, earlier stages.
- They are dominated by species tolerant of competition for resources.

# Primary Succession



# Secondary Succession

- Looks very similar to primary succession but does not require soil forming pioneer species



- **What is the difference between primary and secondary succession?**
- a. Primary succession is rapid and secondary succession is slow.
- b. Secondary succession begins on soil and primary succession begins on newly exposed surfaces.
- c. Primary succession modifies the environment and secondary succession does not.
- d. Secondary succession begins with lichens and primary succession begins with trees.