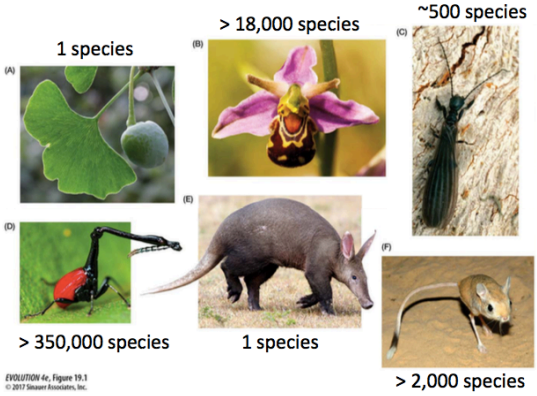
CHAPTER 19 - THE EVOLUTION OF BIOLOGICAL DIVERSITY

DEFINITIONS

1. **Biological diversity:** refers to all of the different kinds of life on Earth.
2. **Species richness:** is the number of different species represented in an ecological community, landscape or region
3. **Speciation rate:** the probability that one of the species “gives birth” to a second species in a short period .
4. **Carrying capacity:** Equilibrium number that can stably coexist
5. **Ecoscape:** The organisational shape or layout of an ecosystem.
6. **Background extinction:** Some lineages have become extinct during every geological time interval.
7. **Mass extinctions:** When great many or even most species became extinct.
8. **Ecological opportunity:** many open ecological niches.
9. **Key adaptations:** Features that enable a lineage to interact with the environment in a new way and to use new resources.
10. **Replicated sister group comparison:** Diversity of a number of clades with a novel character can be compared with the diversity of their sister groups that retain the ancestral character state.
11. **Species selection:** the process responsible for the proliferation of species that have lower extinction and higher speciation rates.

- *Diagram to the right:* Contrasts in species richness. (A) single species of Ginkgo Biloba , (B) one of more than 18 000 species of Orchidaceae , (C) the Webspinners order is far less diverse than (D) the beetles. The order Tubulidentata (E) has a single living member , the African Aardvark. (F) The order Rodenta includes more than 2280 species.



- Biodiversity can be studied from the complementary perspectives of Ecology and evolutionary history.
- Ecologists focus on factors that operate over short time scales to influence diversity within local habitats or regions.
- BUT factors that operate on a large scale also affect biodiversity.
- In millions of years : extinction , adaptation, speciation , climate change and geological change create potential for entirely new assemblages of species.

ESTIMATING AND MODELING CHANGES IN BIOLOGICAL DIVERSITY

- Changes in diversity over time measured by : Paleontology and Phylogenetic analysis of living species.

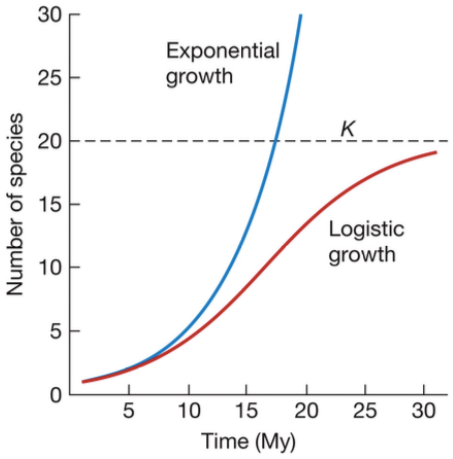
dN/dt = (S-E)N = DN

- N - number of taxa (changes over time by speciation and extinction - these events are analogous to the births and deaths of individual organisms in a population)
- S- Speciation rate in a short time period that is dt long (dt is often 1 year)
- E- Extinction rate
- D- the net diversification rate (D= S-E)
- D>1 (Number of species will increase if the speciation event is greater than the extinction rate)
- D<1 (Number of species will decrease)

- The number of species that can speciate: SN dt
- The number of species that become extinct: EN dt

This model can be used to describe changes in the number of higher taxonomic categories such as genera and families EXCEPT:

- S- rate of origination of new taxa
- D- diversification rate: The average rate per taxon of an increase or decrease in diversity.



- *Diagram to the right:* 2 models for the change in species diversity through time. With logistic growth diversification rate decreases as the number of species increases.
- If D remains constant , the number of species will grow or shrink exponentially BUT D may decrease as the result of diversity-dependent factors such as competition for food or space that becomes more intense as the diversity of competing taxa increases.
- The diversity may attain an equilibrium at K species.

- *Diagram to the right:* Two clades can differ in species richness because of differences in (A) carrying capacity , (B) The rate of diversification or (C) their age , meaning the time they had to diversify.