Tree Cover Configuration and Connectivity

This EnviroAtlas map illustrates configuration and connectivity of tree cover using one-meter resolution data for selected communities. Morphological spatial pattern analysis (MSPA) was used to classify tree cover into structural landscape elements such as core, bridge, and edge.[1]


Photo: Virginia Lake, T. McCabe, NRCS

Why is tree cover configuration and connectivity important?

Worldwide, forested landscapes are undergoing conversion to meet the ever-growing needs of human societies. Landcover change has led to the loss, degradation, and fragmentation of forest habitat. Fragmentation is a process by which large areas of habitat are broken into smaller patches that become isolated within 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 forest species and habitats is beneficial not only to the environment, but to society as well.

Disturbance-sensitive wildlife, from the tiny Louisiana waterthrush (*Parkesia motacilla*) to the giant grizzly bear (*Ursus arctos*), require extensive forest habitat in order to live and breed successfully.[4] Where "core" habitat is not available, species like these may become regionally or even globally extinct. The loss of one species typically affects others and can alter the integrity of the entire ecosystem and the services it provides.[5] By protecting species needing large areas, society can also protect habitats for many other species.[4]

In cities and suburbs, core habitat is rare. However, small forest patches and tree clusters are important for many urban wildlife species. In addition, wild plant species may depend on urban remnants of forest habitat, particularly patches containing rare soil types or essential symbiotic organisms. Small forest patches can be critical as bridges or "stepping stones" between core areas. For example, many migratory bird species use a variety of habitats and ecosystems during their life cycles and may need connectors, or corridors, to move safely from one requisite area to another. The extent to which habitat is connected influences animal movements, which are important to reproduction and survivorship and consequently to the health and viability of the larger population.[6] By providing corridors in the landscape, land managers can help to maintain healthy populations and ecosystems.[7]

Fragmentation also increases edge habitat. The forest edge supports different assemblages of species than the interior, because edges experience different ecological conditions.[8,9] Edge habitats are of lower quality for species that depend on interior 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 forest 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, forest edges along roads are related to animal-vehicle collisions, which can be costly and put human lives at risk.[10]

Forest core, bridge, and edge habitats can all be valuable for recreational activities such as wildlife viewing, fishing, and hiking. Core habitat is typically rarer, and thus it offers unique recreational opportunities such as experiencing relatively undisturbed nature and encountering area-sensitive wildlife or their signs and sounds.

How can I use this information?

This map can be used by urban planners and land trusts to identify forest patches and bridge habitats that could be targeted for conservation or restoration efforts. Such an analysis can be enhanced by overlaying hydrologic features available in EnviroAtlas and using the topographic base map. Overlaid with one of several EnviroAtlas national 30m-resolution MSPA connectivity maps, it can be used to assess

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the potential for community corridors between outlying core habitats. It can also be used to assess the impacts of new development on current tree cover extent and connectivity.

This map and companion data layers can be used by researchers to investigate relationships between tree cover pattern and other variables of interest in urban and suburban areas. For example, ecologists may explore how this 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 one-meter resolution land cover data derived for each EnviroAtlas community using remote sensing methods. Tree cover includes trees, forest, and woody wetlands. Landcover 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.

This map relies on methods that cannot detect what lies beneath tree canopy. Understory and ground cover are important habitat components, while pavement under canopy is not. This map does not reflect habitat connectivity for any one species. It is intended as a screening tool to assess forest and tree habitat gaps and opportunities. From this starting point, site surveys and expertise in local landscape and wildlife ecology are recommended to support local decisions.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. To find the EnviroAtlas 1-meter land cover grids created for each community, enter *land cover community* in the interactive map search box.

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. 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.