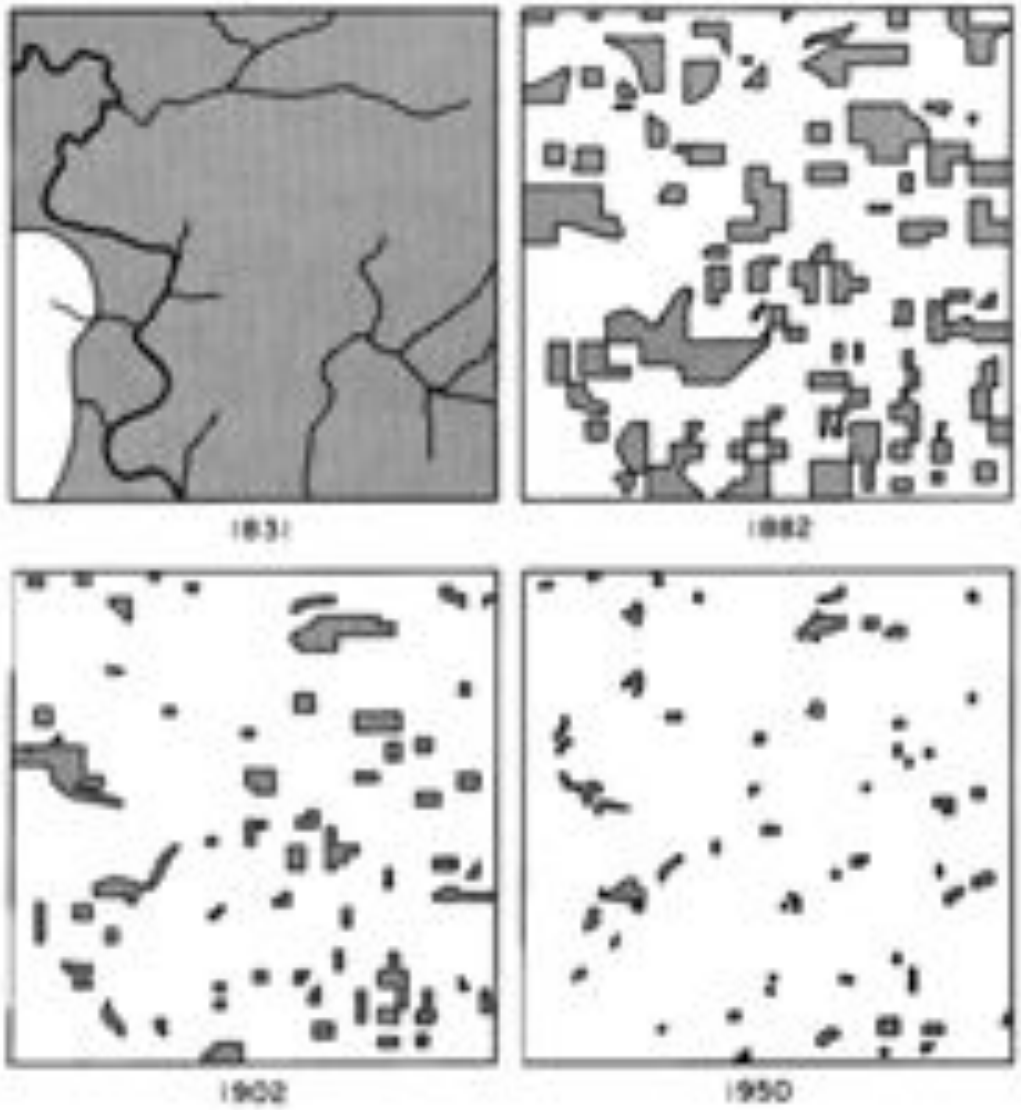
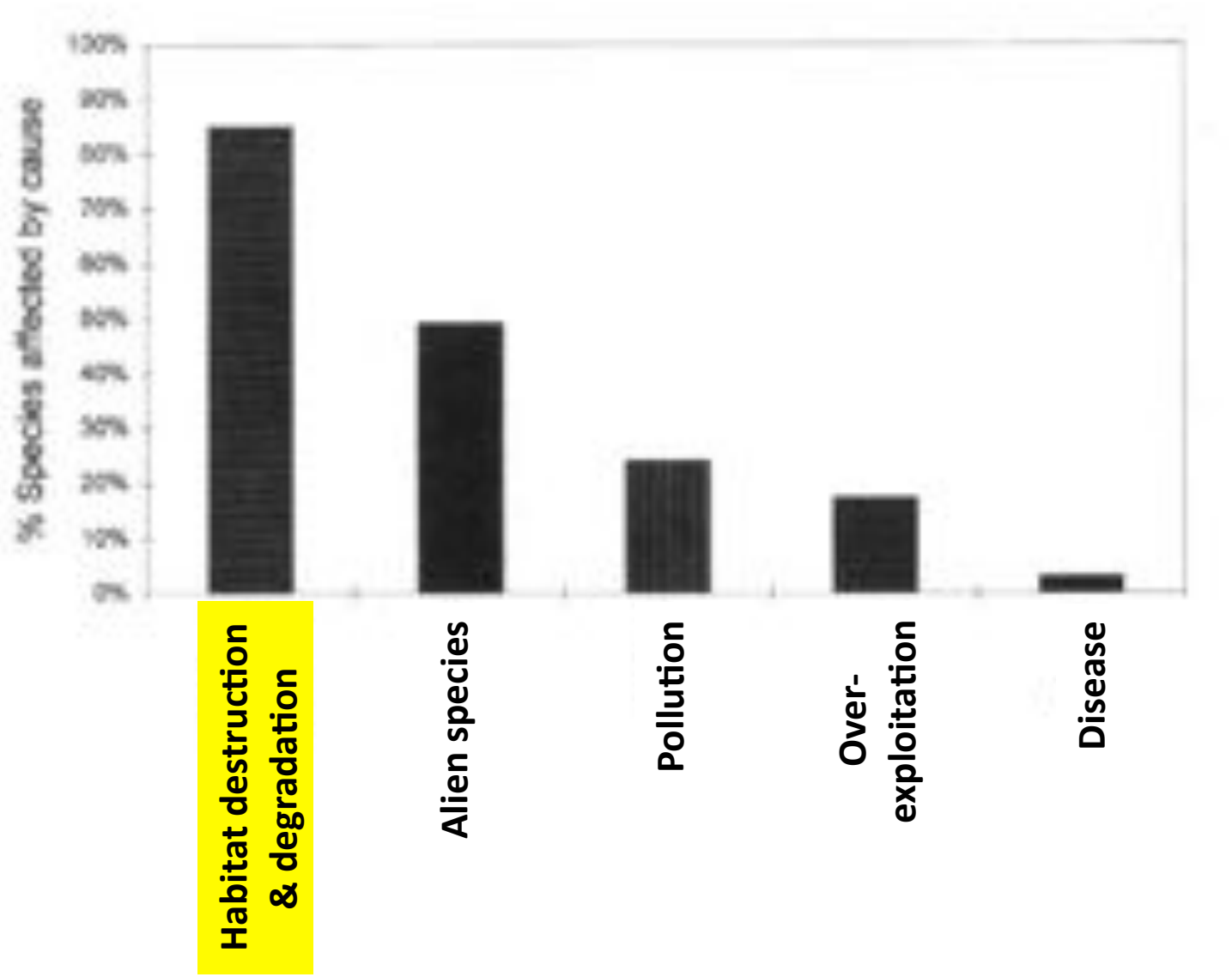

Connecting Landscapes
in a Changing World

- How do humans change natural landscapes?
- How does the area of habitat available affect organisms?
- How does habitat fragmentation affect movement?
- How can we connect landscapes to promote movement?

Curtis 1956



Cadiz Township, WI (1831 – 1950)



Modified from Wilcove, D.S., Rothstein, D., Dubow, J., Phillips, A. & Losos, E. (1998) Quantifying Threats to Imperiled Species in the United States. BioScience, 48, 607–615.

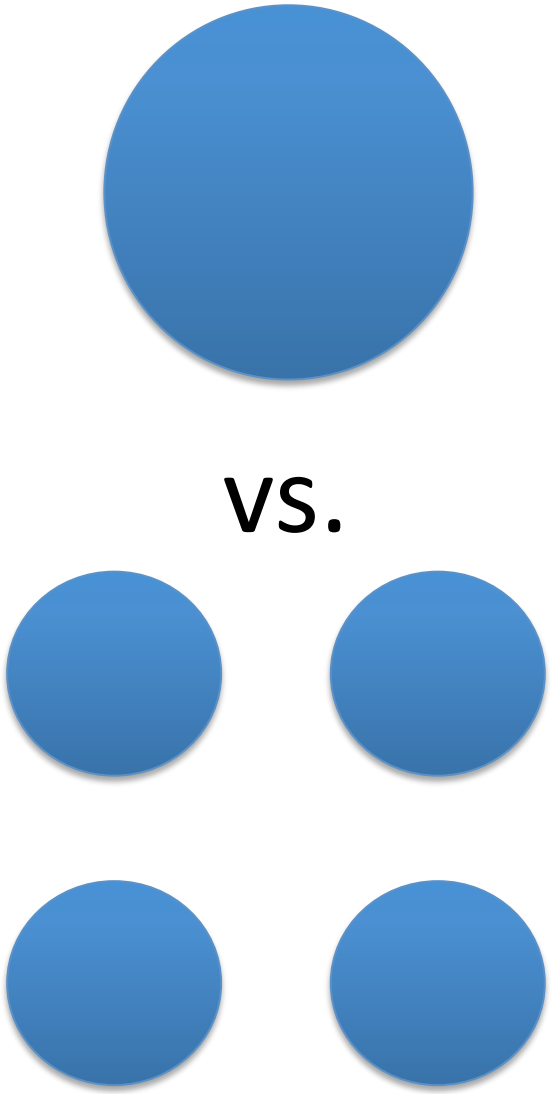
Habitat Fragmentation

Habitat Fragmentation

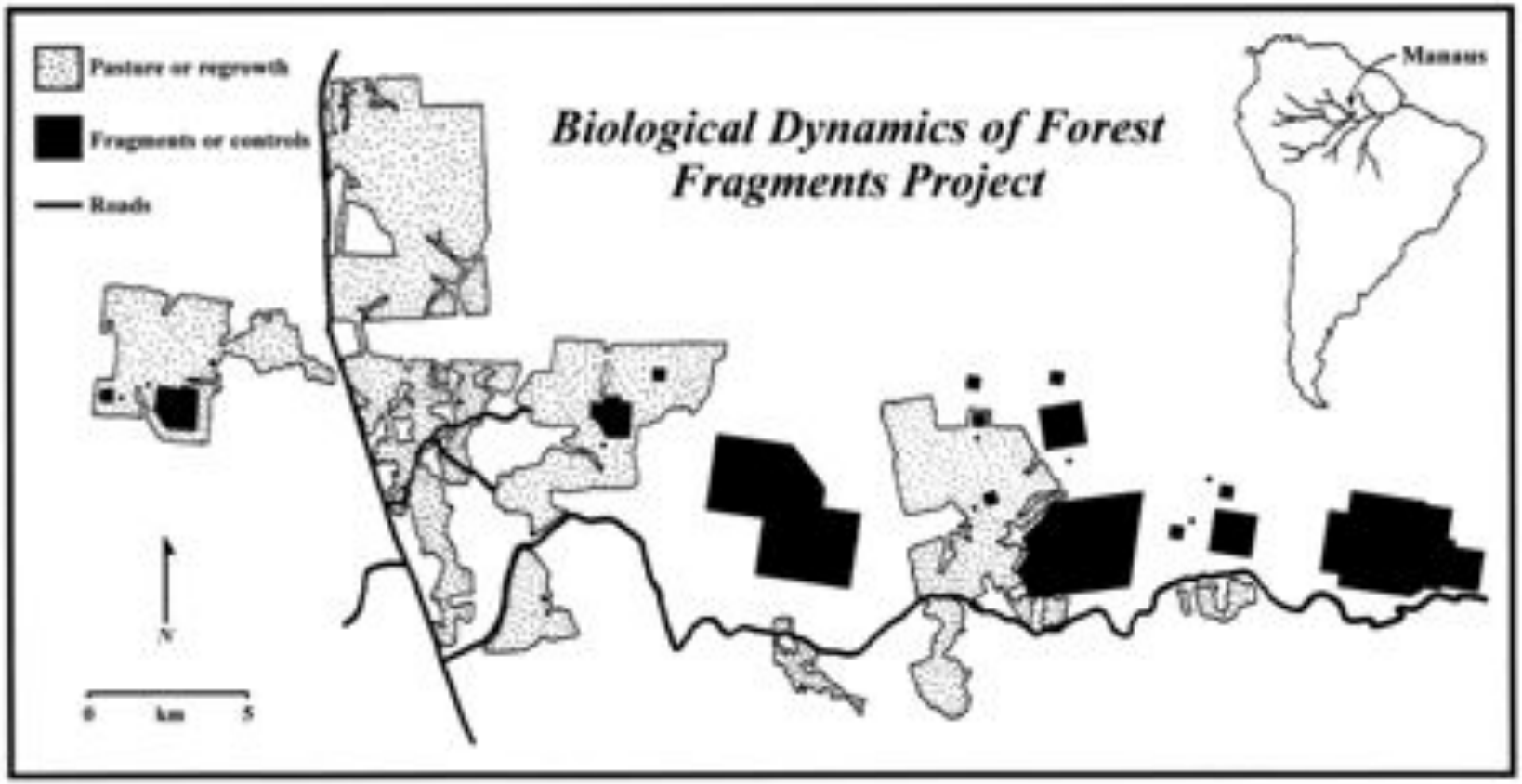
How do we design protected areas to maximize species conservation?

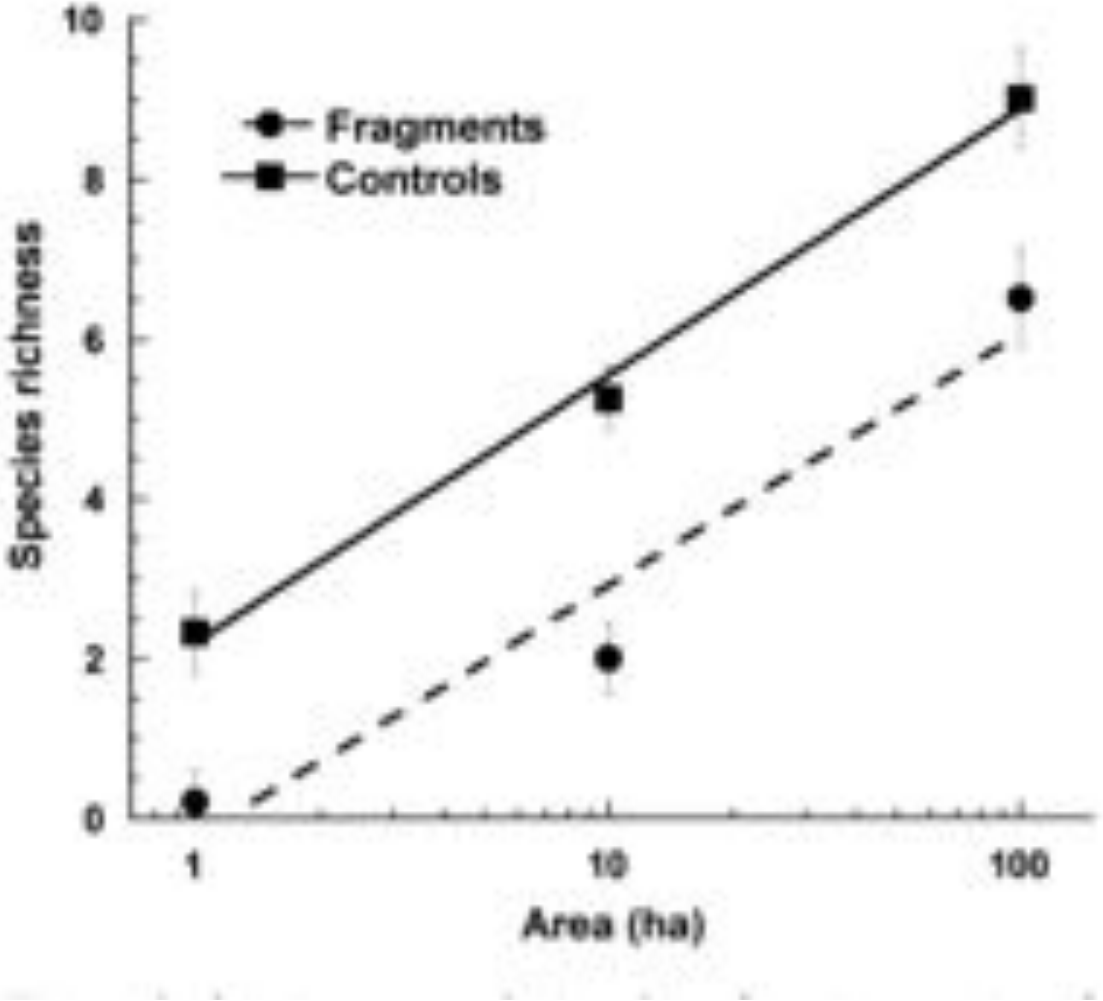
Size of reserve?

- Single large or several small (SLOSS) debate
- All else being equal- would it be better to conserve 1 large plot of land or several smaller plots of land?
- What are the pros and cons of each?



A 22-year study…




Fragments
Controls
Species richness
0
2
4
6
8
10
1
10
100
Area (ha)

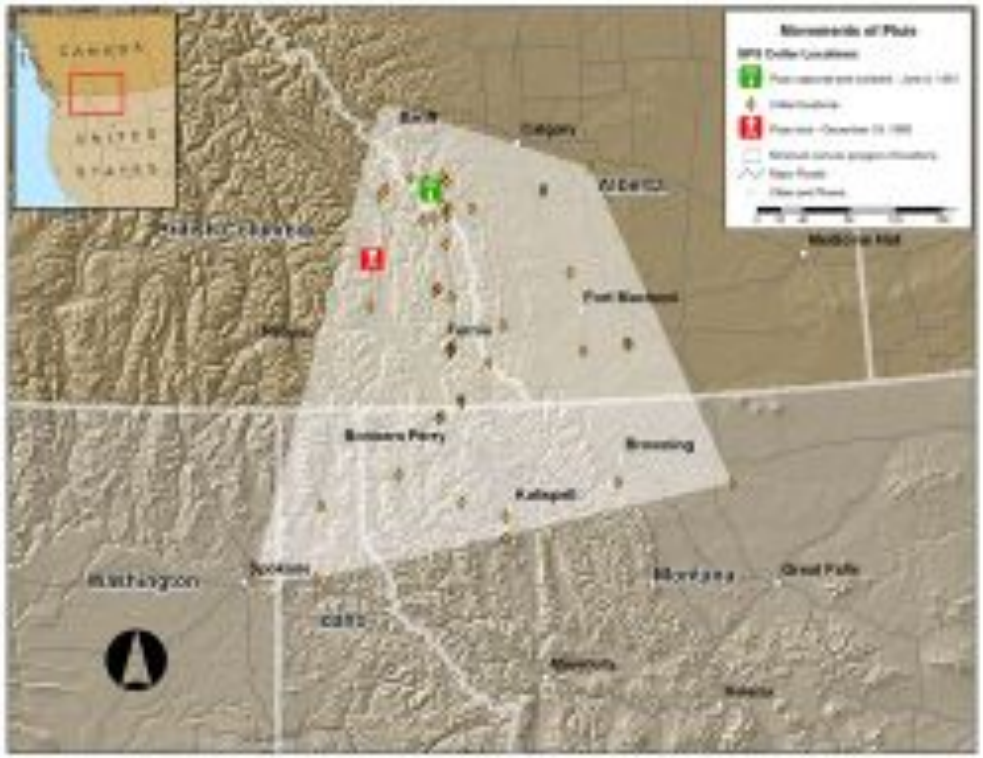
Why do larger areas support greater numbers of species?

Larger Area = More Species

1. Supports species with wide ranges

Pluie, the Wolf

In 1991, a 5 year old female gray wolf was radio-collared in Alberta's Lougheed Provincial Park



Pluie, the Wolf

Pluie was tracked for two years.

She reached three states and two provinces.

Her range size was much greater than the area of the park.

Pluie and her three pups were eventually killed in British Columbia.

Larger Area = More Species

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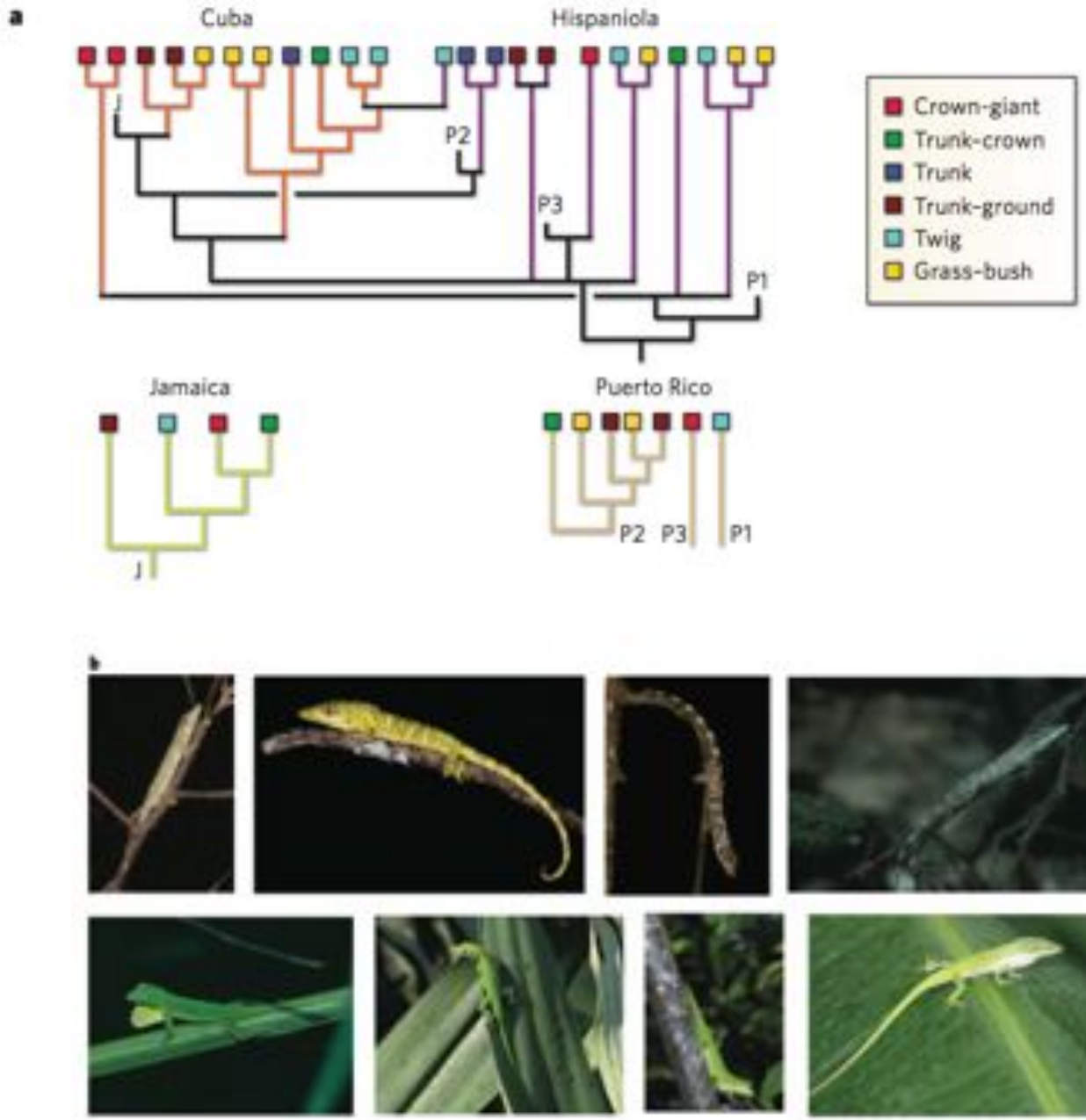
2. Greater Variety of Habitats -> higher speciation

Anolis Lizards


a
Cuba
Hispaniola
J
P2
P3
P1
Crown-giant
Trunk-crown
Trunk
Trunk-ground
Twig
Grass-bush
Jamaica
Puerto Rico
J
P2 P3 P1
b

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Larger Area = More Species

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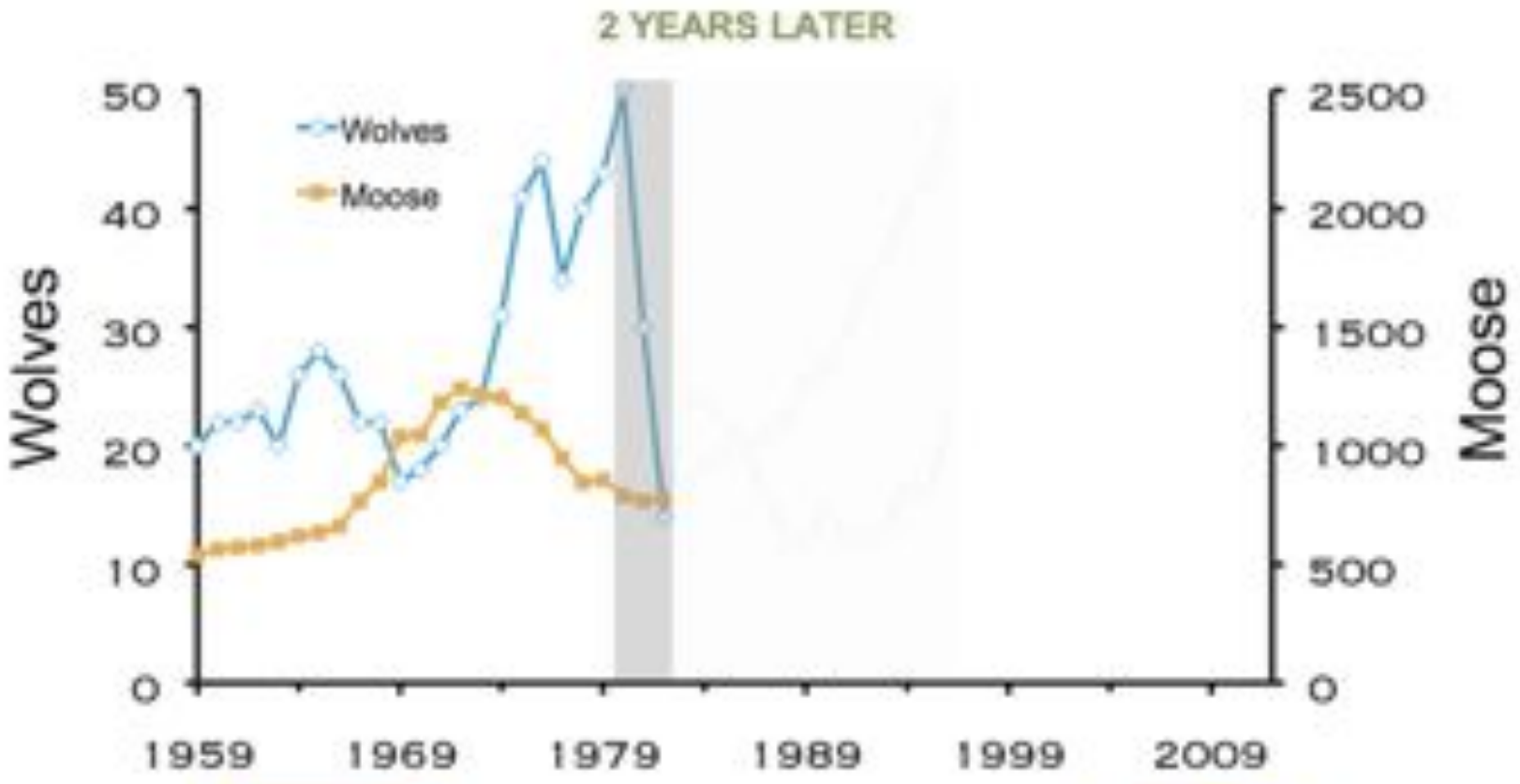
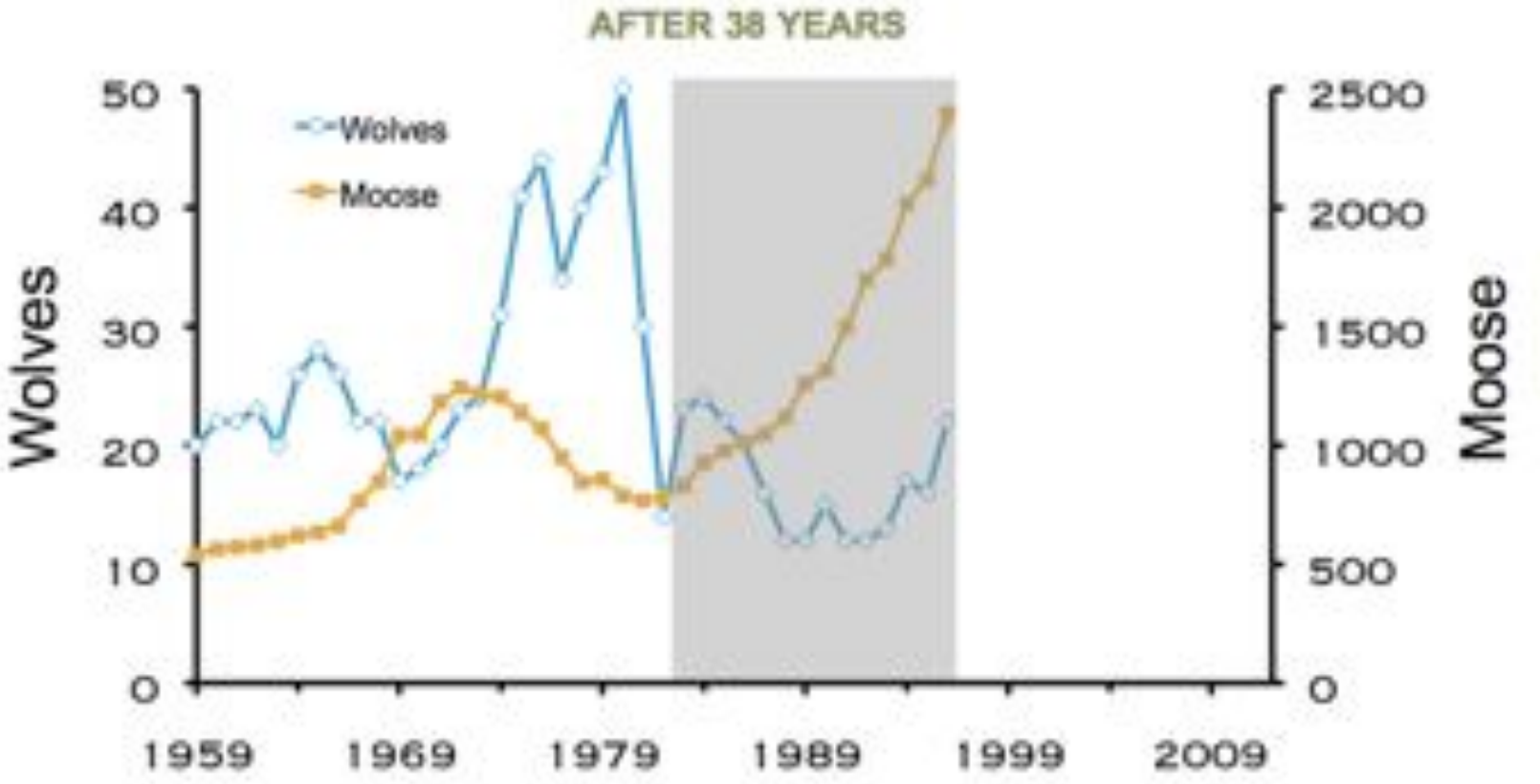
3. Larger populations are less prone to extinction

Wolves on Isle Royale



In 1980, humans introduced parvovirus

Wolves on Isle Royale

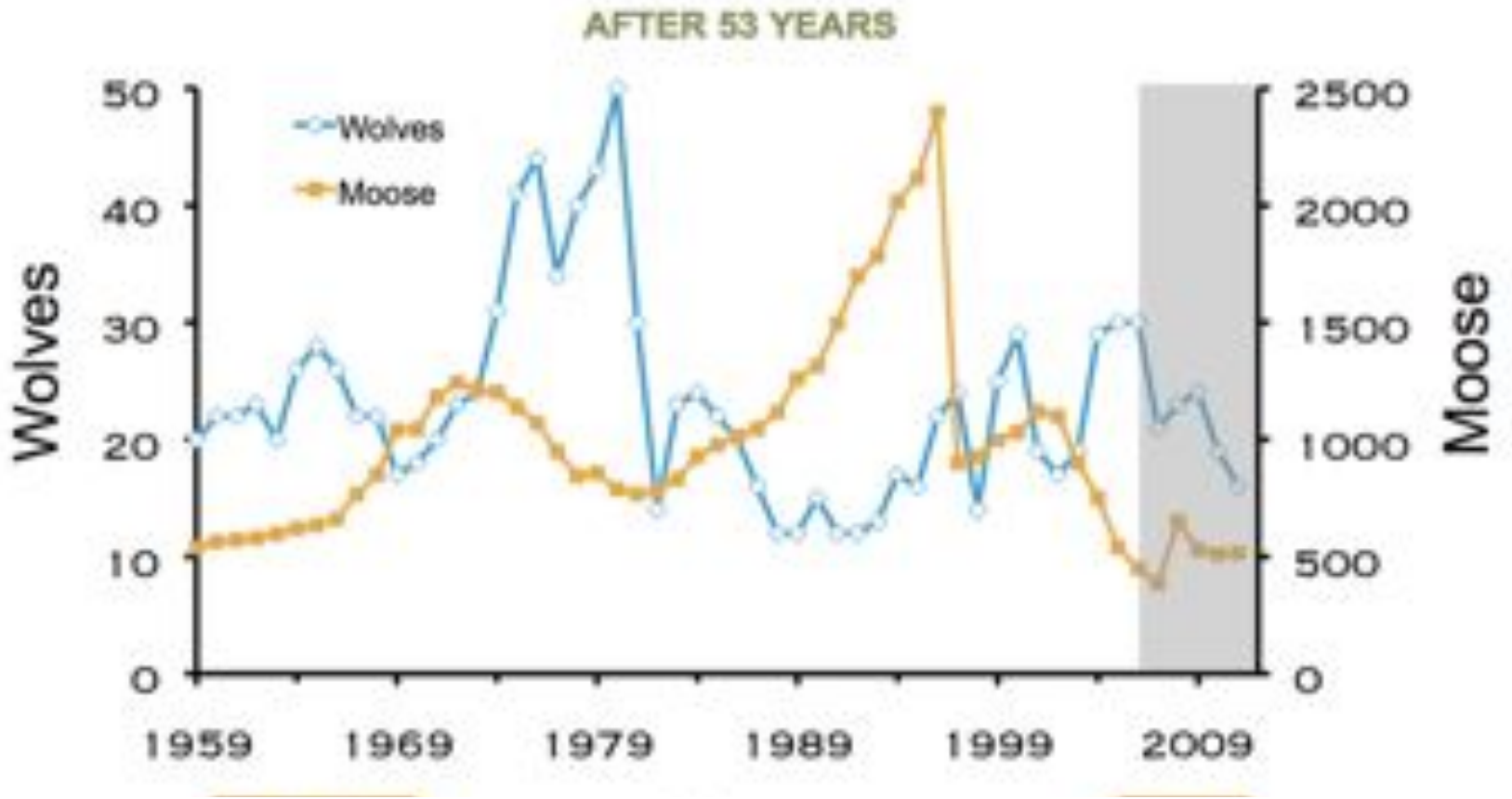


For over a decade they remain in low abundance- probably due to inbreeding (wolves all descended from a single female)

Wolves on Isle Royale

In 1997, a wolf immigrates from Canada, bringing in new genes - wolves do relatively well despite low numbers of moose (their main food source)

Wolves on Isle Royale



Continued low numbers of moose decrease population, making them at risk for extinction

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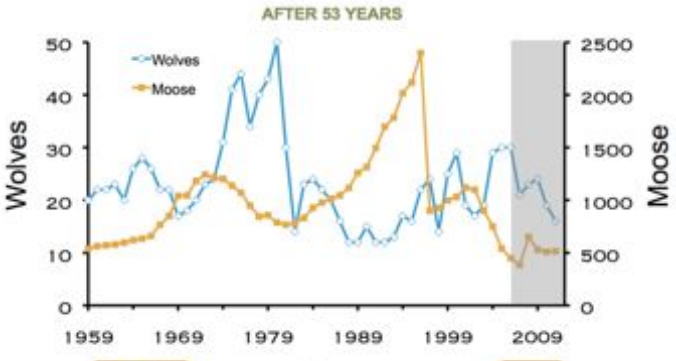
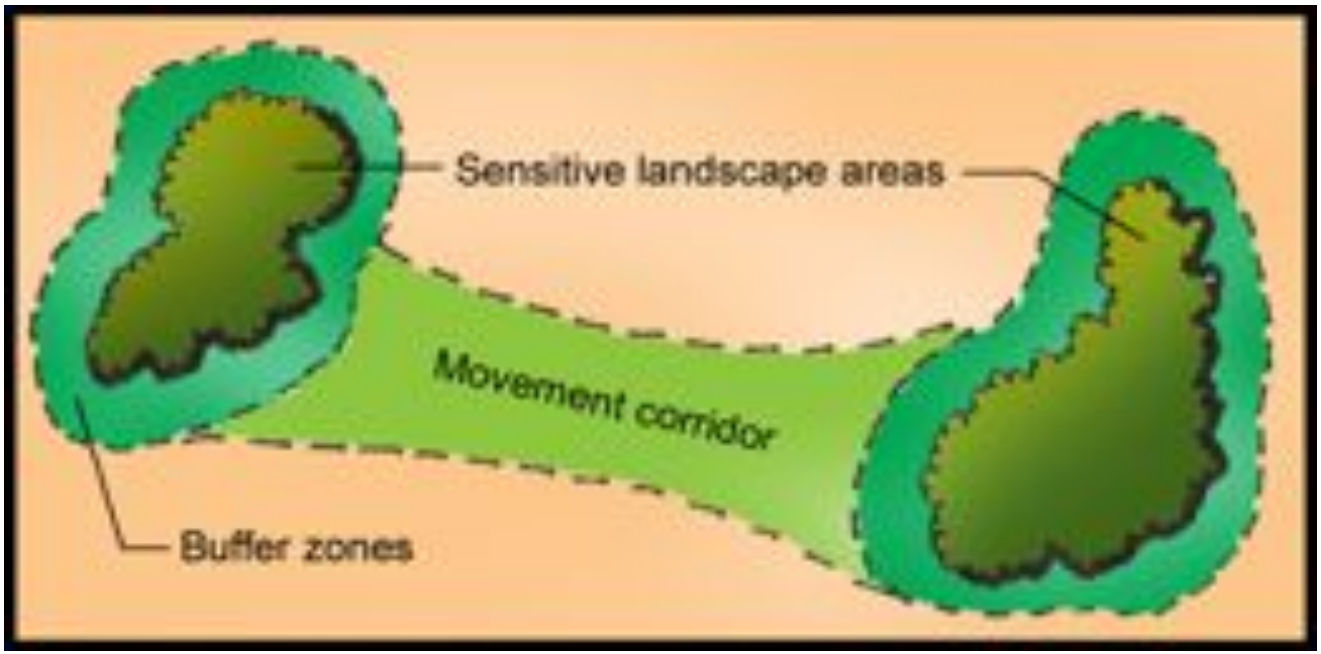


But, establishing a large reserve isn't always possible.

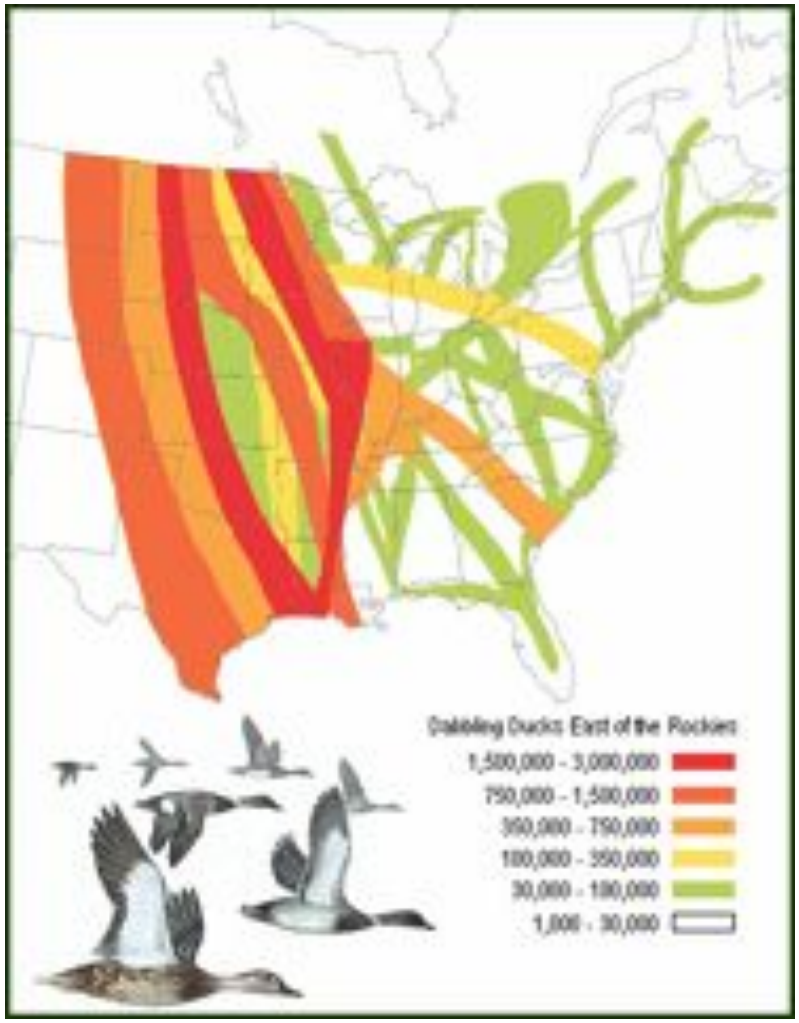
What can we do to conserve the species that live in remaining habitat patches?

Corridors


Sensitive landscape areas
Movement corridor
Buffer zones

There are many types of corridors.

- Natural
- Experimental
- Applied
  - Man-made
  - Large-scale

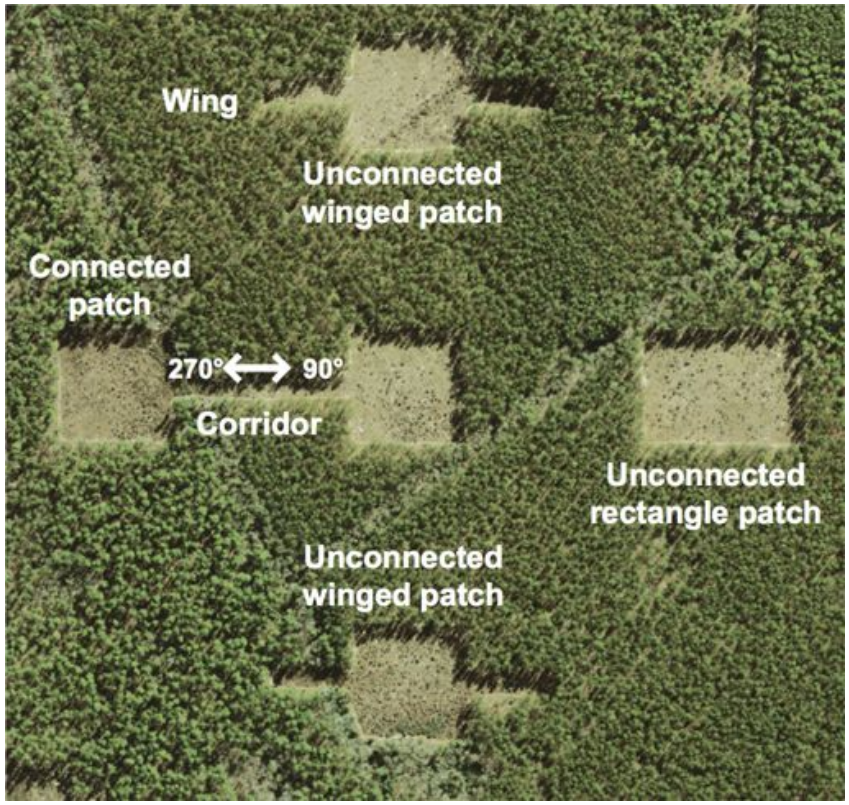


Natural Corridors

- Typically follow geographic features
  - Mountain ranges
  - Rivers
  - “flyways” (e.g., large-scale wind currents)

Experimental Corridors

The Corridor Project – Savannah River Site



http://www.nashturley.org/wp-content/uploads/2012/07/IMG_3927.jpg

http://i.vimeocdn.com/video/303762475_640.jpg

Applying Corridors for Conservation
Man-made Corridors

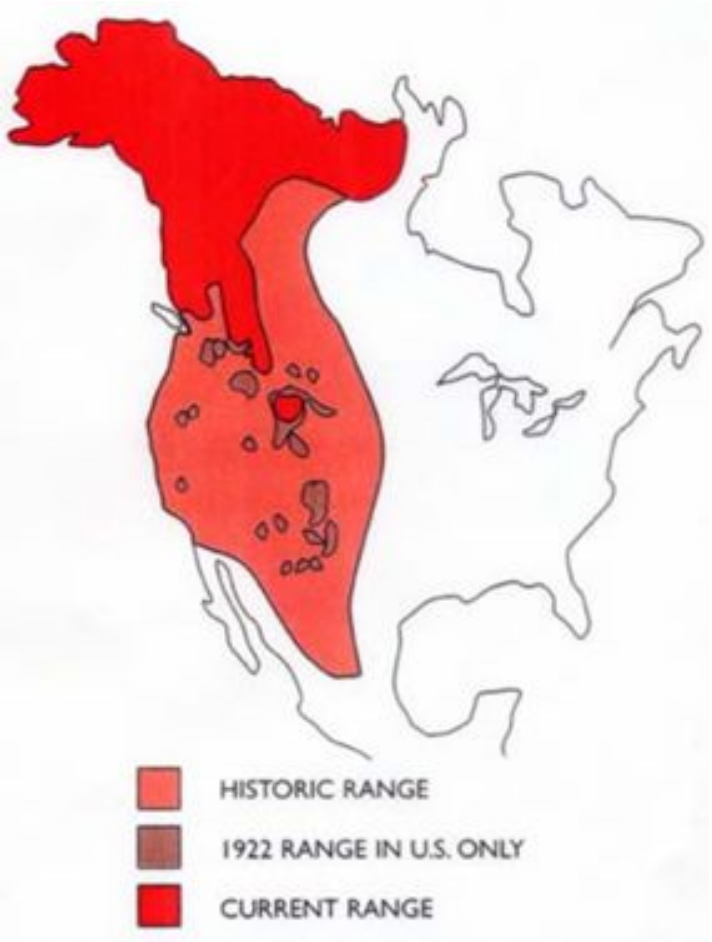
Man-made Corridors

Man-made Corridors

Man-made Corridors

Large-scale Corridors

Large-Scale Corridors



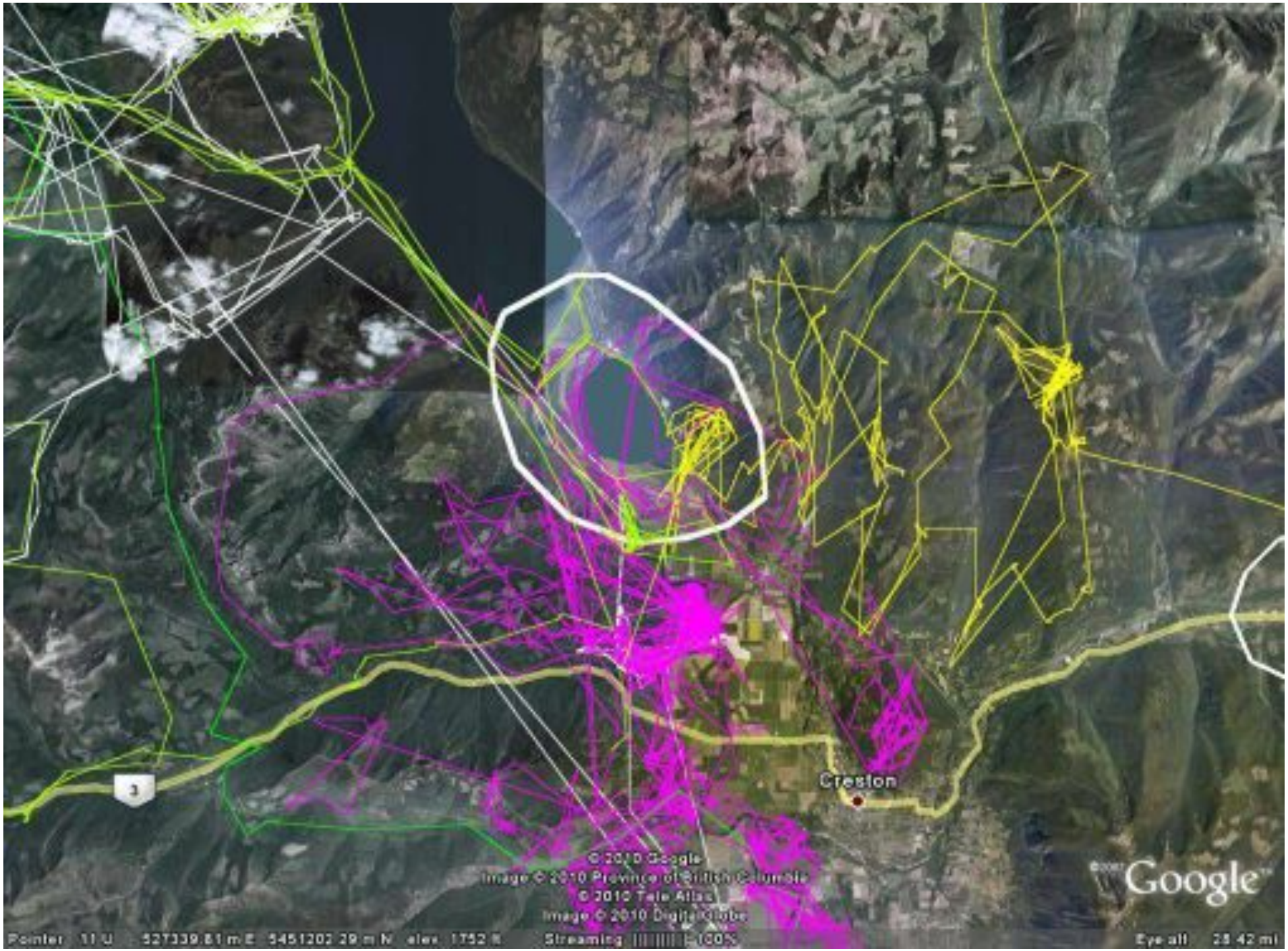

3
Creston
© 2010 Google
Image © 2010 Province of British Columbia
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Image © 2010 DigitalGlobe
Google
Pointer 11 U 527339.81 m E 5451202.29 m N elev 1752 ft
Streaming 100%
Eye alt 28.42 mi


The Frog Bear Conservation Corridor

Organisms move in different ways…

Corridors need to be designed with how organisms move in mind…

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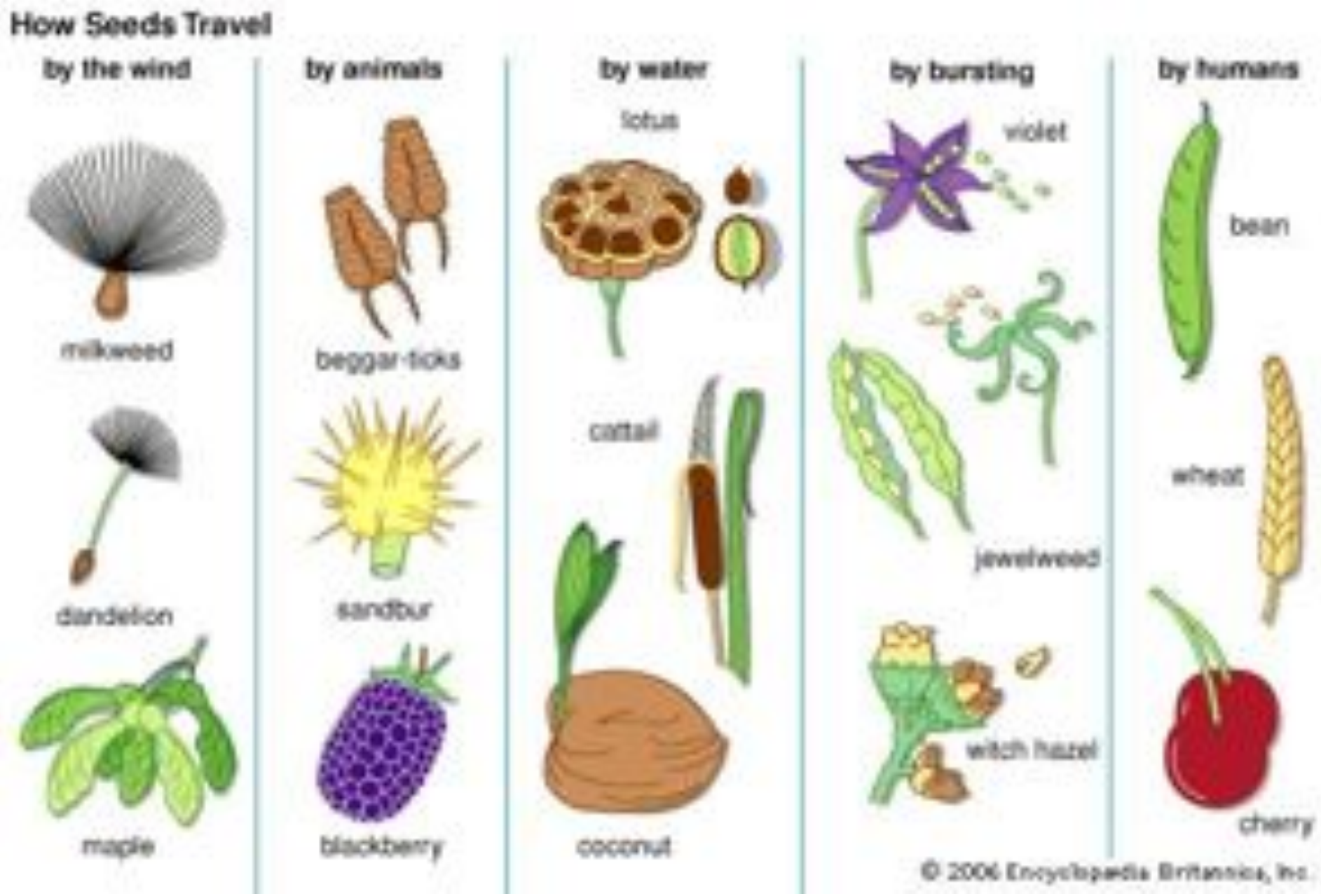
How would designing a corridor for a grizzly bear differ from designing a corridor for a specific group of plants?

How do plants move?

How do plants move?



Seed Dispersal

Wind-dispersed Species

- Key component of savanna and grassland systems
  - Of conservation interest
  - Many threatened or rare
- Important traits help them disperse

Fall velocity: How fast does a seed fall?

Seeds with a lower fall velocity will reach the ground slower and have a greater chance of dispersing further with wind.

Seed release height: How far does a seed have to travel to reach the ground?

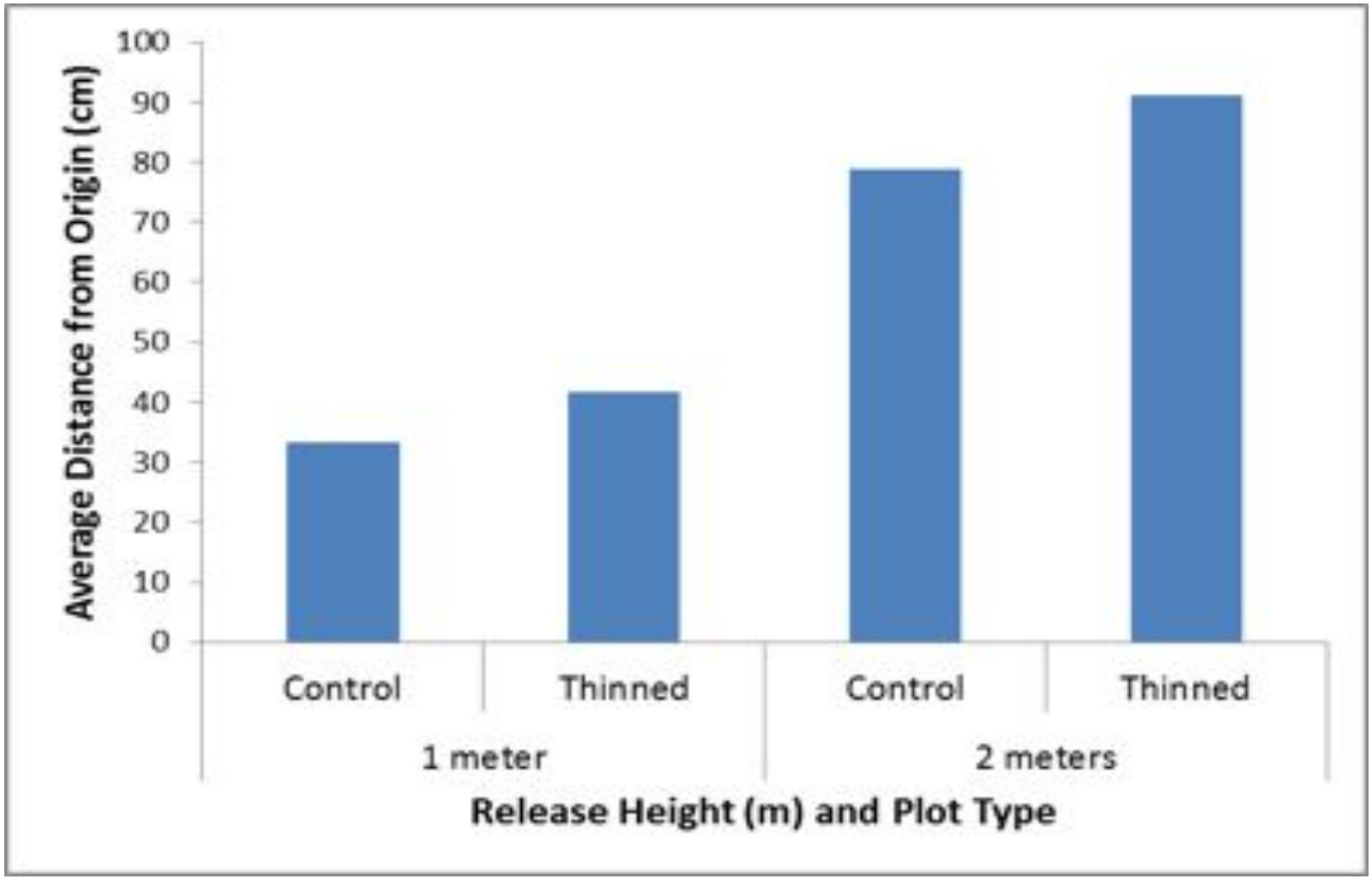
Seeds released at greater heights have a greater distance to travel before reaching the ground, so have a greater change of dispersing further with wind.

What habitat or corridor types would promote dispersal of these types of seeds?

Which would be better? Why?


We can study this.

Preliminary Data from Artificial Seed Releases



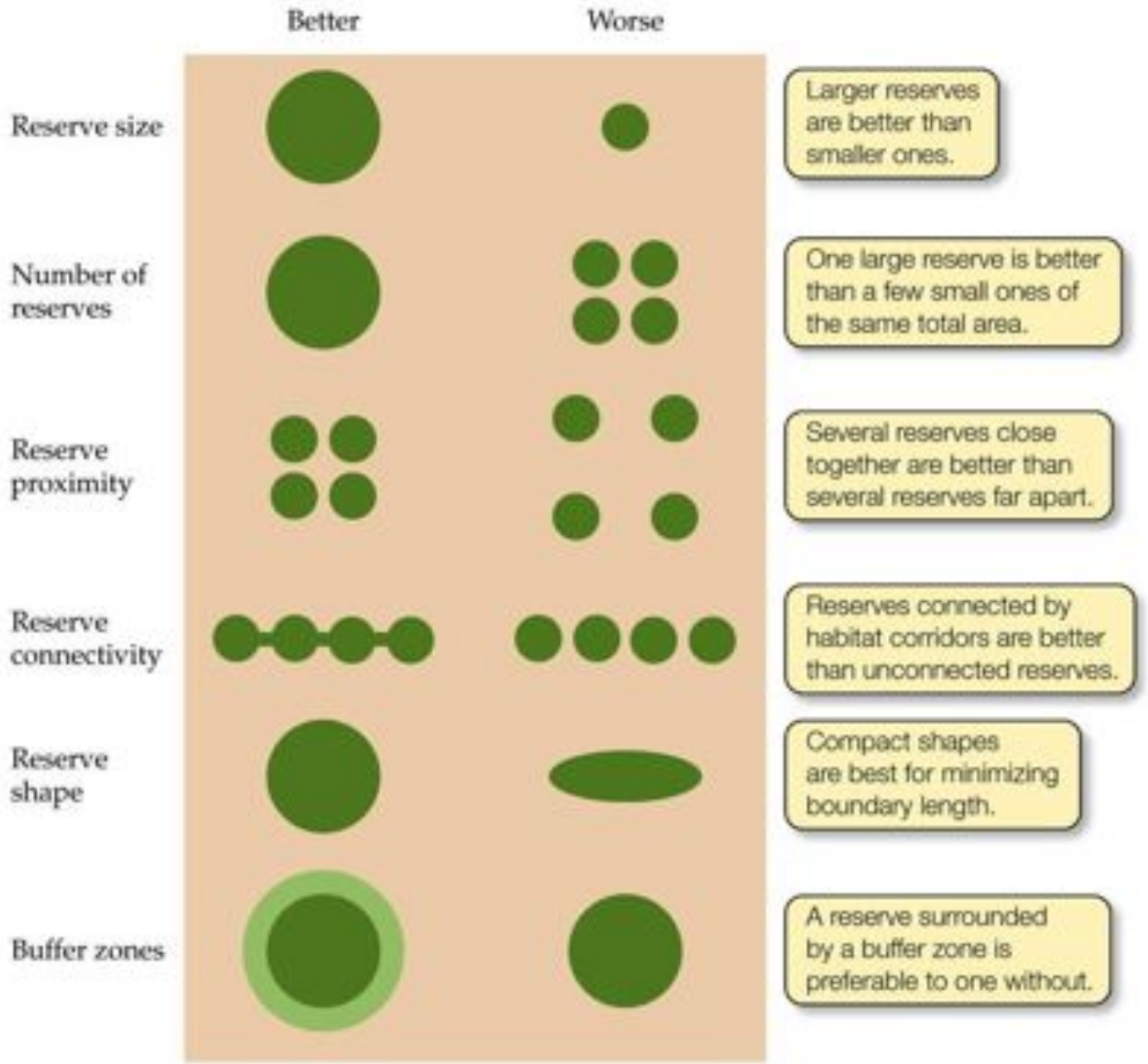
Design the Best Disperser!

- Design wind-dispersed “seeds” with provided materials and goals in mind
- Each “seed” must use a bead seed body
  - System for seed bodies
    - Large seed body = double your distance
    - Medium seed body = keep your distance the same
    - Small seed body = half your distance
- 2+ habitat types (e.g., one windy and one other, decided as a class)
- In each habitat type, each student conducts three seed release trials. At a marked spot on the ground, each student will release their seeds (one at a time) and record their three distances on a piece of paper. Make note of the habitat type each release was conducted in.
- There are multiple ways to win. A student wins if:
  - They have the longest average dispersal distance in habitat 1 area
  - They have the longest average dispersal distance in habitat 2 area
  - They have the longest average dispersal in both habitats combined ("weedy" winner)

Connections

- Broadly:
  - Organisms require different habitats
  - Some move “better” in others
  - Biology must of the mover must be considered

HIDDEN SLIDES



***ECOLOGY*, Figure 23.17**