BioFinder is a product of the Vermont Agency of Natural Resources. This abstract describes one of 21 components of biological diversity that underpin BioFinder. For more info go to biofinder.vermont.gov/biofindercreating.htm.

Connecting Lands (L5)

Description

Habitat Connectivity is a complex process that functions at different scales for different species. Generally speaking, connecting habitat is represented by land that links larger patches of habitat within a landscape, allowing the movement, migration, and dispersal of animals and plants. Riparian areas along streams and rivers, strips of forest cover between developed areas, and even hedgerows/ fencerows all represent potential connecting habitat for wildlife and other organisms. Sometimes these areas are called "corridors" even though they are not always linear, as the term implies.

The composition and functions of connecting land are based on the scale at which it is considered. At the coarsest, eco-regional scale, connecting land in Vermont can be thought of as a "network" supporting genetic heterogeneity and movement of populations of wide-ranging mammal species across huge swaths of the landscape; such as between the Adirondacks Mountains of New York, Vermont's Green Mountains and the White Mountains of New Hampshire. It is a network in the sense that it includes large blocks of contiguous, unfragmented habitat (**Anchor Blocks**), the source and principle home area of many species, as well as C**onnecting Blocks**, large forested habitat blocks that have good cover, but are not necessarily large enough in and of themselves to maintain populations of wide-ranging species, and smaller units, **Connecting Lands** that are less than 2,000 acres and include very small habitat blocks and land outside of blocks (e.g., roadsides, fields and other developed areas).

Habitat is also connected at fine scales, for example by **Riparian Connectivity** and **Wildlife Road Crossings**, where individual terrestrial animals move along waterways and cross roads. This most local scale of movement may not necessarily be of regional significance, but of course, the regional connections cannot function without local movement. There can be no genetic exchange between wildlife populations in New York and Vermont, for example, without individual animals making sections of the trip, crossing roads and eventually breeding with other individuals. Therefore local and regional connectivity are both vital to the long-term sustainability of wildlife populations and the ecological functions that they support. For the purposes of BioFinder, habitat connectivity is captured in the following components:

Table 1. Habitat Connectivity at Regional & Local Scales as Used in BioFinder

Scale	Data #	Component	Description
Network of Connected Lands	L5	Connecting Lands	Habitat blocks that are less than 2,000 acres and lands outside of blocks (e.g., roadsides, fields and other developed areas).
	L6	Connecting Blocks	Habitat blocks greater than 2,000 acres and less than 10,000 acres.
	L7	Anchor Blocks	Habitat blocks greater than 10,000 acres.
Local Connectivity	L8	Riparian Connectivity	Lands along streams, rivers, lakes and ponds including those agricultural lands in pasture/hay, grasslands and all other natural-cover types. Does not include developed lands and agricultural lands with cultivated crop.
	L9	Wildlife Road Crossings	Locations where wildlife is likely to cross roads based on the presence of adjacent natural cover.

Ecological Importance

Movement of animals from one habitat patch to another is the most common function associated with connecting habitat. This function is particularly important for wide-ranging animals, such as bobcats and black bears, or for animals that require a great deal of space to meet their daily life needs, such as barred owls or otter. Although connecting habitat is often associated with wide-ranging mammals, it is equally important for animals with relatively small ranges and even for plants over long time periods as climate changes. Spotted salamanders, for example, use connecting habitat in spring to move from their hibernation sites to breeding pools, sometimes crossing roads or agricultural fields. The value of connecting habitat is a function of both seasonal and spatial patterns of wildlife behavior. For example, connecting habitat may allow black bears to access important food resources during a specific time of year (seasonal), or it may prevent isolation of bear populations by allowing free exchange of breeding adults (spatial). Ultimately, connecting habitat can ensure that the habitat, movement, migration, and behavior requirements of most native plants and animals are conserved across a broad landscape. The broader ecological value of connecting habitat is to join fragmented pieces of habitat, thereby reducing the deleterious effects of habitat fragmentation and population isolation. Linking small or otherwise isolated habitat patches may reduce the risk of local population extinctions by ensuring immigration, recolonization, reproduction, and exchange of genes for some plant and animal species. While conserving corridors has great merit, do not assume that conserving threads of vegetative cover within a developing landscape will maintain an area's ecological values and biological diversity. Nor will corridors alone meet the habitat needs of all of an area's plant and animal species. Only in conjunction with the conservation of large areas of undeveloped land with diverse habitat conditions, will vegetative corridors assist in supporting ecosystem functions and related public benefits.

Connecting Lands Conservation Goal

Conserve local-scale connecting habitats that support seasonal and spatial patterns of wildlife movement and allow for movement between habitat patches across potential barriers. The larger conservation goal for landscape connectivity is to conserve a connected network of lands, waters, and riparian areas that allow for functioning of ecological processes across the landscape and dispersal, movement, and migration of plant and animal species in response to changing environmental conditions.

Component Mapping Goal

To identify and map the most vulnerable small blocks and other lands that provide critical connections between Anchor and Connecting Blocks. These important pinch points and stepping stones help form a multi-scaled network of connected land and water that includes core habitat, natural communities and connecting features.

Source Data and Selection Criteria

Description

1. **Habitat Blocks**, Vermont Fish & Wildlife Department (Sorenson & Osborne, in prep.)
   Habitat blocks show all areas of natural cover (Using 2006 landcover data from NOAA Coastal Change Analysis Program (CCAP)) surrounded by roads, development and agriculture, ranging in size from 500-acres to 153,000-acres and prioritized for biological importance.

2. **Northern Appalachian/Acadian Ecoregion: Priority Locations for Conservation Action** Trombulak et al., 2008. This work identifies priority linkages at the ecoregional scale.

3. **Resilient sites for terrestrial conservation in the Northeast and Mid-Atlantic region**. Anderson et al., 2012. Using Circuitscape software this work models flow concentration areas to assess regional-scale connectedness and pinch points.

4. **From the Adirondacks to Acadia: A Wildlands Network Design for the Greater Northern Appalachians**. Reining et al., 2006). This work identifies a network design for regional connectivity based on habitat models for far-ranging mammals.

5. **Linkage Areas of the Northern Appalachian and Acadian Ecoregion**. 2012. Staying Connected Initiative. Staying Connected used models and field data to identify high priority linkages which were incorporated in their entirety because of their finer granularity.

Selection Criteria

To create the **Network of Connected Lands**, habitat blocks with a high ranking for cost-distance to core (Sorenson & Osborne, in prep.) were selected. Additional habitat blocks and connecting lands were added based on overlap with the regional scale datasets described above to represent connectedness within Vermont and outside of the state to the Adirondacks, Whites, Berkshires, Mahoosics, and Sutton Mountains, as well as numerous locations across the Connecticut River. The resulting Network of Connected Lands dataset was then split into three component datasets (table X) to allow for differential weighting based on potential threat and other factors:

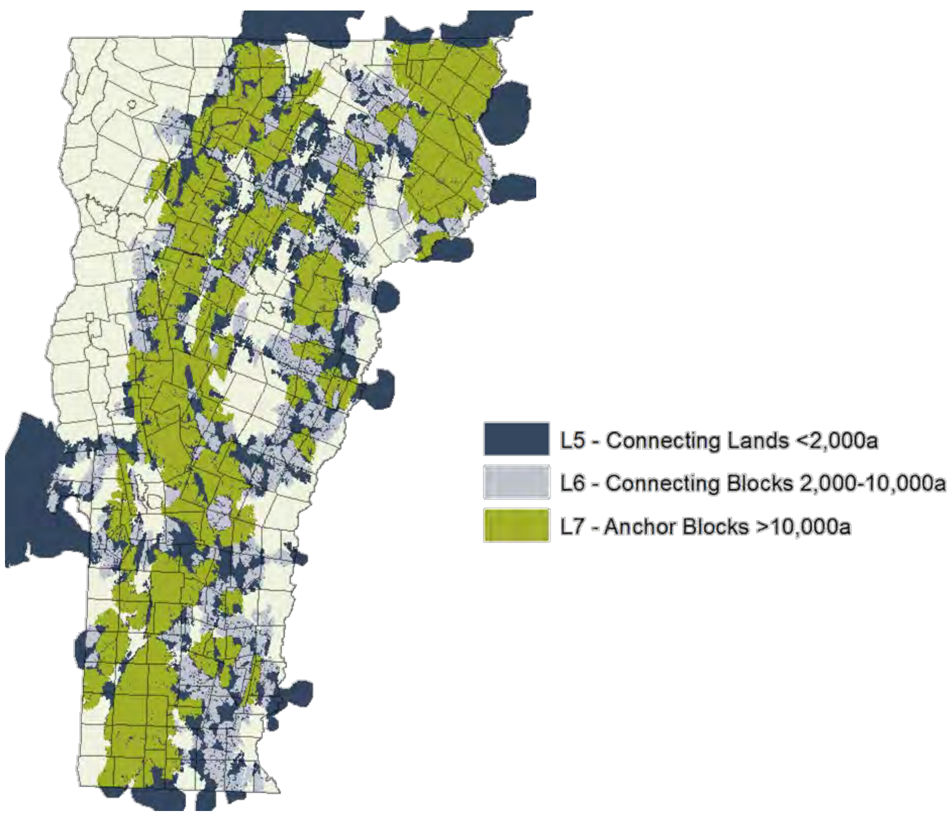

Figure 1. The Network of Connected Lands (datasets L5, L6, L7)

Component Strengths

The Network of Connected Lands dataset addresses regional scale habitat connectivity and associated wildlife and ecological movement. It uses the regional flow data developed by The Nature Conservancy, as well as habitat linkage areas identified by the Vermont Habitat Block project. This gives us a sense of lands within the State that play a role in connectivity well beyond the state's borders. This makes it possible to identify a network within Vermont important for climate change adaptation and other regionally pressing issues that occur at regional scales

The Connecting Lands component has the strength of focusing on the most threatened areas within the network. Places within the Connecting Lands component are either small habitat blocks or the narrow places between blocks where they are closest together. This means this component focuses on the most modified and threatened part of the overall network and allows priority to be placed on these areas because of this function of helping wildlife move.

Component Limitations

The Network of Connecting Lands dataset focuses on lands important for regional-scale habitat connectivity. Only places that allow for movement between contiguous habitat (such as the Adirondacks or Green Mountains) are considered important. This leaves out large areas of the state that are critically important for wildlife at a statewide or local scale. Movement between patches of habitat remains important even if the wildlife populations in question aren't operating at a regional scale of movement.

The Connecting Lands component is the finest scale (smallest area) portion of the Network of Connecting Lands, but still misses locally important connectivity areas, especially for amphibians and reptiles. We rely on the use of the Wildlife Road Crossings dataset and Riparian Connectivity dataset to address more local scale movement areas. The connecting lands component is not based on field data and site visits are always needed to identify specific locations of functioning connectivity within the mapped polygons.

Component Weight and Justification

Connecting Lands was weighted a 7 on a scale of 1-10 (with 10 as highest contribution to biological diversity). This relatively high weighting is based on the critical nature of these connecting lands as part of the network of connecting lands and the high threat that future development will further fragment these areas, tempered by the general lack of site-specific knowledge about the mapped connecting lands.

Summary Statistics for Connecting Lands

Table 2. BioFinder component datasets, component weights, and the distribution (%) of components across tiers

Data #	Weight	Component	Tier 1 Greatest	Tier 2 Very High	Tier 3 High	Tier 4 Moderate	Tier 5 Low
Landscapes							
L1	7	Habitat Blocks	12.7%	18.1%	30.1%	39.1%	0.0%
L2	3	Grasslands & Shrublands	4.3%	20.8%	22.7%	10.9%	41.3%
L3	9	Rare Physical Landscape	15.7%	53.9%	11.0%	19.4%	0.0%
L4	4	Representative Physical Landscape	17.2%	19.1%	43.4%	13.7%	6.6%
L5	**7**	**Connecting Lands (<2000ac)**	**10.1%**	**23.4%**	**19.1%**	**47.4%**	**0.0%**
L6	4	Connecting Blocks	9.2%	12.2%	24.0%	51.8%	2.7%
L7	3	Anchor Blocks	12.1%	19.7%	35.3%	32.7%	0.1%
L8	8	Riparian Connectivity	36.4%	52.9%	10.8%	0.0%	0.0%
L9	4	Wildlife Road Crossings	12.8%	28.1%	20.9%	26.8%	11.4%
Aquatics							
A1	6	Surface Waters & Riparian Areas	31.1%	48.6%	12.9%	7.4%	0.0%
A2	4	Representative Lakes	10.3%	84.5%	5.3%	0.0%	0.0%
A3	8	Important Aquatic Habitats & Species Assemblages	19.9%	75.2%	4.9%	0.0%	0.0%
Species & Natural Communities							
SN1	Tier 1	Rare Species	100.0%	0.0%	0.0%	0.0%	0.0%
SN2	6	Uncommon Species	62.1%	21.7%	10.0%	6.1%	0.0%
SN3	Tier 1	Rare Natural Communities	100.0%	0.0%	0.0%	0.0%	0.0%
SN4	6	Uncommon Natural Communities	57.4%	31.0%	11.4%	0.2%	0.0%
SN5	3	Common Natural Communities	9.8%	52.9%	37.1%	0.2%	0.0%
SN6	7	Vernal Pools (Confirmed)	20.5%	57.0%	8.3%	14.1%	0.0%
SN7	5	Vernal Pools (Potential)	6.0%	30.1%	52.3%	2.4%	9.2%
SN8	8	Wetlands	60.9%	31.0%	5.1%	3.0%	0.0%
SN9	4	Mast production areas	10.3%	49.3%	35.2%	4.0%	1.2%

The sum of percentages for each component is 100.

References

Anderson, M.G., M. Clark, and A.O. Sheldon. 2012. Resilient sites for terrestrial conservation in the Northeast and Mid-Atlantic region. The Nature Conservancy.

Reining, C., K. Beazley, P. Doran and C. Bettigole. 2006. From the Adirondacks to Acadia: A Wildlands Network Design for the Greater Northern Appalachians. Wildlands Project Special Paper No. 7. Richmond, VT: Wildlands Project.

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Sorenson, E. and J. Osborne. In prep. Vermont Habitat Blocks & Wildlife Corridors, an analysis using geographic information systems. Vermont Fish & Wildlife Department. Draft report.

Trombulak, S.C., M.G. Anderson, R.F. Baldwin, K. Beazley, J.C. Ray, C. Reining, G. Woolmer, C. Bettigole, G. Forbes, and L. Gratton. 2008. The Northern Appalachian/Acadian Ecoregion: Priority Locations for Conservation Action. Two Countries, One Forest Special Report No. 1.

For more information

A complete report on BioFinder development, methods and findings, including all 21 component summaries can be found at www.BioFinder.vt.us. For more information specific to this component, contact Jens Hilke, Vermont Fish & Wildlife Department, 802-879-5644, jens.hilke@state.vt.us.