Habitats

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Habitat Definitions

- A **habitat** is the place where a population of a species lives.
- A **population** is a group of living organisms of the same kind living in the same place at the same time.
  - All of the populations interact and form a community.
- A **community** is group of interacting living species sharing the non-living resources of a specific area
  - The interaction of the living species of the community and the non-living resources is an **ecosystem**

Habitat Function

- The habitat must supply the needs of organisms, such as food, water, temperature, oxygen, and minerals
  - When a habitat ceases to be able to do this, it ceases to be a suitable habitat
- Every living species occupies a **niche**, or particular *role* in a habitat
  - E.g. bees fill a reproductive niche for flowers
  - Wolves fill a predatory niche that improves the genetic quality of a herd of elk
  - A habitat has a limited amount of niches to fill.
  - Because of this, **competition, predation, cooperation, and symbiosis** occur.

Niche Interactions

- **Competition** – when two species compete for the same resources; one wins, one loses
  - E.g. Lions and hyenas
- **Predation** - when one species is consumed by another species for resources that it already consumed
  - E.g. Wolves and elk
- **Cooperation** – when two species obtain resources through a mutual relationship
  - E.g. leaf-cutter ants and fungus
- **Symbiosis –** when two species cooperate to the extent that they each become completely dependent on each other
  - E.g. bacteria in a cow's rumen; both need each other to function

Components of a Habitat

- Abiotic Resources
  - Nonliving resources
- Biotic Resources
  - Living components of a habitat
- Structure
  - Plant life components
- Succession
  - Change, and rate of change, of a habitat

Abiotic Resources

- Abiotic resources are the non-living components of a habitat
- These include air, water, sunlight, minerals, etc.
- This could also include the terrain of a habitat, the weather patterns, and the climate

Biotic Resources

- These are the biological aspects of a habitat, including –
  - Food: the resources needed for the energy demands of populations in a habitat
  - Populations: the numbers of different living species
  - Community: the types of different living species
  - Fertility: the capacity for growth and development in a habitat
  - Biodiversity: the numbers of individuals and species in a habitat

Structure

- The shape, height, density, location, and diversity of a habitat's plant life.
- The combination of these factors create…
  - Cover: areas to shelter living species (esp. wildlife)
  - Corridors: connections between different areas of the same habitat
  - Feeding areas: places in which wildlife can graze, forge, or hunt

Structure & Habitat Health

- Habitat health is not just a matter of size but also quality
- For example, moose populations in eastern Canada were wiped out by clear-cut forestry
  - Research found that moose could not tolerate the loss of more than 0.5 square miles (Peek)
- However, even the loss of a specific kind of species (without removing the rest of the vegetation) could cause losses in moose populations.
  - E.g. only removing coniferous trees was still harmful

Succession

- Succession is the natural process of change and transition in a habitat
  - E.g. a pond will eventually fill in with sediment to become a marsh.
  - The marsh will eventually dry into a meadow.
  - The meadow will become scattered with shrubs and then trees.
  - Eventually a full forest will occupy the same area and may remain until it is destroyed by a major natural process (fire, flood, glacier, volcano, etc.)
- Succession occurs over thousands of years; it is a slow process

Case Study: Wild Turkeys

- Turkey populations increase dramatically as plant succession occurs in deciduous forests (Peek, Review of Wildlife Mgmt)
  - As young forests age into mature hardwood stands, turkey numbers increase rapidly.
- Mature, open forests of mixed species create the most secure populations of wild turkeys
- Mature hardwood forests are key for turkeys
  - Under intensive logging or suburban sprawl, turkey populations plummet
  - Human expansion is especially bad in April-June during nesting

Succession vs. Disturbance

- Succession is very different from human disturbance.
- Succession is slow and enables populations to move over time to new habitats that are more suitable
- Habitat disturbance and destruction is rapid; living species cannot adapt to the pace at which the habitat changes
  - This causes species loss
- **Habitat destruction is the greatest cause of extinction**

Measures of Habitat Health

- Biodiversity
- Patchiness
- Edge
- Fragmentation

Biodiversity

- Biodiversity is a measure of habitat health
- The higher the biodiversity, the more secure the habitat
  - E.g. think of the Irish Potato Famine; the lower the diversity of the food supply, the greater the threat to that species' population
- **Biodiversity is maximized when habitat size is maximized**

Patchiness

- **Patchiness** is how "broken up" a habitat is
  - I.e. is the habitat solid or more like a checkerboard
- The more "solid" a habitat, the better
  - Imagine a drinking glass
  - It works far better if it is in one piece
    - A glass might hold some water in its shards, but it works far better as a single piece
  - The same is true for a habitat
  - We want to avoid "shattering" our habitats

From One to 26

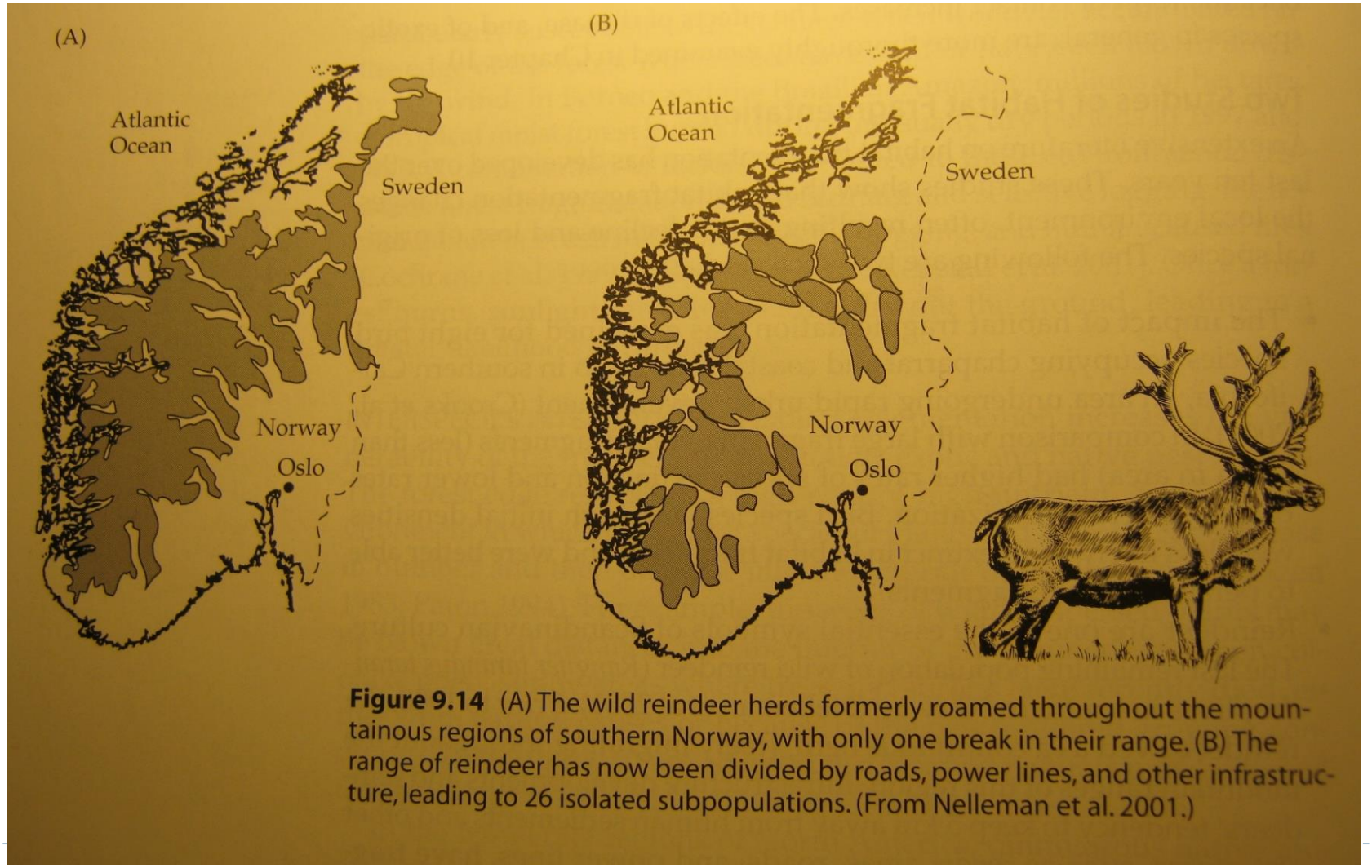
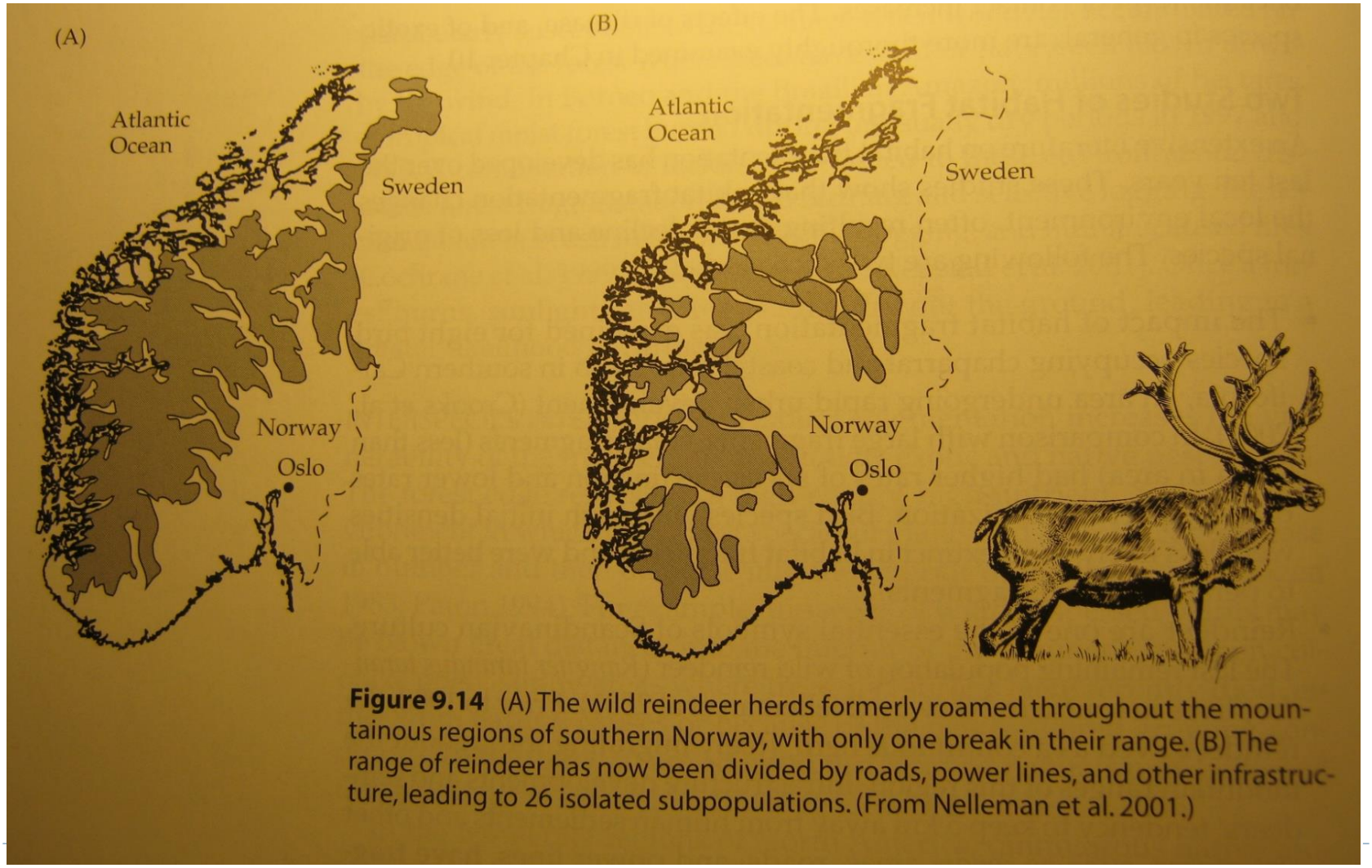


Figure 9.14 (A) The wild reindeer herds formerly roamed throughout the mountainous regions of southern Norway, with only one break in their range. (B) The range of reindeer has now been divided by roads, power lines, and other infrastructure, leading to 26 isolated subpopulations. (From Nelleman et al. 2001.)

Edge

- We want to maximize the amount of isolated interior portions of a habitat
- **Edge** is the amount of borders that exist on a particular habitat.
  - More edge habitat = less interior habitat
  - E.g. a round habitat has less edge than a long narrow habitat
  - Edge almost always has low biodiversity while the interior has high biodiversity

Which has more edge?



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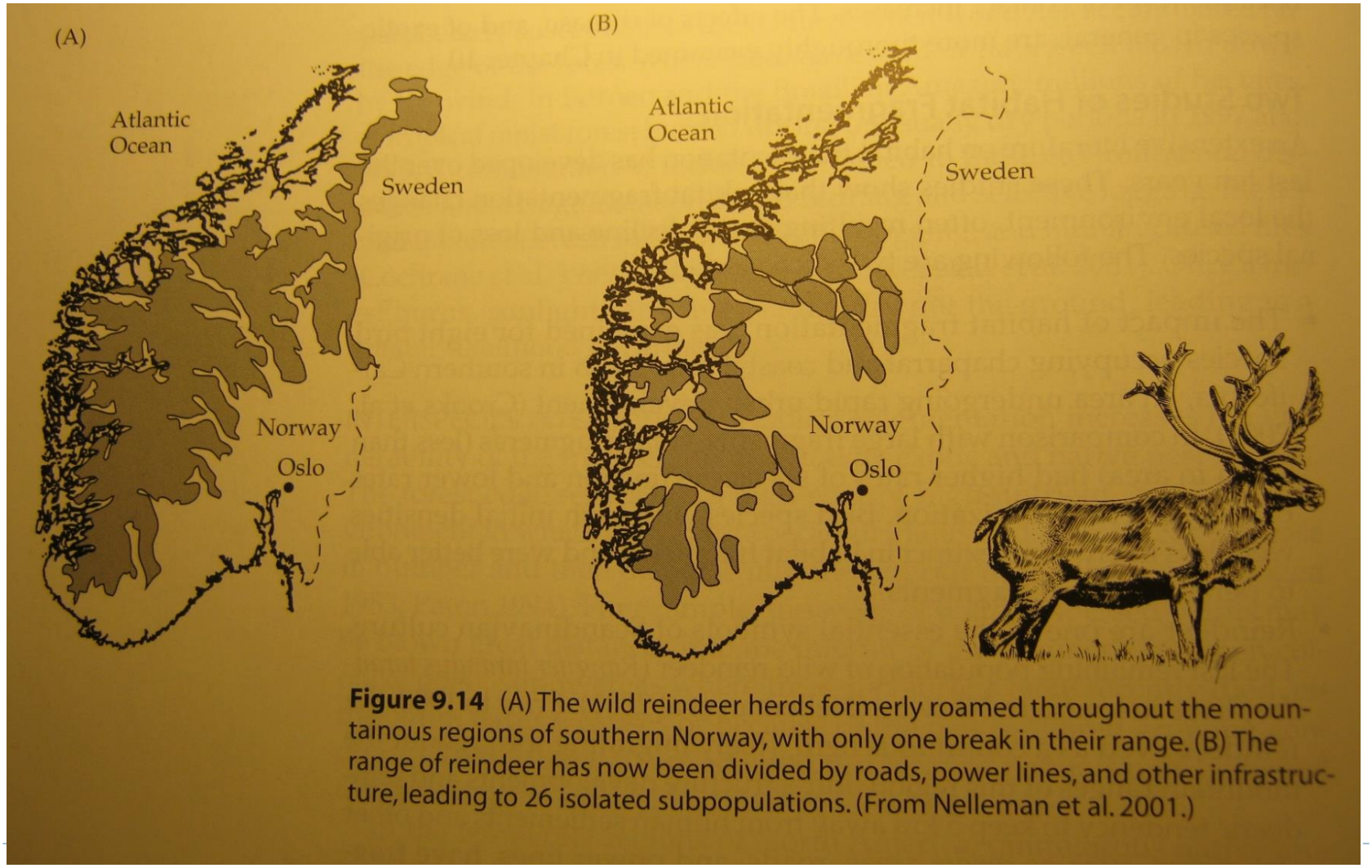
Detrimental Edge

- The habitat edge is usually the most altered and damaged portion of a habitat. For example…
  - The edge has the greatest temperature changes
  - Edge has the most invasive species
    - E.g. Buckthorn and Garlic Mustard prevalence
  - Edge is the most affected by pollution
  - Edge is the most damaged in storms
  - Edge is the most likely to be lost in fire
  - Edge is the most likely to be affected by disease
    - E.g. Emerald Ash Borer

Fragmentation

- **Fragmentation** is the measure of how much edge and patchiness affects a habitat
- The immediate impact of fragmentation is that the surviving species will "huddle" in what remains of their habitat
  - Biodiversity may initially increase because of this concentration of species
  - Over time, species will be slowly lost
- **Higher Fragmentation = Lower Biodiversity**

Which is more fragmented?



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Effects of Fragmentation

- Why are species lost when a habitat is fragmented?
- Many bird, mammal, and insect species will not cross even short distances to reach a new habitat
- Populations of species will become isolated and genetic diversity will be reduced
- As species are lost, their niche will not be filled by new populations and the niche will not be filled
  - Species dependent on the niche will also be lost
  - This creates a sort of extinction domino effect

Effects of Fragmentation

- **Island Biogeography Model**: large areas have more diversity and more species than small areas
  - As habitats are split up, populations become isolated from each other, reducing the availability of diverse genomes from mating pairs
  - Reduced genetic diversity = increased species susceptibility
  - As habitats become split up, the availability of species to fill a needed niche are lost.

- **As habitats shrink, so does genetic diversity and species biodiversity**
  - As biodiversity decreases, species are lost at faster rates due to disease, predation, competition from invasives, etc.
  - If a species is lost in a small habitat, the other species dependent on that species are also lost.
  - A road dividing a habitat in half causes far more damage than is immediately obvious. Why? TPS