

Summary of: **“Biodiversity in a changing world: land use and other effects on landscape and regional diversity”** by **Sandra Lavorel**.

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Biodiversity is declining due to human activities that accelerate global change. We can observe these biodiversity changes directly by our eyes or projecting climate and land-use change effects. On the other hand, it is crucial to characterize plant functional approaches (concepts and methodologies) in order to project land-use change effects on plant diversity and ecosystems with the purpose of assessing consequences for ecosystem service delivery.

Currently, we can detect a discernible “fingerprint” of climate change effects on species distributions and phenology. Thus, we are able to predict it accurately (Parmesan & Yoh 2003). An example of biodiversity changes in response to climate change during the last decades are the raise of species on high summits due to the invasion by warm-climate plants.

However, we can not assume the same pattern of biodiversity loss everywhere. Sala *et al.* (2000) presented which are the factors (land use, climate, N deposition, invasive species and CO₂) that mostly affect different environments in the Earth. Additionally, they operate at different scales (genes, species, populations and biomes).

People have permanently transformed or disturbed natural patterns like vegetation mosaics. High population density in biodiversity hotspots could affect quickly by increasing numbers of small households (Cincotta *et al.* 2000). Natural landscape is increasingly fragmented into “land islands” due to the new infrastructures (roads) and the species are divided into subpopulations. That fragmentation impedes climate response that affect to species-specific responses like British butterflies (Warren *et al.* 2001).

In quantitative ecology, landscape biodiversity quality is quite difficult to measure; generally counting the number of species is the most popular approach for evaluating the complexity of a plant community. Moving towards large scales and measuring species richness in plots, it highlights the possibility that species show an autocorrelation in its richness distribution, and these species are more sensitive to land fragmentation and habitat destruction. To assess diversity response to global change projections there are three methodologies: (1) niche based modelling, (2) statistical models and (3) models based on plant traits.

1. Niche based modelling take information from real datasets and performs a modelling taking into account ecological dimensions (degree-days, water availability, etc.) to project back into geographical space, in order to obtain current and future range prediction. These models provide simulated distribution of plants and animals using response curves for the potential realised niche. For a better prediction niche-based models need primary assumptions like: (a) data adequate (species distribution and environmental variables), (b) environmental variables control geographic range limits, (c) statistical methods detect correct relationships, (d) climate and land-use will change as predicted..., (e) no plasticity or genetic adaptation, and (f) niche conservatism.
2. Statistical models based in habitat change and species-area show the effects of land use change on biodiversity by means Climate Change projections (i.e. Millennium Ecosystem Assessment) connecting habitat availability for the different scenarios to the estimated species loss. These models are relatively sensitive for different biomes that depend of different factors (Sala *et al.* 2000).

Mountains and Mediterranean region are the most threatened regions in Europe. In mountains greatest changes are expected especially at intermediate altitudes (e.g. Prealps).

3. Models based in plant traits to explain community distributions within landscapes attend to reduce the complexity of life using a functional rather than taxonomic perspective (Garnier *et al.* 2004). The traits of the plants are used as markers of plant function, they are: fecundity, dispersal, establishment, light interception, competitive ability, resorption of nutrients, decomposability of litter, absorption, carbon fluxes, etc. Those effects of traits on species distributions have been disposed along regional climatic gradients in order to predict the value for regional distributions and climate response (Thuiller *et al.* 2004) and at global scale (Wright *et al.* 2005). One approach is study the variation in Leaf Dry Matter Content (LDMC) with climate. LDMC is the ratio dry to fresh mass of leaves, in other words is the density in structural tissue. There is a correlation that colder sites have more 'dense' leaves (Wright *et al.* 2005), it means the increase in LDMC in response to less intensive land use will be strongest at the warmest sites (Garnier *et al.* 2007). To model dynamics at the landscape scale there is software called LAMOS (Landscape MOdelling Shell) (<http://gcte.org/lamos.htm>) used in GCTE that assess plant dynamics and support spatial processes as well as dispersion, disturbances, fluxes, etc. Finally, it's necessary to project the effects on ecosystem services identified by stakeholders and proxies to quantify them, the statistical relationships between functional composition and ecosystem properties, and scenario projections of ecosystem services (Quétier *et al.* submitted).