

# Contiguous Forest Blocks and Riparian Areas in Burke, Vermont

## Investigation Report for the Burke Conservation Commission

by

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This report describes the results of our investigation of contiguous forest blocks and riparian, or stream, areas in Burke, Vermont. In addition to mapping and describing the most ecologically valuable forest riparian reaches (segments), we map riparian areas suitable for restoration. Our maps and report identify Burke's most important forest and stream natural resources, and provides some recommendations for the means of protecting these resources. This project was conducted through a December 28, 2012, contract between the authors and the town of Burke. Because of its geographical nature, most of the work was conducted in ArcGIS 10.1 environment at the GIS lab at Lyndon State College. Data used in our investigation is available online from Vermont Center for Geographic Information. Most of the wildlife data is from the Vermont Fish & Wildlife Department; the department's Natural Heritage Inventory provided data on rare, threatened, and endangered species, and significant natural communities. All of the products of the investigation accompanying this report, including shapefiles and hardcopy maps, were created through analysis of existing data, i.e. no new field work was done as part of the investigation.

For the three primary maps generated we include a general description, descriptions of featured units, and recommendations for protection. Three additional secondary maps produced show the primary map data on different base layers, namely town parcels and subwatersheds. A table found in the Appendix describes map layers used and created for this project. It also lists the statewide datasets reviewed, but not used because of lack of data for the town of Burke, or data that was not usable in our investigation. List of products accompanying this report are found in the table below.

Hardcopy Map Title	PDF file name	Base Layers	Primary shapefile and raster created
Ecological Significance within Contiguous Forested Blocks	Burke Forest Blocks_topo	USGS 1:24,000 topographic map	Contiguous Woodland0308.shp; Burke_Contig forest weight raster 1.tif
Ecological Significance within Contiguous Forested Blocks	Burke Forest Blocks_parcel	Burke Parcels & Subwatersheds	Same as preceding
Significant Stream Reaches	Burke Signif. Stream Reaches_topo	USGS 1:24,000 topographic map	Burke_Hydro_NHD.shp; no raster
Significant Stream Reaches	Burke Signif. Stream Reaches_parcel	Burke Parcels & Subwatersheds	Same as preceding
Riparian Areas Suitable for Restoration	Burke Riparian Restoration Areas_imagery	Microsoft 2010 imagery via ArcGIS Online	BURKE_Riparian_RestorationAcres.shp; no raster
Riparian Areas Suitable for Restoration	Burke Riparian Restoration Areas_parcel	Burke Parcels & Subwatersheds	Same as preceding

## Primary Map Descriptions

### ***Ecological Significance within Contiguous Forest Blocks Map***

General Description: This map depicts the wildlife and ecological hotspots of contiguous forest blocks in Burke, and general importance of the blocks based on block size. Created by digitizing over 2010 aerial photographic imagery, contiguous forest blocks were defined as continuous forest that is not fragmented by state highways and town roads (class 1 to 3), housing, and other development that can be barriers to wildlife movement and can disrupt natural processes. The forest blocks do not include yards and agricultural fields, and pastures, but can include naturally open wetlands and canopy openings created by timber harvest. A total of 37 blocks ranging in size from 9 to 3763 acres appear on the map. Since larger forest blocks generally have a greater value for wildlife, and better represent the naturally forested condition of the Vermont landscape, the larger blocks appear more orange than the yellow small blocks. The redder areas depict hotspots where several ecological values overlap, hence the high wildlife and ecological significance. Available wildlife and ecological data, such as deer wintering areas, moose salt licks, rare species, state-significant natural communities, and wetlands, within contiguous forest blocks, add to the significance of different forest areas in Burke. Each data type was weighted equally in our analysis. Only 11 forest blocks with the most significant features are described, the remaining 26 blocks fall in the lower two size classes and have less ecological/wildlife values.

Large forest blocks accrue many special wildlife values not shown on the map due to lack of data. These values can be applied to all the larger forest blocks. Most of our native wildlife species, from chipmunk to moose, winter wren to northern goshawk, are forest dwellers. While some wildlife species will take advantage of fields and hedgerows, they are adapted for forest living. Thus, they rely on forests for cover, raising their young, and food. Birds such as the northern goshawk – our largest forest hawk – are forest interior species, meaning they depend on large forest blocks where they can nest and not be disturbed by humans. Many of our neotropical migratory birds – warblers, thrushes, and tanagers – do best in large forested blocks for a host of reasons. Rural and suburban development in recent years have led to forest fragmentation, which has been part of the reason for the steady decline in many of these songbirds that winter in the tropics. Add to this the smaller wildlife species, such as salamanders and some frogs, which require forest to live in for most, if not all, of their lives. The bigger the forest the better is a maxim that holds true for many of these wildlife species.

Large forest blocks have many other important environmental and cultural values including maintaining good air and water quality, providing forest products, and creating places where the public can learn about and interact with forested landscapes

While our analysis focused only on the forest blocks within the town of Burke, it is important to point out that most of the larger contiguous forest blocks extend into adjacent towns thereby becoming greater in size and ecological significance. As described individually below, the two largest forest blocks in the east side of town are small portions of vastly greater forest blocks that extend east into the Victory Basin and northeast into the Northeast Kingdom highlands. These are forest blocks of state and regional significance for wildlife and ecological systems.

Description of Significant Contiguous Forest Blocks:

ID	Acres	Subwatershed	Location	Context	Ecological/Wildlife Values
1	3763	East Branch	Burke Mtn. vicinity	Highest elevation & greatest elevation range; non-limy metamorphic bedrock district; part of Victory forest block with next to highest ranked biological/conservation value in VT.	Bear mast areas; small wetlands; state significant examples of natural communities; rare Bicknell's Thrush; mountain migratory songbird habitat
2	2225	East Branch	East corner of town, north of Flower Bk.	Higher elevations down to East Branch; non-limy metamorphic bedrock district; part of Northeast Kingdom forest block with highest ranked biological/conservation value in VT.	Moose salt lick area; several med.-sized wetlands; state significant examples of natural communities; moose travel zone (high moose accidents on adj.Rt. 114)
3	934	East Branch	E. of East Branch, N. of Dish Mill Bk.	Low to mod. elevations; non-limy metamorphic bedrock district	Small to med.-sized wetlands, incl. bear wetland; sections of Dish Mill Bk.;
4	879	West Branch	Roundy Bk. headwaters west of Brook Rd.	Low to mod. elevations; limy metamorphic bedrock district; gently sloping terrain; forest block extends north into Newark	Large deer wintering area; large wetlands, including cedar swamp; rare plant
5	590	West Branch	Between Brook and Burke Green rds., NE of Burke Hollow	Low to mod. elevations; limy metamorphic bedrock district; gently sloping terrain	One mapped wetland & more unmapped seepage wetlands likely; includes portions of Roundy Bk.
6	570	West Branch	E. of West Burke	Low to mod. elevations; limy metamorphic bedrock district; steep terrain	Couple small mapped wetlands & likely more small wetlands unmapped
7	523	West Branch	N. corner of town	Low to mod. elevations; limy metamorphic bedrock district; gently sloping terrain; less than half of a forest block extending N. into Newark; extensive early successional forest and tree plantation	Couple small mapped wetlands; Roundy Brook headwaters
9	470	East Branch	W. of East Branch, S. of White School Rd.	Low elevations; limy metamorphic bedrock district; moderately sloping terrain; close proximity to more wetlands in Duck Pond block	Several small to medium-sized wetlands; extends down to East Branch; wetland wildlife
11	428	West Branch	E. of West Branch, N. of Lyndon line	Low elevations; limy metamorphic bedrock district; moderately sloping terrain	Several riparian wetlands; extends down to & across West Branch; rare plant; falls of the West Branch
14	369	West Branch	Burke Hollow	Low elevations; limy metamorphic bedrock district; drainage bottom; part of large wetlands complex extending upstream out of forest block	Includes half of largest wetland complex in town; state-significant wetland natural community; several rare plants
15	365	East Branch	Duck Pond vicinity	Low elevations; limy metamorphic bedrock district; moderately sloping with benches	Several wetlands; only natural pond in town; likely rare plant habitat; wetland wildlife

### Recommendations for Protection:

- Designate “Forest and Conservation” districts through zoning as a means of minimizing forest fragmentation
- Promote conservation easements on privately-owned forestlands
- Create a town forest through town acquisition of forestland
- Public education/outreach focusing on forestland values and protection
- Encourage private owners to enroll their forestlands in Use Value Appraisal program
- Seek protection of state-significant cedar swamp and its rare species

### ***Significant Stream Reaches Map***

General Description: Stream reaches in Burke with the highest flood attenuation value are displayed in this map. The total number of wetland and alluvial soil acres found along individual stream reaches determined level of significance. Reaches containing the greatest number of acres, i.e. >88 acres, of these two features received the highly significant ranking, while reaches with between 30 and 88 acres received a medium rank. Because alluvial soils and riparian wetlands occur in basins (narrow and shallow ones in Burke), they act as pool zones where flood waters can spread out and dissipate the energy and volume of channel waters. This map also shows the single state-significant natural community known from along stream reaches in Burke: the northern white cedar swamp along the West Branch in Burke Hollow.

Forested riparian areas, including these significant stream reaches and all other stream reaches in Burke, have values beyond flood attenuation. The deep, extensive root systems of trees prevent stream bank erosion. Trees also shade stream waters, thus cooling water temperatures in summer and encouraging coldwater fisheries. Trees falling into streams also provide special habitat for fish and aquatic life. Riparian forests are natural animal corridors, and provide specialized habitat for some wildlife species, such as otter, mink, common merganser, belted kingfisher, and wood turtle. For a full description of the conservation significance of riparian buffers and corridors, refer to the VT Agency of Natural Resources’ *Riparian Buffers and Corridors: Technical Papers*.

Description of Significant Stream Reaches:

<b>Reach ID</b>	<b>Length Miles</b>	<b>Wet/Alluvial Acres</b>	<b>Subwatershed</b>	<b>Location</b>	<b>Wildlife/Ecological Values</b>
26	4.3	206	East Branch Passumpsic	East Branch mainstem	Most extensive floodplain with alluvial soils in Burke. High concentration of moose activity based on moose accidents along adjacent stretch of Rt. 114. Moose salt lick. High water quality & aquatic habitat based on macroinvertebrate sampling
33	3.2	153	West Branch Passumpsic	Burke Hollow	State-significant cedar swamp with rare plant species. Wild brook and brown trout indicating high water quality. Largest wetland in Burke.
1597	1.5	88	West Branch Passumpsic	Roundy Brook	Large wetland, including cedar swamp. Rare plant.
38	1.7	78	Calendar Bk.	Calendar Bk.	Large area of alluvial soils. Wild brook and brown trout indicating high water quality.
332	1.3	74	West Branch Passumpsic	West Branch trib. E. of West Burke	Wetlands, though most may not drain into this trib. Maybe a fluke of analysis
293	1.0	69	West Branch Passumpsic	Roundy Bk. trib.	Large wetland
32	1.9	69	West Branch Passumpsic	West Branch mainstem	Mix of alluvial soils and wetlands; rare plant
365	0.7	58	East Branch Passumpsic	Short East Branch trib.	Large wetland. High concentration of moose activity based on moose accidents along adjacent stretch of Rt. 114. Moose salt lick.
327	2.8	33	West Branch Passumpsic	West Branch trib. N. of West Burke	Several wetlands
314	1.3	31	West Branch Passumpsic	Roundy Bk. trib. along Carter Rd.	Medium-sized wetland

### Recommendations for Protection:

- Protect riparian areas through limiting development and clearing in 100' buffer along both sides of all streams
- Promote conservation easements on privately-owned forestlands along these significant stream reaches
- Protect/reforest the riparian buffer in the East Burke town park
- Public education/outreach focusing on stream and watershed values and protection
- Seek protection of state-significant cedar swamp and its rare species, and rare species downstream on the West Branch

### ***Riparian Areas Suitable for Restoration Map***

General Description: This map was created by mapping open lands (non-forested, undeveloped) within the 100' stream and riparian wetland buffer along the three main streams in town. The goal of restoration would be to reforest these riparian buffers with trees and shrubs that would naturally occur in these riparian habitats. A 100' buffer is recommended for large streams and adjacent riparian wetlands by the VT Agency of Natural Resources in their 2005 report: *Guidance for Agency Act 250 & Section 248 Comments Regarding Riparian Buffers*. As noted for the map of preceding Significant Stream Reaches map, full documentation of the numerous benefits for water quality, fisheries, and wildlife of riparian buffers and corridors can be found in VT Agency of Natural Resources' *Riparian Buffers and Corridors: Technical Papers*.

While 50' riparian buffers are given as a second option for smaller streams in the ANR reports, 100' is preferable on smaller streams in areas where hydric (wet) soils occur. Since there are extensive hydric soils mapped along Burke's small, headwater streams, 100' stream buffers are recommended for all streams in town.

Description of Riparian Areas Suitable for Restoration:

<b>Stream</b>	<b>Location</b>	<b>Total Acres</b>	<b># Areas</b>	<b>Description</b>
East Branch Passumpsic	Full length in Burke	26	16	One 8-ac. mapped wetland in field upstream from East Burke + several 240-2100' lengths of 100' buffer on both sides of river in same vicinity. Another concentration of 400-800' lengths of 100' buffer along w. bank at and upstream from Flower Bk. confluence
West Branch Passumpsic	West Burke village down to Hayden Rd.	18	9	One 6-ac. low field mapped as wetland/muck soil on east side of West Branch near village; + lesser areas downstream, including restoration of gravel pit slopes.
Calendar Brook	Full length in Burke	11	6	One 7-ac. field mapped as wetland, plus several small sections of open lands in the 100' buffer

Recommendations for Protection & Restoration:

- Begin reforestation on property of willing landowners within 100' (both sides of stream) riparian buffer zones in open areas depicted on the Burke Riparian Restoration Areas map, using trees and shrubs native to the habitat
- Do invasive plants control in these same riparian restoration areas
- Plan on long-term monitoring and multiple plantings in these restoration areas
- Promote conservation easements of these reforested riparian buffer zones
- Protect riparian areas through limiting development and clearing in 100' buffer along all streams
- Publicly promote riparian buffer reforestation by tree plantings along the East Branch in the East Burke town park
- Public education/outreach focusing on functions and values of riparian buffers and corridors

## SOURCES

*East Branch Passumpsic River Corridor Plan (1/1/2009)*, found at <https://anrnode.anr.state.vt.us/SGA/finalReports.aspx>

*Passumpsic River Water Quality Assessment Report (June 2009)*, found at [http://www.vtwaterquality.org/mapp/docs/mp\\_basin15.assessment\\_report.pdf](http://www.vtwaterquality.org/mapp/docs/mp_basin15.assessment_report.pdf)

Vermont Agency of Natural Resources, 2005. *Riparian Buffers and Corridors: Technical Papers*. Found at <http://www.anr.state.vt.us/site/html/buff/buffer-tech-final.pdf>

Vermont Agency of Natural Resources, 2005. *Guidance for Agency Act 250 & Section 248 Comments Regarding Riparian Buffers*. Found at <http://www.anr.state.vt.us/site/html/buff/BufferGuidanceFINAL-120905.pdf>

Vermont Fish & Wildlife Department, description of Contiguous Forest and town planning strategies for its protection, found at: [http://www.vtfishandwildlife.com/cwp\\_elem\\_land\\_cf.cfm](http://www.vtfishandwildlife.com/cwp_elem_land_cf.cfm)

## Appendix: GIS Mapping Layers for Contiguous Forest & Riparian Areas project, 2013

Area of Interest	Vector Layer	Use	Raster Layer	Use
<b>Contiguous Forest Blocks</b>	Contiguous Woodland0308.shp  EcologicalHabitatBLKS .SHP	Generate a data layer of contiguous forest. This was derived from using 2010 Bing Imagery and digitizing forested land that is not intersected by class 3 roads driveways and houses. The layer was then overlaid onto older existing data layer generated from ANR EcologicalHabitatBLKS consisting of 20 acres or more digitized from 1:100,000 scale. Our data set aligned with older Contiguous forest layer, with a few minor changes that were a result of higher resolution imagery, development and fragmentation. In other words retrofitted for the Town of Burke as opposed to the State of Vermont.	Contiguous Foresthab_Ras	Forest blocks were classified according to forest block size. The class values assigned were: 1 for under 100 acres. 2 for 100 to 500 acres. 3 for 500 to 900 acres and. 4 for over 900 acres, which consisted of 3 forest blocks.
			Burke_ContigForest weight raster.tiff Burke_Deer_WN_RAS Burke_Moosesalt_200m BURKE_Bearmast Acres Burke_Bear_Wetland Wetland_NWI_VSWI_MU CK_ADD_Ras BURKE_EO's BURKE_BICKNELLTHRUSH_200mRAS BURKE_NCs_STATE_SIG	This is a raster of weighted overlays of the following raster layers. The resulting pixel values represent a sum of. The higher the value then the more significant the area to conservation.
<b>Vermont Heritage Data</b>	AKN_Query _TWN.shp	Clipped from the State BicknellThrush geodatabase. There are 3 points located near the summit of Burke Mt. Each was buffered 100m to create polygons.	BURKE_BICKNELLTHRUSH_200mRAS	The image was classified into two classes: 0; no 1; yes; Bicknell thrush.
	Burke_Eos_Species _TWN.SHP  Burke_Eos_Species1 _TWN.SHP  Burke_Eos_Species2 _TWN.SHP	There are a series of 4 shp files that make up this data set.  Each data set was created to add weight to the different species, some of which shared the same spatial location.	BURKE_Eos_SPECIES _RAS  BURKE_Eos_SPECIES1 _RAS  BURKE_Eos_SPECIES2 _RAS	All images were classified with two classes: 0 for no presence and 1 for a presence.

	Burke_Eos_Species3_TWN.SHP		BURKE_Eos_SPECIES3_RAS	
<b>Hydrology</b>	Burke_Hydro_NHD.shp  Line	Clipped from the National Hydrological data set at the HUC 12 level. The data represents streams by reach and watershed. This data layer was then unioned to each the Alluvialsoils_merged_Buke.shp and the Burke_Riparian_wetlands_Merge.shp in order to calculate the cumulative wetland and alluvial soils by stream reach. Each reach was classified into the following classes: High > 88 acres Medium > 30 Acres Low > 10 Acres Insignificant < 10 Acres	No Raster data	
	nhdregion_wb_Burke_Lstreams.shp	Both Calendar Brook and E. Branch clipped from Nat. Hydrological data, then redigitized over 2010 imagery	No raster data	100' buffer of these 2 large streams calculated from these polygons for use in the Restoration Acres mapping.
	Water_WBD12VT_poly	This is the HUC 12 level of watershed that represent those watersheds that ultimately have some impact on the Town of Burke. The most influential of the six watersheds are the East and West branch of the Passumpsic river	No Raster data	
<b>Soils</b>	BURKE_MUCK_SOILS	Generated from the selection of muck type soils from the NRCS soils layer available from VCGI.	No Raster data	
	BURKE_SOILS.Shp	NRCS soils layer	No Raster data	
	Alluvialsoils_merged_Burke  Polygon	Extracted alluvial soils, clipped to Town of Burke and polygons merged. Polygons then edited to reflect stream reach id which was added to the field REACH_ID and then Unioned with NHD streams in order to populate the fields of NHD_Level and _NHD_Name and NHD_meters in the data layer. ACRES field was also calculated in order to be able to generate number of acres by stream reach.		
<b>Wetlands</b>	BURKE_NWI_VSWI  Polygon	Generated from the union of both the National Wetlands inventory and the Vermont State Wetlands inventory. Each data set and attributes were merged into one data set and overlapping polygons were dissolved. There is some discrepancy as the spatial accuracy of this data set as they are coming from two data sources.	No Raster data	
	Wetlands_NWI_VSWI_MUCK.shp	The Burke_NWI_VSWI was merged with the BURKE_MUCK_SOILS shp (See Soils section above for more description on this layer) files to gain a	Wetlands_RAS	Values were assigned to this image of 0; Not a Wetland 1: Wetland

		representation of all possible wetlands.		
	WETLANDS_NWI_VSWI_MUCK_Additiona_TWN_Clip.shp	Several wetlands obvious on 2010 imagery and known by B. Engstrom were added to the preceding wetlands shapefile to create this most complete Burke wetlands layer, clipped to town of Burke.	WETLANDS_NWI_VSWI_MUCK_ADDIT_RAS.tif	Used as an additional significance feature in Contiguous Forest Block map and for riparian wetlands in Significant Stream Reach map.
<b>Riparian</b>	Burke_Riparian_wetlands_Merge	Generated from the NWI and VT WI. The data layer was edited to the NHD streams and fields assigned. Polygons then edited to reflect stream reach id which was added to the field REACH_ID and then Unioned with NHD streams in order to populate the fields of NHD_Level and _NHD_Name and NHD_meters in the data layer. ACRES field was also calculated in order to be able to generate number of acres by stream reach.		
	BURKE_Riparian_RestorationAcres.shp	Digitized open areas within 100' buffer of NHD streams & riparian wetlands, except for East Branch and Calendar Brook where buffer created from nhregion_wb_Burke_Lstreams.shp		
<b>Wildlife</b>	BURKE_DEER_WN.shp	This layer was clipped to the Burke Town boundary from the ANR deer winter habitat layer. There are four polygons that are within Burke representing about 1,000 acres of deer winter habitat within the town boundary.	BURKE_DEER_WN_RAS.shp	The image was classified as: 0; No Deer Hab 1; Deer Hab
	Ecological_DeerWn.shp	ANR Statewide coverage of all deer winter habitats.	No Raster layer	
	BURKE_DEER_WN.shp	Deer winter yards clipped to town of Burke	BURKE_DEER_WN_RAS	The image was classified as: 0; No Deer Hab 1; Deer Hab
	Bear_mast.shp	Statewide point data from VFWD. 2 points, converted to polygons based on acreage in description		
	BURKE_BEARMast_Acres	Bear mast clipped to the town of Burke	BURKE_BEARMastAcres_RAS	The image was classified as: 0; No Bear Mast 1; Bear Mast
	bear_wetland.shp	Statewide point data from VFWD. 1 point in Burke converted to polygon based on acreage in description		
	BURKE_BEARwetlandAcres.shp	Bear wetlands clipped to Town of Burke.	BURKE_BEARWETLANDSAcres_RAS	The image was classified as: 0; No Bear Wetland 1; Bear Wetland
	moose_salt_licks.shp	Statewide point data from VFWD. 2 points, converted to polygons		
	BURKE_MOOSEsalt_200m.SHP	Moose salt areas clipped to Burke and buffered 200 meters.	BURKE_MooseSalt_200m_RAS	The image was classified as: 0; No Moose salt area 1: Moose salt area.

<b>Base Layers</b>	BING Aerial Photography		Available through the ESRI ArcGIS Desktop server.	
	USGS topographic maps		Available through the ESRI ArcGIS Desktop server.	
		Spatial data reviewed, but with no data found in Burke		
	Amphibian_Reptile.shp	Statewide point data from VFWD. No data in Burke.		
	bear_nuisance.shp	Statewide point data from VFWD. No data in Burke.		
	bobcat_crossing.shp	Statewide point data from VFWD. No data in Burke.		
	bobcat_wetland.shp	Statewide point data from VFWD. No data in Burke.		
	bear_collision.shp	Statewide point data from VFWD. 2 points along highways in Burke		
	bear_crossing.shp	Statewide point data from VFWD. 3 points in Burke: 2 along Pinkham Rd., 1 along Mountain Rd.		
	Bobcat_den	Statewide point data from VFWD. 1 point 170m outside Burke. Point converted to polygon, then polygon clipped to Burke town line	Not used	
	med_zone.shp	Statewide polygon data from VFWD reflecting (moose activity zones??). Single 11,669-ac. polygon in Burke	Not used	
	moose_high_zone.shp	Statewide polygon data from VFWD. One 2747-ac. polygon in Burke. Reflects area along Rt. 114 with high moose collisions.	Not used	
	moose_rds_high_full.shp	Not used		
	moose_rds_med_full.shp	Not used		
	roadkill(2004).shp	Statewide point data from VFWD. Moose and bear roadkills in Burke covered in individual species' collision data.		