



IX: Habitat Fragmentation

Habitat Fragmentation:

- **Components of habitat fragmentation:**
 - Reduction of total amount of habitat type
 - Apportionment of the remaining habitat into smaller and more isolated patches

Habitat Fragmentation: (*continued*)

- Fragmentation has proven to be an important factor in landscape ecology:
 - local extinctions
 - species abundance patterns
 - composition of the communities
 - introduction of exotics is favored
 - generalist and human-adapted species may be favored instead of species sensitive to human activities


Habitat Fragmentation: (*continued*)

- **Fragmentation and Heterogeneity**
 - All landscapes can be viewed as mosaics that are "shifting" and "interconnected".
 - Natural disturbances play an important role in creating heterogeneity in landscapes:
 - fire, floods, avalanches, earthquakes, etc.

Habitat Fragmentation: *(continued)*

- Distinctions between natural "patchiness" and "fragmented" landscapes:
 - naturally patchy landscapes have a rich internal structure
 - fragmented landscapes exhibit simplification (cornfields, clear-cuts, tree farms, channelized streams, etc.)
 - naturally patchy landscapes have less contrast between adjacent patches (less edge effects)

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- fragmented landscapes often exhibit human activities that threaten movement in the landscape (roads, subdivisions, parking lots, plowed fields, etc.)
 - fragmentation is usually associated with habitat loss and modification

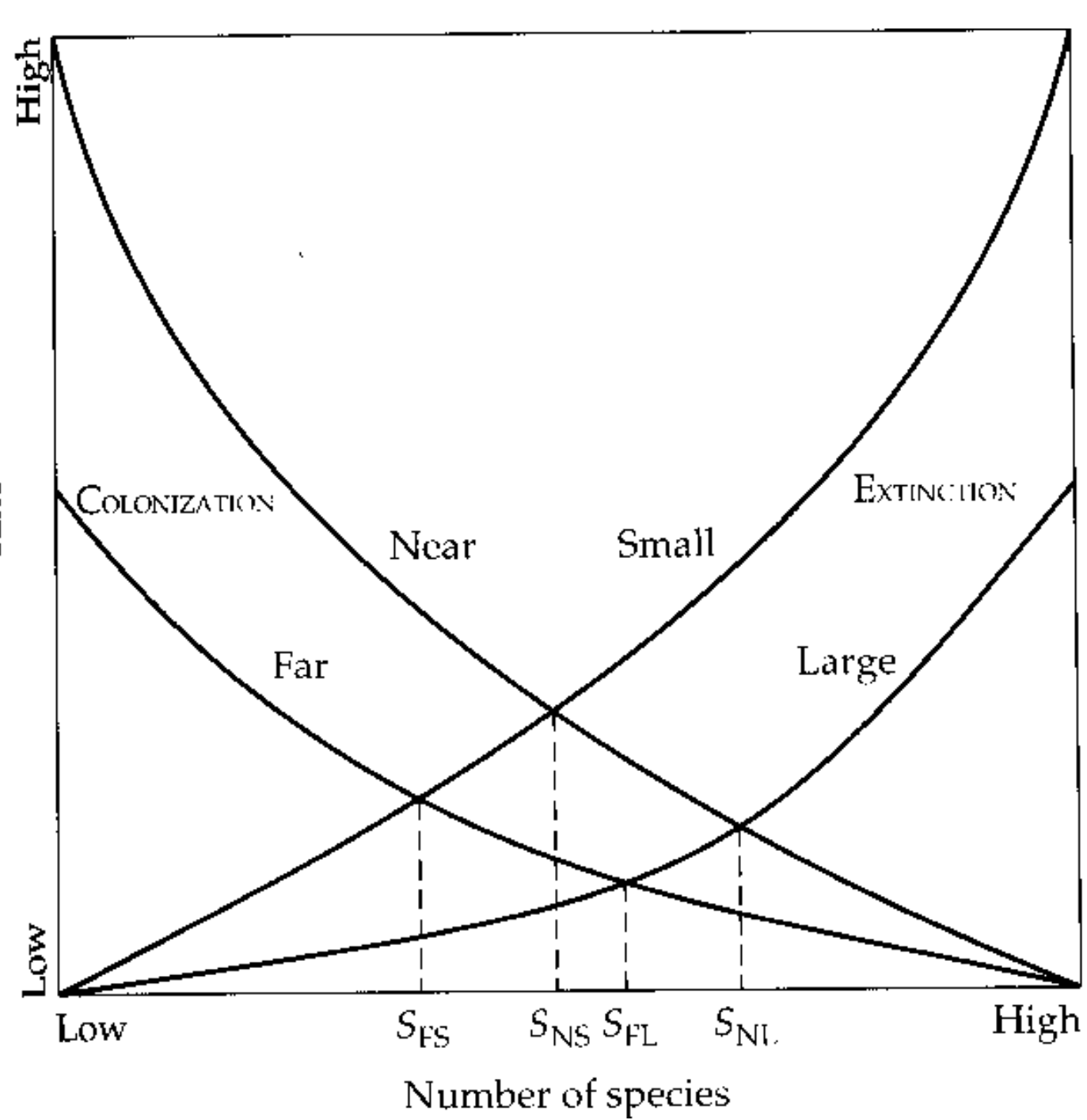
(continued)

- **Insularization and Area Effects**
 - species-area relationships hold for terrestrial landscapes; the slope is less steep than on islands
 - area and habitat diversity probably explain why the species-area relationships exist
 - many species are "area sensitive"
 - carnivores can have really large home ranges (*Felis concolor* 400km²; *Ursus arctos horribilis* 900 km²)
 - land-bridge islands undergo loss of species through time (relaxation); this effect of

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- island biogeography is applicable to terrestrial habitats that are fragmented (examples: loss of diversity in parks, reserves).

Island Biogeography Theory

- Colonization rate is higher for near islands than far islands.
- Colonization rate decreases as the number of species accumulates on the island (species packing)
- Extinction rates are higher for small islands than large islands.
- Extinction rates increase as the number of species accumulates on the island (species packing).



Biological Consequences of Fragmentation

- Some species might thrive in a fragmented landscape (pioneer species).
- Some species might maintain viable populations within habitat fragments.
- Some species persist by being highly mobile and may use a number of separate habitat patches connected by *travel corridors*.
- Some species may suffer local extinction as their habitats are destroyed (expected with endemic species; initial exclusion).

Biological Consequences of Fragmentation (*continued*)

- **Barriers to movement may cause isolation of habitats. Human created habitats can function as significant barriers (ex: roads, urban areas, agricultural fields, clear cuts).**
- **Barriers often act as filters allowing some species but not others to pass.**

Biological Consequences of Fragmentation (*continued*)

- Fragmentation effects are not limited to terrestrial systems, stream ecosystems are also subject to major effects:
 - dams cause many problems: genetic isolation, loss of genetic variation, interruption of migration/spawning activity (100 salmonid populations have been extirpated; 214 more at risk of extinction)
 - patterns of nutrient cycling can be interrupted by blocking migratory activities.
 - groundwater exploitation can sever lateral connections between stream channels and

aquatic effects continued:

- adjacent springs and wetlands.
- **Population densities of mobile species may increase in habitat fragments and cause crowding effects.**

aquatic effects continued: ***(continued)***

- **Species vulnerable to fragmentation:**
 - **Naturally rare species:**
 - **species with limited or patchy geographic distribution (narrowly endemic species)**
 - **species with low population densities (animals with large home ranges)**
 - **Wide-Ranging species:**
 - **carnivores, migratory ungulates, animals with varied habitat needs during phases of their life cycles**
 - **Nonvagile species:**

Nonvagile species continued:

- Insects of old growth forests.
- Bird species that have low colonizing ability.
- Species with low fecundity:
 - Neotropical birds
 - K-selected carnivores, raptors
- Species with short life cycles:
 - Plants with short life cycles: herbaceous species, epiphytes.
- Species Dependent on Patchy Resources



- **Ground Nesters**

- **mesopredators**

- **Large-Patch or Interior Species**

- **Species vulnerable to human exploitation**

(continued)

■ Edge Effects

- Ecological "trap" effect (cowbird nest parasitism; predation by jays, crows, raccoons, opossums, foxes, squirrels and skunks)**
- Invasion by exotics is encouraged.**
- Game management texts promote creating edge because it is good for game species.**
- Changes in species composition and abundance.**
- Disruption of natural disturbance regimes by habitat fragmentation (fire)**

Recommendations for maintaining diversity in fragmented landscapes.

- Conduct a landscape analysis.
- Evaluate the landscape in a larger context.
- Avoid further fragmentation.
- Minimize edge effects.
- Do not ignore small habitat fragments.
- Identify wildlife migration routes and steer human activities away from them.
- Maintain native vegetation along streams, fencerows, roadways to minimize edge effects.

Recommendations for maintaining diversity in fragmented landscapes. *(continued)*

- Minimize the area and continuity of artificially disturbed habitats containing exotic/weed species.
- Maintain natural processes like fire in the habitat fragments.