

Forest fragmentation and edge effects

Feb. 5, 2014

Forest fragmentation

- Division of contiguous tracts of forested lands into progressively smaller, semi-isolated remnants
- Results in changes in the size and shape of remaining forest habitat
 - ➔ Causes changes in the influx of animals and plants, energy, seeds, other materials (e.g., pollen, insects, dust, precipitation)

Forest fragmentation



Major effects of landscape fragmentation

Changes in the size and shape of forested areas:

- Less contiguous habitat
- Smaller interior habitat patches
- More edge created



John Greenwood

Forest fragments scattered across the Waikato landscape

Major effects of landscape fragmentation

Changes in the connectivity and isolation of remaining forested areas:

- Increased isolation of remnant patches
- Increased access for logging, mining, hunting, poaching

Major effects of landscape fragmentation

- Loss of sensitive species from small remnant patches
- Altered balance of exotic and native species
- Altered balance of edge and patch interior species

Forest fragmentation

- Remnant natural areas become sole refuge for many species
- Isolation of populations is the most serious threat to biological diversity
- Primary cause of present extinction crisis

Fragmentation in the Amazon

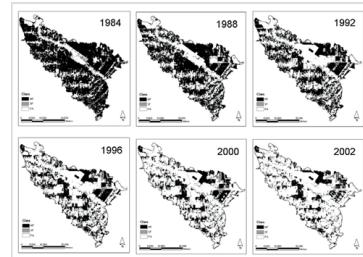


FIGURE 10.6 The loss and fragmentation of forest cover caused by clearing for small farms is illustrated in this time series of forest cover maps (MF = mature forest, SF = secondary forest, PA = pasture).

Declines of populations of species that:

1. Occur naturally in low densities
2. Have large area requirements
 - Require large territories and are negatively impacted by a reduction in habitat area
3. Do not do well in edge habitats
 - Interior species – inhabit only the interior portions of relatively large tracts and avoid forest edges
4. Are sensitive to human contact
5. Are unlikely or unable to cross roads
6. Are frequently killed on roads (seek out roads for heat, food, salt)
7. Are otherwise sensitive to extinction resulting from habitat fragmentation or disturbance

Increase in edge species

- New clearings like logging roads, homesteads, clearcuts, utility corridors create openings in the middle of the forest
- Edge tolerant species invade
- Generalists with broad distributions and rapid dispersal abilities
- Illinois study – cowbirds parasitized 76% of nests; predators invaded 80% of all nests
- Primary predators of ground nests were foxes, skunks, raccoons, domestic dogs and cats, crow family

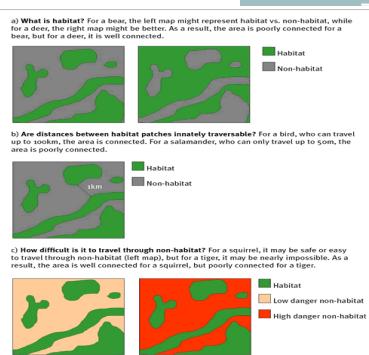


FIGURE 10.5 The challenge of relating connectivity, as measured from landscape structure, to biodiversity impacts.

Roads



- Number one fragmenting force
- Create abrupt, unnatural edges that serve as barriers and corridors
- Subdivide landscapes, remove habitat, inhibit species dispersal and migration
- Speed up movements of exotic species and parasitic species into natural areas (e.g., Dutch elm disease)

Sensitive habitats

Habitat sensitive to roads:

- Raptor nesting sites
- Large mammal wintering areas
- Habitats for species at risk
- Heron rookeries
- Highly productive streams
- Old growth



Animals with lower densities near roads:

- Wolves
- Caribou
- Elk
- Grizzlies
- Mountain lions
- Pine marten



Edge effects

- Interactions between 2 adjacent ecosystems separated by an abrupt transition
- Abiotic impacts and biological impacts



Abiotic effects

- Movement of chemical compounds, such as dust, salt, pesticides, across edge
- Edge increases light intensity and drying, and lowers soil moisture



Biological effects

- Increase in light levels promotes plant growth
 - ➔ Attracts herbivorous insects
 - ➔ High density of insects attracts nesting birds
 - ➔ Nesting birds attract nest predators and parasites
- Early successional species penetrate into the forest
- Sensitive species avoid edge, or suffer from increased mortality from road collisions, predation



Biological effects

- The nearer to forest edge, the greater the predation effects on forest species, and the greater the proportion of forest bird nests parasitized
- Threatening numerous eastern forest bird species with extinction
- “Ecological trap” - birds attracted to productivity of forest edge, but nesting there, experience lower reproductive success

Some species in Nova Scotia associated with older forests and/or sensitive to forest fragmentation and edge effects:

- Flying squirrels
- American marten
- Fisher
- Lynx
- Wood frog
- Goshawks

▫ Study by Gosse and Montevercchi (2001) found the abundance of birds-of-prey highest and most diverse in old growth forests

- Northern hawk-owl
- Swainsons and gray-cheeked thrushes
- Warblers: Tennessee, magnolia, bay-breasted, black-throated, black-and-white
- Moose

Using Robbins et al. (1989) and the NS bird checklist (<http://avibase.bsc-eoc.org/checklist.jsp?region=cans>) :

- Read the Abstract, Introduction and pp. 17-29 (at a minimum) in Robbins *et al.*
- Using Figures 2-7:
 - List forest bird species that one would be increasingly likely to find in forested areas greater than 100 ha
 - List forest bird species that one would be as likely to find in a 1 ha patch of forest as a 1,000 ha forested area
 - List forest bird species that one would be more likely to find along forest edges and in small patches of forest
 - List forest bird species that one would be most likely to find in ~100 ha forest patches
- Only include bird species known to Nova Scotia. Use the NS bird checklist to see if the bird species occurs in Nova Scotia. Make a note if the species is Rare/Accidental.
- Due on Friday