Tree Cover Configuration and Connectivity

This EnviroAtlas community map, located in Supplemental Maps under Landcover and Biophysical Data, illustrates the configuration and connectivity of tree cover surrounding selected communities. A morphological spatial pattern analysis (MSPA) was used to classify forest cover into structural landscape elements such as core and forest edge.[1]

Why is tree cover configuration and connectivity important?

Worldwide, forested landscapes are undergoing conversion to meet the ever-growing needs of human societies. Forest conversion has resulted in the loss, degradation, and fragmentation of tree cover. Fragmentation is a process by which large areas of habitat are broken into a number of smaller patches and isolated from each other by a matrix of dissimilar habitats and development. Habitat loss and alteration are considered principal threats to global biodiversity,[2,3] which is essential to support and maintain the ecosystem services on which humankind depends. Thus, conserving species and habitats is beneficial not only to the environment, but to society as well.

An important step in conserving species is to understand the arrangement and configuration of the habitat or multiple habitats on which those species depend. For example, some species, such as the grizzly bear (*Ursus arctos*), require large areas of relatively undisturbed habitat in order to live and breed successfully.[4] In landscapes where large patches of habitat, often referred to as core habitat, are not available, species like the grizzly bear may become locally extinct. Local extinctions can alter the integrity of the ecosystem and the services it provides.[5] An added benefit of protecting species with large area requirements is that habitat for other species with smaller area requirements may also be protected.[4]

Many species, such as migratory birds, use a variety of habitats and ecosystems during their life cycles and may need connection points, or corridors, to move from one area to another. A related consequence of habitat loss is that remnant patches become smaller and more disconnected from other areas of habitat through fragmentation.[2,3] The extent to which habitat is connected influences animal movements, which are of importance to both the reproduction and survivorship of individual organisms and consequently also to the health and viability of the larger population.[6] By providing corridors in the landscape, land managers can help to facilitate animal movements, and therefore help to maintain healthy populations and ecosystems.[7] Fragmentation also leads to an increase in area of edge habitat. Edge habitats support different assemblages of species than interior habitats,[8] because edges experience different biological conditions.[9] Edges are often considered to be of lower quality to species that depend on more contiguous patches of core habitat since edge habitats frequently have greater rates of resource competition, parasitism, predation, and human disturbance relative to interior habitats.[2]

Understanding the extent and configuration of habitat in the landscape is important not only for managing biodiversity. Forest edges can also pose a direct risk to human health, as they may increase exposure of individuals to wildlife-associated illnesses such as Lyme disease. Moreover, habitat edges along roads are related to animal-vehicle collisions, which can be costly and threaten human lives as well.[10]

Both edge and core habitats are valuable for recreational activities such as hunting, fishing, and wildlife-watching. Core habitat is typically rarer, and thus offers unique recreational opportunities such as experiencing relatively undisturbed nature and viewing area-sensitive wildlife species like the ovenbird or wood thrush.

How can I use this information?

This map, Tree Cover Configuration and Connectivity, can be used to understand the extent and pattern of tree cover in the landscape, which is useful in conservation and land-use

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planning. It can be used by urban planners and land trusts to identify core and corridor or bridge habitats that could be targeted for conservation or restoration efforts. The data can be used to assess the impacts that new development would have on current tree cover extent and connectivity. The data can also be used by researchers to investigate relationships between land cover structure and other variables of interest. For example, ecologists may want to understand how landcover pattern influences the distribution of a species, its abundance, or the movements of individuals.

How were the data for this map created?

This map is based on the land cover data derived for each EnviroAtlas community. The land cover data were created from one-meter aerial photography through remote-sensing methods. Tree cover includes trees, forest, and woody wetland classes. The data were processed using the MSPA analysis tool available within the GUIDOS (Graphical User Interface for the Description of image Objects and their Shapes) Toolbox.

What are the limitations of these data?

All of the EnviroAtlas community maps that are based on land cover use remotely-sensed data. Remotely-sensed data in EnviroAtlas have been derived from imagery and have not been verified. These data are estimates and are inherently imperfect. The land cover maps used in the community component of EnviroAtlas typically have an overall accuracy of between 80 and 90 percent. This level of accuracy means that there is a probability of at least 80 percent that the land cover at any given point on the map is correct. The land cover maps will be updated over time; updates may have improved accuracy as data and classification methods improve. This map shows the extent and connectivity of tree cover within the community. This map was not designed to reflect habitat connectivity for any specific organism, but more generally to show connectivity across the tree cover land cover classes considered.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. EnviroAtlas land cover maps created for each community are available under the Supplemental Maps tab in the interactive map.

Where can I get more information?

Selected publications are listed below that explore the influence of landscape configuration and extent on environmental variables and wildlife populations. For additional information on data creation, access the metadata for the data layer from the drop down menu on the interactive map table of contents and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about these data, please contact the EnviroAtlas Team.

Acknowledgments

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Selected Publications

1. Soille, P., and P. Vogt. 2009. Morphological segmentation of binary patterns. *Pattern Recognition Letters* 30: 456–459.

[2]. Fischer, J., and D. Lindenmayer. 2007. Landscape modification and habitat fragmentation: A synthesis. *Global Ecology and. Biogeography* 16: 265–280.

[3]. Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. *Annual Review of Ecology Evolution and Sys*tematics 34: 487–515.

4. Roberge, J.M., and P. Angelstam. 2004. Usefulness of the umbrella species concept as a conservation tool. *Conservation Biology* 18:76–85.

5. Beschta, R., and W. Ripple. 2009. Large predators and trophic cascades in terrestrial ecosystems of the western United States. *Biological Conservation* 142: 2401–2414.

6. Fahrig, L. 2007. Non-optimal animal movement in human-altered landscapes. *Functional Ecology* 21: 1003–1015.

7. Gilbert-Norton, L.B., R. Wilson, J.R. Stevens, and K.H. Beard. 2010. A meta-analytic review of corridor effectiveness. *Conservation Biology* 24: 660–668.

8. Ries, L., R.J. Fletcher, J. Battin, and T.D. Sisk. 2004. Ecological responses to habitat edges: Mechanisms, models, and variability explained. *Annual Review of Ecology Evolution and Systematics* 35: 491– 522.

9. Harper, K.A., S.E. MacDonald, P.J. Burton, and P.A. Esseen. 2005. Edge influence on forest structure and composition in fragmented landscapes. *Conservation Biology* 19: 768–782.

10. Gunson, K., G. Mountrakis, and L.J. Quackenbush. 2011. Spatial wildlife-vehicle collision models: A review of current work and its application to transportation mitigation projects. *Journal of Environmental Management* 92: 1074–1082.