01

Lecture 10, 23 Sept 2004
Van Dyke Ch4 n 5

Conservation Biology
ECOL 406R/506R
University of Arizona
Fall 2004

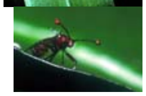
Kevin Bonine
Kathy Gerst

02

Conservation Biology 406R/506R

1. Biodiversity
-Van Dyke Ch 4

2. Paradigms and Theories
-Van Dyke Ch 5



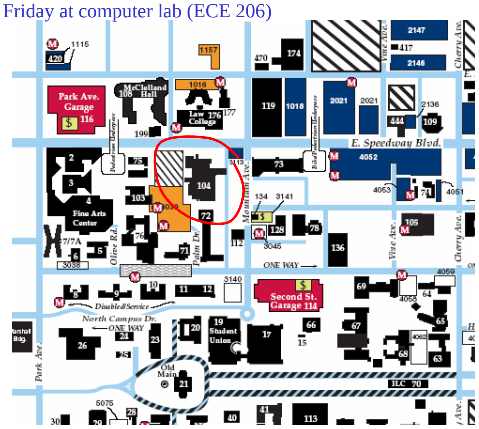
-Thailand Study Abroad (isdsi)
-Brazil (Antioch)

3. Lab Friday at computer lab (ECE 206)

4. Exam Tuesday next week
Old Exam on website, review sheet?

02b

Friday at computer lab (ECE 206)



03

CITES:

04

Genes From Engineered Grass Spread for Miles, Study Finds

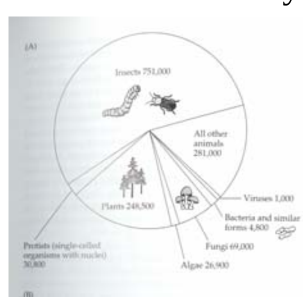
Watrud et al. 2004, PNAS

NYTimes, 21 Sept 2004

http://www.nytimes.com/2004/09/21/business/21grass.html

05

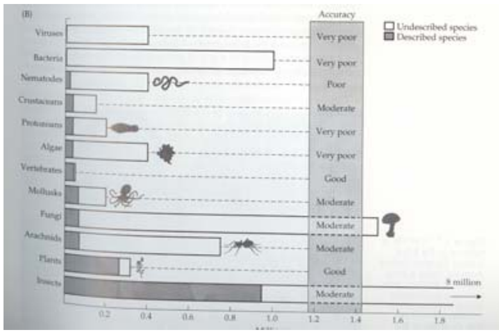
What is biodiversity?



Thanks to Chuck Price

06

How many species on earth?



Thanks to Chuck Price

07

Biodiversity Tid Bits

Species or DNA out of context?

Umbrella Species
Indicator Taxa (or structure or function, redundancy)
Keystone Species (bison)

Areas of high endemism for one group may
not be high areas of endemism or BD for another group

Where is biodiversity?
One tree in Peru with same ant diversity as Britain

08

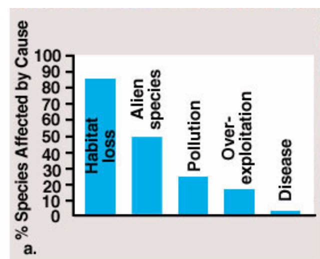
What factors correlated with high diversity?

- Energy
- Precipitation
- Temperature
- Area
- Stable environment
- Moderate disturbance level

Thanks to Chuck Price

09

Threats to biodiversity – habitat loss



Thanks to Chuck Price

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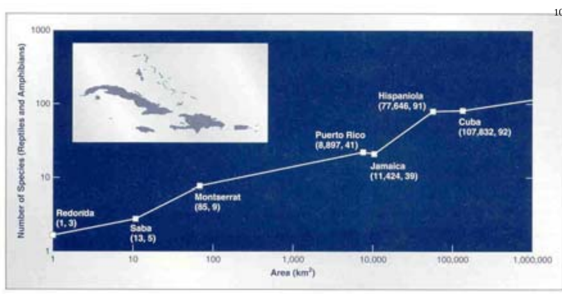

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Figure 4.4
A general species-area relationship among some Caribbean islands. Note that species richness on islands increases with increasing area.
Based on data from Darlington (1957:483).

Species-Area Relationship

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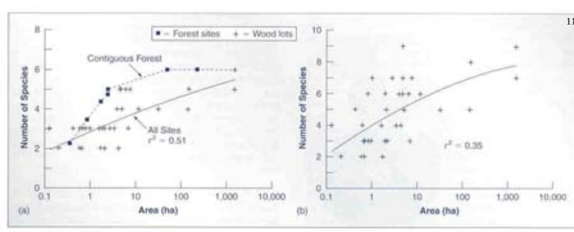

Figure 4.5
An illustration of the relationship between area and species richness of (a) granivores and (b) all small mammal species in woodlots (crosses) and contiguous forest sites (squares). Species richness increases with woodlot area. In (a), note that granivore species richness increases with area more rapidly in contiguous forest than in woodlots. This pattern suggests that species richness not only declines with habitat loss, but also with habitat fragmentation.

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After Nupp and Swihart (2000).

Woodlots vs. contiguous forest

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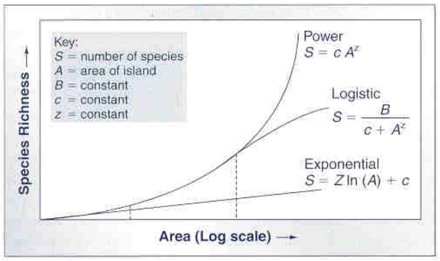

Species Area Curves

Figure 5.8
Species-area curves and their relationship. More than one equation can be used to develop species-area curves. Presented are three equations that can be used to generate a graphical representation of a species-area relationship, forming a species-abundance curve.

After Fangliang and Legendre (1996).

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Species-Area Relationship

3 step loss of biodiversity
(Rosenzweig)

1. Endemics
2. Sink populations
3. Stochasticity

$S = cA^Z$

S = species richness
c = taxon specific constant
A = area
Z = extinction coefficient for taxon

Therefore end up with lower steady state species richness and loss of biodiversity

-Endemism and Islands (Tuatura, Silversword)
-Island Biogeography

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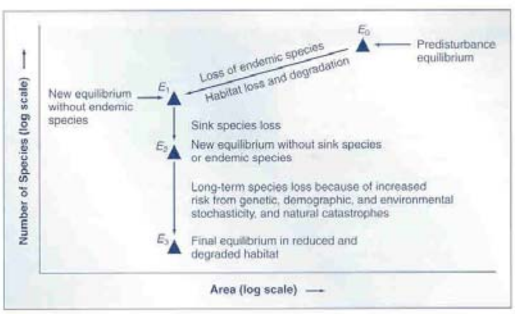

Figure 4.6
When the size of a natural area is decreased, the first species lost are endemics. Next, sink species (those that are not reproducing fast enough to replace themselves) go extinct locally. Finally, failure to replace accidental losses fast enough brings the province to a still lower steady state of biodiversity.

After Rosenzweig (1999).

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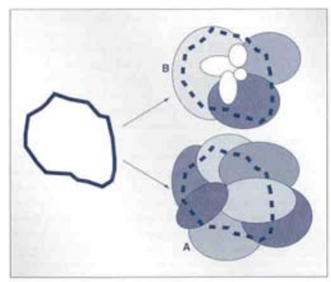

Figure 4.7
The "cookie cutter" model of the effects of habitat loss on endemic species. If the cookie cutter strikes at subarea A, seven species lose habitat but none is exterminated. In contrast, if the cookie cutter strikes subarea B, an area containing species with more restricted ranges, seven species lose habitat, and four species are exterminated. Thus, random habitat loss produces a disproportionately high rate of extinction in endemic species.

After Pimm (1998).

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Endemics
Habitat Size
Habitat Loss

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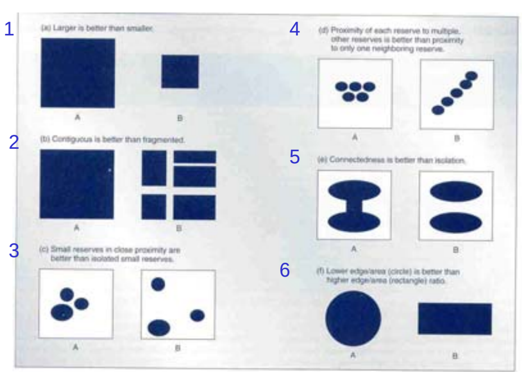

Figure 5.10
A graphical representation of the "rules" of island biogeography applied to nature reserves. In each case, design A is considered superior to design B.

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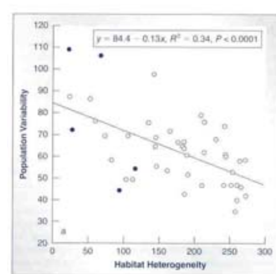
Habitat Heterogeneity

Population Variability

Bush Crickets



Van Dyke 2003

Figure 5.23
Populations of bush cricket (*Metrioptera bicolor*) subunits exemplify that population size is less variable as heterogeneity increases. Dark circles indicate patches where local extinctions occured. White circles indicate patches with extant populations. Population variability was measured by the coefficient of variance (cv) of local population size, and habitat heterogeneity was measured using digitized infrared aerial photographs. Each patch was assigned values according to how much the patch deviated from the standard level of gray in the photographs (SD-hue).

After Kindvall (1996).

Island
Biogeography
(MacArthur and Wilson 1967)

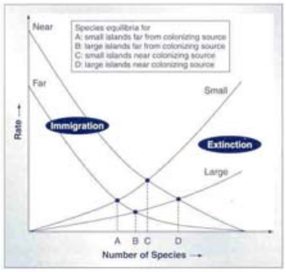
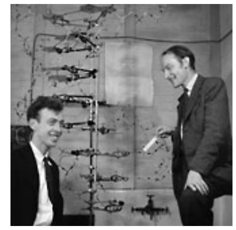


Figure 5.9
The equilibrium model of island biogeography predicts that numbers of species on an island represent an equilibrium between rates of immigration and extinction. Immigration rates increase with decreasing distance from an island's colonizing source. Extinction rates increase with decreasing area of the island. The four equilibria shown (A, B, C and D) depict different combinations of island size and distance from its colonizing source. The equilibrium theory of island biogeography predicts that large islands near a colonizing source will have more species than small islands far from a colonizing source.

- -Metapopulations
- -Spatial Relationships
- -Nature Reserves
- -Rescue Effect

Chapter 5

- -Metapopulations
- -Genetic Diversity
- -MVP, PVA
- -Island Biogeography
- -Disturbance



Metapopulation:

"Spatially disjunct groups of individuals with some demographic or genetic connection"

"largely independent yet interconnected by migration"

1. All local populations must be prone to extinction
2. Persistence of entire population requires <u>recolonization</u> of individual sites.

See p.193 in VanDyke text

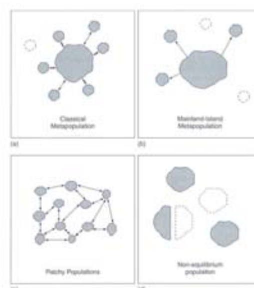


Figure 5.16
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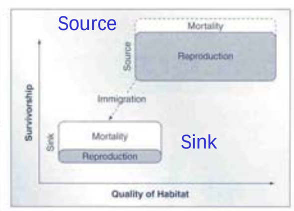
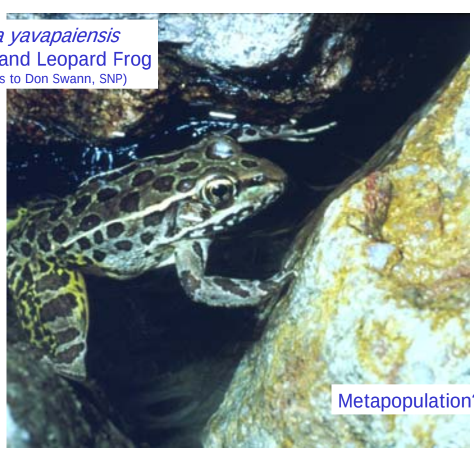


Figure 5.17
A visual representation of the source-sink model of habitat distribution. In source habitats, reproduction produces a population surplus (i.e., mortality does not decrease the number of individuals because of overcompensation through reproduction). Surplus individuals move to sink habitats where mortality exceeds survivorship. Sink habitats cannot be maintained by reproduction, but depend on immigration to maintain a population.

Rana yavapaiensis
Lowland Leopard Frog
(Thanks to Don Swann, SNP)



Metapopulation?

Habitat Loss
Alien species
Disease (chytridiomycosis)

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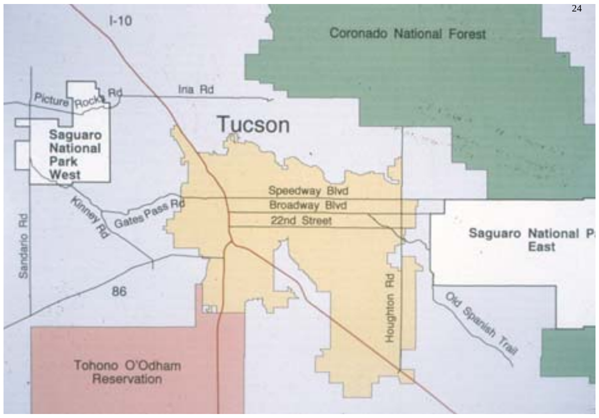

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Santa Cruz River

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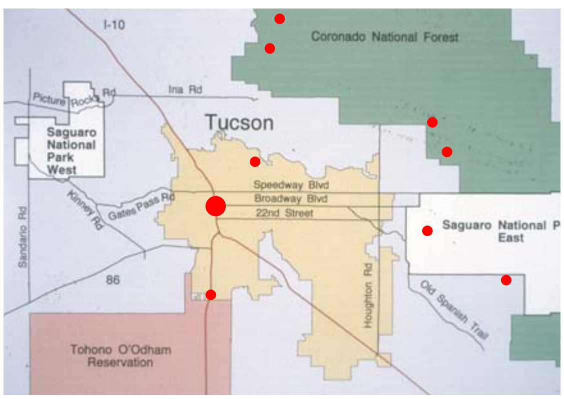

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Environmental Stochasticity

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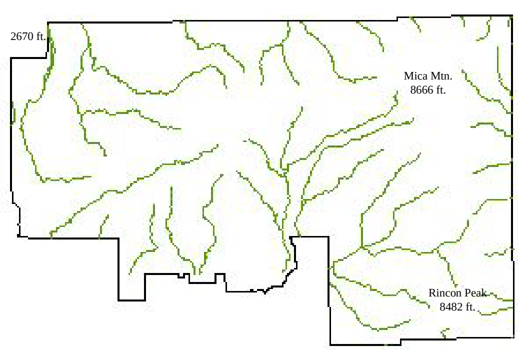
Saguaro National Park - Rincon Mountain District



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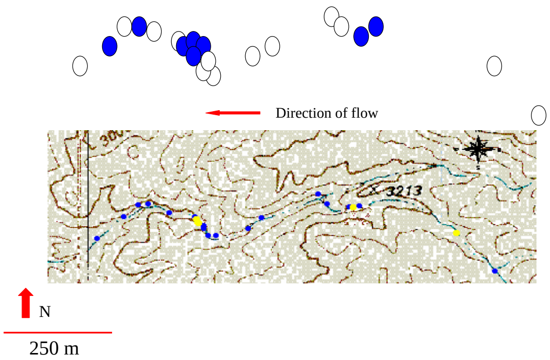
Schematic of Study Canyon, Saguaro NP



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Environmental Stochasticity
Human Influences?

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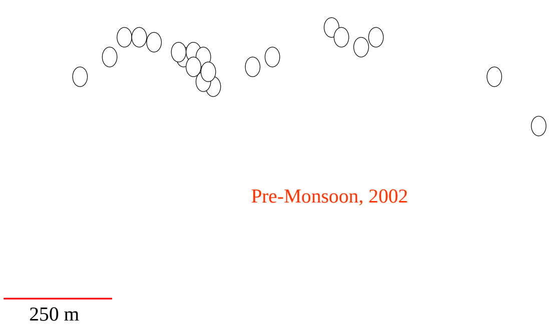

Pre-Monsoon, 2002

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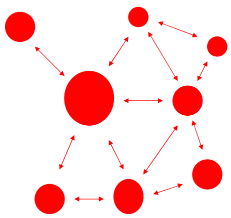

Metapopulation Dynamics

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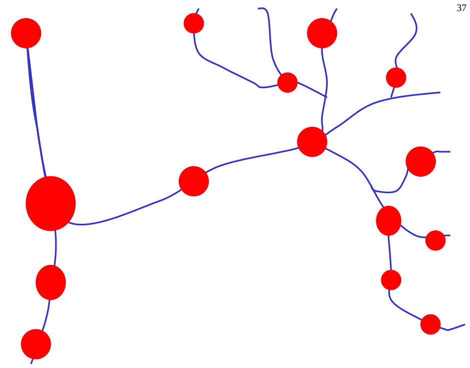

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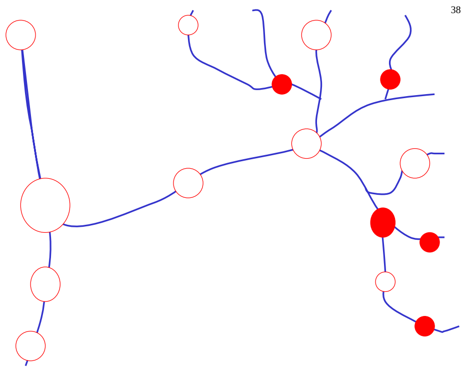

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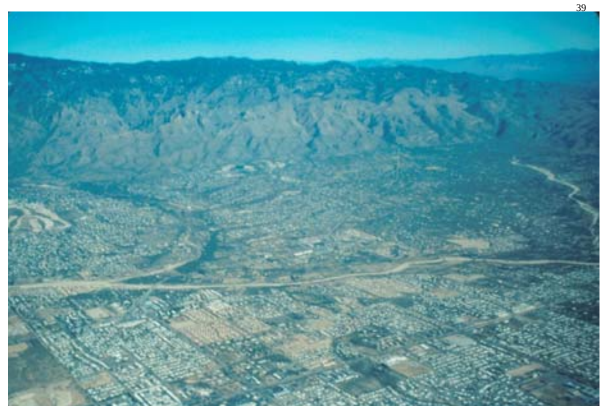

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El Endo