Conserving habitats and landscapes

Why it's ecology and not biology

The biggest current problem

- 88% of the species listed by the ESA are there because of …

Data from IUCN

Fig. 3.6

In just one biome?

Does eating matter?

Rainforest loss & fragmentation

- Amazonian deforestation
  - From 1978 to 1988:
    - Deforestation increased 3 fold
    - Adjacent forest degradation increased 3 fold

Skole and Tucker (1983)

Sodhi et al. (2011)

L & F in action (1)

- Transamazonian highway—Part 1

Tanentzap et al. (2015)
Habitat problems are multi-dimensional

- Fragmentation is confounded with habitat loss—you need to test for effects of breaking apart of habitat after controlling for loss
- One model by Fahrig (1997) found:
  - All model runs
  - 20% left runs

Fahrig (1997)

Fig. 7.4

Lenore Fahrig

Loss vs. fragmentation
Loss vs. fragmentation review

One early review (Fahrig, 2003) only found 17 studies available to test these distinct aspects of habitat problems; results?

We need experiments

Haddad et al. (2015)

Biological Dynamics of Forest Fragments Project

Amazon rain forest, Brazil

1979

William Laurance, Thomas Lovejoy, Rob Bierregaard

Fragmentation creates edges

Hypothetically, removing 2% of habitat can have a big differential impact:

- **Interior species** lose 46% of habitat
- **Edge species** gain 76% of habitat

Grey = edge
Black = interior

Also see Fig. 7.12

Edge vs. interior species

Or: Wildlife management vs. conservation ecology

Wood thrush

Brown-headed cowbird
One more issue—time

Conserving habitat

- Because habitat is so important, conservation reserves are a major focus
- This leads to some key questions:
  - What and where should we be conserving?

States vs. processes

- Should we try to conserve ‘states’ of conditions?
  - OR
- Should we try to conserve natural ‘processes’?
- What is required for each endpoint?

What does ecology have to say about reserve design?

- Many consider MacArthur and Wilson’s Island Biogeography theory (1967) to be the primary stimulus for modern conservation biology
- Although started with oceanic islands, there have been many applications in other systems
- Strengths:
  - Provided testable hypotheses
  - Brought the landscape into the picture—more ‘real-world’

Haddad et al. (2015)

Semenggoh National Park, Malaysia

Some past ideas (1)

Some past ideas (2)
An important figure

Some issues
- Considered all species the same—colonization ability not considered, for example
- Considered all habitats the same as long as they were the same ??
- Equilibrium-based theory
- Actual tests have been pro and con

The SLOSS debate
- S _____ L ______
- O ______
- S _____ S _____?
- One 10,000 ha reserve vs. four 2,500 ha reserves—which is better?
- Usually depends on degree of nestedness

Total area matters
Extinction rates for 299 mammals in 14 western NA Parks

Heterogeneity also matters (1)
MN stream invertebrates
Terrestrial isopods on Greek islands (Hortal et al., 2009)

Heterogeneity also matters (2)
- How do you incorporate it?
- Bigger areas
- Multiple, unique areas
- Preserve heterogeneity-forming processes
- Minimum Dynamic Area (MDA)
The 3 C’s

C________, c_________, and c_________

Some pros and cons of corridors
- Purchase of a small connecting area can:
  - Result in an overall much larger area
  - Enhance gene flow
  - Enhance movement of predators and disease

Overpasses as corridors
- Review by Corlatti et al. (2009) found:
  - Most studies were observational and quantify use/no use vs. numbers of crossings
  - Genetic effectiveness not well studied (i.e., is gene flow enhanced with overpasses?)
  - Then why bother?

How Corridors Reduce Indigo Bunting Nest Success

AIMEE J. WELDON
Department of Zoology, Box 7617, North Carolina State University, Raleigh, NC 27695-7617, USA

How Corridors Reduce Indigo Bunting Nest Success

How Corridors Reduce Indigo Bunting Nest Success

AIMEE J. WELDON
Department of Zoology, Box 7617, North Carolina State University, Raleigh, NC 27695-7617, USA

Edge effects, not connectivity, determine the incidence and development of a foliar fungal plant disease

BRANDA L. JOHNSON and NICK M. HADDAD
North Carolina State University, Department of Biology, Box 7617, Raleigh, North Carolina 27695-7617 USA

Three examples (1)

(A) Banff National Park

Road collisions with large mammals decreased by 96% after fencing & corridors

Three examples (2)

(A) Banff National Park

Sanctuary along Belize River plus aerial bridges help black howler monkeys.
Three examples (3)

- Brudvig et al. (2009)