Invasive Species

Preview

1. Getting There
2. Impacts of Invasives

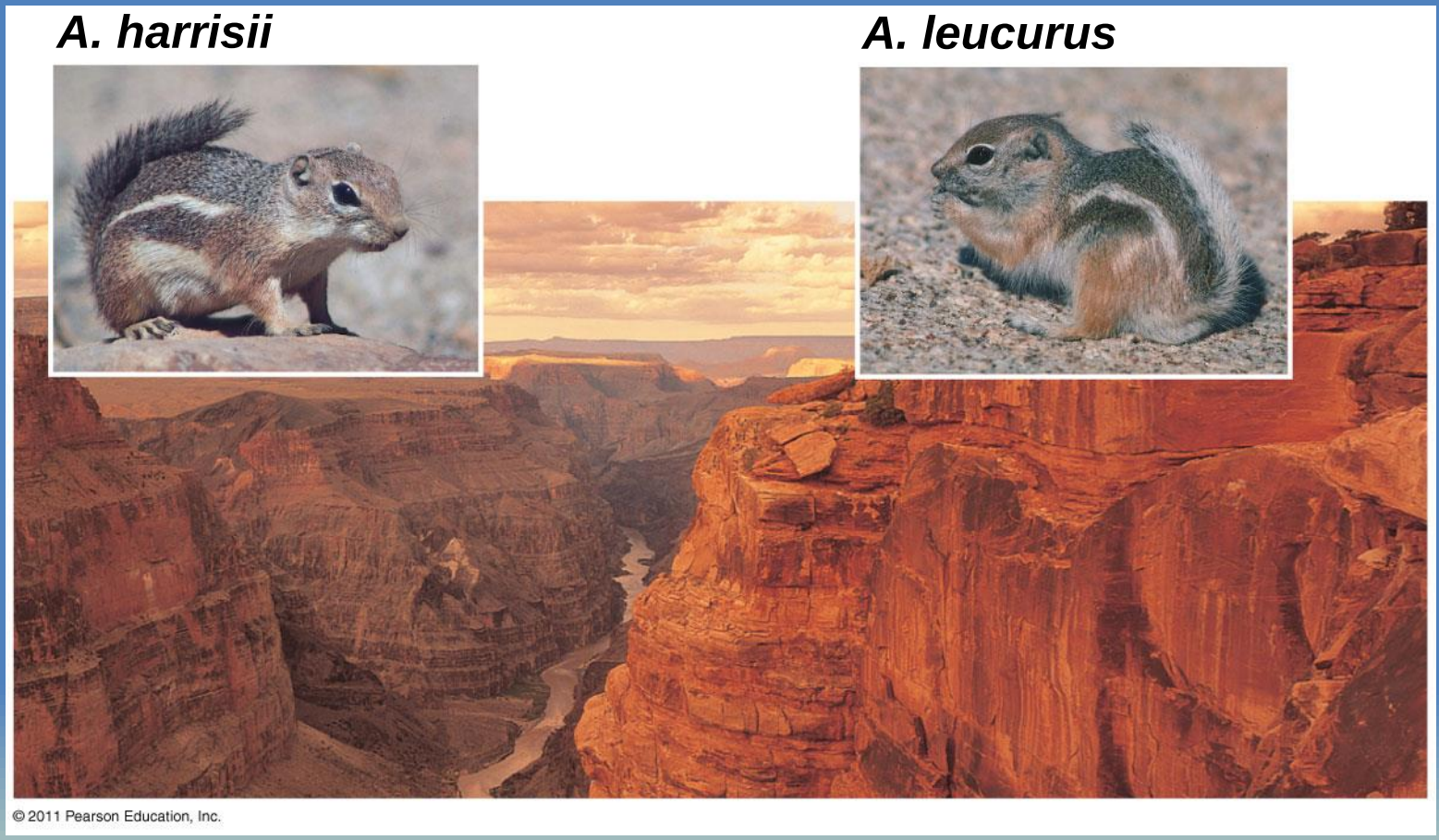
1.

Getting There

- Recall that…
  - Species divergence/extinction often driven by isolation
  - How does it happen?
    - Geologic events: millions of years
    - Climatic/Ecological events: thousands of years

1.

~6 million years ago



Reece et al. 2014

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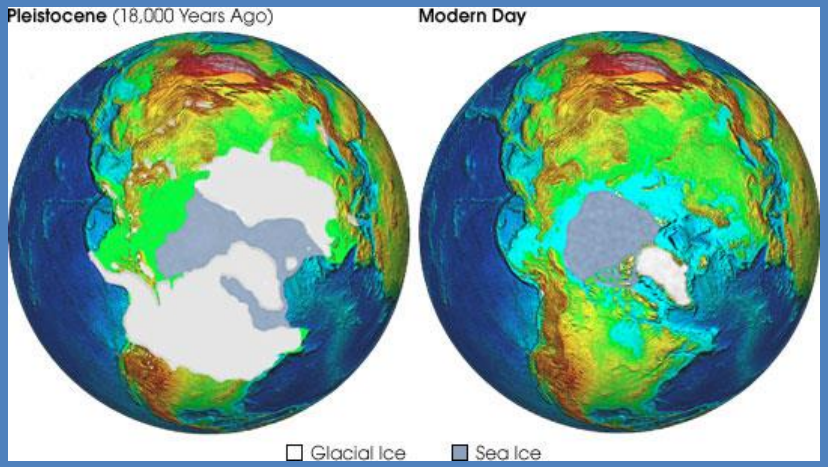
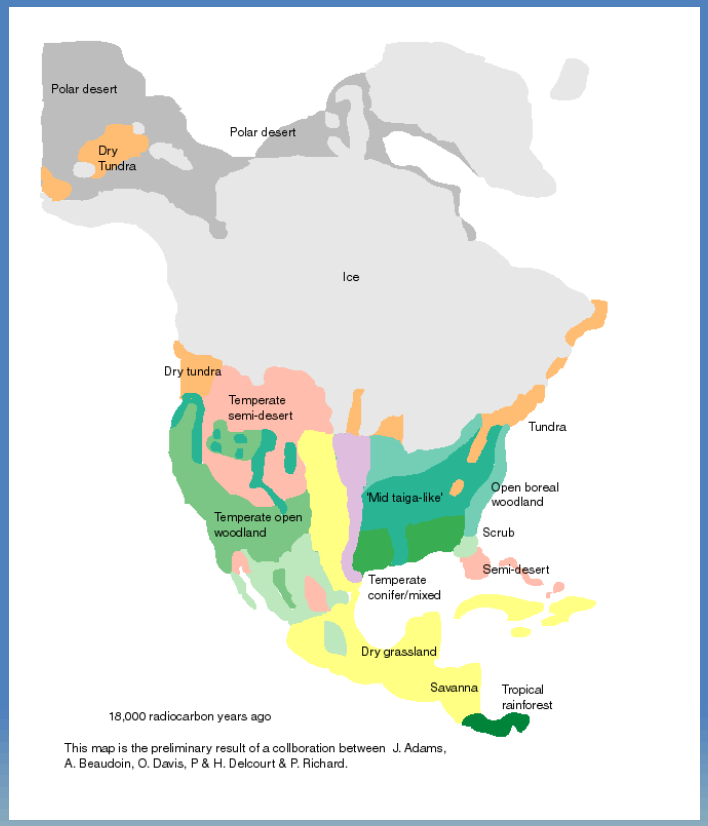
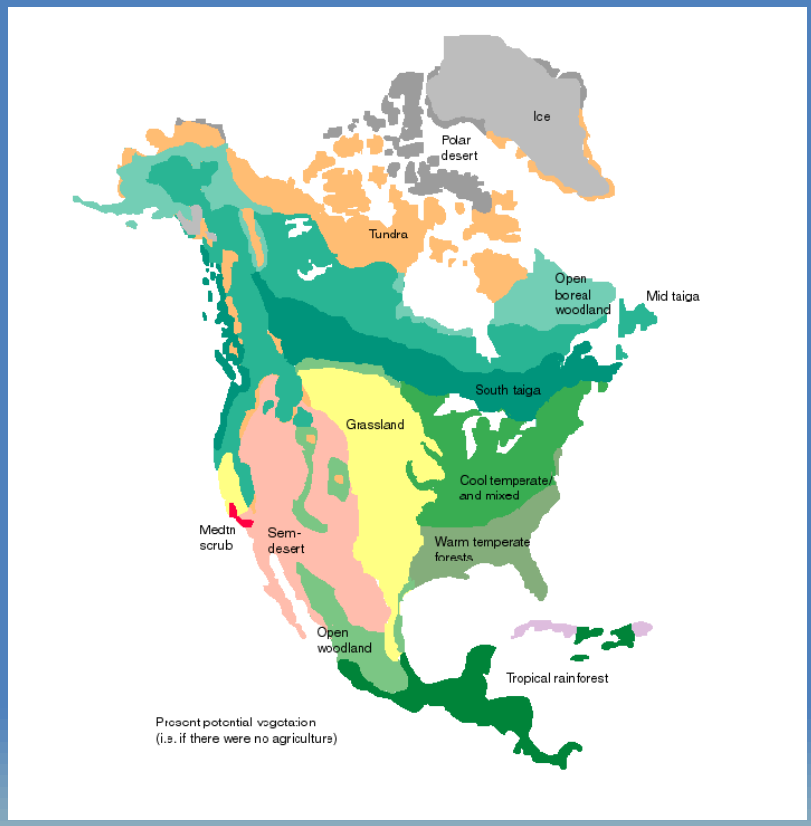
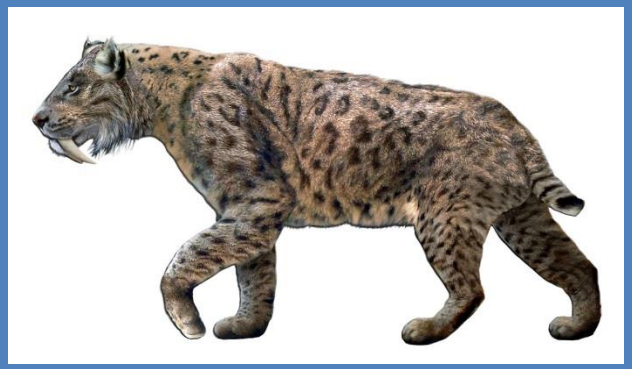






~18 thousand years ago

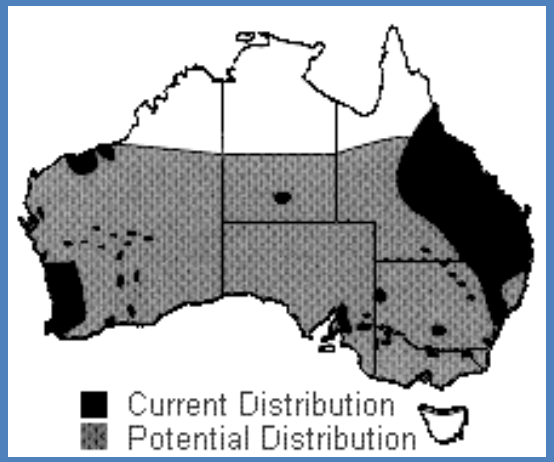
1.



To…

From…

1.



The Invasion of Australia

A Silent Terror that has Captured 29,000,000 Acres of Our Inheritance

AUSTRALIA is invaded by a mighty foe. It came many years ago, invited. It took up its abode among the settlers, biding its time. It watched their making, as they thought, the continent their own. All the time it was silently, insidiously working, gaining ground day by day, year by year. A long time passed. The foe had grown to big proportions and had captured much of the country. Little notice was taken of it. It was recognised as an invasion, but no one thought of it as fighting us for our continent.

Then one day Australia woke up. Hundreds of thousands of acres gone! People were alarmed. But there seemed to be plenty of room left; so they let it continue. "Something ought to be done," they said, but no one did anything. When the enemy was found to be in possession of not hundreds of thousands but millions of acres, Governments showed concern.

Nothing much else happened. So it went on. Computations were made from time to time of the progress of the encroachment, and it was found that it was advancing at an incredible rate. That was some years ago. It is still advancing. We have not beaten it back. It beats us back. This is how the Advisory Council of Science and Industry of the Commonwealth puts it:—

The spread of prickly pear is like the invasion of

Here is an accurate measurement as the result of a survey:—

The Mungle Scrub, in the Warialda district, contains about 42,000 acres of pear. A traverse was made in 1908, and certain surveys were carried out in the same locality in 1910. It was discovered that in the intervening two years the pear had advanced about half a mile in a solid mass on a frontage of about four miles. That is to say, in two years in that one spot a piece of land four miles long by half a mile in breadth had been lost.

How It Grows

It is something diabolic, this enemy of ours. It is covered with long stiff spikes with needle points, and the stuff is rendered impenetrable. It is covered with them, but worse even than these myriad chevaux de frise are the almost invisible bristles, of which the plants are full, that find their way through the clothing and into the skin, often causing serious irritation. A plant or two of the pear will make its appearance in a paddock, carried there in the seed by some bird or animal, and, if not destroyed, will grow up quite indifferent as to whether it is provided with water or not. Droughts will not stop it. As it grows, the leaves or slabs drop in a circle around it. They lie on the ground. Very soon they are seen to be curving up at the ends. A root has started underneath that leaf, right in the centre, and is sometimes down in the ground. There

National Library of Australia nla.pic-an24261643-v

~120 years ago

1.

Getting There

- Human activities can accelerate speciation/extinction
  - Rates
  - Magnitude

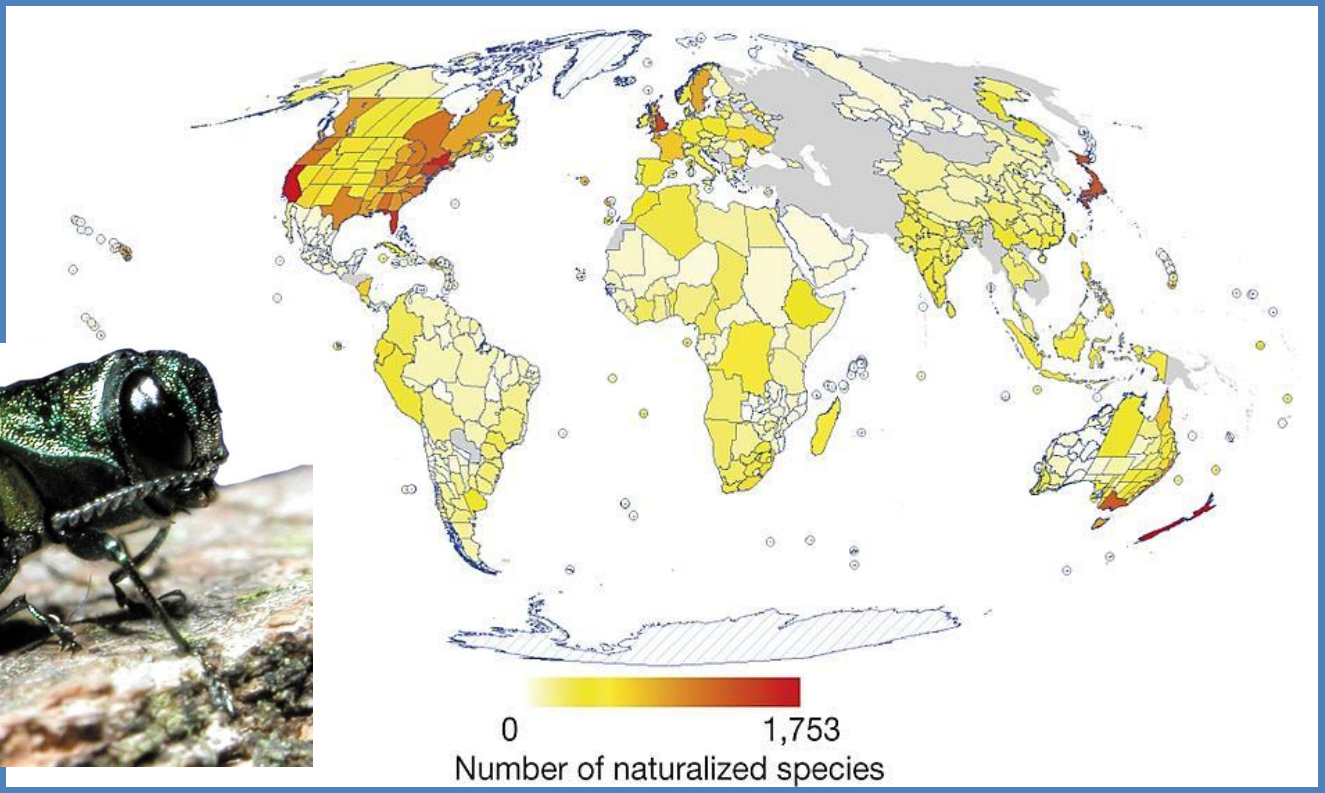
1.

Getting There

- Some terms:
  - Non-native/Alien/Exotic – a species outside its native range
  - Naturalized – non-native species that has established a relatively stable population outside its native range
  - Invasive – non-native species that has caused ecological or other problems

Invasive species in the USA

1.



[Emerald Ash Borer]

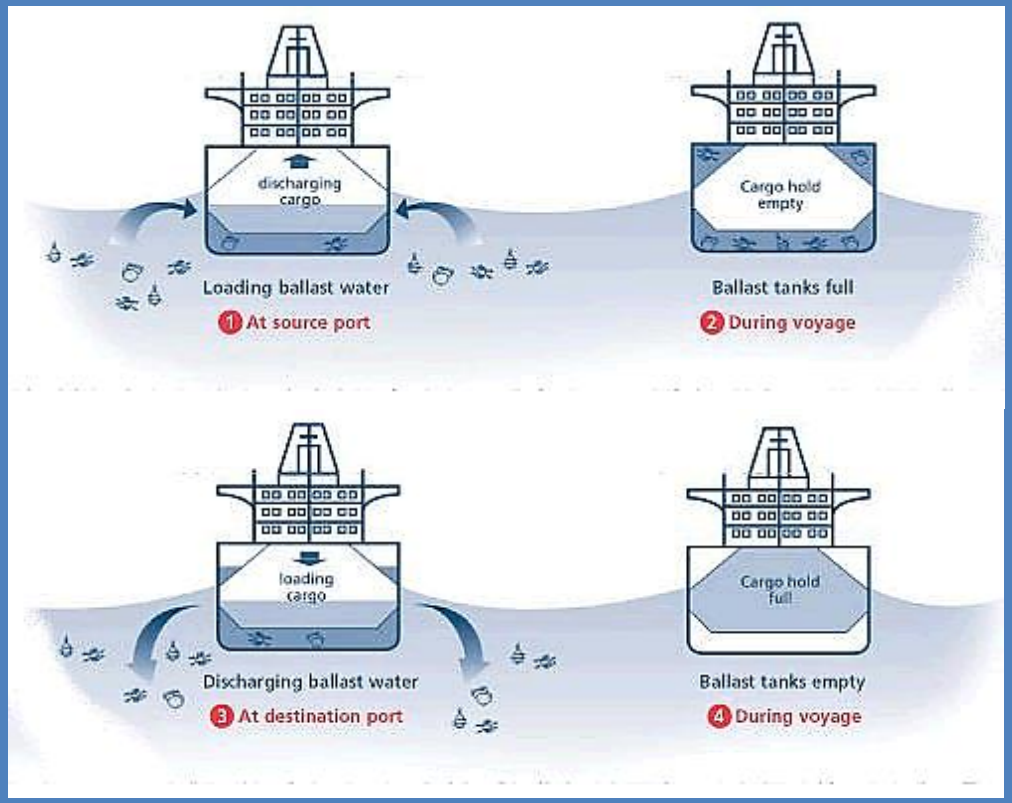
1.

Getting There

- Stowaways
  - Often small and/or difficult to find
  - Transported accidentally (mostly)
  - E.g., rats, mice, snakes, earthworms, pathogens

Brown Tree Snake

1.



[Zebra Mussels]

www.fws.gov

1.

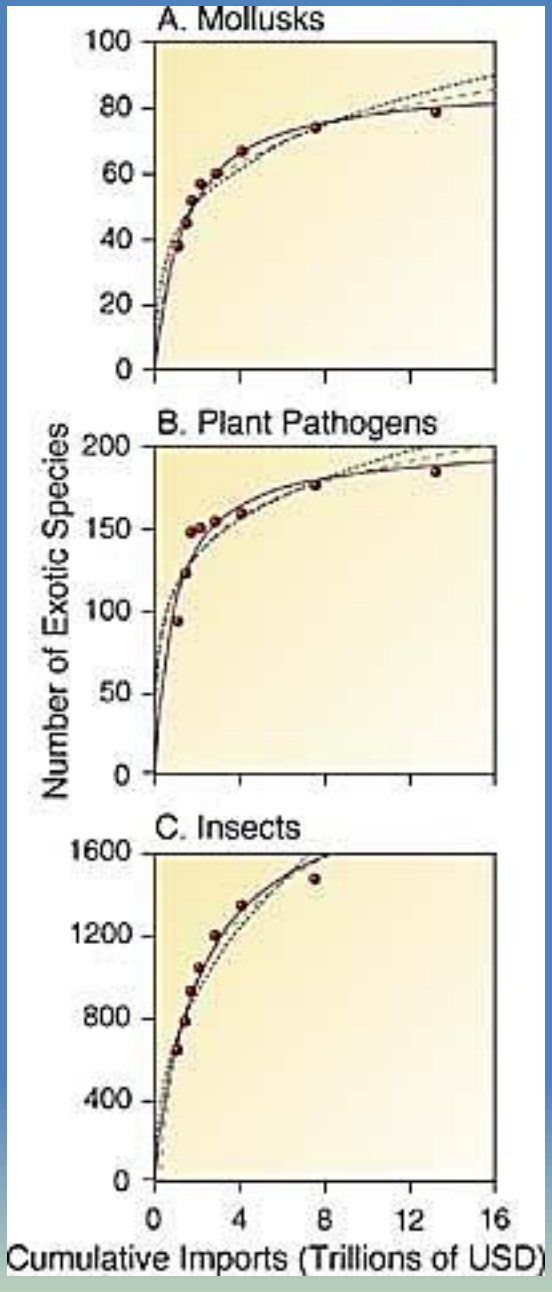
Getting There

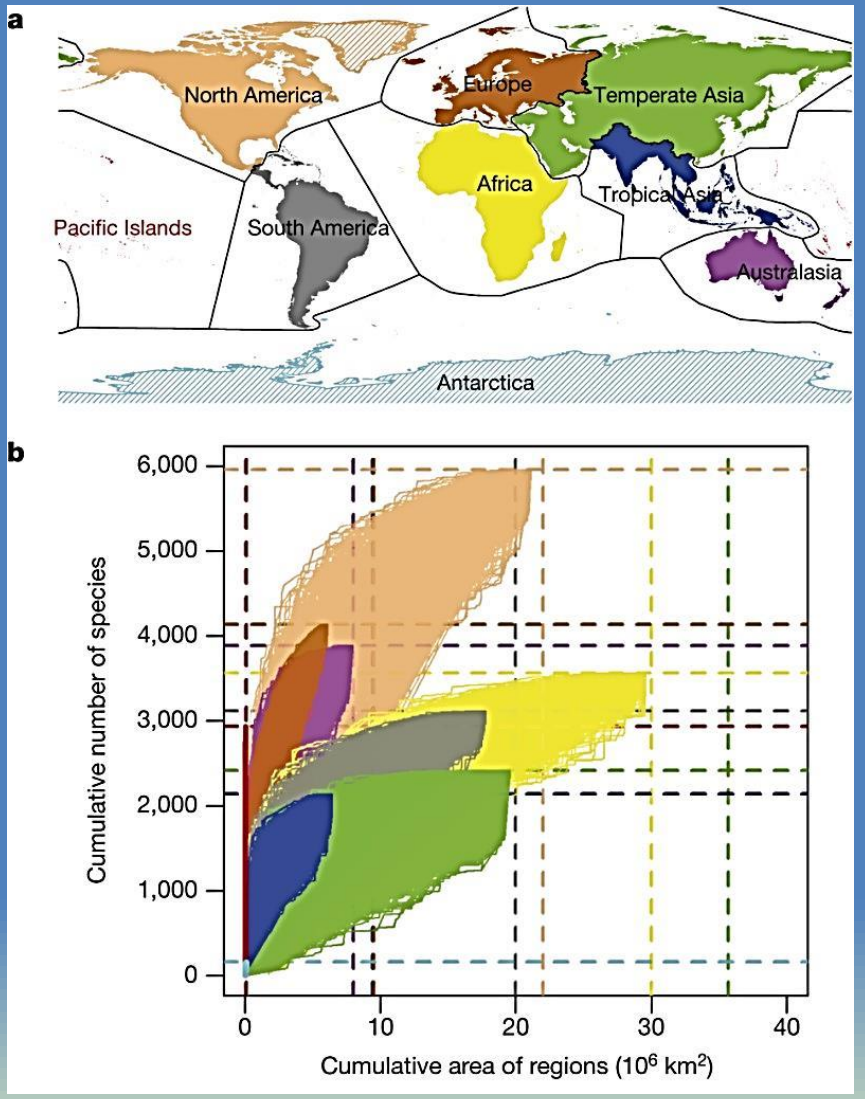
- Commerce
  - Transport of familiar/new foods and plants
  - Differs by geographic region and organism group

Jefferson's Garden

1.

Accumulation Curves



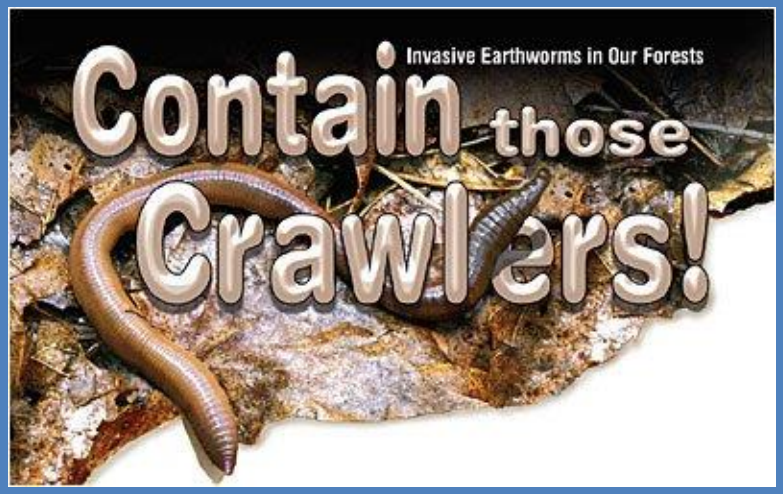


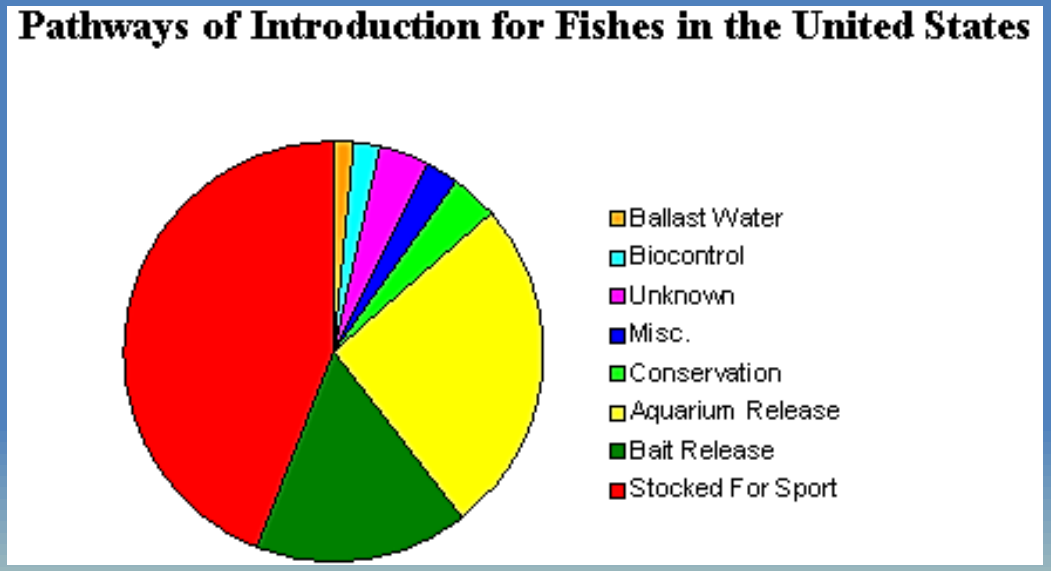
1.

Getting There

- Recreation
  - Bait Species
  - Fish stocking
  - Exotic birds
  - Feral animals

1.


Invasive Earthworms in Our Forests
Contain those Crawlers!


Pathways of Introduction for Fishes in the United States
Ballast Water
Biocontrol
Unknown
Misc.
Conservation
Aquarium Release
Bait Release
Stocked For Sport

1.

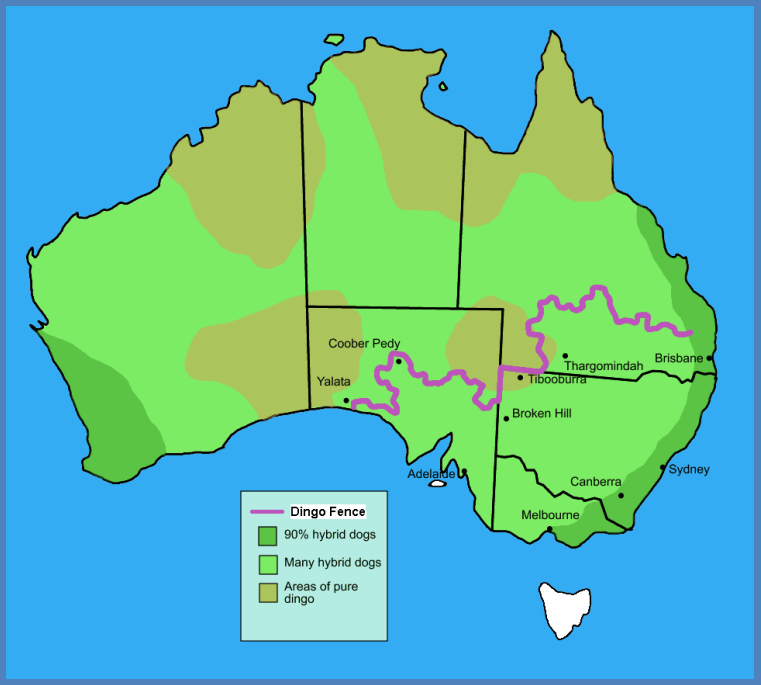
Getting There

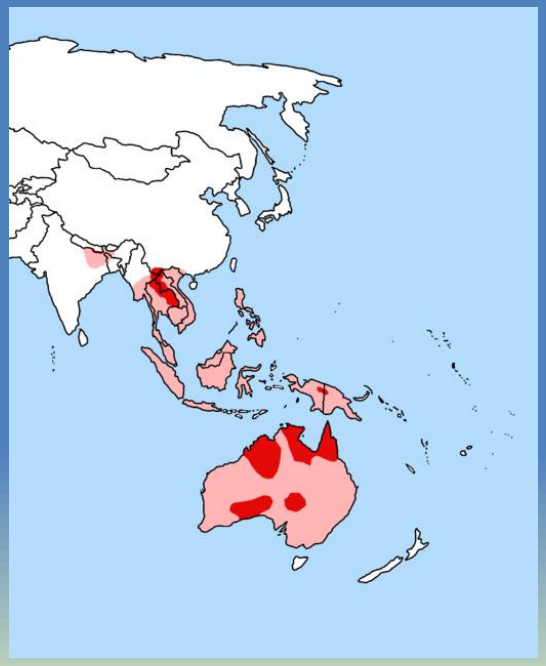
- Aesthetic
  - Pets
  - Horticulture
  - Food Fancies

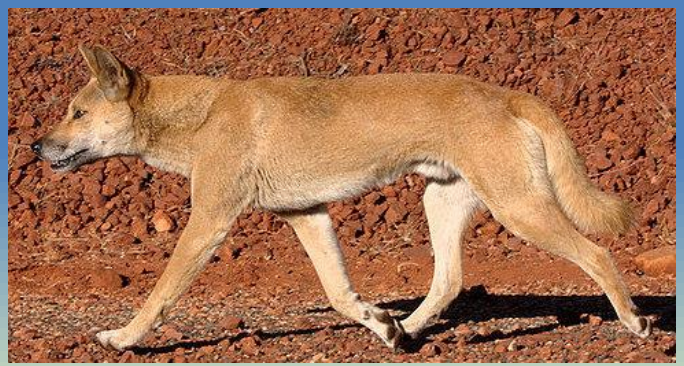
1.

Getting There

- Habitat Changes
  - Human or natural





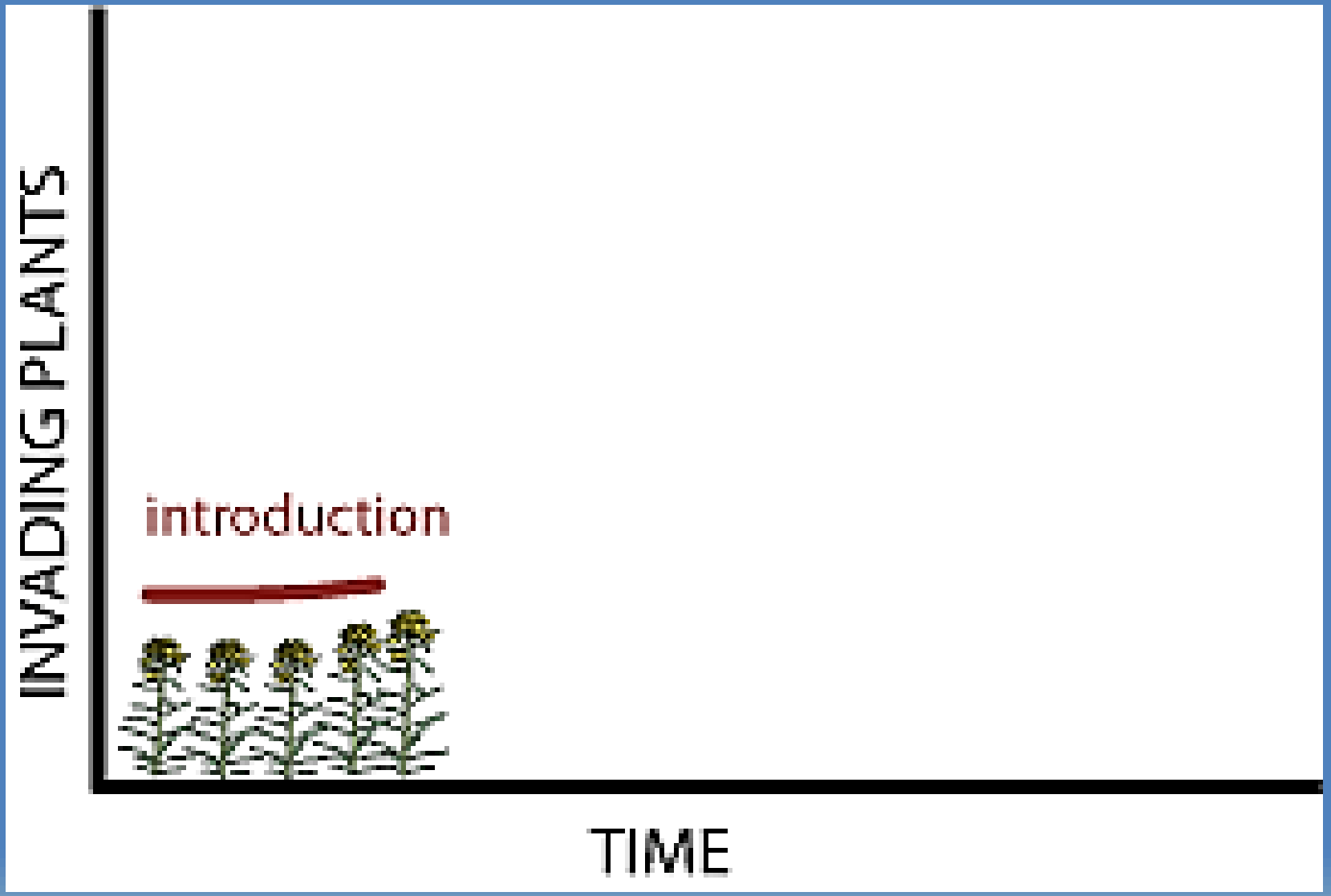


2.

Impacts of Invasives

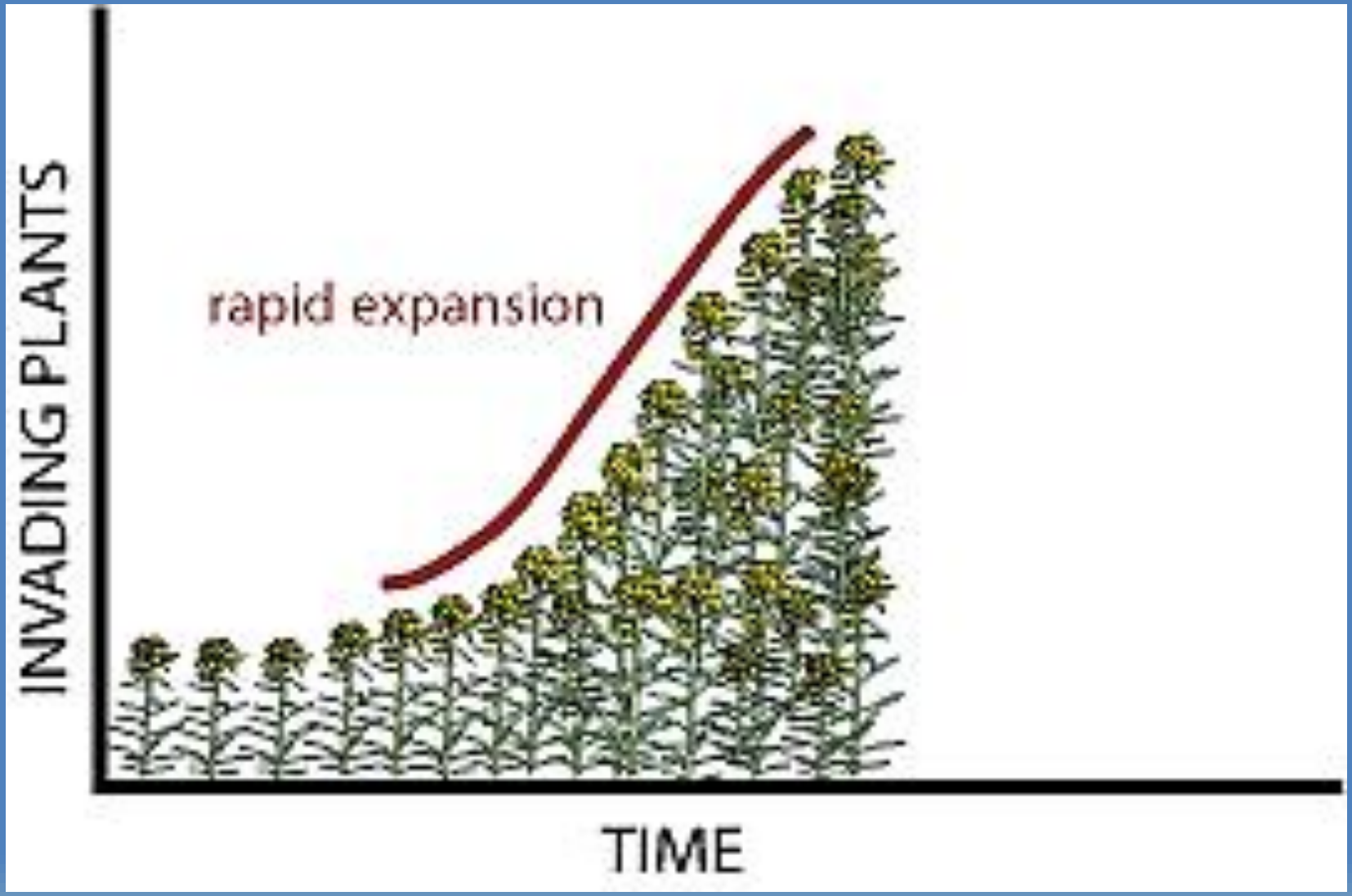
- Invasions occur in stages
  - At first, growth is exponential
    - Little competition
    - Few natural controls
    - Small population
  - Over time, population growth slows and stabilizes

2.



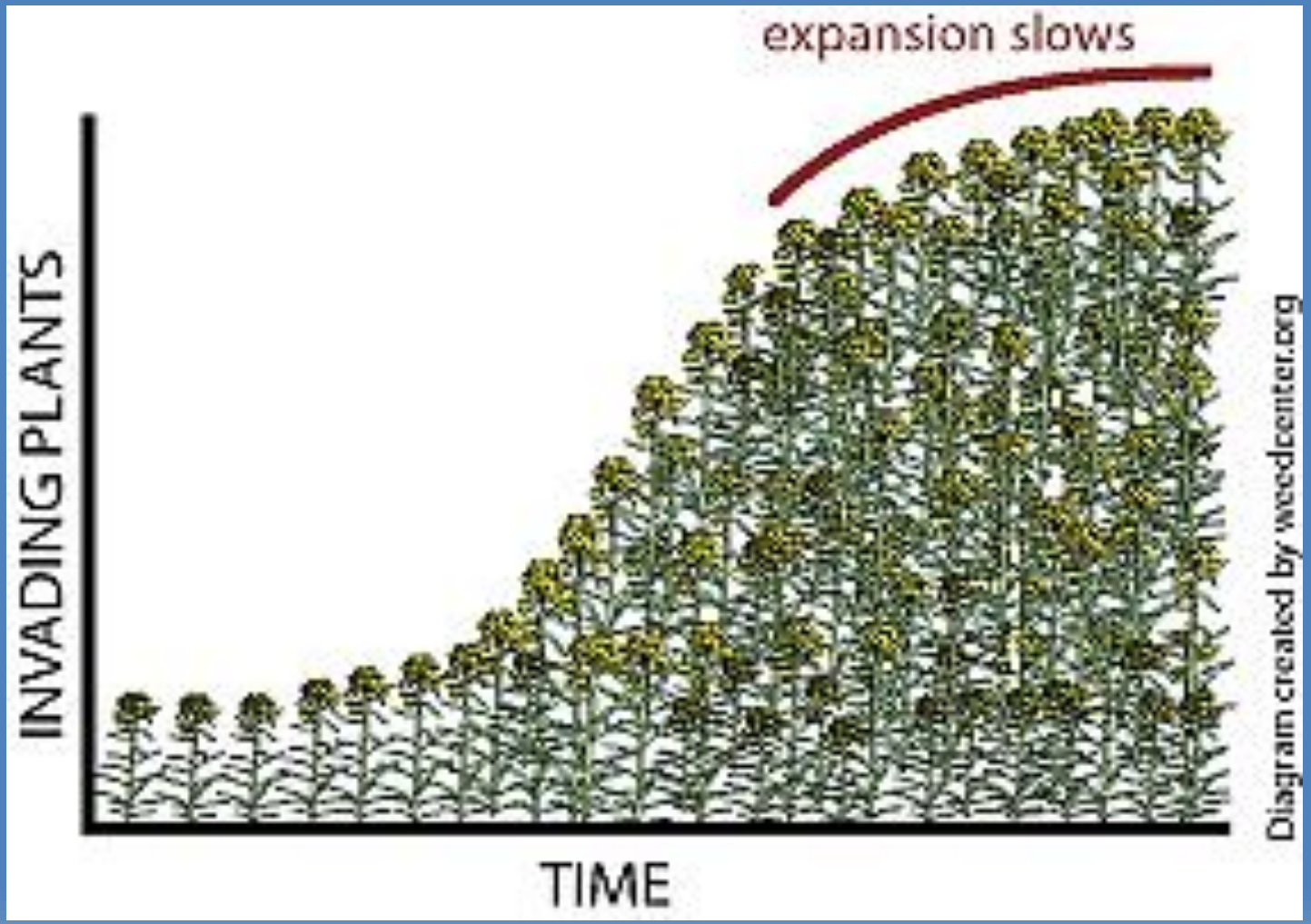
Management Goal: Detection

2.



Management Goal: Control

2.



Management Goal: Restoration

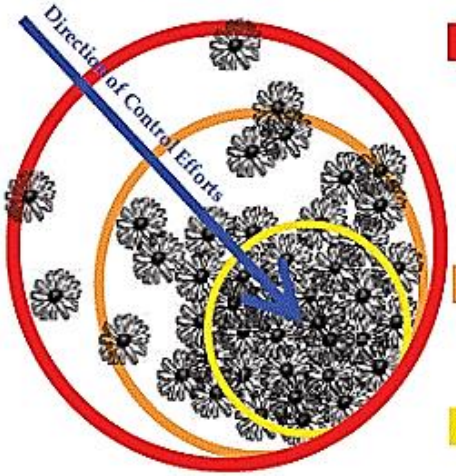
2.

Impacts of Invasives

- Management must be customized
  - Stage of invasion
  - Spatial attributes of invasion
  - Life history of invader

2.

Prioritizing Control Efforts for a Single Species by Density of Infestation



Outliers – Highest priority

- Lowest density of infestation
- Goal = eliminate small, isolated infestations
- Prevent the reproduction and survival of outliers
- Monitor annually beyond the known infestation for new outliers
- Lowest level of commitment, resources and effort needed

Advancing Front

- Goal = control the advancing front and perimeter of core infestations
- Prevent the expansion of the core infestation

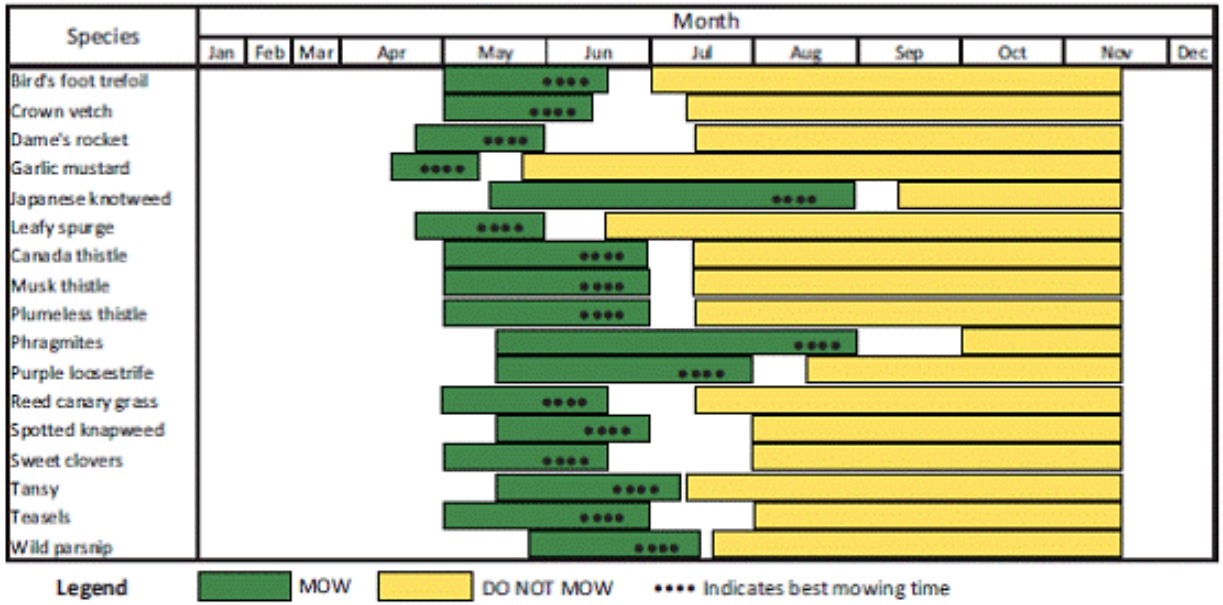
Core – Lower priority

- Highest density of infestation
- Goal = suppress the interior of core infestations
- Highest level of commitment, resources and effort needed

Note: Effective control may require the use of multiple control methods. Control efforts must be followed up by monitoring for new plants, regrowth, and flowering, generally within the same growing season. Monitoring should be done annually.

red Clark, Clark Forestry, Inc. and Wisconsin DNR-Urban Forestry

Mowing times for common invasive species in southern Wisconsin



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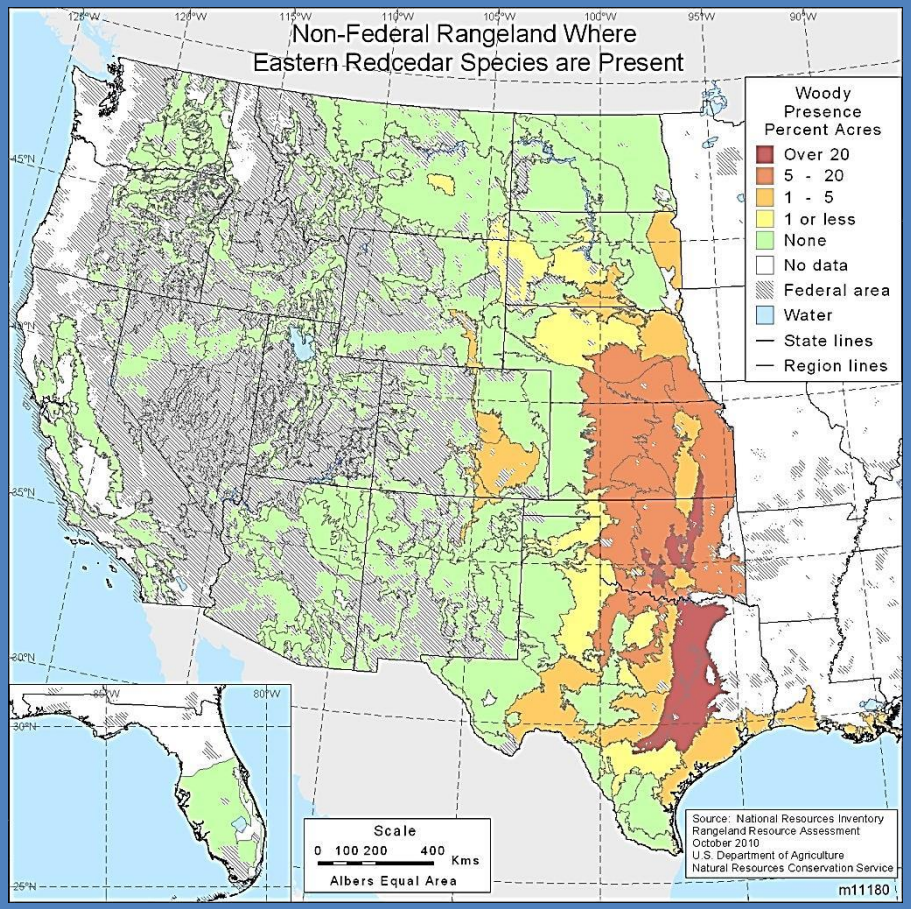
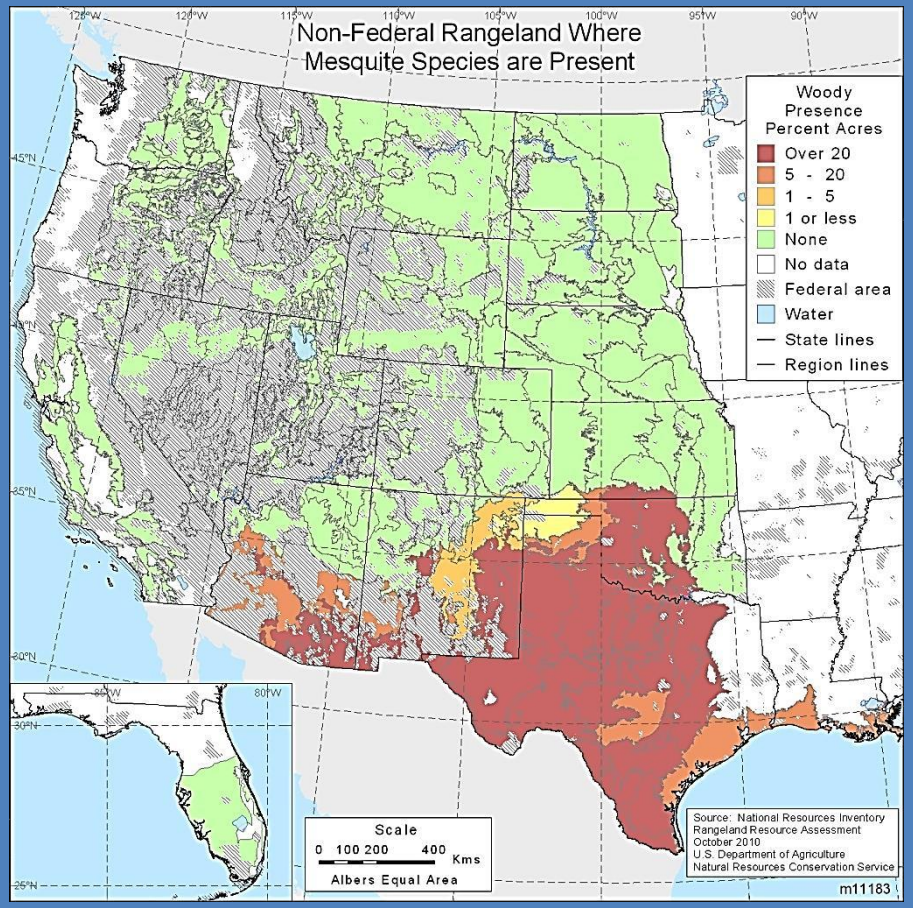




Redcedar vs. Mesquite:
Dispersal and Impacts of Grazers

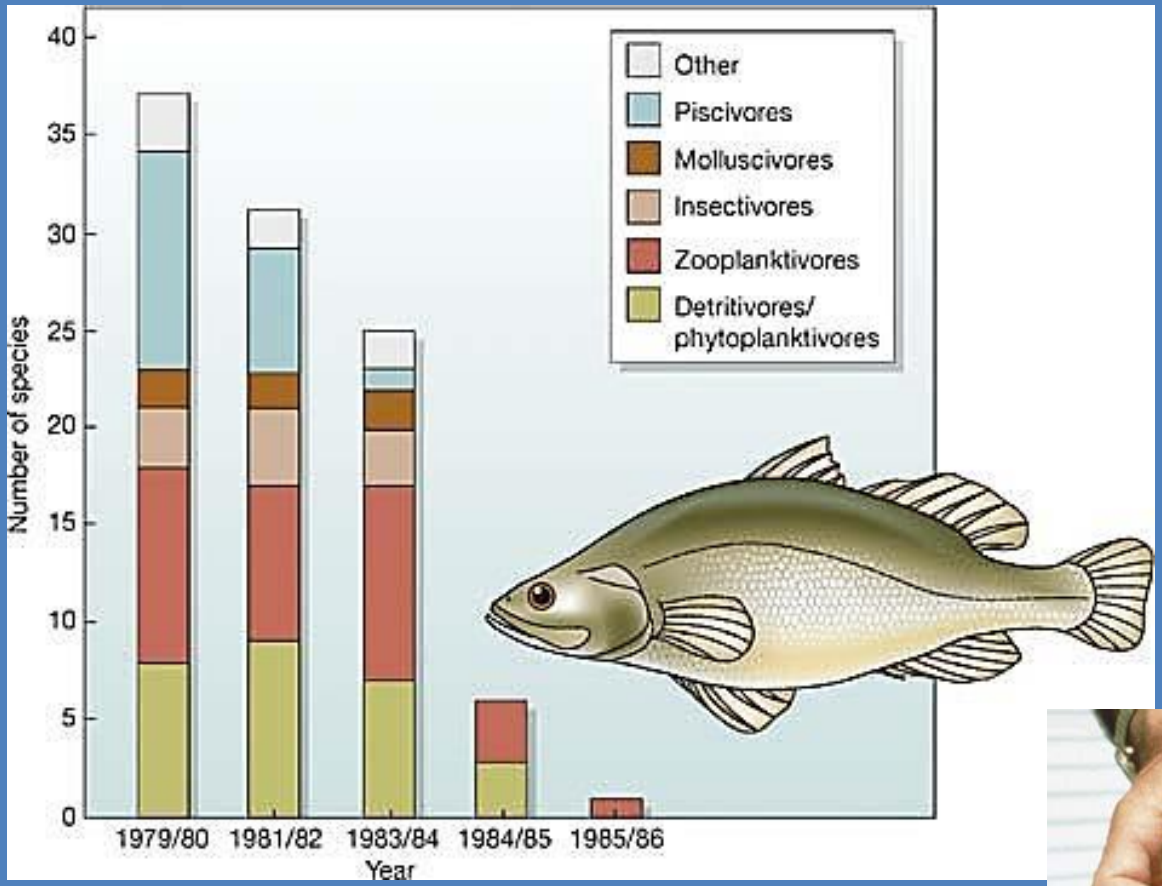
2.

Impacts of Invasives

- Various effects of invasives
  - Biodiversity
  - Nutrient cycling
  - Erosion
  - Crop damage
  - Fishery collapse
  - Extinction

2.

Nile Perch in Lake Victoria



Lampreys in upper Great Lakes

2.

Impacts of Invasives

- Not all invasives are successful
  - Rule of ten = introduced, escapes, invades
- Some invasives can create habitat/fill empty niches

2.

Impacts of Invasives

- Tamarisk (*Tamarix* spp.)
  - Introduced from Asia
  - Uses:
    - Erosion control
    - Ornamental
    - Windbreaks
  - Displaced native plant communities
  - Influenced river hydrology

2.

Impacts of Invasives

- Southwestern Willow Flycatcher (*Empidonax* spp.)
  - Small, insectivorous bird
  - Listed as endangered 1995
  - Nests in riparian forests

2.

Impacts of Invasives

- Tamarisk beetle (*Diorhabda* spp.)
  - Introduced from China in 2001 to control tamarisk
  - Population increased faster than expected
  - Beetles traveled further than expected
  - Tree defoliation threatens flycatcher nest success in certain areas

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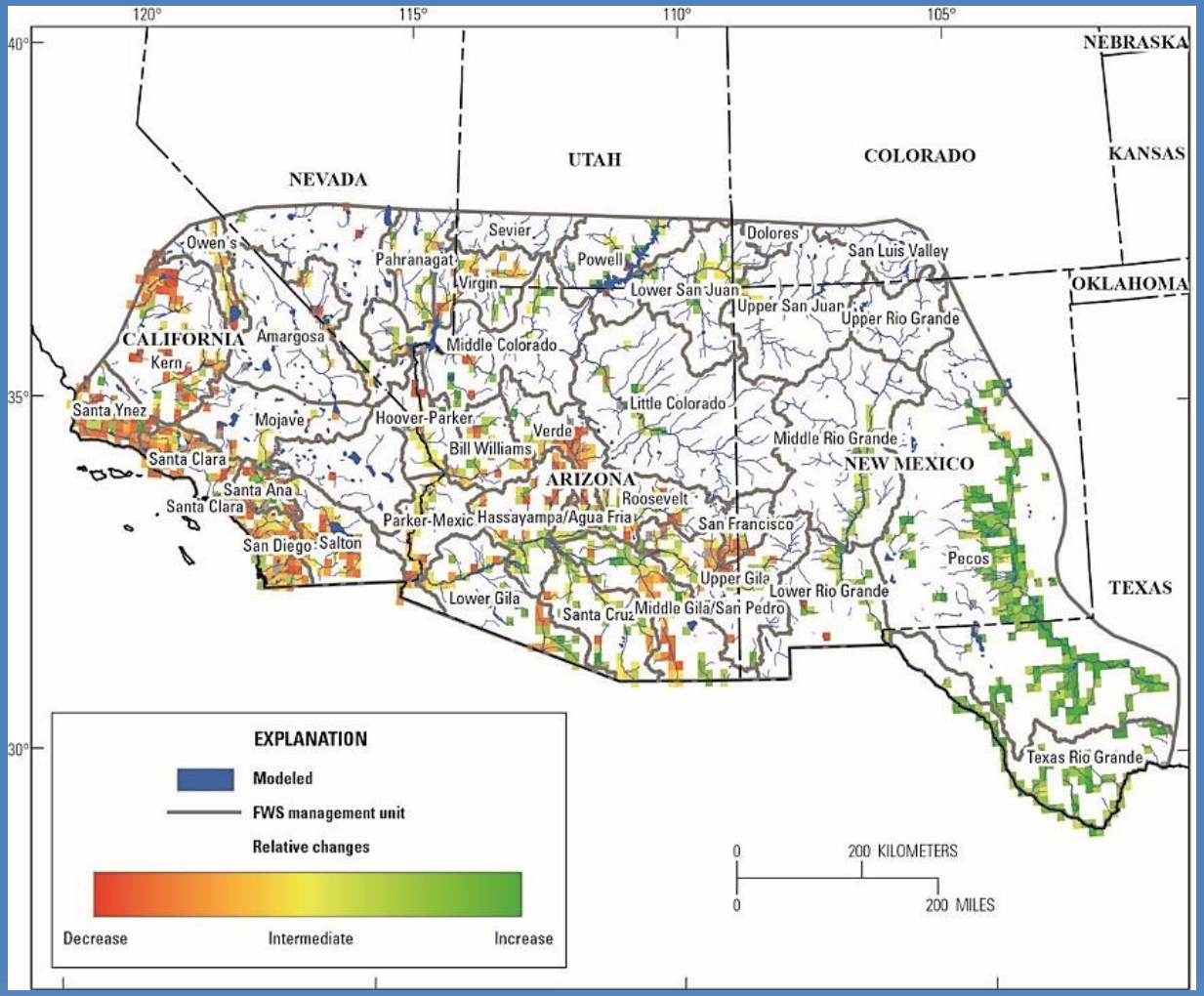


Satellite model

- Some regions experiencing declines (up to 94%)
- others increases

2.

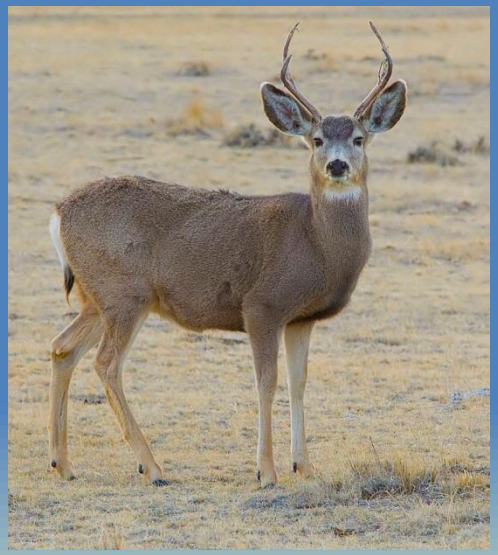
Impacts of Invasives

- Islands are vulnerable
  - Small land area quickly colonized
  - Less resilience against disturbance
  - Few species; relatively simple food web
  - Generalists vs. specialists

New Zealand

2.

Angel Island State Park, CA



Resources

Publications

Hunter Jr., M. L., and J. Gibbs. 2007. Fundamentals of Conservation Biology, 3rd Edition. Blackwell, Malden.

Multimedia

The Trouble with Earthworms:
http://www.npr.org/templates/story/story.php?storyId=9105956