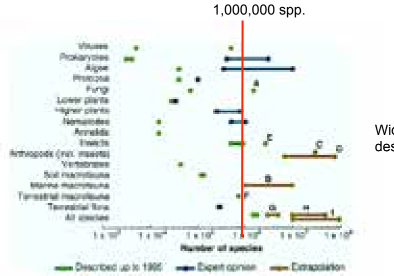
What is biodiversity?

Number of Species

1,000,000 spp.



Wide range between described and actual

Biogeography *Pimm et al., 1995* Prof. J. Hicke

Distribution of species among groups

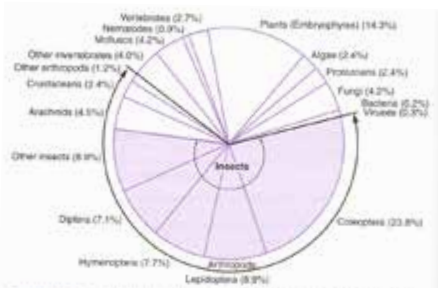


FIGURE 14.2 The distribution of known species (in 1990) among different plant and animal groups (after World Conservation Monitoring Center, 1992).

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Number of new species described recently

TABLE 14.1 Number of New Species Described per Year between 1978 and 1987 for Selected Groups of Organisms

Organisms	Species Described Per Year (1978–1987)
Mammals	
Birds	
Amphibians and reptiles	
Fish	
Mollusks	
Insects	
Arachnids	

Source: World Conservation Monitoring Center (1992).

How many?

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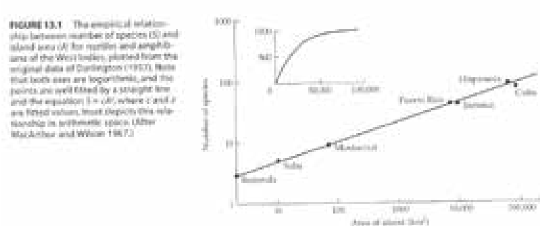
Species-area curve



Lomolino et al., 2006

Species-area curve

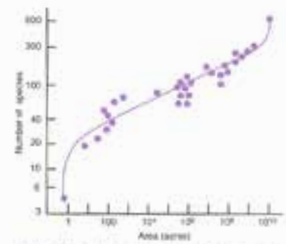
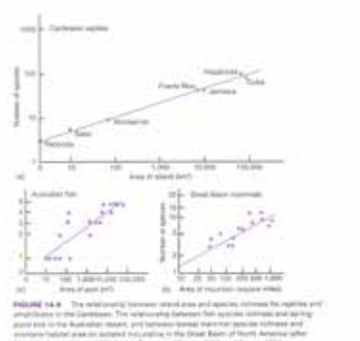
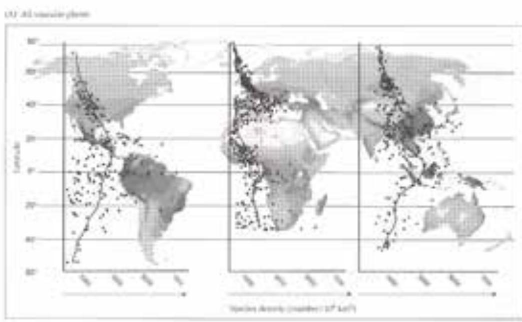


FIGURE 14.1 The relationship between sampling area and bird species richness in North America. The data are plotted on a log-log graph to render the species-area curve into a relatively straight line. As the size of the sampling area increases, the number of bird species found also increases (after Preston, 1960).

Species-area curves for different animal groups

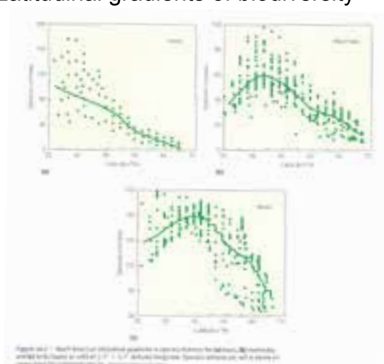


Geographic patterns of biodiversity



Lomolino et al., 2006

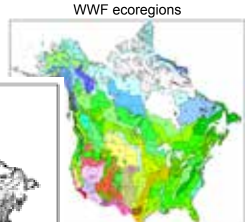
Latitudinal gradients of biodiversity



 Smith and Smith, 2006

Geographic patterns of biodiversity

WWF ecoregions



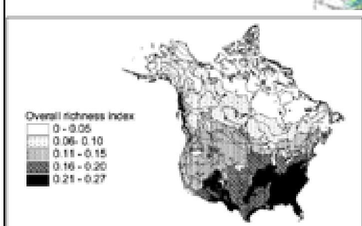


Figure 2. Map of overall richness index. This map incorporates richness values for all nine taxa: mammals, birds, reptiles, amphibians, butterflies, tiger beetles, land snails, trees, and nontree vascular plants.

Ricketts et al., 1999

Species richness (S) at high latitudes is 1-10% of S at lower latitudes

TABLE 14.2 Examples of Latitudinal Gradients of Species Richness for Selected Terrestrial and Marine Organisms

Organism	Region	Low Lat. Species	Richness	High Lat. Species	Richness
Mammals	N. America	8° N	240	66° N	21
Mammals	S. America	12° N	327	54° S	26
Land birds	N. America	8° N	600	66° N	50
Reptiles	N. America	30° N	60	45° N	10
Amphibians	N. America	30° N	40	45° N	10
Ants	S. America	20° S	220	55° S	2
Orchids	S. America	0°	2500	55° S	15
Marine fish	N. America	32° N	229	42° N	119
Marine mollusks	N. America	25° N	500	50° N	95

Source: Brown and Lomolino, 1998.

low latitudes high latitudes

S at higher elevations is less than that of S at lower elevations

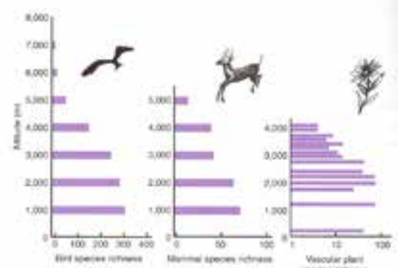


FIGURE 14.4 Declining species richness of birds and mammals at higher elevations in the Himalayan Mountains.

Fragmentation of tropics drove allopatric speciation

FIGURE 14.8 Suggested extent of tropical rainforest in South America, Africa, and Southeast Asia during the last glacial maximum approximately 20,000 years ago. However, not all biogeographers believe that the fragmentation of rainforest was so severe.

Local biodiversity differences can be explained by historical theory

Lake Baikal: 1 M years old:
580 benthic invertebrates, many endemic

Great Slave Lake: 10,000 years old:
4 benthic invertebrates

www.worldlakes.org/uploads/GreatSlave%20Lake_locatmap.gif

www.lib.utexas.edu/maps/middle_east_and_asia/asia_ref04.jpg

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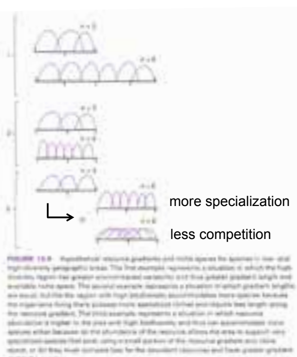
Relevant theories about resource gradients and niches

1. differences in length of resource gradient

2. more specialization

3. more resources



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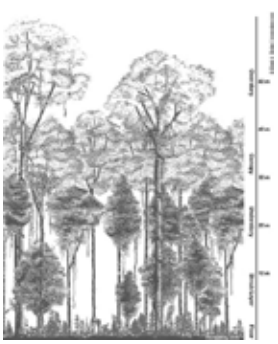
Habitat variability influences biodiversity



Vertical structure of a rainforest

www.mongabay.com

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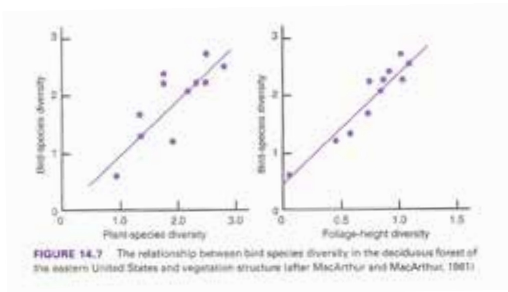
Increases in bird species diversity in response to habitat variability



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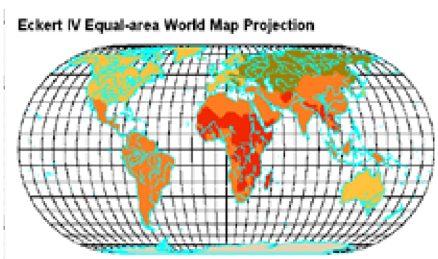
Large area in tropics allows for greater S



atlas.nrcan.gc.ca/site/english/learningresources/carto_corner/eckert.gif/image_view

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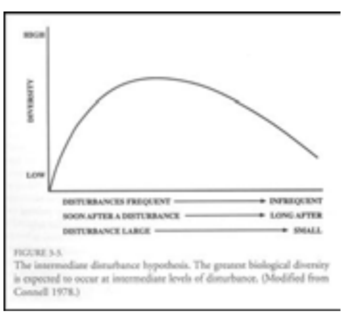
Intermediate Disturbance Hypothesis



efc.muskie.usm.maine.edu/Landscape_Ecology_for_Planners_files/slide0061_image078.jpg

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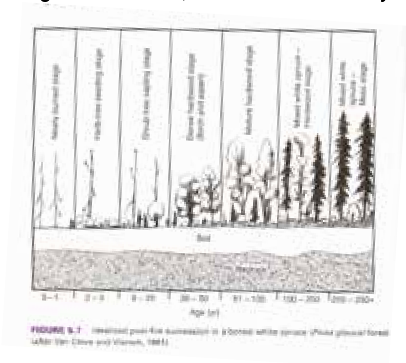
Following disturbances, where is biodiversity highest?



Evidence against disturbance as a control on global biodiversity patterns

Intense, frequent fires

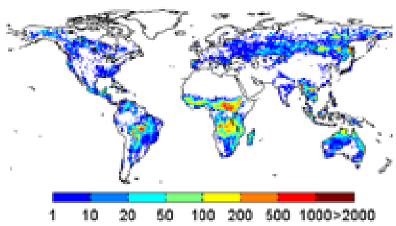
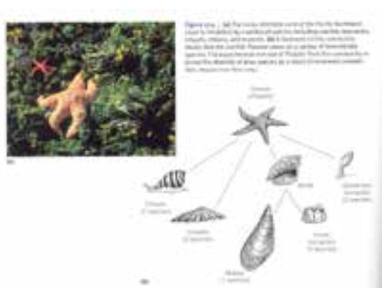


Fig. 6. Mean annual fire emissions (g C m^{-2} $year^{-1}$) averaged o 1997–2004.

van der Werf et al., 2006

Predator controls on biodiversity

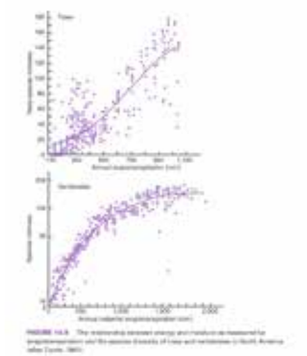
Artificial exclusion experiments



Prey species before: 15
Prey species after: 8

Smith and Smith, 2006

Increases in diversity with increasing evapotranspiration



Types of ecosystem services

Pereira and Cooper, 2006