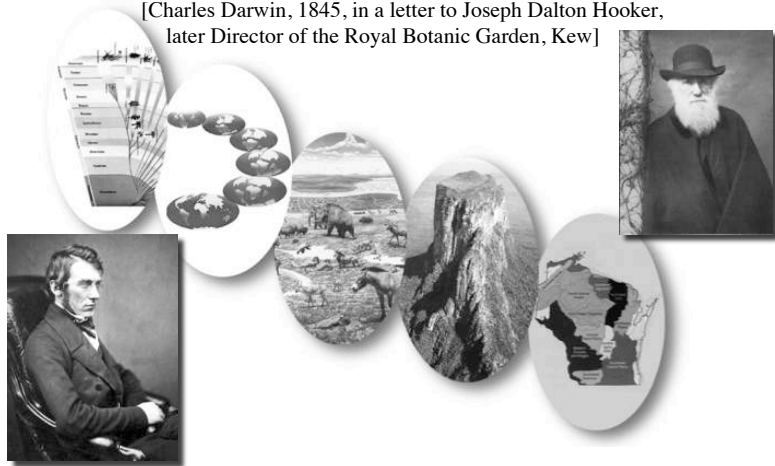


# The Biogeography of Life

" . . . that grand subject, that almost keystone of the laws of creation,  
**Geographical Distribution**"

[Charles Darwin, 1845, in a letter to Joseph Dalton Hooker,  
later Director of the Royal Botanic Garden, Kew]



## What is Biogeography?

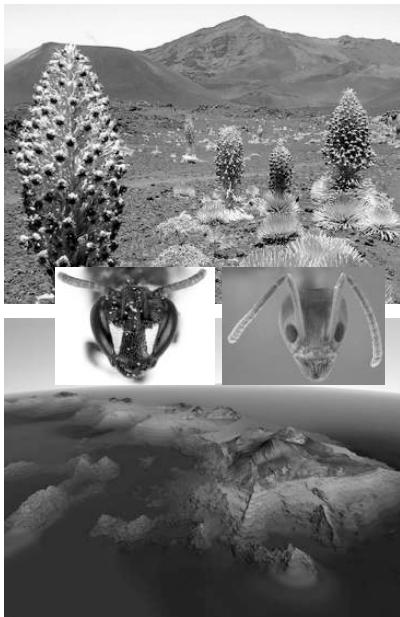
- read “*The Science of Biogeography*”  
Lomolino 4<sup>th</sup> ed, pp. 3-14 (Learn@UW)

## What is Biogeography?

- 1.6 million described species of organisms, and perhaps 10X more either not named or undescribed
- untold millions of species that are now extinct, only a fraction recorded as fossils
- organisms found in all environments, yet each extant and extinct species has or had a unique geographic distribution
- a few species share with the silversword this unique distribution

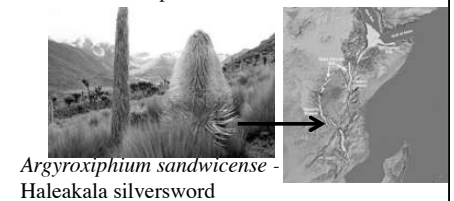
— **floristics, faunistics!**

*Argyroxiphium sandwicense* -  
Haleakala silversword

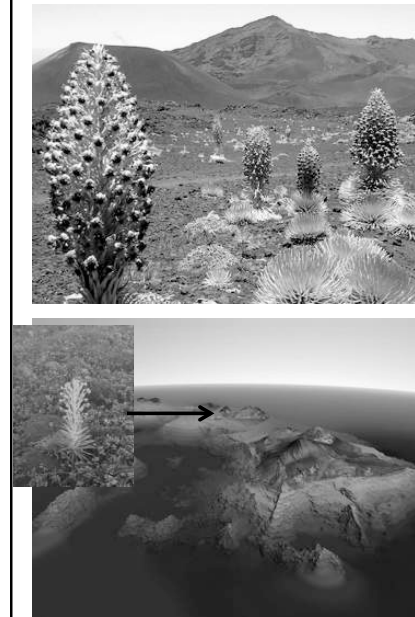


## What is Biogeography?

- each species inhabits only a part of the earth’s surface, is specifically adapted to this habitat, and varies in abundance over its geographic range
- each species tracks its “species niche” as climate changes – or goes extinct
- close relatives diverge (form, physiology, etc.) into adjacent, but different habitats
- mimics, or convergents, occupy similar habitats in other parts of the world



*Argyroxiphium sandwicense* -  
Haleakala silversword



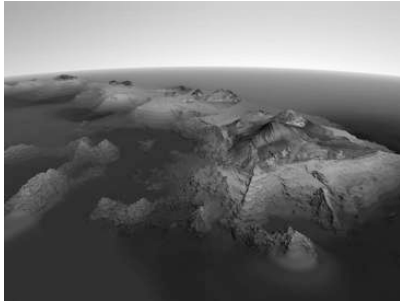


## What is Biogeography?

- each species is descended from another species (or several)
- species' range initiates from splitting of ancestral species' distribution, or by long distance dispersal event
- species' range changes dynamically through time, eventually decreasing to extinction

— **history!**

*Argyroxiphium sandwicense* -  
Haleakala silversword

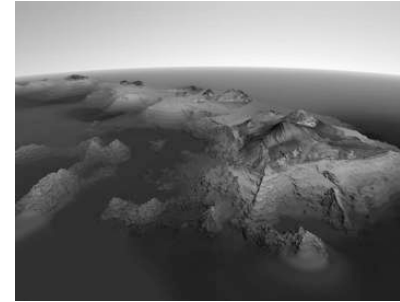


## What is Biogeography?

"Earth and Life Evolve Together"

Leon Croizat (1964)

Panbiogeography  
(Space, time, form: the biological synthesis)



*Argyroxiphium sandwicense* -  
Haleakala silversword



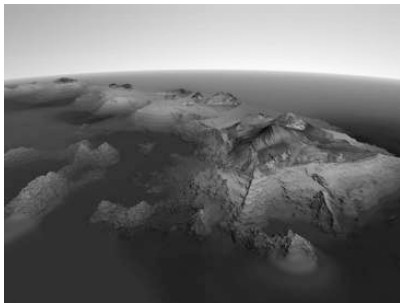
## What is Biogeography?

1. *How* are organisms and their attributes distributed over the surface of the earth, and over the history of the earth?
2. *Why* do organisms and their attributes show these patterns of distribution?

*How and why does diversity (biodiversity) vary over the surface of the earth?*

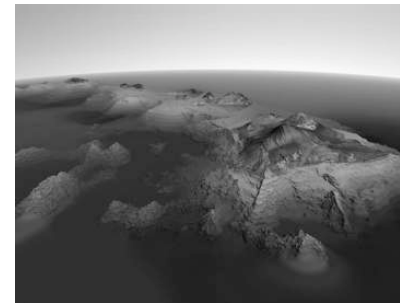
(from 1<sup>st</sup> reading in Lomolino)

*Argyroxiphium sandwicense* -  
Haleakala silversword



## Approaches to Biogeography

- Biogeography is a broad field!  
ecology, systematics, evolutionary biology, population biology, genetics, cytology, morphology and anatomy, physiology, paleobiology, the geosciences, and natural history
- Three basic kinds



*Argyroxiphium sandwicense* -  
Haleakala silversword

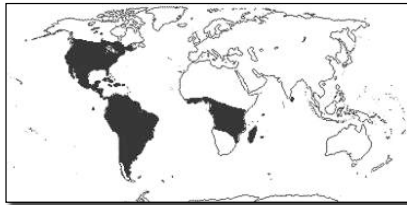
## Floristic (or Faunistic) Biogeography



— Where various *taxa* are distributed

Where are members of the Cactaceae (cactus family) found?

**Answer:** almost exclusively in the Americas, deserts to cloud forests; 1-3 species across tropical Africa



## Floristic (or Faunistic) Biogeography



— Where various *taxa* are distributed

Where are members of the Bromeliaceae (pineapples) found?

**Answer:** almost exclusively in the Americas, deserts to cloud forests; 1 species in tropical West Africa



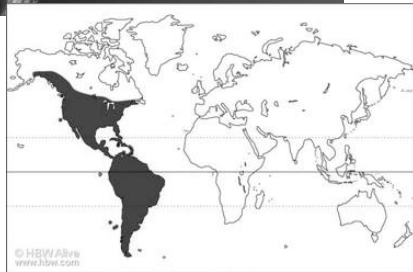
## Floristic (or Faunistic) Biogeography



— Where various *taxa* are distributed

Where are members of the Trochilidae (hummingbirds) found?

**Answer:** exclusively in the Americas, deserts to cloud forests to temperate forests



Provides the backbone of data for historical biogeography

## Ecological Biogeography

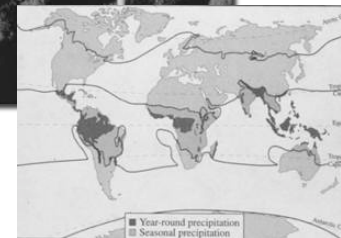


*Koompassia*  
(Fabaceae)

— Distributions of *vegetation* and *attributes* of organisms without concern to their classification

Why do rainforests occur where they do?

The plants that dominate the rain forests of southeast Asia are taxonomically distinct from those of South America, but forests are physiognomically similar



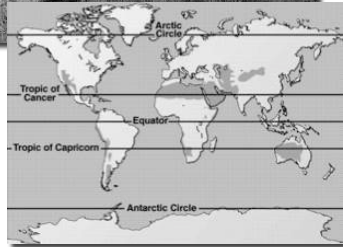
**Vegetation** looks the same, but the **floras** are different

## Ecological Biogeography



— Distributions of *vegetation* and *attributes* of organisms without concern to their classification

Why do deserts occur where they do?



The plants that dominate the deserts of North America are taxonomically distinct from those of Africa, but succulent plants are physiognomically similar

**Vegetation** looks the same, but the **floras** are different

## Historical Biogeography



— Combines organismal history with geological events to explain past and present distributions

Why would so many genera like *Fagus* (beech tree) and *Trillium* in the Great Smoky Mountain National Park be familiar to an ecotourist from Japan?

Requires information from previous two branches of biogeography plus **phylogenetics** and **earth history**

## Historical Biogeography



— Combines organismal history with geological events to explain past and present distributions

Why would *Calceolaria* (ladies' purse) have this unusual Southern Hemisphere disjunct distribution?



Requires information from previous two branches of biogeography plus **phylogenetics** and **earth history**

## Biogeography

- Climate, vegetation, flora – biomes of the world
- Evolution of life
- Evolution of earth
- Relationships of floras and faunas
- Biogeography of islands
- Paleobiogeography
- Global changes and future of biogeography

