

Ecological processes in the landscape



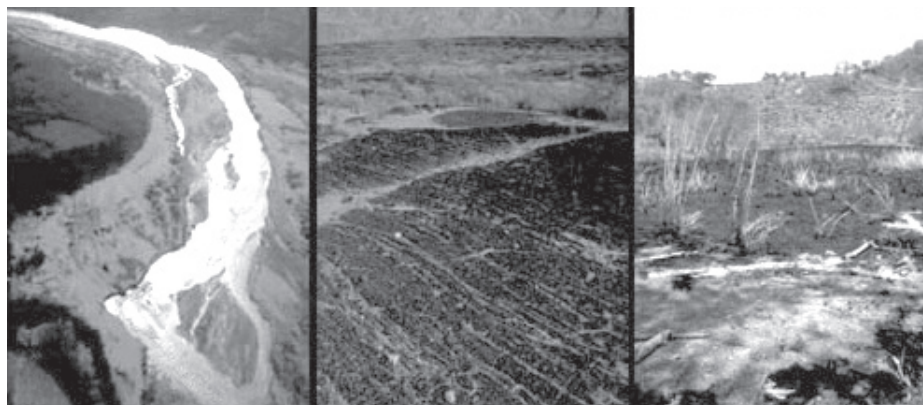
The science of "landscape ecology" or regional ecology, a term proposed by the German geographer Carl Troll (1899-1975), has developed in the past 20 years. This science has been incorporating concepts developed in the anthropogenic landscapes of Europe, which emphasize the classification, nomenclature and concepts developed in the USA with a particular focus on processes, such as the **theory of island biogeography proposed** by U.S. ecologist Robert MacArthur (1930-1972) and entomologist Edward O. Wilson (1929 -), and the models of metapopulations of ecologist Richard Levins. The development of geographic information systems (GIS) and the availability of remote sensing techniques have provided powerful tools for landscape analysis.

The landscape consists of a mosaic of habitats and occupies a wide space between the habitation area of an

organism and its regional distribution (50 to 10,000 km²). Landscape elements affect populations through their form and composition.

Induced and natural disturbances. The regional habitat mosaic is formed and maintained by regionally characteristic natural disturbances. Variations in the frequency, magnitude, and extent of disturbances produce complex patterns in the composition, age structure and size distribution of habitats within these mosaics. For example, the Canadian boreal forests, the Californian coastal shrublands and the African savannah are all periodically disturbed by fire. Following these fires, the mosaic of habitats typically changes in terms of composition and structure. Similarly, The forests of the Yucatan Peninsula are disturbed each year by the passage of hurricanes and floods.

Currently, disturbances induced by human activities (agriculture, construction of dams, etc.) dominate the landscape and change ecological processes at the landscape level. One of the main consequences is habitat fragmentation, which affects the natural movement patterns of individuals, i.e. dispersal. New habitats represent barriers to some species and corridors for others, affecting landscape processes as complementarity, supplementation, neighbourhood effects and the relationships between donor and recipient habitats.



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Complementarity. Many species require resources (food, nesting sites) from different habitats at some point in their life cycle. Extreme cases exist, such as the great migrations of whales, sea turtles, monarch butterflies and neotropical migratory birds that breed in one region and spend their non-breeding season in another.

However, on a smaller scale, there are many examples of daily movements for food or some other resource. For example, parrots often have feeding areas some distance away from their nesting sites. Populations are greater when their required habitats are in close proximity, and smaller when they are more distantly located.

Supplementation. When there are additional resources in neighbouring habitats, the population of a species may increase if it has access to them. For example, areas of cultivation with a high production of food attract species (parrots, deer, coatis) that inhabit the surrounding areas. Rubbish dumps have the same effect on gulls and vultures.

This supplementation results in increased populations of species that use the resources of their neighbouring habitats.

Neighbourhood effects. These effects, also known as "small landscape effects", occur when the abundance of a population is more influenced by adjacent habitats than by distant habitats. Neighbourhood effects always depend on the form of the landscape: Edge effects are

an example of this process. One of the most documented examples of neighbourhood effects is nest parasitism by the brown-headed cowbird (*Molothrus ater*).

These birds live in large flocks in open areas and do not make nests, but lay their eggs in the nests of other birds on the edges of the forest and leave them to be raised by the hosts. This has a large impact on birds that nest near the edges, as they generally lose their own brood in the process.

Relationships of habitat donor and recipient (*Source/sink*). Relatively productive habitats (with better soils, higher moisture and more suitable weather conditions) may act as donors (sources) of individuals that disperse to less productive habitats known as recipients (sinks). Populations in recipient habitats can not persist over time because reproduction is insufficient to counter rates of mortality and they require continuous migration from more productive nearby donor habitats.

The composition (habitat types) and structure (distance between habitats) of the landscape influences the relationship between donor and recipient habitats. Few studies have described the relationship between these habitats, because it is so difficult to fully document reproduction and dispersion in various habitats for several years. However, it is easy to imagine situations where this dynamic is created by human intervention. For example, hunting near protected areas may establish a donor/recipient habitat.

