Edge and edge effect

A LANDSCAPE consists of *communities of varying sizes and compositions* embedded in a MATRIX

Every landscape has broadly two elements:

1. Natural patterns of PATCHES or landscape elements (distinct communities that make up the mosaic) within this landscape are affected by human disturbance

2. introduced patches (altered patches that often involve the elimination of natural ecosystems / the introduction of exotic species)

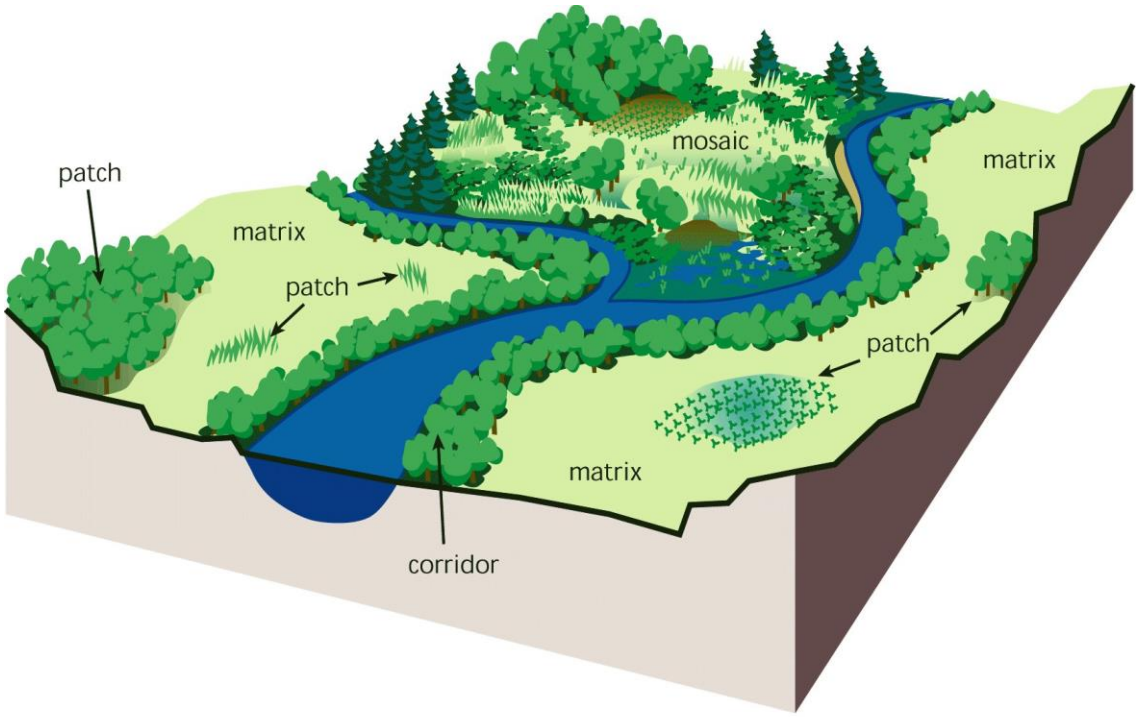


Fig. 1.4 -- Spatial structure. Landscapes can be described in terms of matirx, patch, corridor, and mosaic at various scales.
In Stream Corridor Restoration: Principles, Processes, and Practices, 10/98.
Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the US).

Key ecological terms:

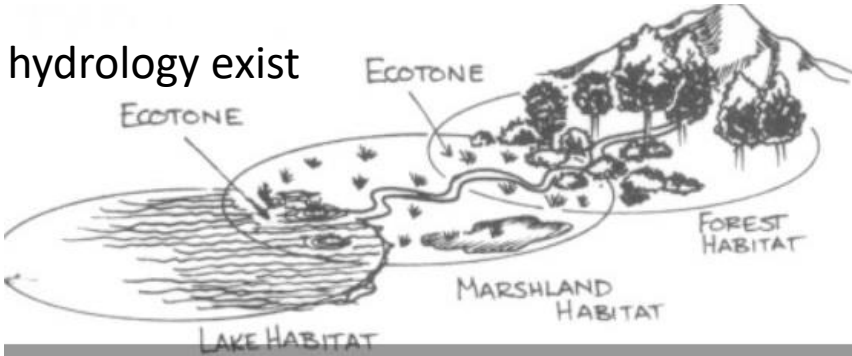
•An ***edge*** is the boundary or interface between two biological communities (*e.g. forest and grassland*) or between different landscape elements (*e.g. land and water*).

•An ***ecotone*** is the transition zone along the edges of two adjacent ecological communities, where one ecological community meets the other (*e.g. the area between forest and grassland*).

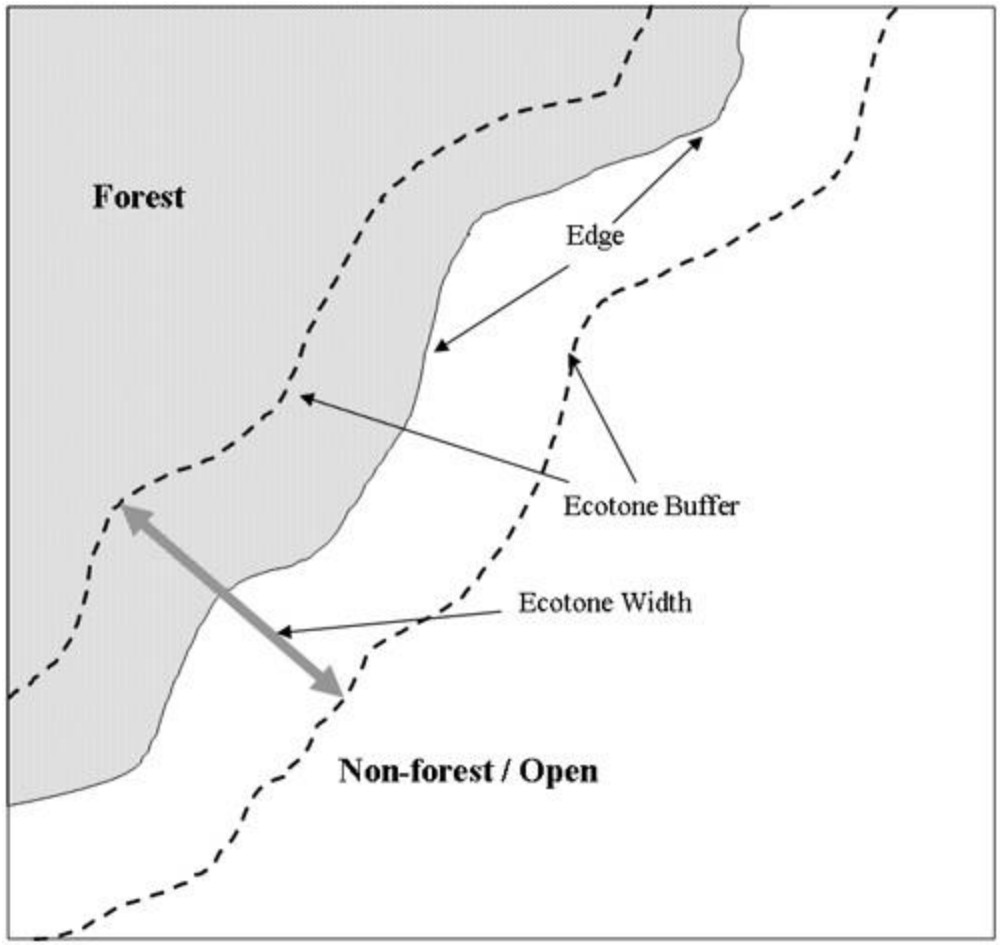
•The word ecotone was coined from a combination of *eco*(logy) + *-tone*, from the Greek *tonos* or tension – in other words, a place where ecologies are in tension.

Edge environments occur naturally at many ecosystem boundaries, some examples of these are:

- –along the perimeter of bodies of water, such as river, lakes and streams
- –where forests verge on rock outcrops, riparian areas (i.e. river banks), grasslands
- –along outcrops of exposed rock and cliffs
- –where forested areas border clearings
- –where sharp discontinuities in soil type or hydrology exist
- –where estuaries meet the ocean



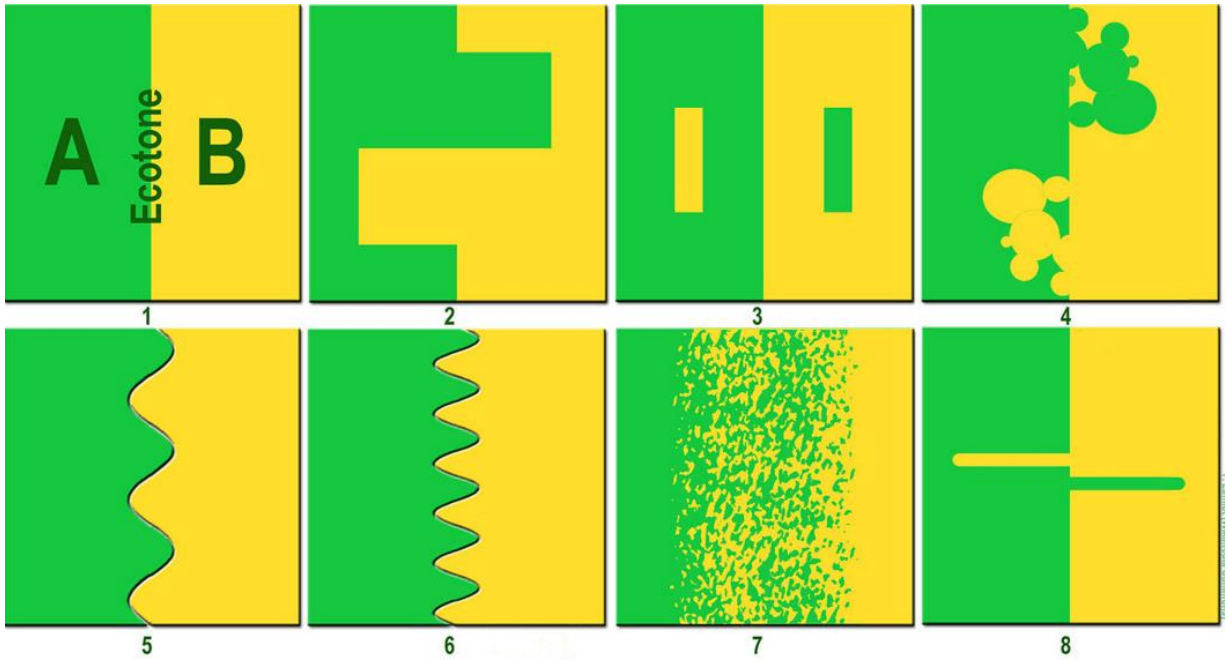
- First described in 1905 by Clements as “tension zones” where principal species from adjacent communities meet their limits.
- Importance further stressed by Odum (1959) as transition zones between two communities.
- Basically, ecotones have species in common with both adjacent interior communities, as well as edge-specialist species
- Tends to have higher diversity than surrounding areas, and consequently may be interpreted as a habitat in itself (frontier habitat).


Forest
Edge
Ecotone Buffer
Ecotone Width
Non-forest / Open

Types

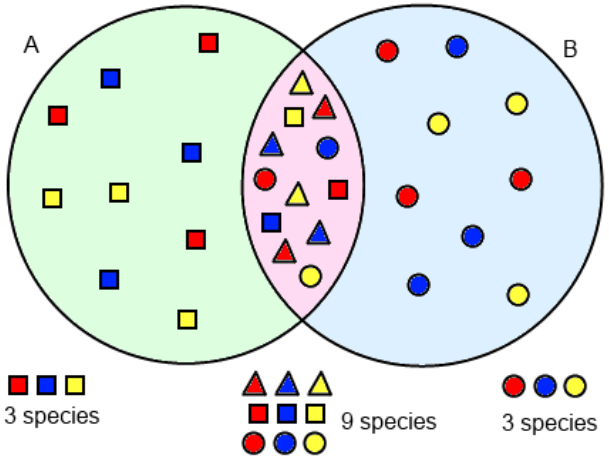
- Inherent – Natural features stabilize the border location.
- Induced – Transient natural disturbances (e.g., fire or flood) or human related activities, subject borders to successional changes over time.

- Narrow – One habitat abruptly ends and another begins (e.g., an agricultural field.)
- Wide (ecotone) – A large distance separates the borders of two clearly and purely definable habitats based upon their physical conditions and vegetation, and in between there exists a large transition region.
- Convoluted – The border is non-linear.
- Perforated – The border has gaps that host other habitats.



Edge effect

- Each ecosystem, labelled A and B, contain only three species, coloured red, blue and yellow.
- Ecosystem A contains 3 species represented by squares and ecosystem B has 3 represented by circles.
- In the region where they overlap, called the *ecotone*, there are red, blue and yellow squares and circles.
- The combination of squares and circles (which represent six species) produce unique conditions which can now support three new species, represented as red, blue and yellow triangles.
- So, while ecosystems A and B each contains three species, the overlapping transition zone contains nine.
- This increase of diversity that results from ecosystems overlapping is known as the ***edge effect***.



The 'edge effect' – Where two ecosystems overlap, the overlapping area supports species from both, plus another species that is only found in the overlapping area.

- Formation of edges
  - Changes in the physical environment may produce a sharp boundary, as in the example of the interface between areas of forest and cleared land.
  - Plants in competition extend themselves on one side of the ecotone as far as their ability to maintain themselves allows. Beyond this competitors of the adjacent community take over.

Human effects

Human activity creates edges through development and agriculture. Often, the changes are detrimental to both the size of the habitat and to species. Examples of human impacts include:

- Introduction of invasives/exotics
- Higher severity and frequency of fires
- Companion animals (pets) acting as predators and competitors
- Trails
- Pollution, erosion
- Loss of foraging habitats
- Habitat fragmentation

The three factors affecting edges can be summarized:

- Abiotic effect—Changes in the environmental conditions that result from the proximity to a structurally dissimilar matrix.
- Direct biological effects—Changes in species abundance and distribution caused directly by physical conditions near the edge.
- Indirect biological effects which involve changes in species interactions such as predation, brood parasitism, competition, herbivory, and biotic pollination and seed dispersal.

- These ecotones (the regions where the edges of two ecosystems overlap), contain a greater diversity of species than either of the two separate ecosystems, and have significantly greater productivity, for the following reasons:
  - Resources from both ecosystems can be accessed in the one place.
  - Conditions such as air temperature, humidity, soil moisture and light intensity levels all change at edges.
  - Variations in the conditions at the edges can create favourable microclimates which can support unique species.
  - Increased availability of light to plants along the edges allows more plants to be supported (greater diversity) and increases productivity.
  - Increased plant diversity increases herbivorous insects, which increases birds, and ultimately predators.
  - Ecosystem edges and borders act as 'energy nets' or sieve, capturing the massive movement of materials, nutrients and energy across their boundaries- leaves and soil are blown by the wind against barriers, shells wash up on the beach, etc.
  - Adjacent ecosystems are connected via flows of energy, material (nutrients) and organisms across their boundaries, and these flows can exert strong influences on the fertility and productivity of ecosystems.

❑ Features of ecotone

1. Ecotone may be narrow or wide.
2. It can be local or regional.
3. An ecotone can have a sharp vegetation transition, with a distinct line between two communities. For example, a change in colors of grasses or plant life can indicate an ecotone.
4. A change in physiognomy (physical appearance of a plant species) can be a key indicator. Scientists look at color variations and changes in plant height.
5. A change of species can signal an ecotone. There will be specific organisms on one side of an ecotone or the other.
   - Invasive species can be invade
6. Density of plants also found high in ecotones.
7. Those species which found in highest density in ecotone, called “edge specises”.
8. Due to high density of plants, there are ample opportunities of nesting, reproduction and feeding for animals.

Thanks