Ecosystem Diversity

Preview

1. What Is An Ecosystem?
2. Ecosystem Classification
3. Ecosystem Values
4. Landscapes

1.

What Is An Ecosystem?

- Community = group of species populations living in the same area at the same time
- Questions:
  - How many species are there?
  - How are they interacting?
  - How do these interactions change over time?

1.

What Is An Ecosystem?

- Ecosystem = community of organisms interacting with one another and with the nonliving environment
- Questions:
  - What are the boundaries?
  - What are the driving processes?

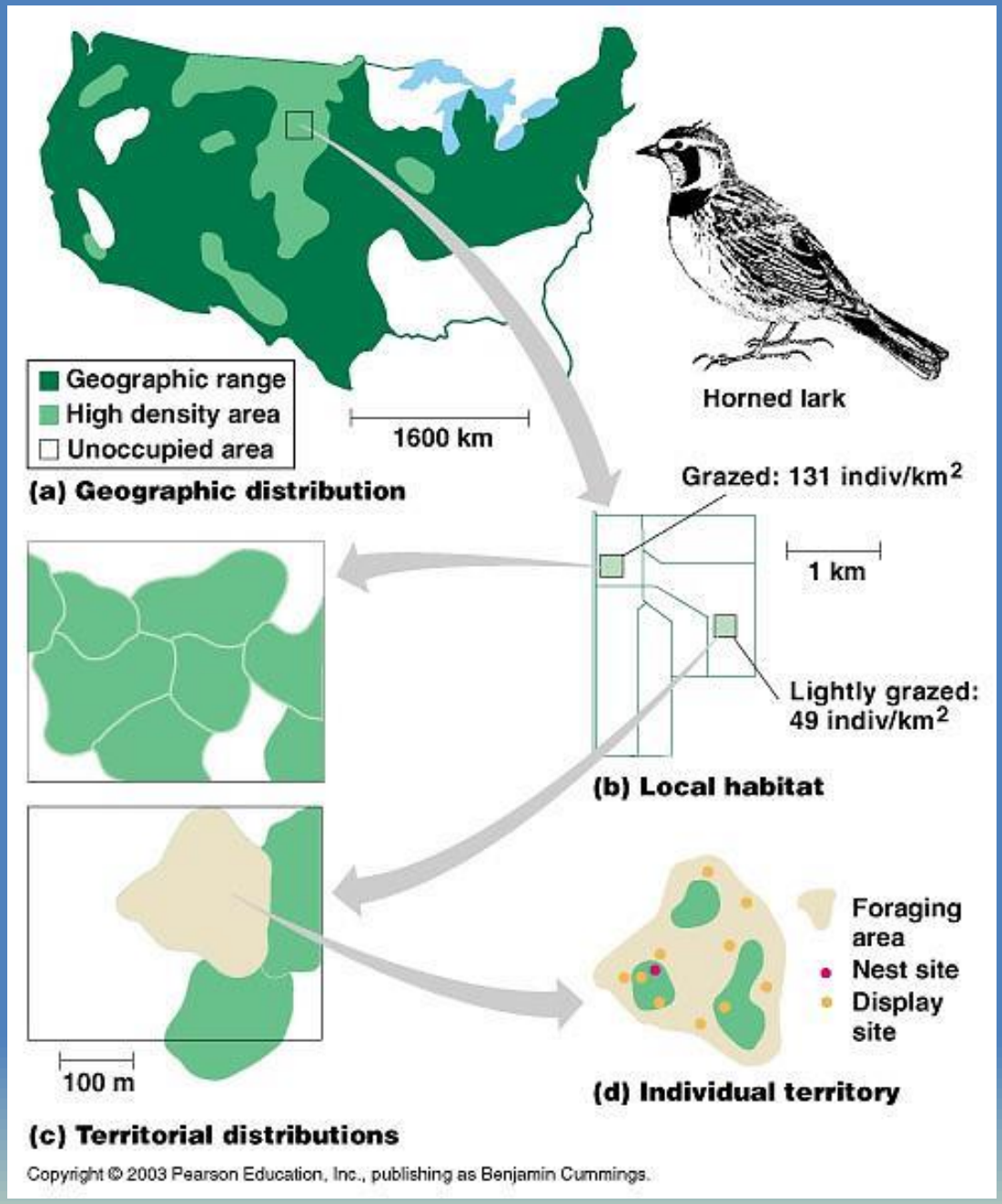
Mount St. Helens

What Is An Ecosystem?

- Ecosystems cont'd
  - Spatial scale important in setting ecosystem boundaries
    - Habitat selection
    - Abruptness of transition
      - Edge
      - Ecotone

1.

Range-wide occurrence of Horned Lark



1.

Habitat Management

Breeding/Nesting Habitat:

- Pastures
- Wetlands
- Regenerating forest

Post-fledging Habitat

- Mature forest

Images: www.allaboutbirds.org; www.marietta.edu

2.

Ecosystem Classification

- No universal classification system for ecosystems
- Most are hierarchical and spatially-explicit
- Some categories
  - Floristic – based on plant species
  - Physiognomic – based on vegetation structure

Ecosystem Classification

- National Vegetation Classification (NVC)
  - Natural vs. cultural
    - Natural = unmodified by humans
    - Cultural = managed for human benefit (e.g., cropland)

2.

www.wikipedia.org

What's the difference?

2.

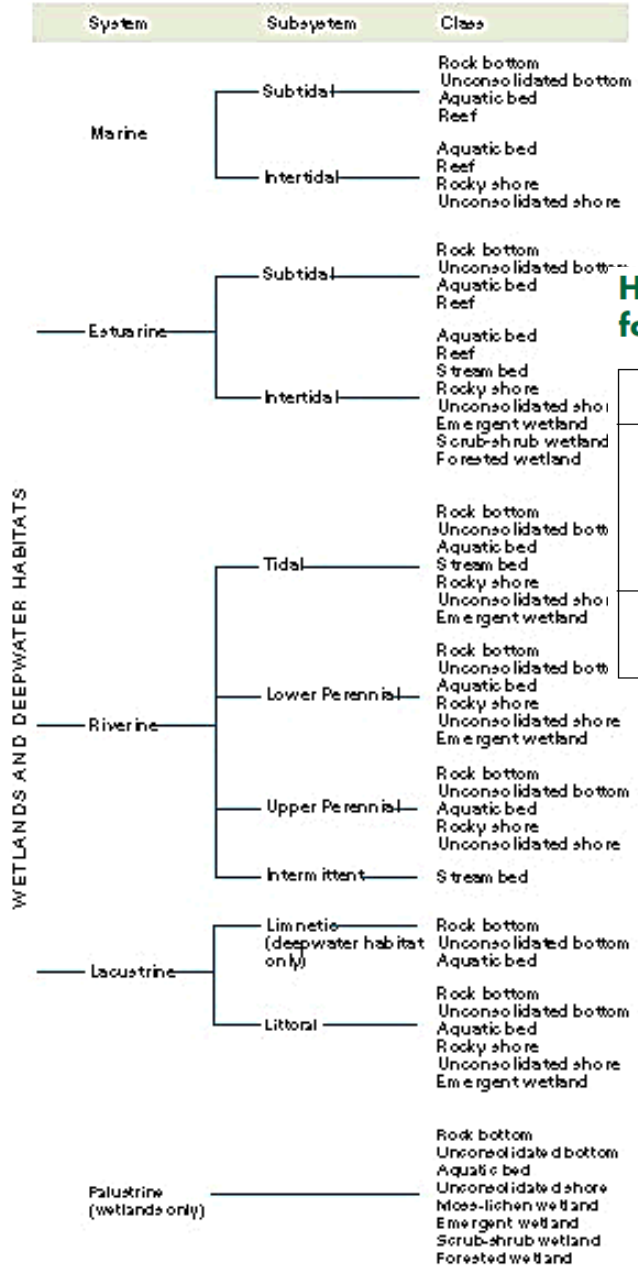


Figure 15. Classification hierarchy of wetlands and deepwater habitats showing systems, subsystems, and classes. *(Source: Cowardin and others, 1979.)*

Hierarchical Vegetation Classification System for the Terrestrial Ecological Communities

SYSTEM: TERRESTRIAL

physiognomic levels

FORMATION CLASS
FORMATION SUBCLASS
FORMATION GROUP
FORMATION SUBGROUP
FORMATION

floristic levels

ALLIANCE
ASSOCIATION

Ecosystem Classification

- Ecoregions (USEPA; WWF)
  - "a large unit of land or water containing a geographically distinct assemblage of species, natural communities, and environmental conditions."
  - Spatially explicit classification
  - Different factors at different scales
  - Floristic and physiognomic characteristics

2.


Canada
United States of America
Estados Unidos Mexicanos
ECOLOGICAL REGIONS OF NORTH AMERICA
REGIONES ECOLÓGICAS DE AMÉRICA DEL NORTE
RÉGIONS ÉCOLOGIQUES DE L'AMÉRIQUE DU NORD
Level I
Nivel I
Niveau I
1.0 ARCTIC CORDILLERA
CORDILLERA ÁRTICA
CORDILLÈRE ARCTIQUE
2.0 TUNDRA
TUNDRA
TOUNDRA
3.0 TAIGA
TAIGA
TAÏGA
4.0 HUDSON PLAIN
PLANICIE DE HUDSON
PLAINE D'HUDSON
5.0 NORTHERN FORESTS
BOSQUES SEPTENTRIONALES
FORÊTS SEPTENTRIONALES
6.0 NORTHWESTERN FORESTED MOUNTAINS
MONTAÑAS BOSCOSAS NOROCCIDENTALES
MONTAGNES FORESTÉES DU NORD-OUEST
7.0 MARINE WEST COAST FOREST
BOSQUE COSTERO OCCIDENTAL
FORÊT MARITIME DE LA CÔTE OCCIDENTALE
8.0 EASTERN TEMPERATE FORESTS
BOSQUES TEMPLADOS DEL ESTE
FORÊTS TEMPÉRÉES DE L'EST
9.0 GREAT PLAINS
GRANDES PLANICIES
GRANDES PLAINES
10.0 NORTH AMERICAN DESERTS
DESIERTOS DE NORTEAMÉRICA
DÉSERTS DE L'AMÉRIQUE DU NORD
11.0 MEDITERRANEAN CALIFORNIA
CALIFORNIA MEDITERRANEA
CALIFORNIE MÉDITERRANÉENNE
12.0 SOUTHERN SEMI-ARID HIGHLANDS
ELEVACIONES SEMIÁRIDAS MERIDIONALES
HAUTES TERRES SEMI-ARIDES MÉRIDIONALES
13.0 TEMPERATE SIERRAS
SIERRAS TEMPLADAS
SIERRAS TEMPÉRÉES
14.0 TROPICAL DRY FORESTS
SELVAS CÁLIDO-SECAS
FORÊTS TROPICALES SÈCHES
15.0 TROPICAL WET FORESTS
SELVAS CÁLIDO-HÚMEDAS
FORÊTS TROPICALES HUMIDES
ARCTIC OCEAN
OCÉANO ÁRTICO
OCÉAN ARCTIQUE
PACIFIC OCEAN
OCÉANO PACÍFICO
OCÉAN PACIFIQUE
ATLANTIC OCEAN
OCÉANO ATLÁNTICO
OCÉAN ATLANTIQUE
Gulf of Mexico
Golfo de México
Golfe du Mexique
Escala Échelle Scale
Proyección Azimutal de Igual Área de Lambert
Lambert Azimuthal Equal Area Projection
Produced in partnership with:
Elaborado en colaboración con:
Réalisé en partenariat avec :
cec.org
Canada
INEGI

Ecosystem Classification

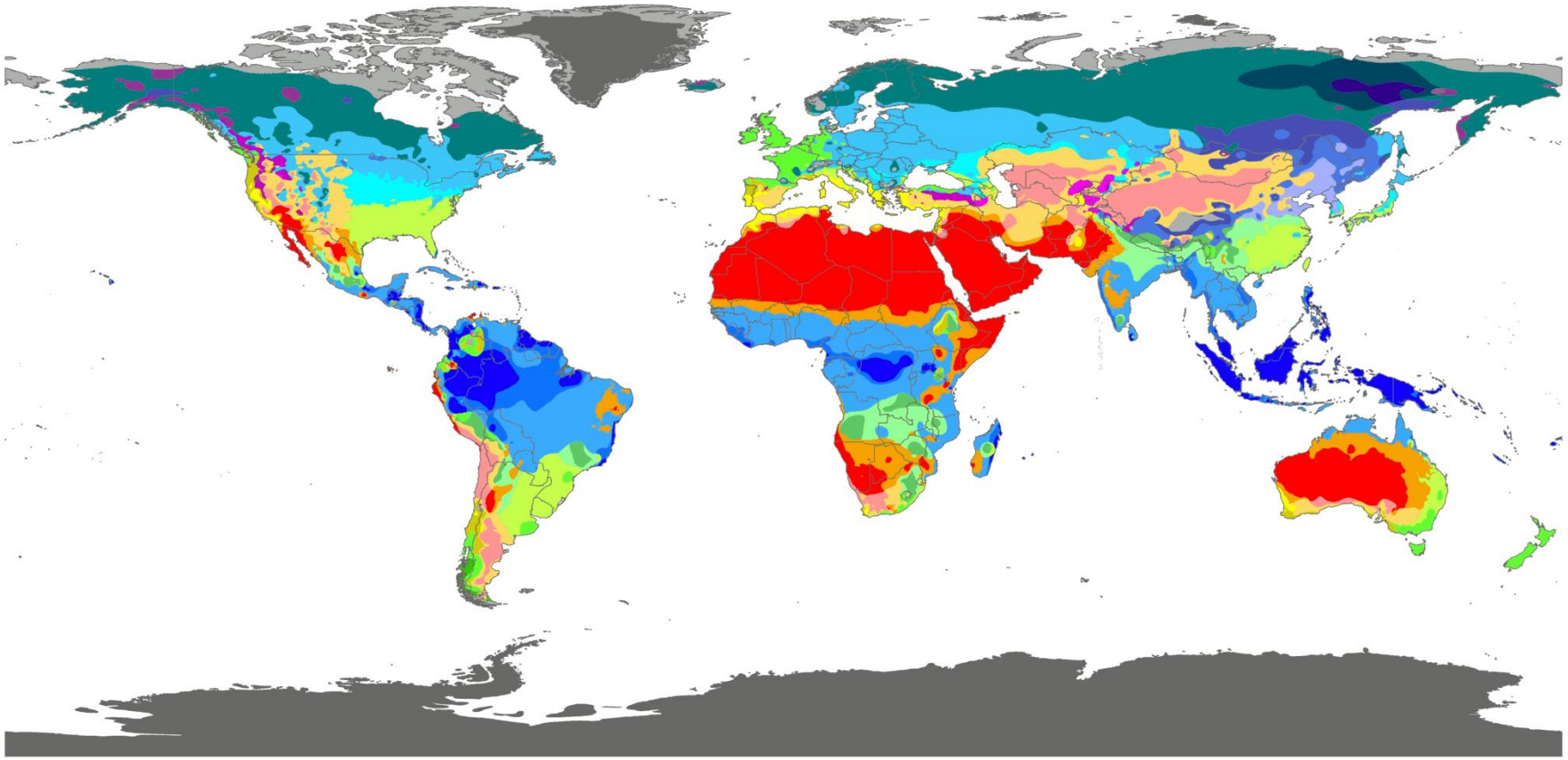
- Köppen Classification
  - Large-scale system
  - Based on major climatic zones
    - Temperature
    - Precipitation
  - Allows for broad comparison, but can group dissimilar systems

Ecosystem Classification

- Köppen Classification cont'd
  - How it's coded
    - 1st letter: major climatic region
    - 2nd letter: precipitation
    - 3rd letter: temperature

2.

World map of Köppen-Geiger climate classification



Af	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSh		Cwc	Cfc	Dsc	Dwc	Dfc	
	BSk				Dsd	Dwd	Dfd	

THE UNIVERSITY OF MELBOURNE

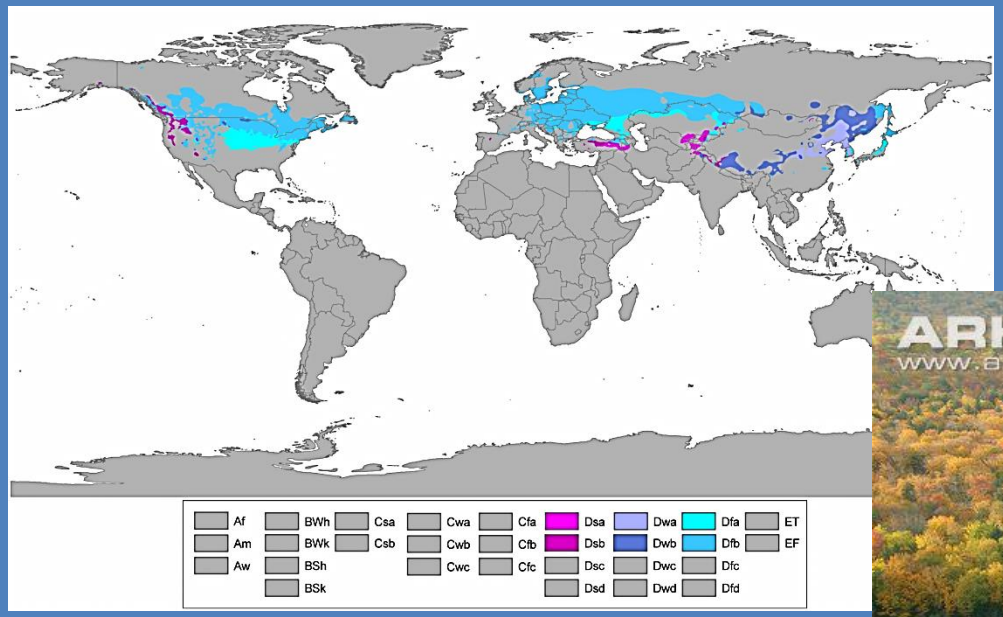
Contact : Murray C. Peel (mpeel@unimelb.edu.au) for further information

DATA SOURCE : GHCN v2.0 station data
Temperature (N = 4,844) and
Precipitation (N = 12,396)

PERIOD OF RECORD : All available

MIN LENGTH : ≥30 for each month.

RESOLUTION : 0.1 degree lat/long

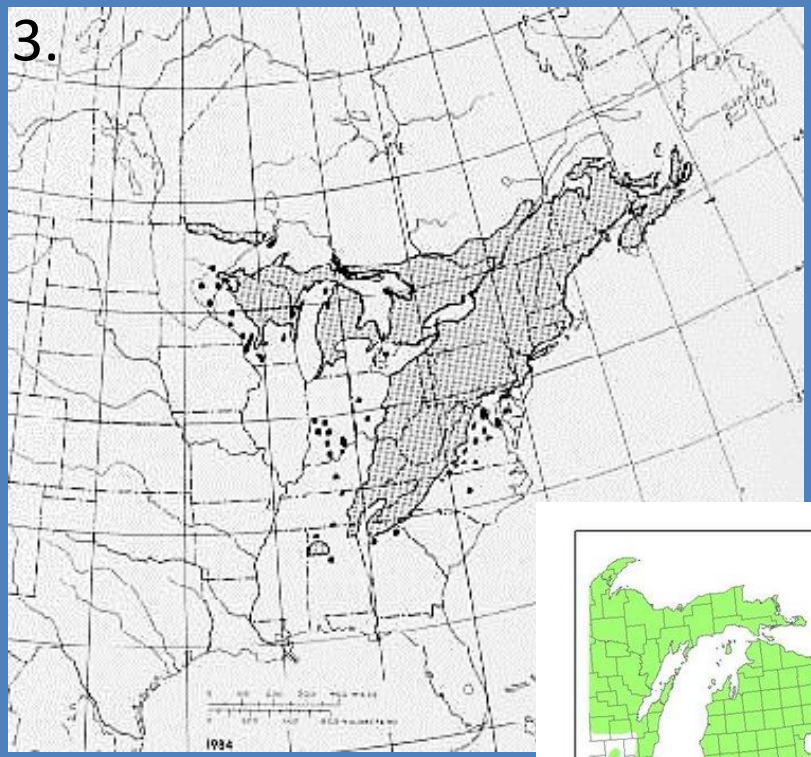


- Type D (Dfa)– Mid-latitude Temperate
  - Cold moderate climate
  - Wet; precipitation every month
  - Relatively hot summer

Ecosystem Values

- Intrinsic Value
  - Endangered ecosystems?
  - What to save?
    - All occurrences
    - Representative sample

3.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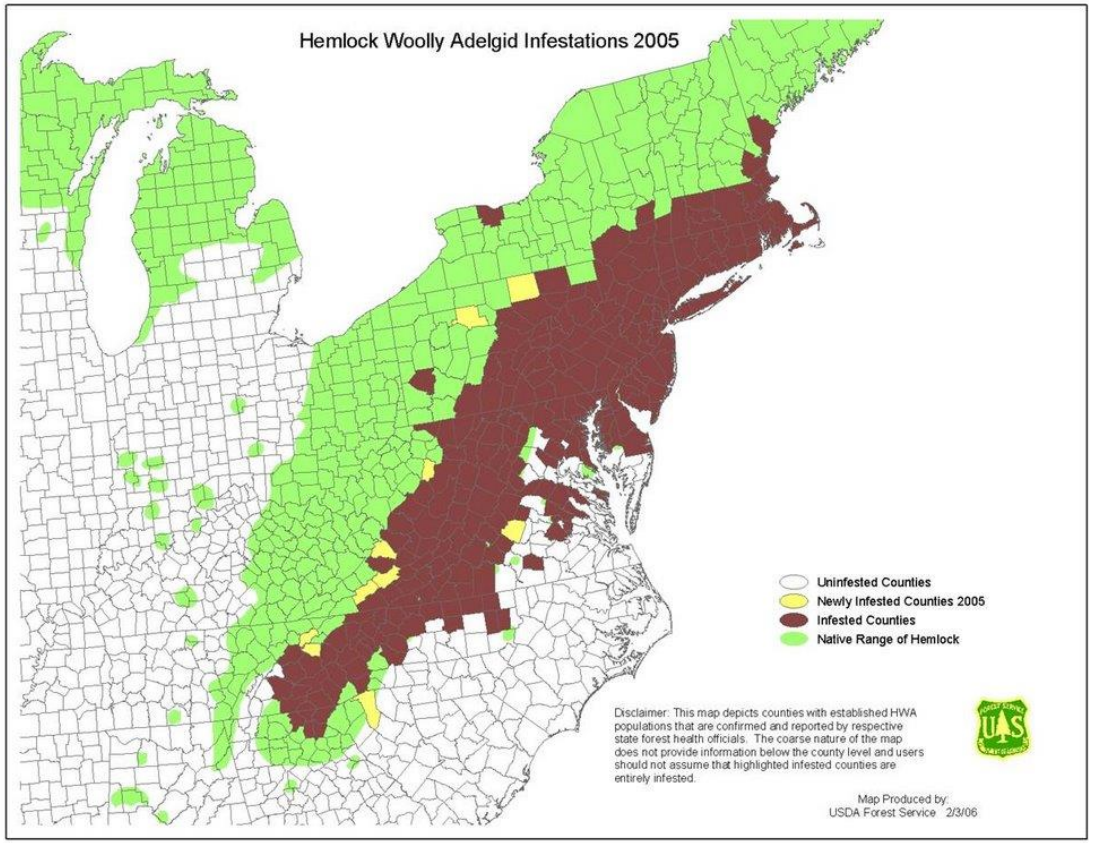

Hemlock Woolly Adelgid Infestations 2005
Uninfested Counties
Newly Infested Counties 2005
Infested Counties
Native Range of Hemlock
Disclaimer: This map depicts counties with established HWA populations that are confirmed and reported by respective state forest health officials. The coarse nature of the map does not provide information below the county level and users should not assume that highlighted infested counties are entirely infested.
Map Produced by:
USDA Forest Service 2/3/06

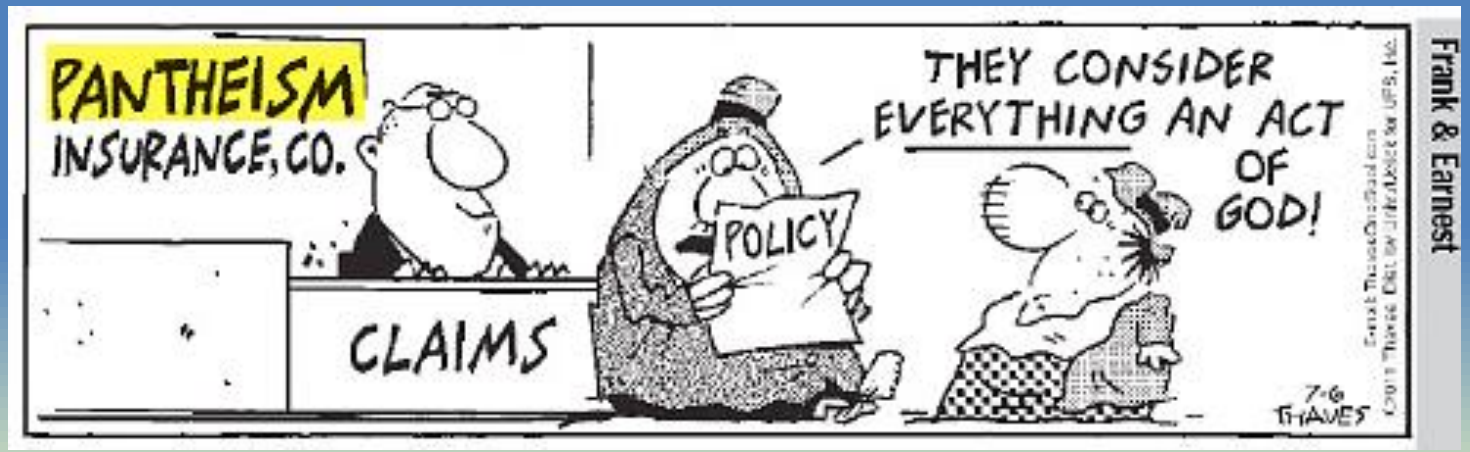
Ecosystem Values

- Instrumental Value: Economic
  - Wetlands
  - Salt marshes
  - Forests
  - Estimated value of world's goods and services = $33 trillion

3.

Ecosystem Values

- Instrumental Value: Spiritual
  - Care for "Creation"
  - Form of worship



Ecosystem Values

- Instrumental Value: Scientific
  - Interconnection of life
  - Importance of scale

Ecosystem Values

- Instrumental Value: Ecological
  - Are some ecosystems more valuable?
  - Keystone ecosystems
  - TNC: Coarse filter/fine filter

3.

Coarse: protect valuable ecosystem
Fine: protect specialized individual species

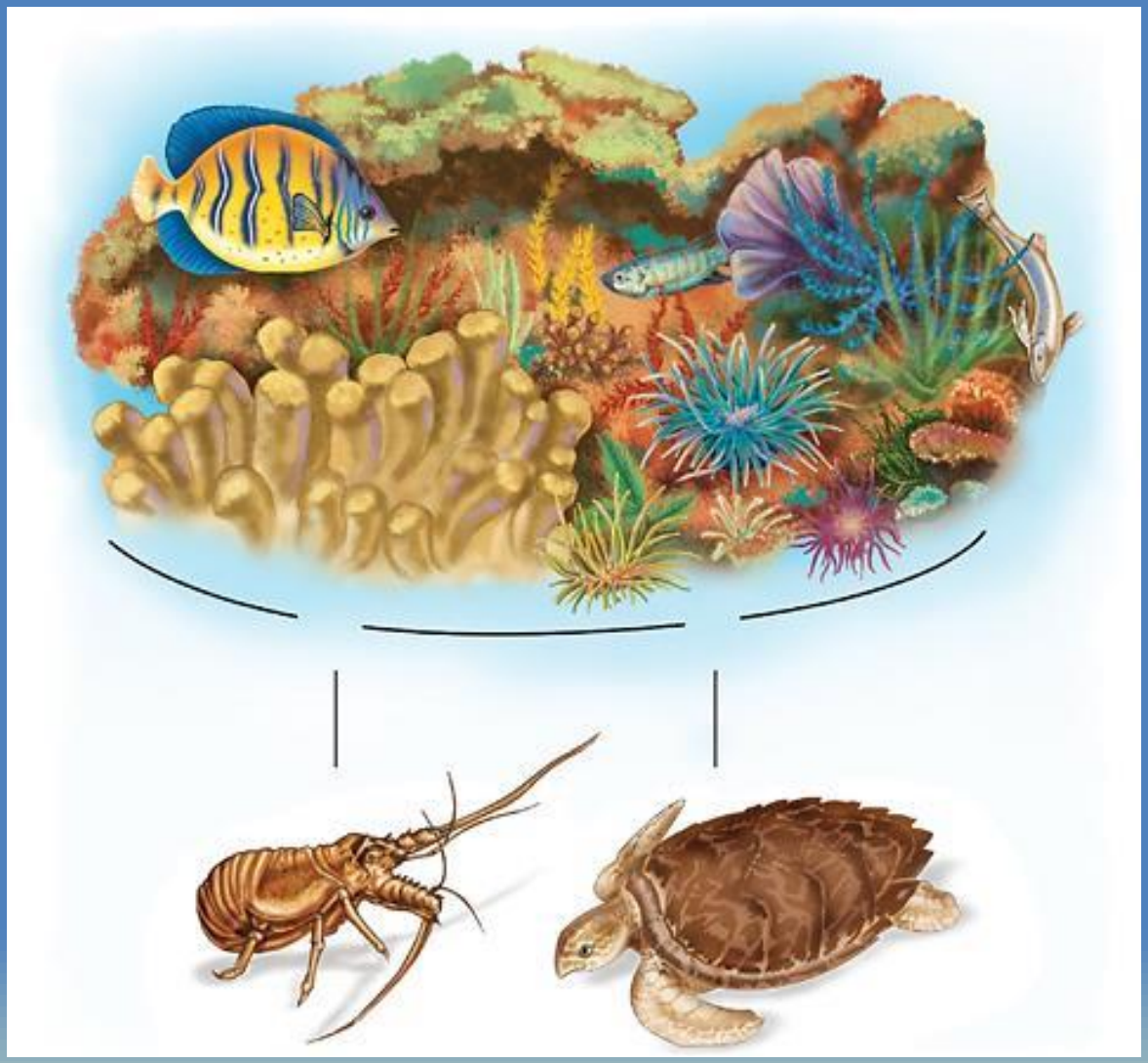
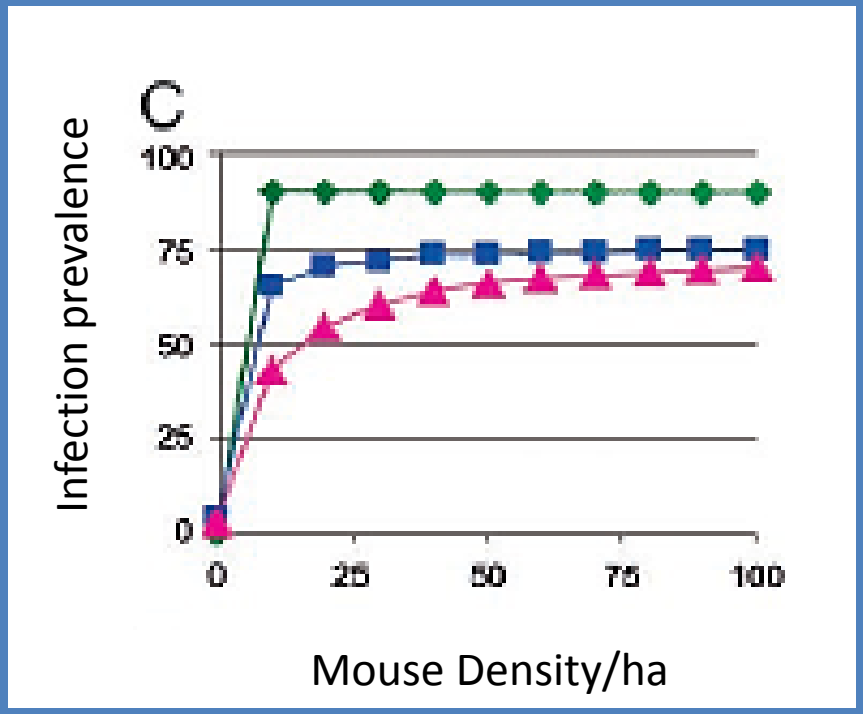


Figure 4.6

Ecosystem Values

- Instrumental Value: Ecological cont'd
  - Diversity and stability
    - Complex food web
    - Lower invasion potential
    - Decreased disease transmission
  - Need more field evidence

3.



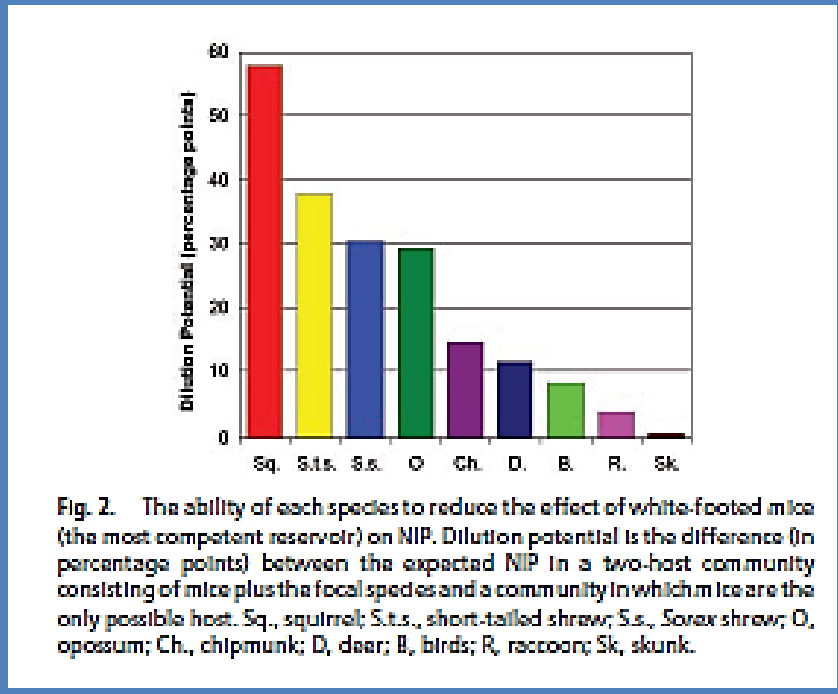


Fig. 2. The ability of each species to reduce the effect of white-footed mice (the most competent reservoir) on NIP. Dilution potential is the difference (in percentage points) between the expected NIP in a two-host community consisting of mice plus the focal species and a community in which mice are the only possible host. Sq., squirrel; S.t.s., short-tailed shrew; S.s., Sorex shrew; O, opossum; Ch., chipmunk; D, deer; B, birds; R, raccoon; Sk, skunk.

Kathleen LoGuidice et al. (2003)

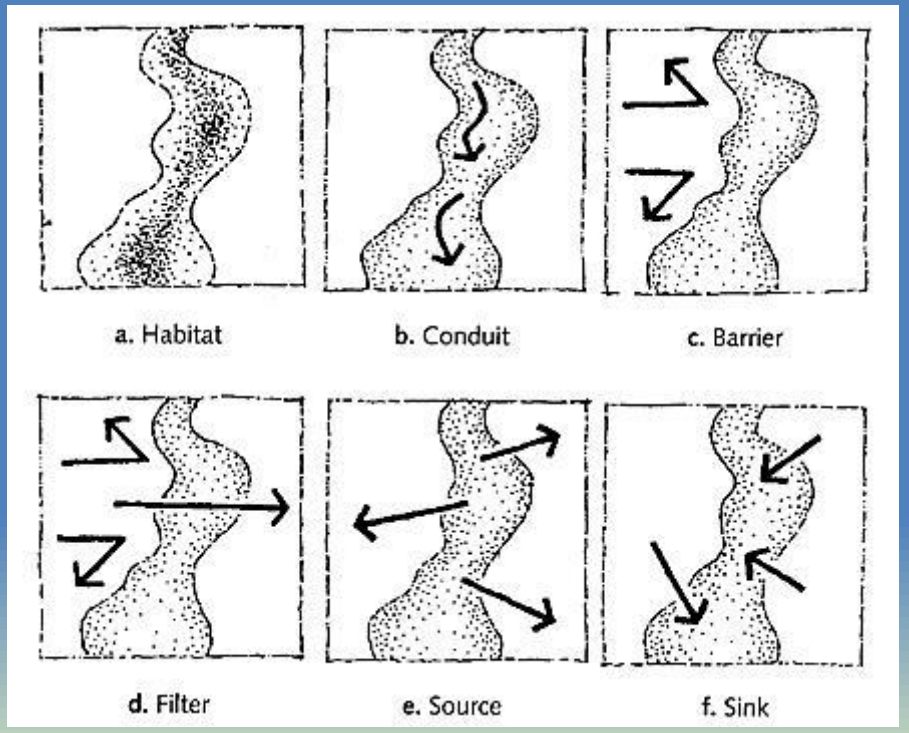
Landscapes

- Landscape Ecology
  - Usually larger scale patterns
  - Mosaic of ecosystems

4.

Landscapes

- Corridors
  - Narrow strips of habitat that allow for
    - Movement
    - Dispersal
    - Cover
    - Breeding
    - Refuge

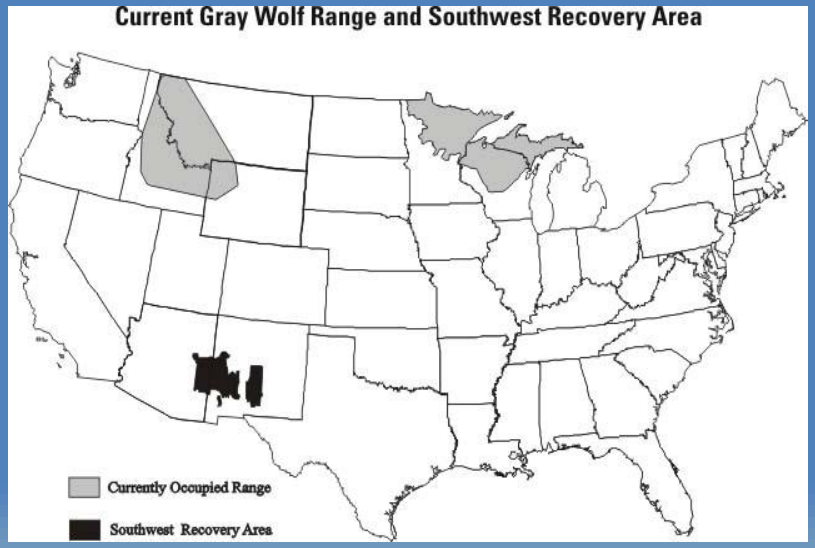


Landscapes

- Patches and Matrix
  - Patch: Habitat of interest
  - Matrix
    - surrounding habitat
    - May be hospitable or inhospitable

4.

Large predators use many ecosystems within the landscape



Landscapes

- Take-home point
  - To conserve species, we need to conserve _____
  - To conserve ecosystems, we need to conserve _____

Resources

Publications

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

Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., and R.B. Jackson. 2014. Campbell Biology, 10th edition. Pearson, New York.