Main Points

1) A note about debate style and content

2) Landscape complexity and conservation efforts
- **-- metapopulation dynamics and the many meanings of "connectivity"**
- **-- source-sink dynamics**
- **-- example: mountain lion harvests in Utah**

3) The ontogeny of a really good idea
- **-- non-equilibrium island biogeography and species-area relationships**
- **-- predicting species distributions in a warming world**
- **-- example: small mammals on mountaintops in the Great Basin**

Pre-reading: Tuesday 21 March = Bui et al
Thursday 23 March = guest lecture

Tuesday 9 March = presentation #1 evaluations due

Tuesday 21 March = homework/extra credit #2 due

Thursday 23 March = group #2 presenters meet with Jake before this date

Terms: metapopulation, matrix, connectivity, source, sink, stable age (stage) distribution, island biogeography theory, species turnover, equilibrium, nestedness

Debate Pointers

1) **Where are you going with your talk? What are the things you want us to know?**

   “Tell them what you are going to tell them. Tell them. Tell them what you told them.”.

Tip: Use outlines.

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3) **If you include something on a slide, explain it. Walk your audience through it. Connect the dots. Hold their hands.**

Tip: Use "white boxes" in power point to cover things irrelevant to your points.

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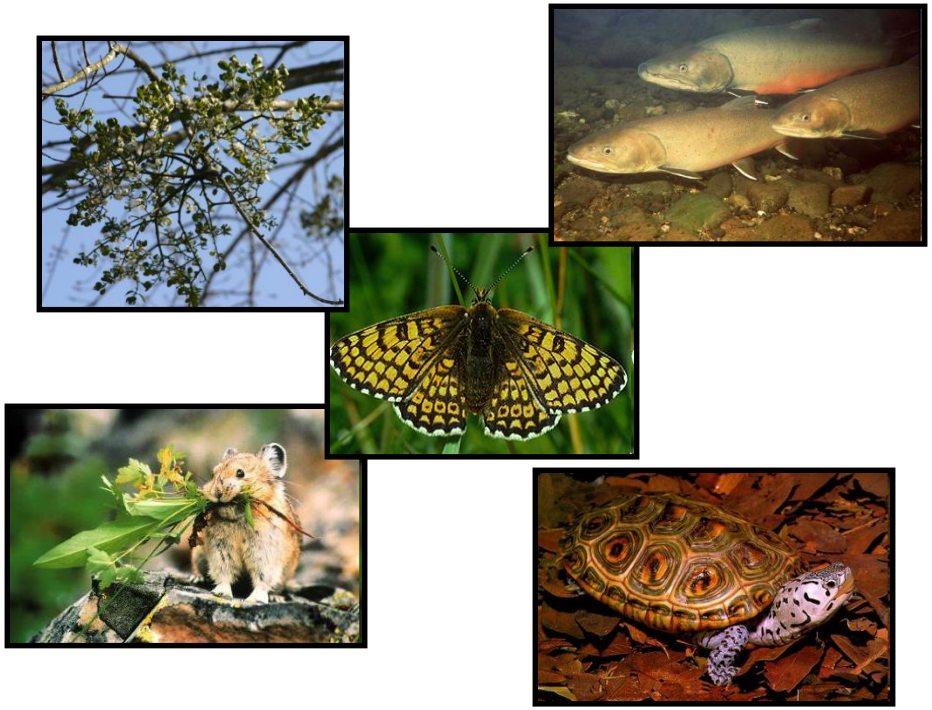
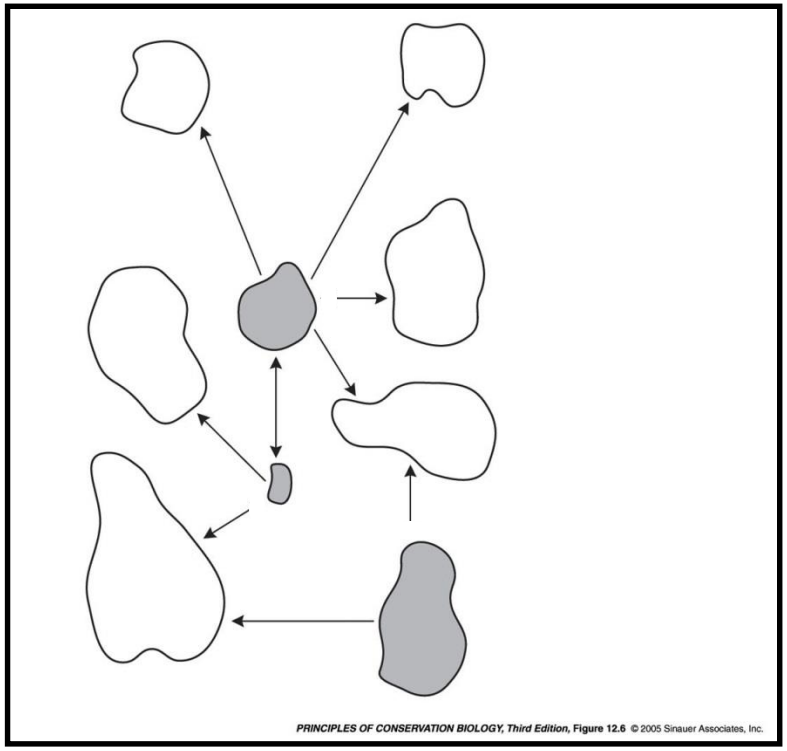
6) Do not use words/terms that are vague, unless you define them. Examples of vague words/terms: ecosystem health, integral role, diverse role.

7) Sometimes (in fact, often) less is more. Focus on teaching us fewer things, but at a pace and with a level of detail that we will understand.

Landscape complexity in conservation biology

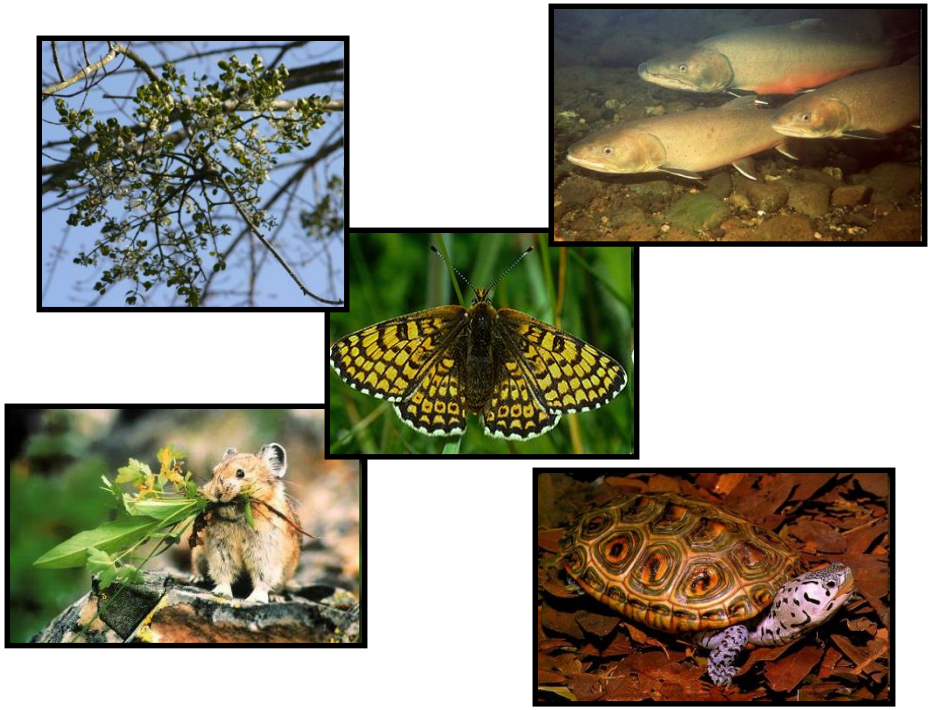
<u>metapopulation</u> = a series of populations linked by occasional dispersal and embedded in an inhospitable <u>matrix</u>

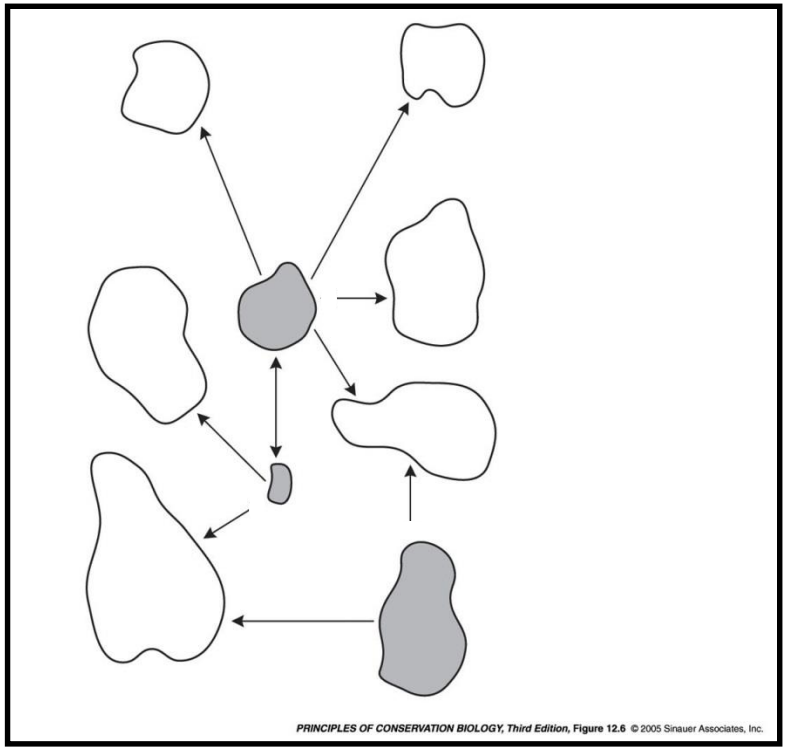




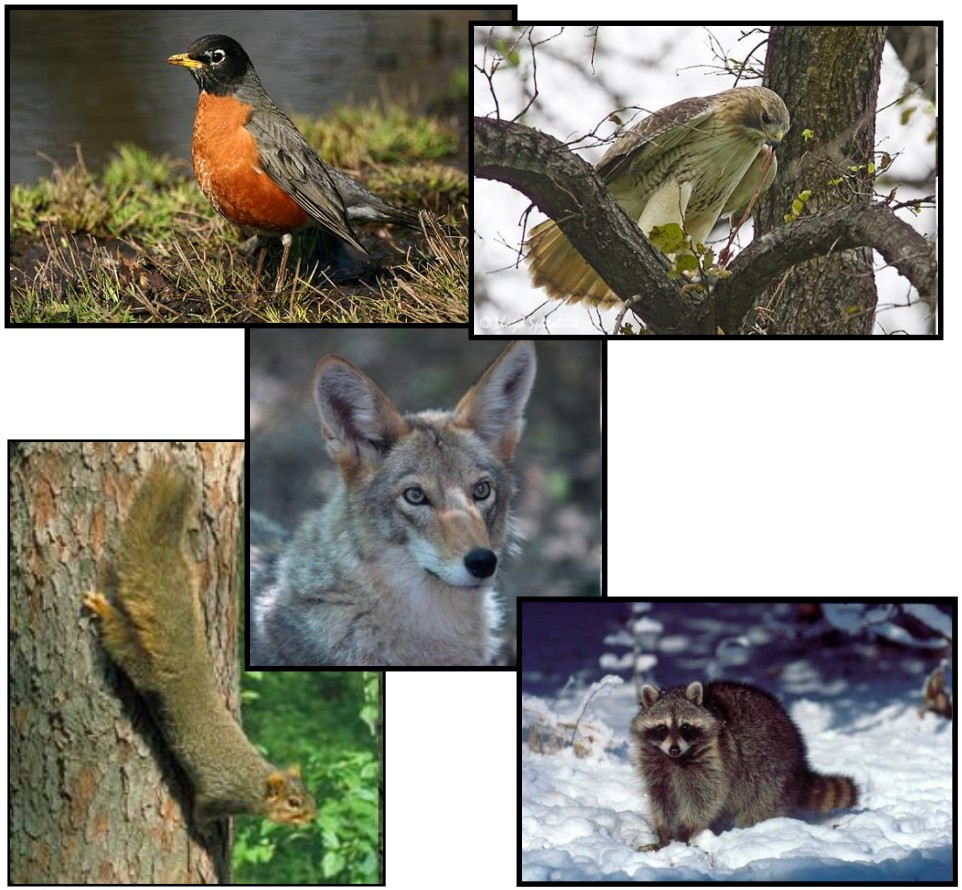
Landscape complexity in conservation biology

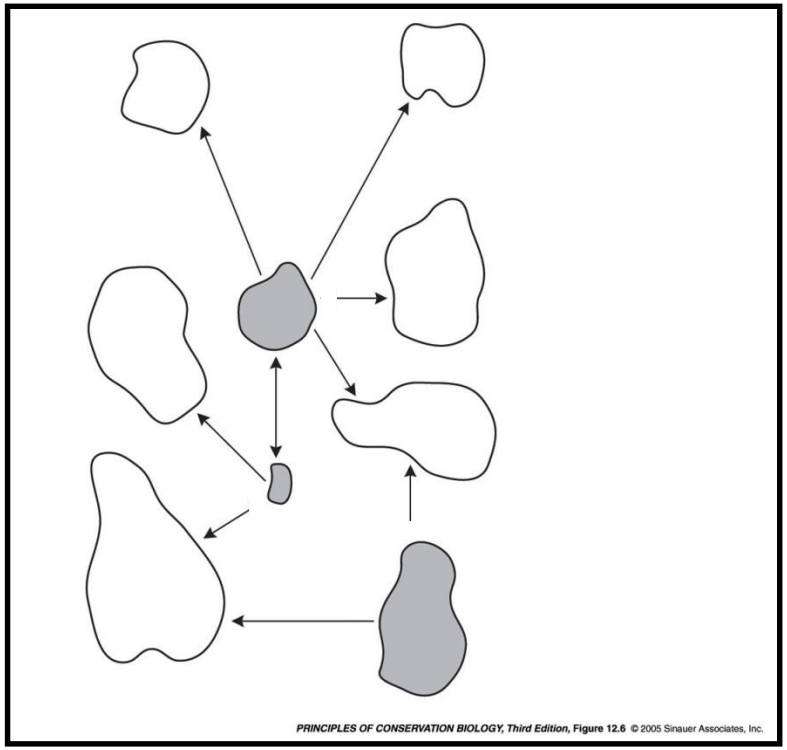
<u>connectivity</u> = the degree to which the landscape facilitates movement among discrete habitat patches





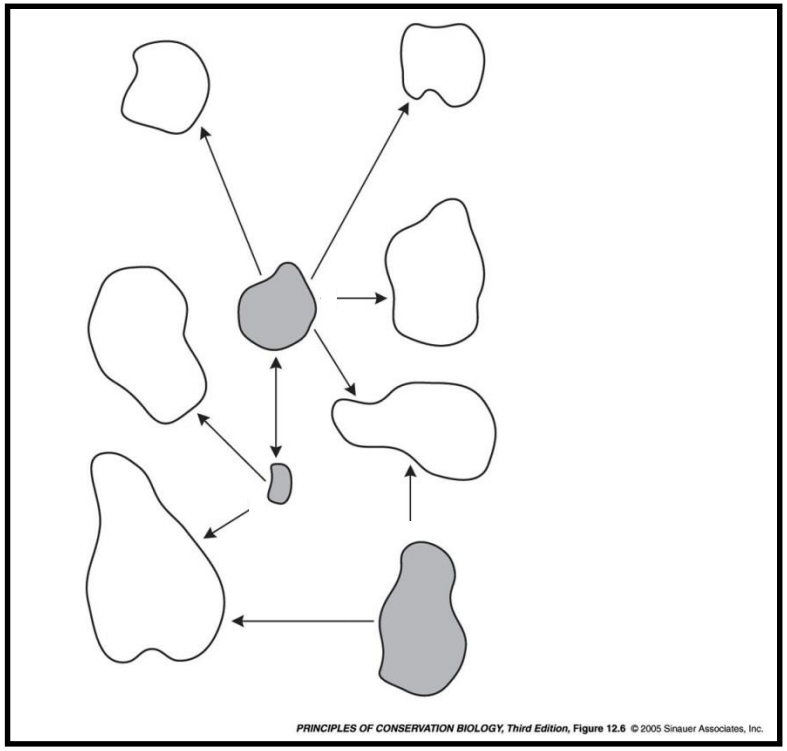
Discussion Q: The species below are among those that tend not to show metapopulation structure; that is, they do not occupy well-delineated habitat patches. Why not? What does this say about the definition of connectivity?





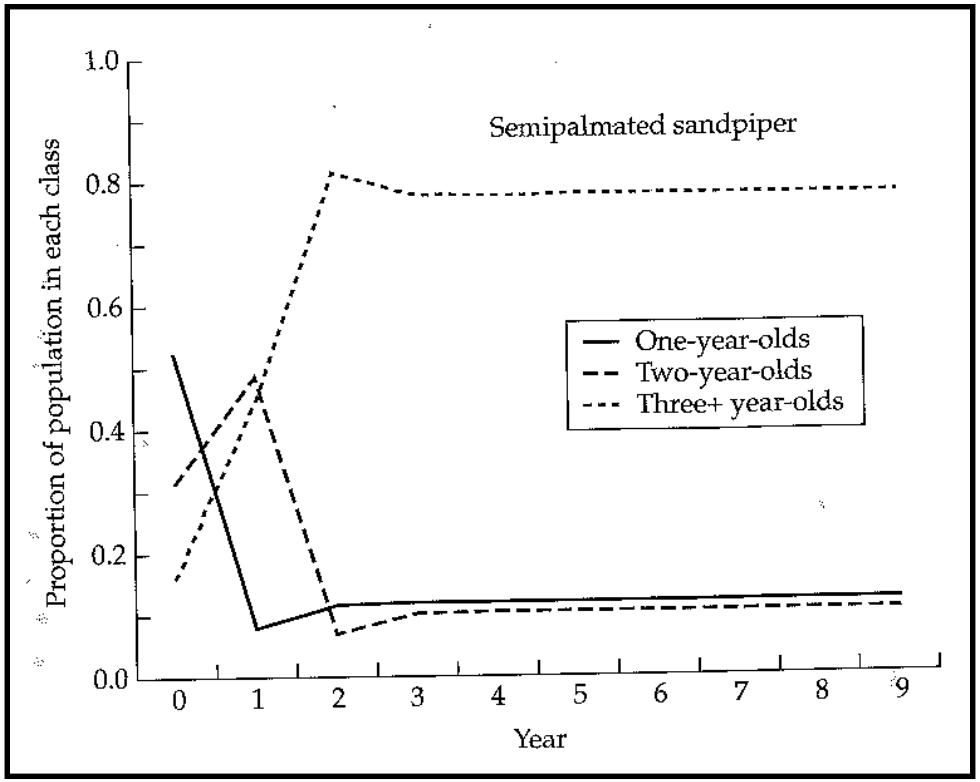
Landscape complexity in conservation biology

<u>source-sink dynamic</u> = spatial linkage of populations such that high-quality habitats (<u>sources</u>) provide excess individuals that disperse and maintain low-quality habitats (<u>sinks</u>)



Stable Age Distributions

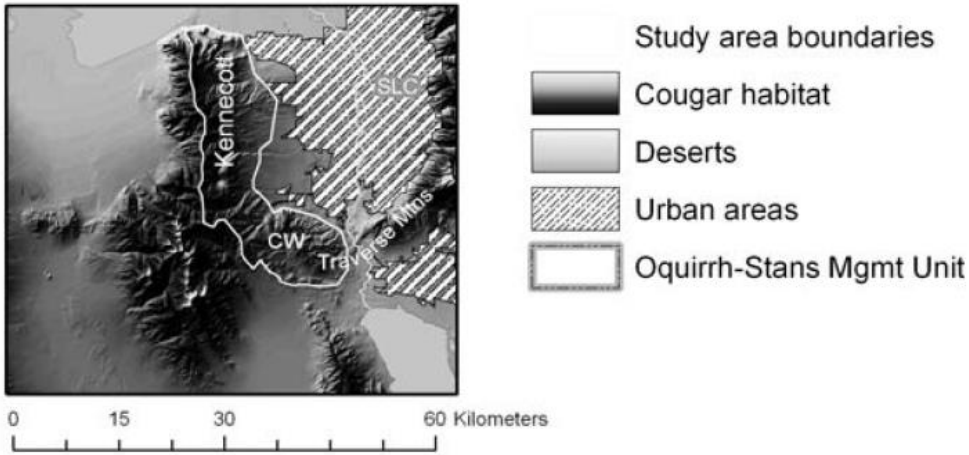
<u>Stable age (or stage) distribution</u> = the proportion of individuals falling into age classes (or stages) toward which the population tends



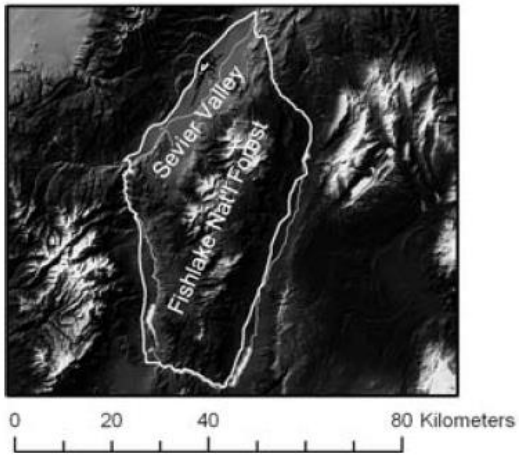
Hitchcock and Gatto-Trevor. 1997.

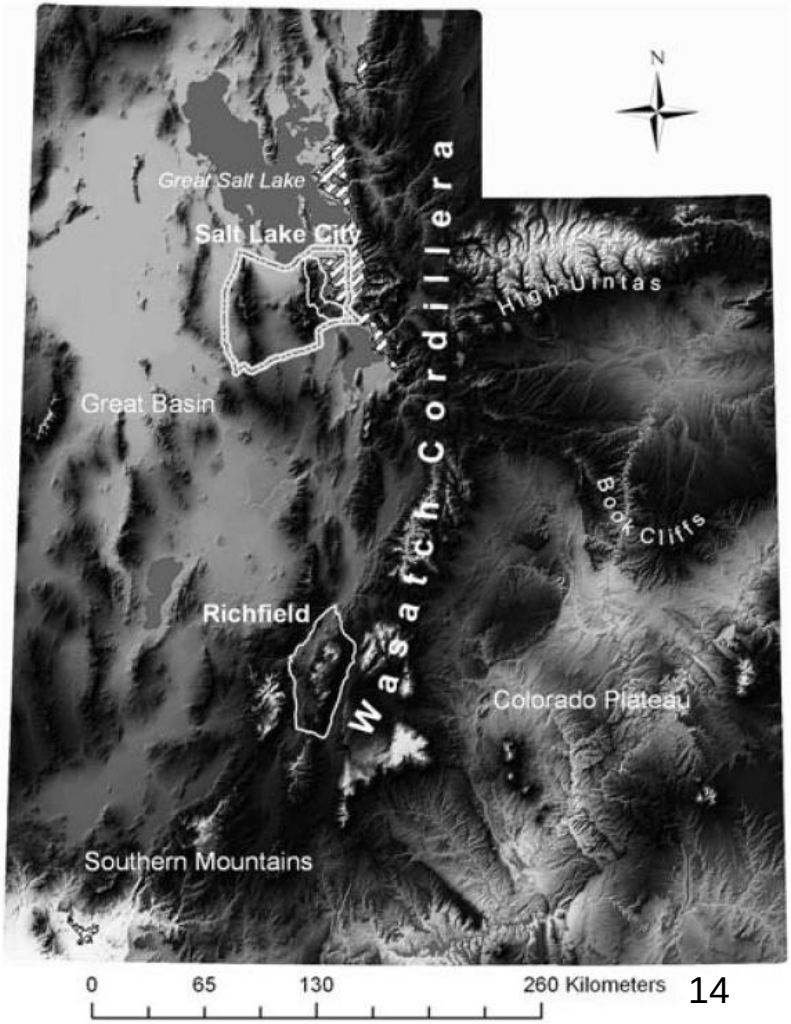
Stable Age Distributions and Source-Sink Dynamics

Oquirrh Mtn Study Area --no lion hunting

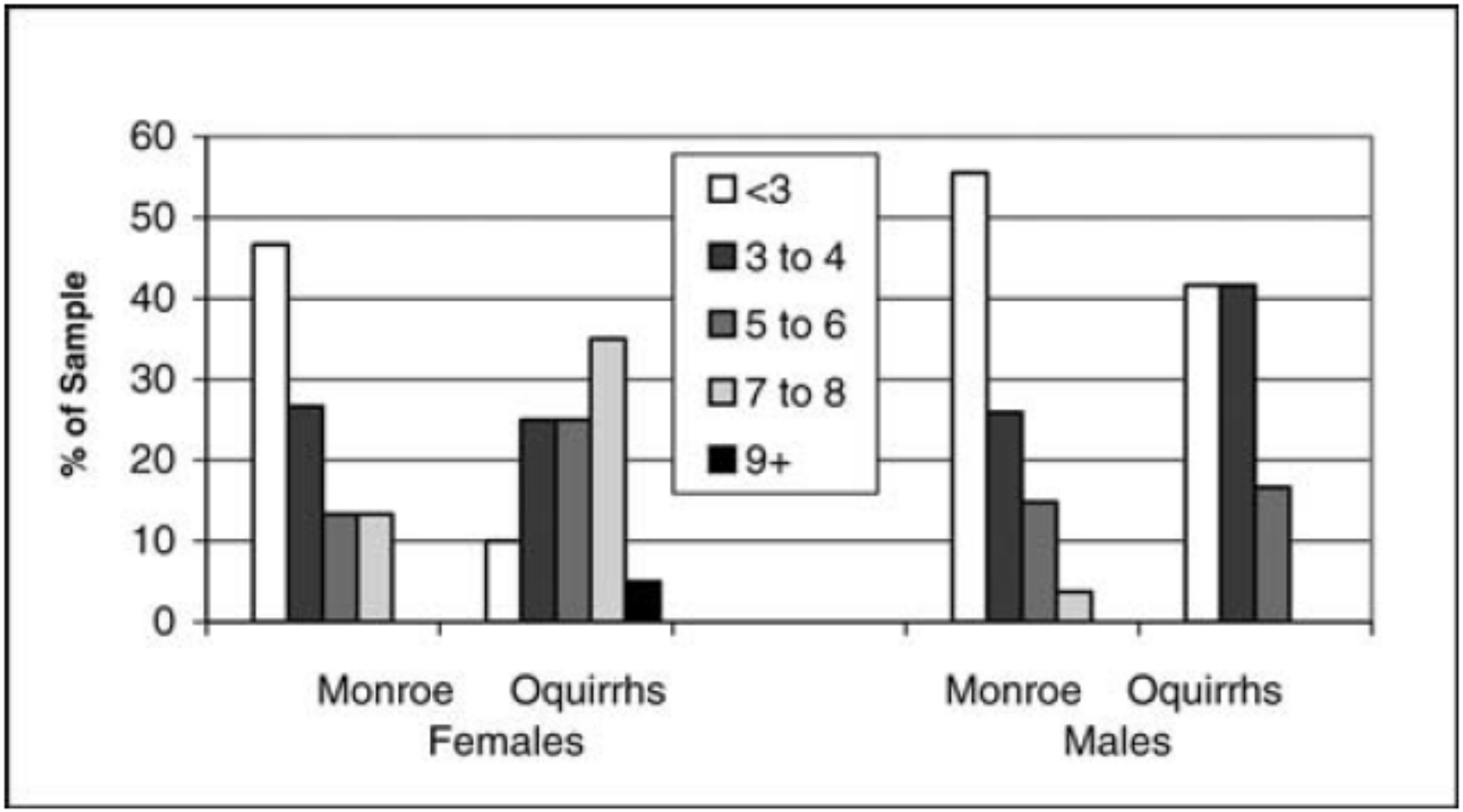


Monroe Mtn Study Area --lion hunting

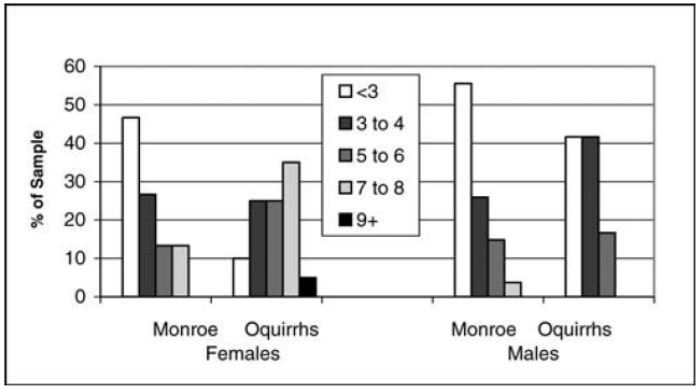




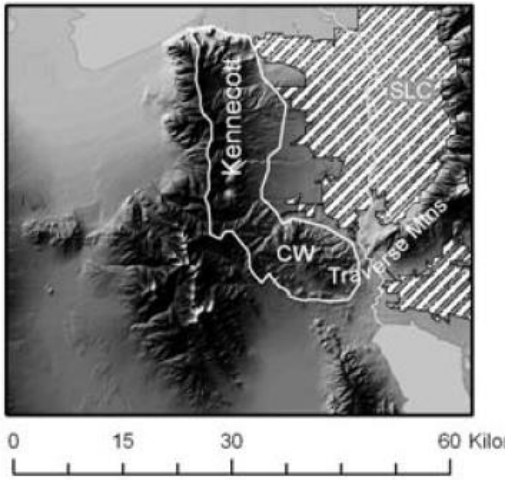
Stable Age Distributions and Source-Sink Dynamics



Discussion Q: exploited populations of mountain lions consisted of fewer individuals and age structure skewed to younger individuals. There are at least two interpretations of these data; what are they? How could you distinguish between the two of them?



Oquirrh Mtn Study Area



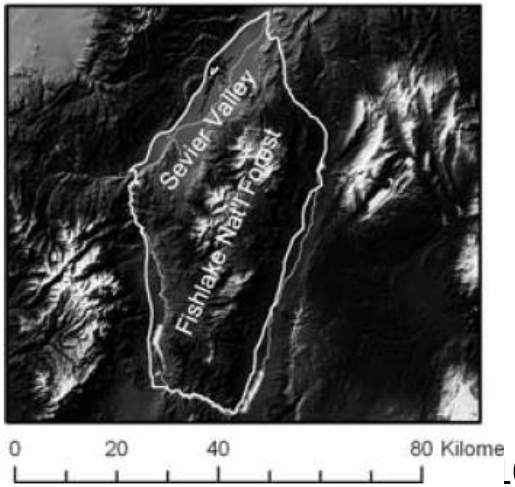
Study area boundaries

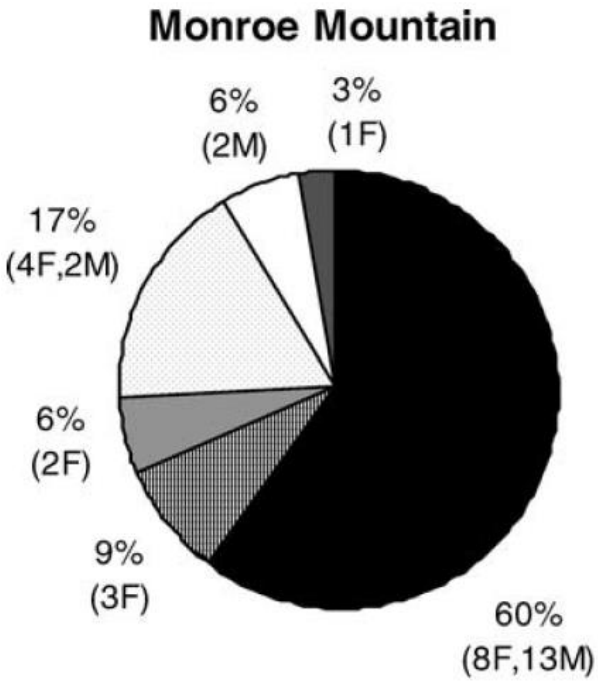
Cougar habitat

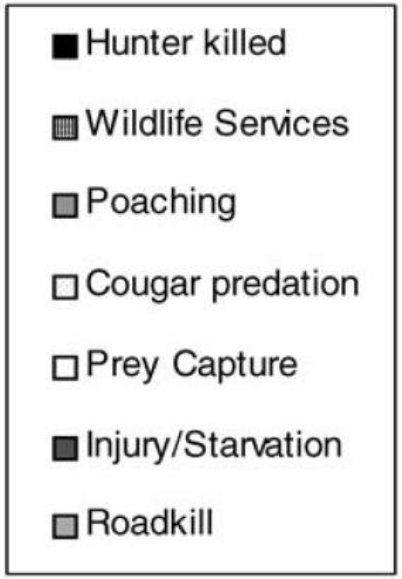
Deserts

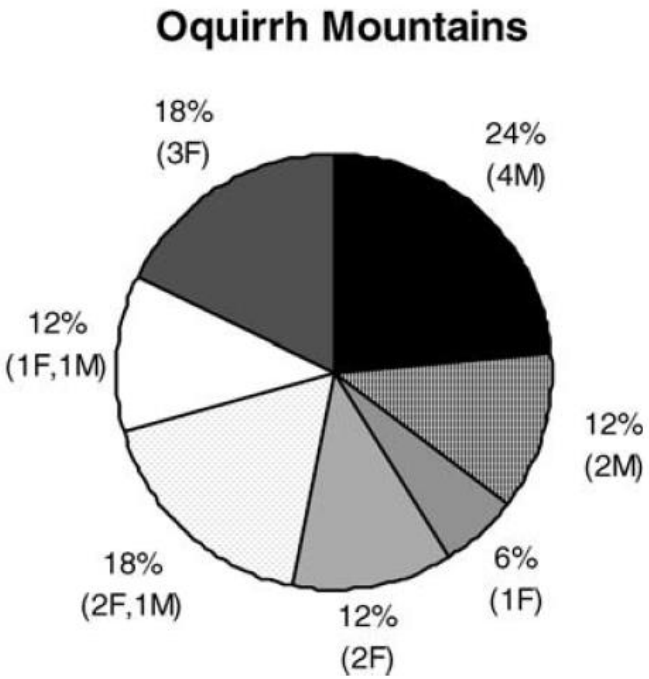
Urban areas

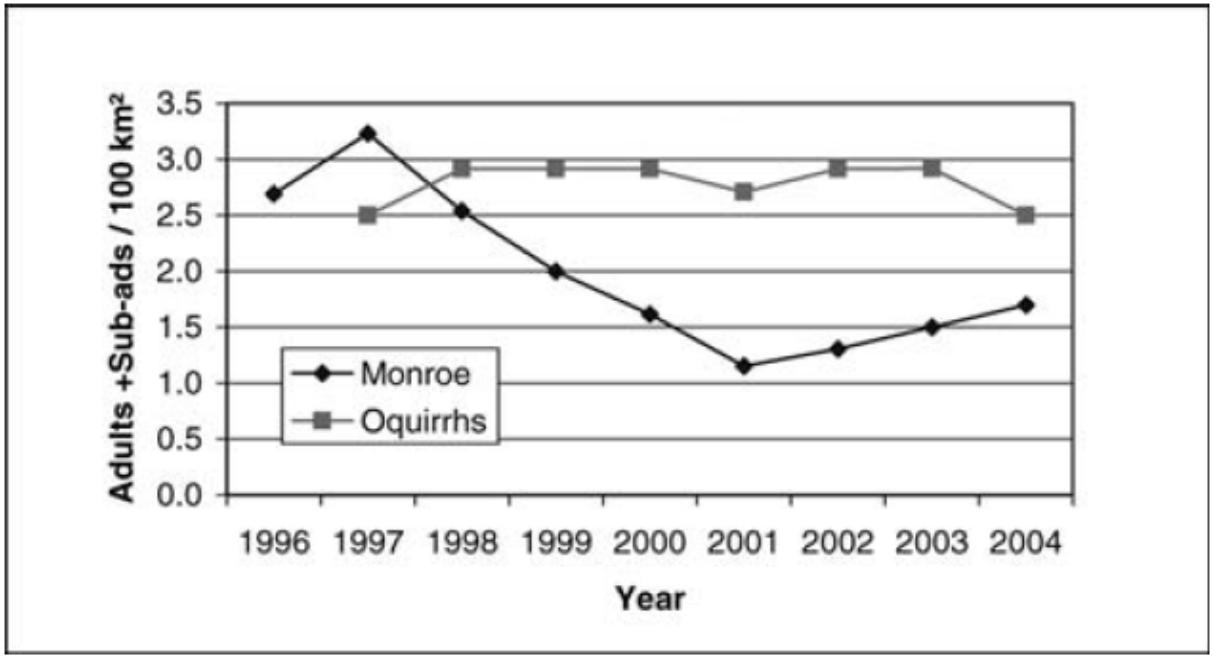
Monroe Mtn Study Area



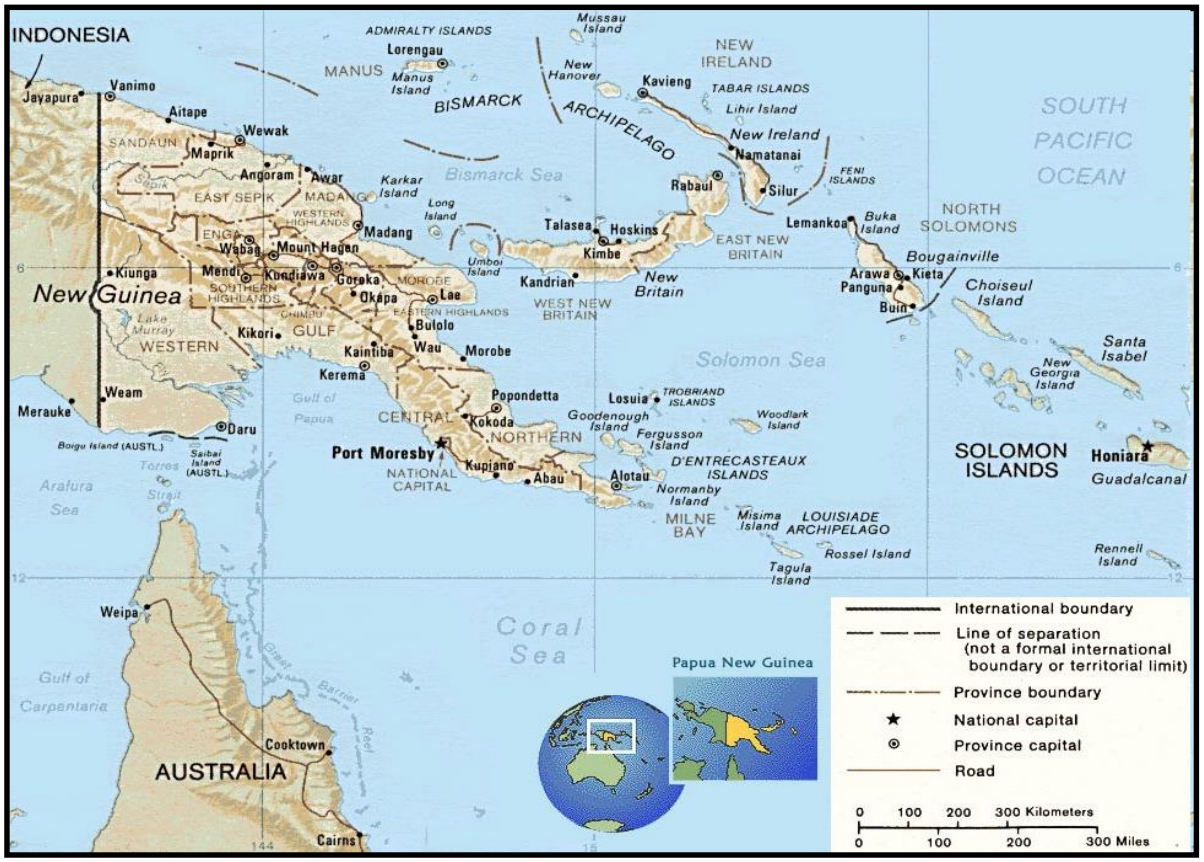

Monroe Mountain
6%
(2M)
3%
(1F)
17%
(4F,2M)
6%
(2F)
9%
(3F)
60%
(8F,13M)


Hunter killed
Wildlife Services
Poaching
Cougar predation
Prey Capture
Injury/Starvation
Roadkill

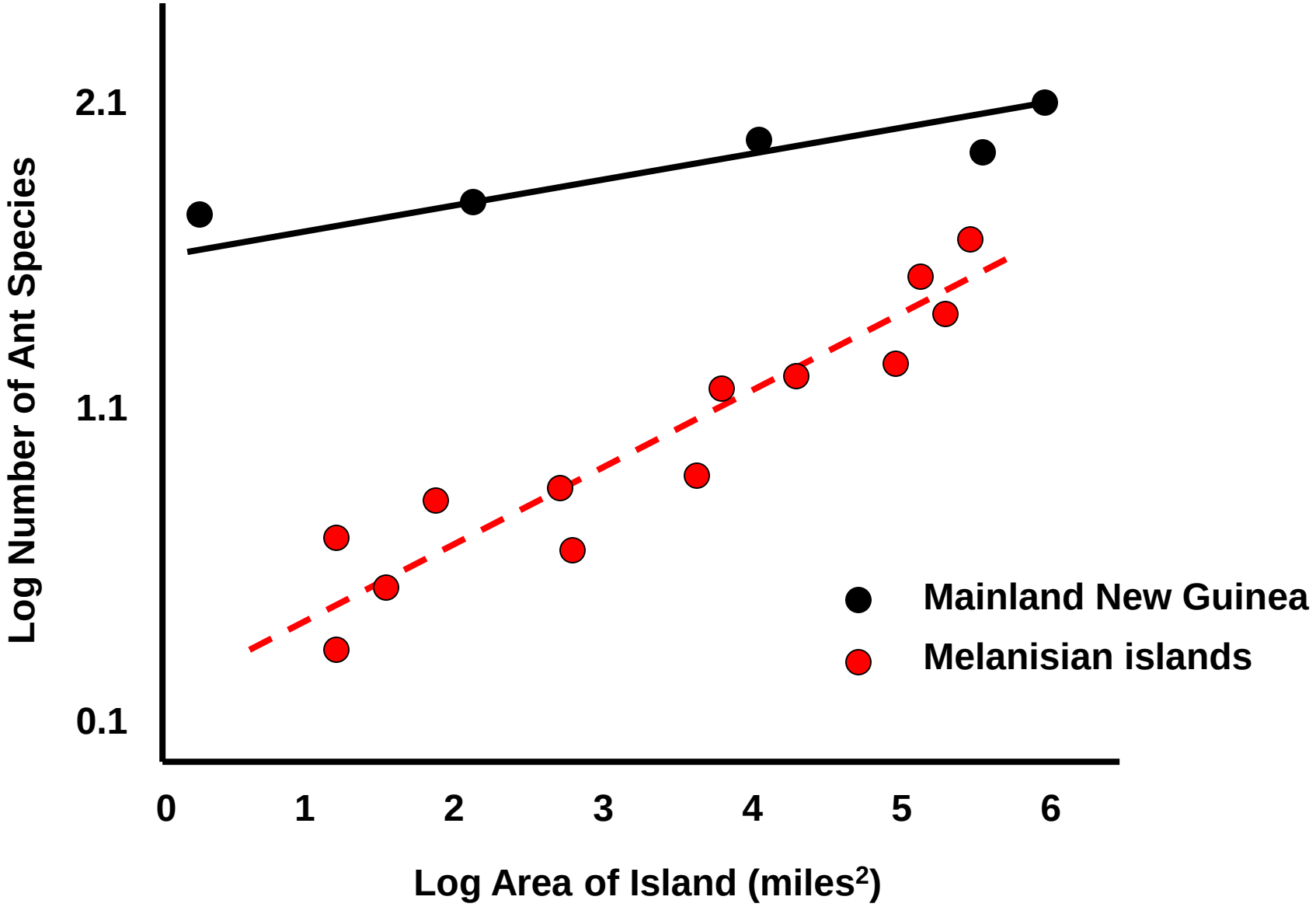

Oquirrh Mountains
18%
(3F)
24%
(4M)
12%
(1F,1M)
12%
(2M)
18%
(2F,1M)
6%
(1F)
12%
(2F)


Adults +Sub-ads / 100 km²
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Monroe
Oquirrhs
1996
1997
1998
1999
2000
2001
2002
2003
2004
Year

Island Biogeography Theory: the ontogeny of a really good idea



The Species-Area Relationship



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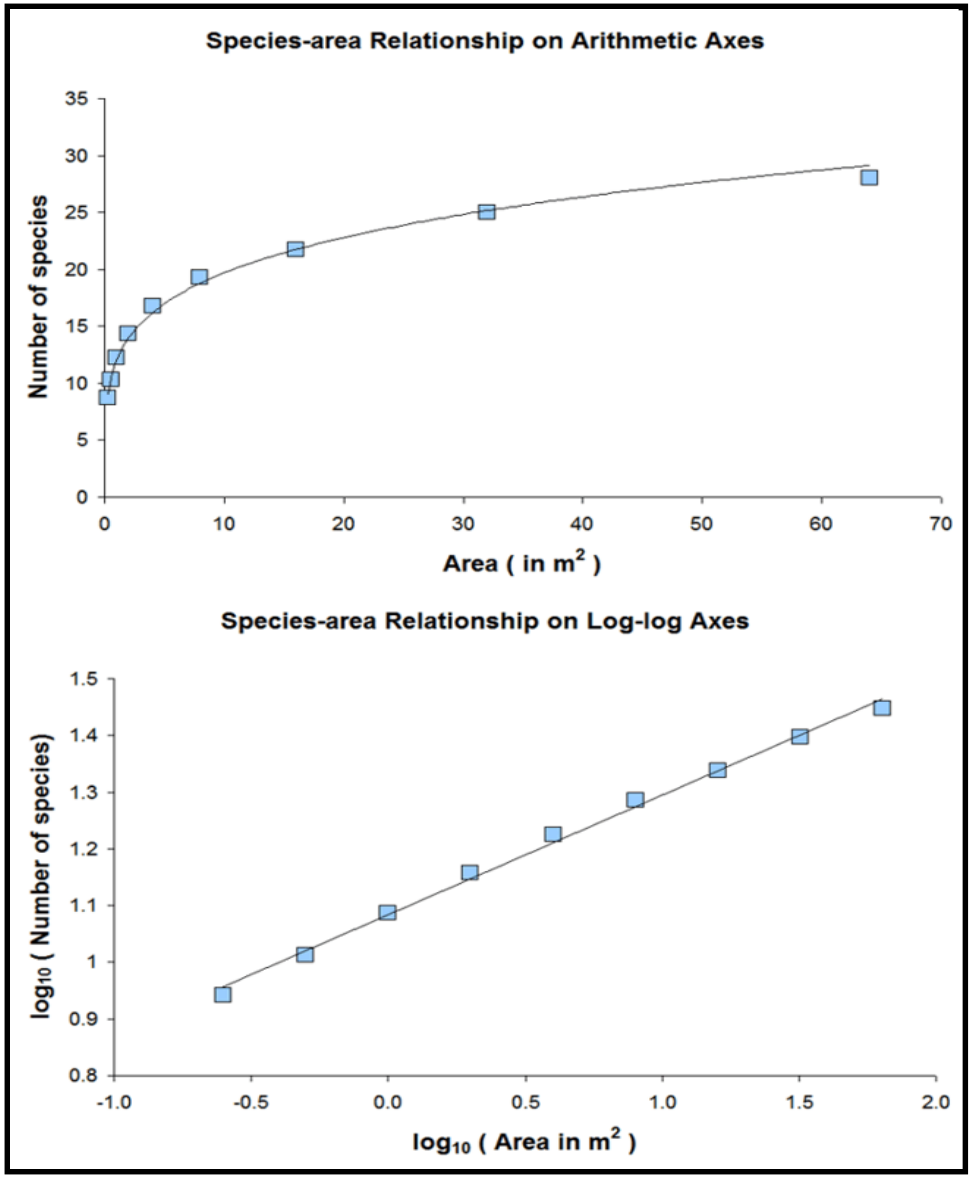
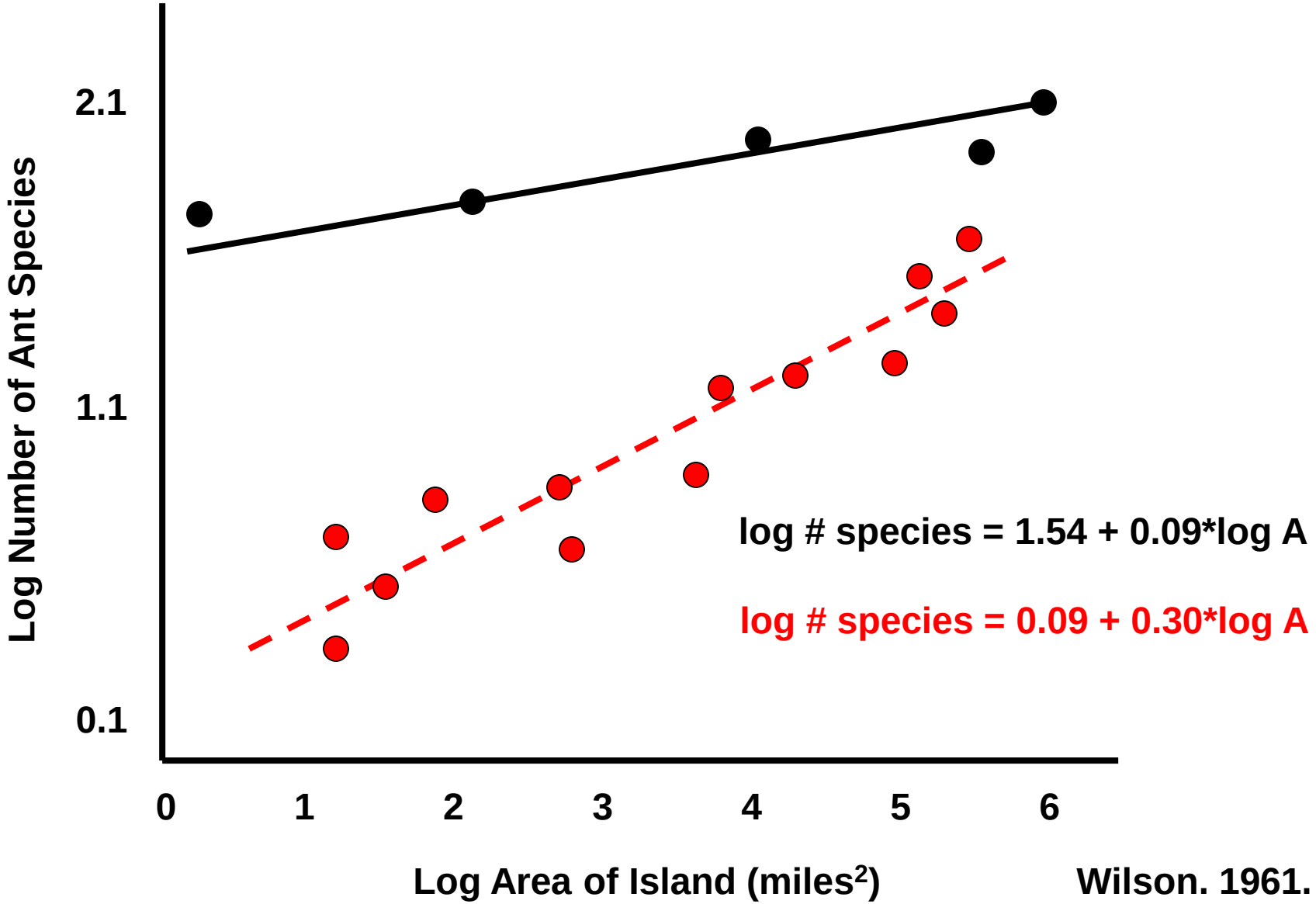


$$\# \text{ species} = c(\text{Area})^{Z}$$

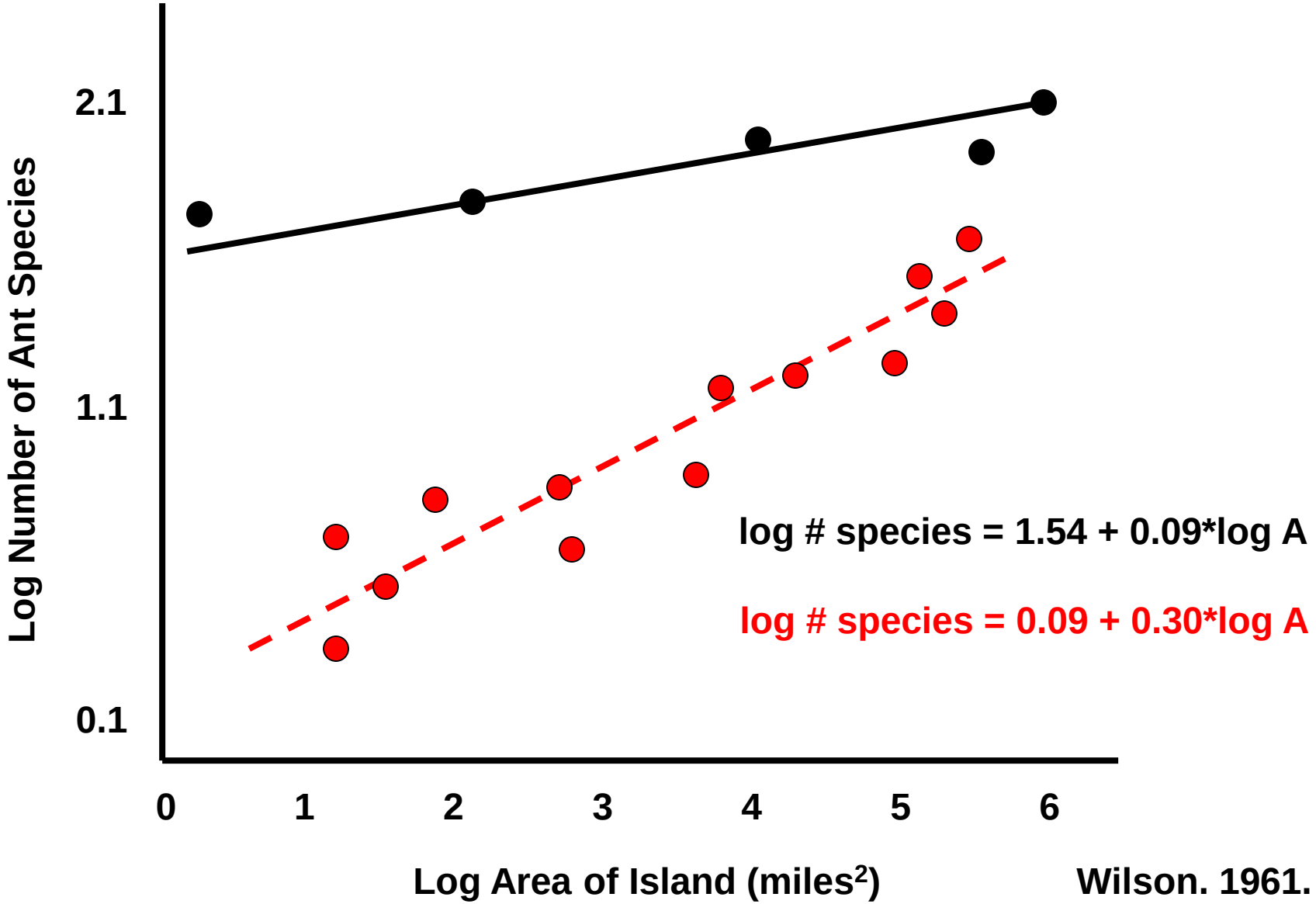
$$\log \# \text{ species} = \log C + z*\log(\text{Area})$$

The Species-Area Relationship



Wilson. 1961.

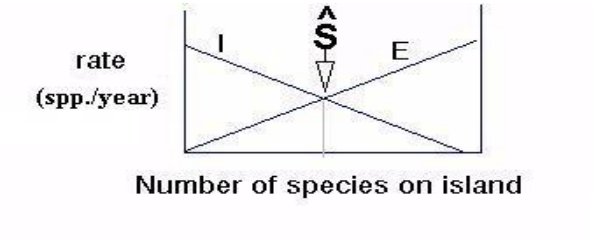
The Species-Area Relationship



Wilson. 1961.

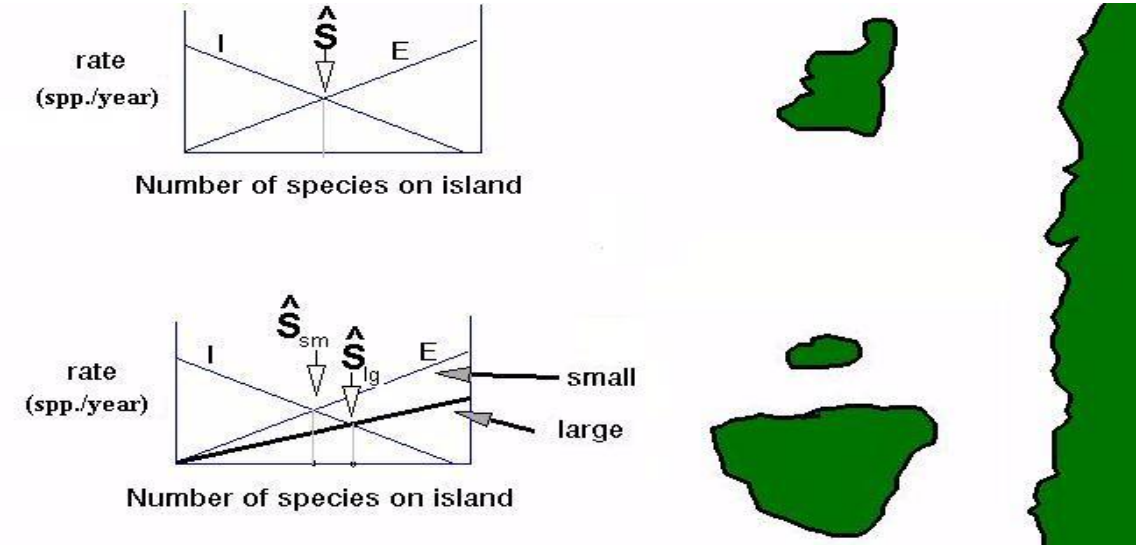
The Theory of Island Biogeography

- **<u>IBT</u> = MacArthur and Wilson's idea that the number of species on islands represent a dynamic equilibrium between immigration and extinction.**



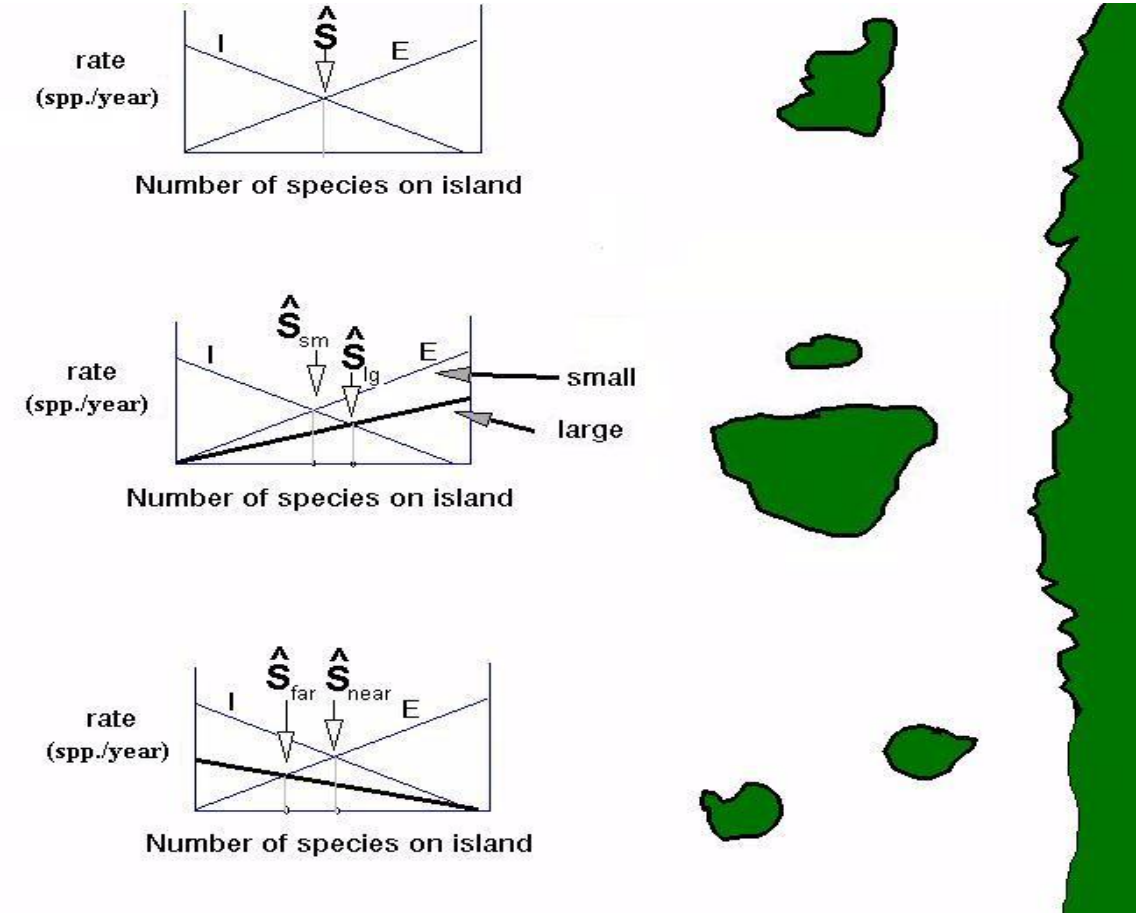
The Theory of Island Biogeography

- **Island area influences extinction; larger populations (on larger islands) are buffered from extinction.**



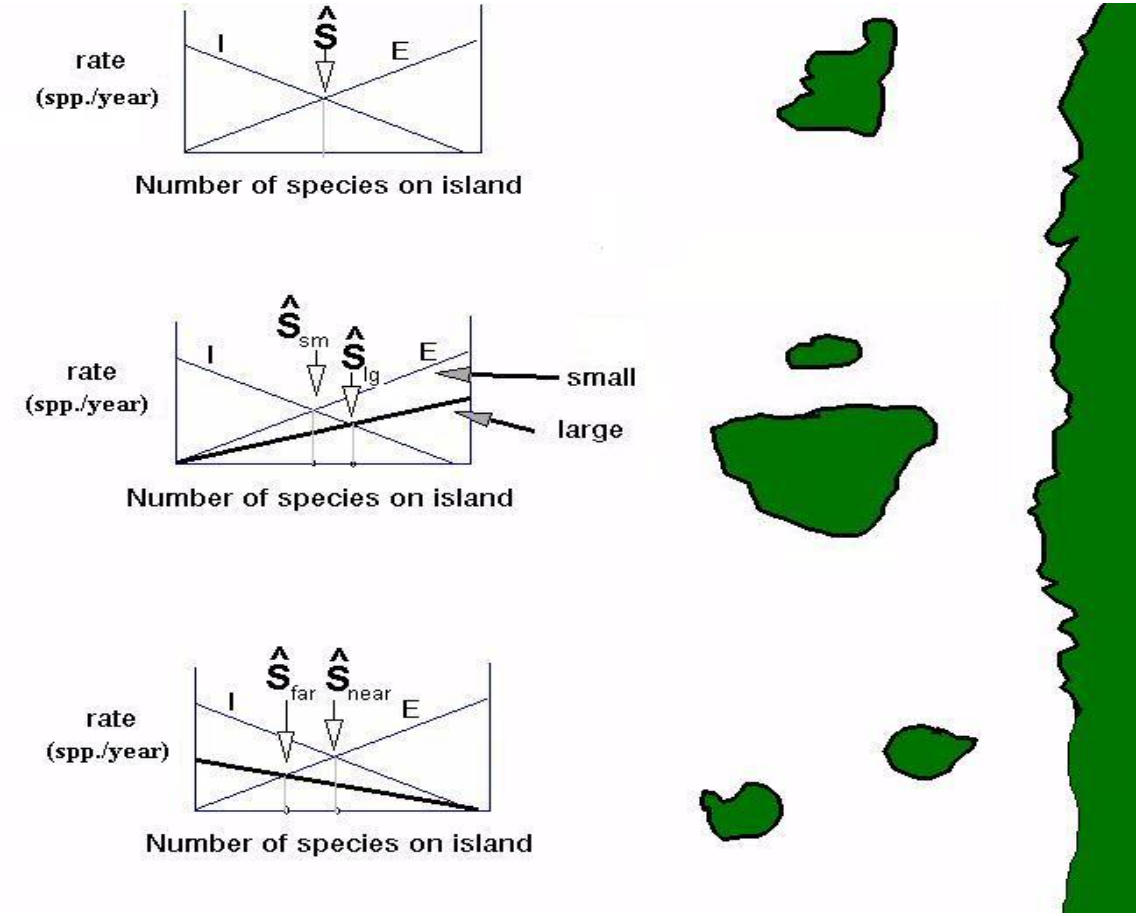
The Theory of Island Biogeography

- **Island isolation influences immigration; more dispersal (to islands near the mainland) yields more immigration.**



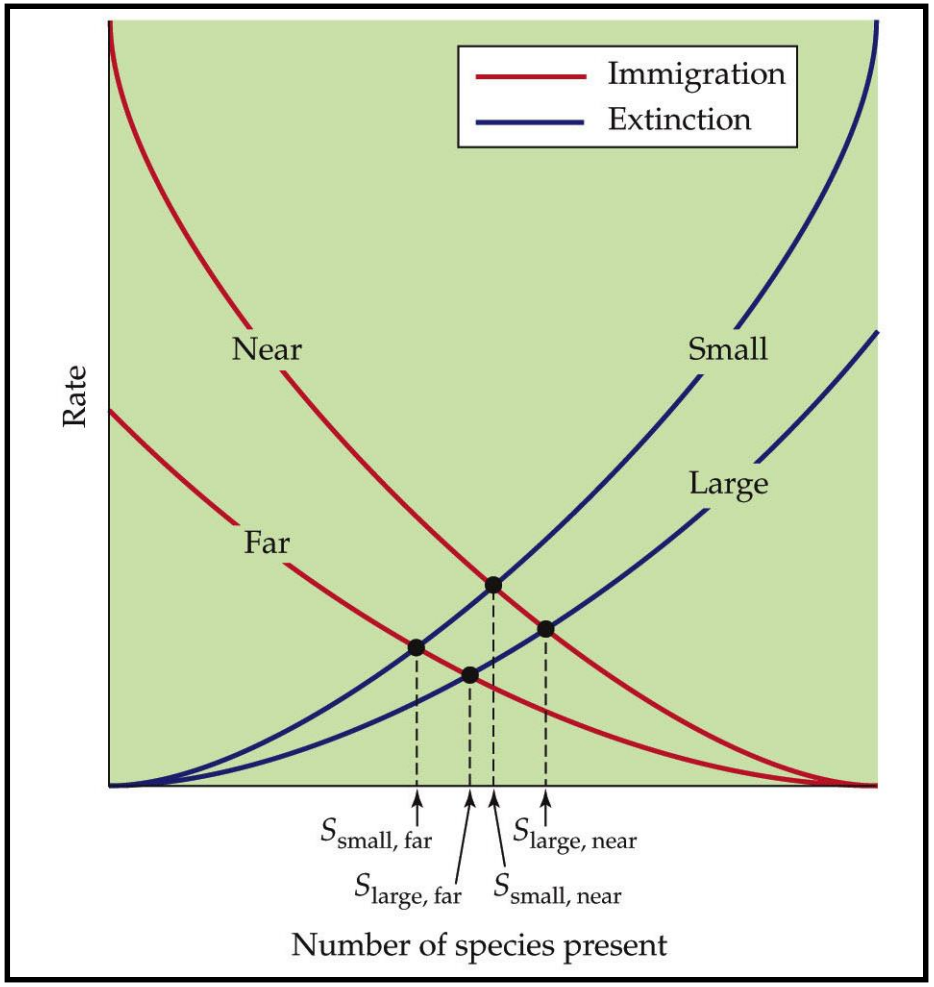
The Theory of Island Biogeography

- <u>species turnover</u> = change in species composition through time caused by immigration and extinction.



The Theory of Island Biogeography

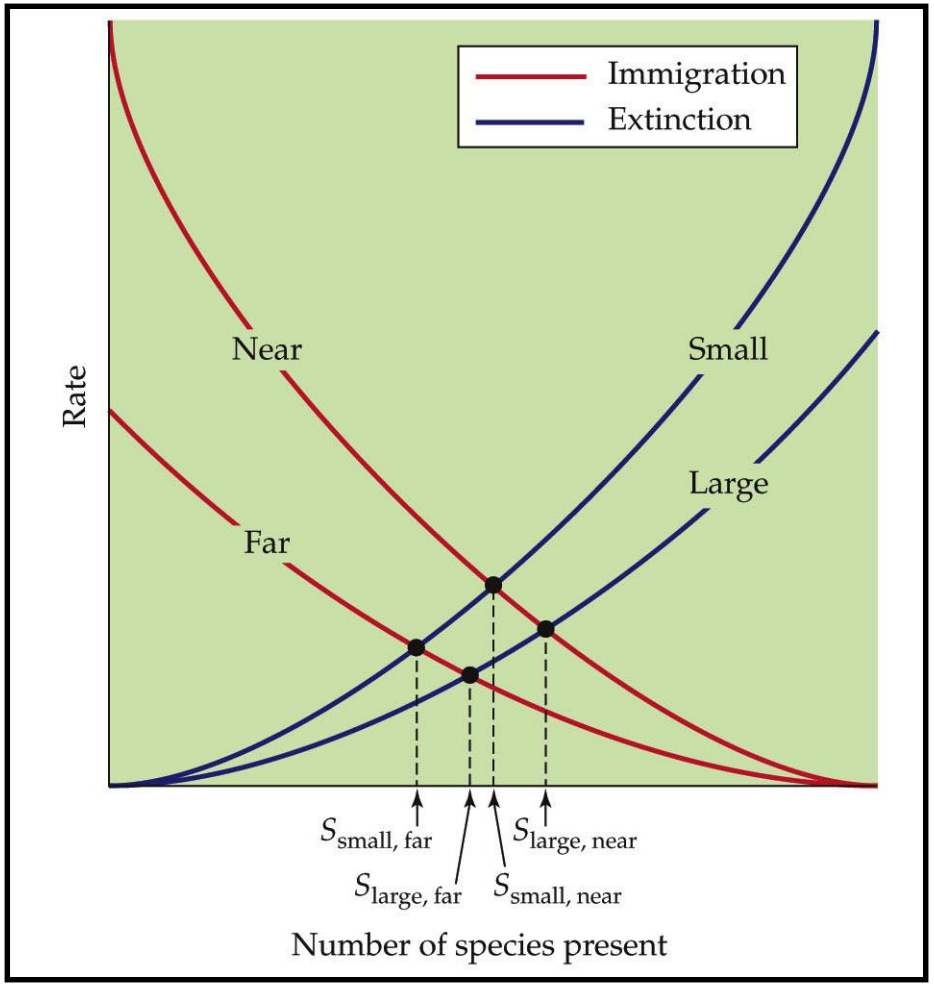
- **<u>equilibrium</u> = a condition in which opposing rates balance, giving rise to a steady-state number of species.**



The Theory of Island Biogeography

- <u>equilibrium</u> = a condition in which opposing rates balance, giving rise to a steady-state number of species.

- "dynamic" because immigration and extinction occur continuously, and composition (but not number) of species is predicted to change through time.



Nested Subsets in Insular Systems

Nested Subsets in Insular Systems

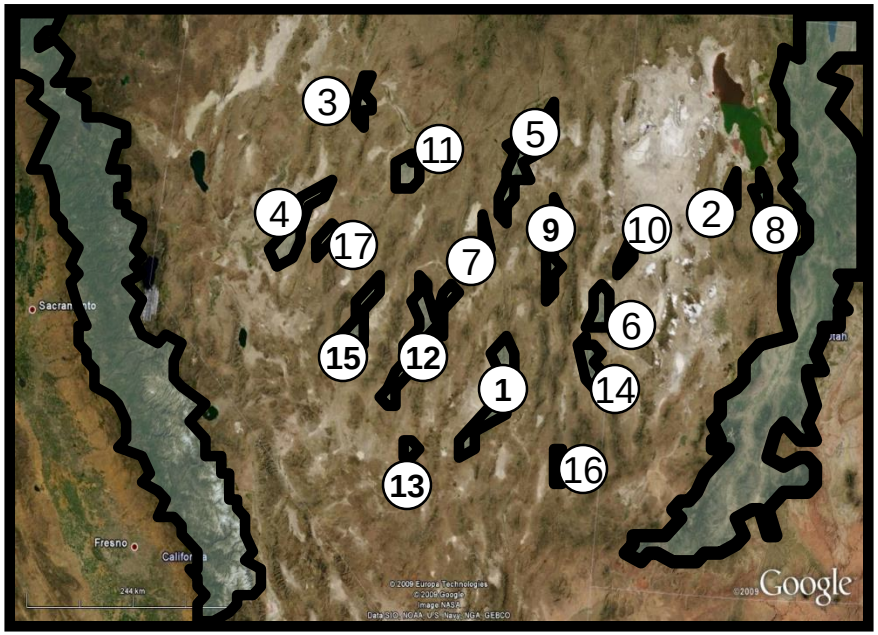
<u>nestedness</u> = tendency for successively species-poorer communities to form predictable subsets of species-rich communities.

	Mountain ranges																			
Species	*Toiyabe*	*Ruby*	*Toquima*	*White-Inyo*	*Snake*	*Oquirrh*	*Deep Creek*	*Schell*	*Desatoya*	*Stansbury*	*White Pine*	*Spring*	*Grant*	*Diamond*	*Roberts Creek*	*Spruce*	*Sheep*	*Panamint*	*Pilot*	***Present number of ranges inhabited***
Eutamias umbrinus	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			17
Neotoma cinerea	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	17
Eutamias dorsalis	X		X	X	X	X	X	X	X	X	X	X	X	E		E	E	X	X	17
Spermophilus lateralis	X	X	X	X	X		X	X	E		X	X	X	E		E			E	14
Microtus longicaudus	X	X	X	X	X	X	X	X	E	X	E		E		X					13
Sylvilagus nuttalii	X	X	X	X	X		E	E	E		E	E	E					E		12
Marmota flaviventris	X	X	X	X	X	X	E	E	E	X	E									11
Sorex vagrans	X	X	X	X	X	X	E	E		X		E								10
Sorex palustris	X	X	X	X	E	X				E					E					8
Mustella erminea	X			E	E	E	E			E										6
Ochotona princeps	X	E	E	E					E											5
Zapus princeps	E	E	E			E									E					5
Spermophilus beldingi	E	E																		2
Lepus townsendii		E				E														2
Present number of species	13	12	11	11	10	10	9	8	8	8	7	6	5	4	4	4	3	3	3	

MacDonald and Brown. 1992.

Nested Subsets in Insular Systems

- **if extinction risk decreases with area, we should note a positive relationship between size of mountaintop and number of species.**

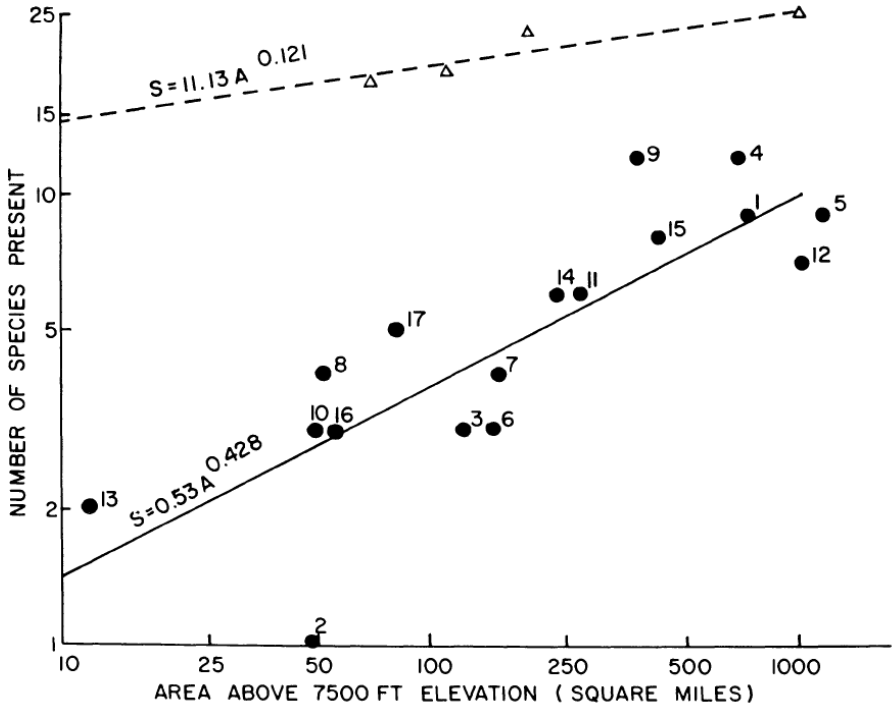


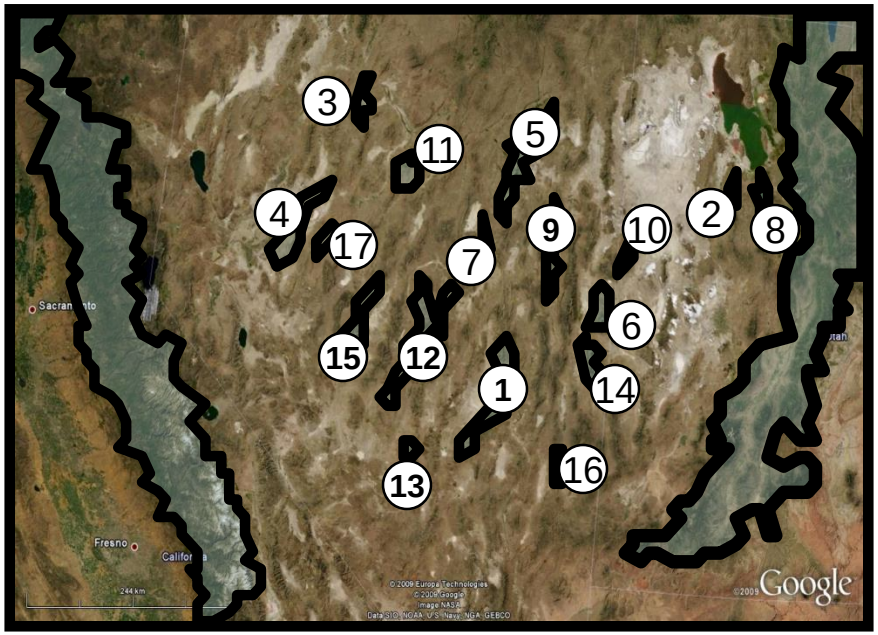
Nested Subsets in Insular Systems

- **if extinction risk increases with area, we should note a positive relationship between size of mountaintop and number of species.**

△ = mainland areas within the southern Rockies

● = “islands” (i.e., mountaintops)





Nested Subsets in Insular Systems

- **if immigration decreases with isolation, we should note a negative relationship between distance of mountaintop to the mainland and number of species.**