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The importance of scenario based conservation planning to preserve biodiversity and ecosystem services

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DESCRIPTION

Biodiversity loss and species extinction are projected to be high over the next century, driven in large part by climate change and land use changes that convert natural vegetation into agricultural and urban uses. Local and regional conservation plans aimed at minimizing habitat loss, habitat degradation, fragmentation and promoting landscape connections can help reduce the effects of urbanization on species extinction and biodiversity loss . To develop informed plans for the future - plans that balance needs of both humans and the ecosystems they depend on decision makers need quantitative assessments that describe the potential response of biodiversity and ecosystem services to future land use decisions.

The importance and benefits of conservation planning and other actions aimed at reducing the loss of biodiversity and related ecosystem services (e.g. genetic resources, biological prospecting opportunities, primary productivity and pollinators) are well established in the literature. However, the making and implementation of conservation plans can have unintended consequences for biodiversity, ecosystem services and human health. Conservation benefits may come at the expense of other ecosystem services or neighboring biological systems, affect ecosystems that serve vulnerable segments of human societies, or have transnational and geopolitical impacts. Given these uncertainties, conservation plans aimed at conserving biodiversity, ecosystem services and minimizing unintended consequences will benefit from the results of alternative scenarios.

Scenarios can provide spatial representations of possible future urban developments and landscape changes. Satellite imagery, Geographic Information Systems (GIS) and species niche information can be used to develop estimates of past, existing and future species distributions. These estimates allow us to identify potential changes in spatial and temporal patterns of biodiversity associated with anthropogenic land use and habitat changes. These scenarios give policy makers, planners and land managers a way to consider and communicate the potential impacts of land use decisions on people and the environment. Scenario planning does not involve predictions of a single outcome, but rather the intention is to offer a range of plausible situations based on multiple, usually conflicting, assumptions about what the future might hold. Scenario-based planning and the development of multiple alternative scenarios are becoming increasingly necessary given the high degree of uncertainty about the nature of future climate change and the ecological and social response to these changes.

To better understand and predict how these alternative scenarios of future urban, suburban and extra-urban growth patterns may affect biodiversity. The loss of biodiversity is a major driver of global changes in the functioning of ecosystems. While most studies examining the relationship between biodiversity and ecosystem functioning have examined randomized species losses, trait-based filtering associated with species-specific vulnerability to diversity loss factors can strongly influence how well functioning ecosystem responds to the decline of biodiversity. Furthermore, the responses of ecosystem functioning to the loss of diversity can be mediated by environmental variability that interacts with the set of traits left in poor communities. Compared to communities based on randomized diversity losses, communities resulting from realistic (drought-induced) species losses had greater resistance to invasion under climatic conditions consistent with trait-based filtering they experienced. However, overall years, regardless of climatic conditions, productivity declined more with realistic species losses than with random species losses. Functional response traits are aligned with effect traits for productivity, but not resistance to invasion.