Appendix A5

Mammal SGCN Conservation Reports

Vermont's Wildlife Action Plan 2015

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Unknown
Extirpated in VT? NA **Regional SGCN?** no

Assessment Narrative:

The trend of the cinereus (masked) shrew in Vermont is unknown. Historic records indicate a widespread distribution of the species in the state. Since 2008, during an effort to develop a small mammal atlas, the masked shrew was verified at 28 sites in Vermont further supporting the belief that the species continues to be widely distributed throughout the state. Although it may be the most common of the small shrews, it is still believed to be relatively rare at most locations and there is insufficient data on this species in Vermont to fully assess its status. The masked shrew may be more common at higher elevations but the overall role of elevation on the species distribution remains unclear. It is believed that masked shrews are more common in old growth or late successional forests.

Distribution

Considered rare though broadly distributed.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

Masked shrews are know to favor cool mesic deciduous and coniferous forests often at higher elevations. They are sometimes found in mixed habitat types such as edges of bogs and other cool and wet sites (seeps). The masked shrew uses grasses, rocks, and logs or stumps for cover. They are primarily carnivorous and insectivorous consuming worms, spiders, snails, slugs, and small amounts of vegetable matter. Dampsness of site and depth of leaf litter, seems to be critical factors in determining habitat use. The species is known to utilize down woody debris. Its home range is understood to be less than 0.5ha.

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

Habitat Types:

Upland Shores

Outcrops and Alpine

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Open Peatlands

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Habitat Alteration

Climate Change

Description of habitat threat(s): Climate changes, habitat alterations/degradations, and/or habitat conversions resulting in overall drier conditions may significantly limit the species in Vermont. Although it is speculated that the direct impacts of energy infrastructure development (e.g. industrial wind power projects) could result in the reduction of upper elevation spruce fir habitats used by this species, more

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

research is needed to determine just how severe this impact would be on Vermont's population of maksed shrews.

Non-Habitat Threats:

Competition

Pollution

Loss of Prey Base

Description of non-habitat threat(s): Previous studies indicate that competition from other shrews may pose a significant risk to masked shrews. Furthermore, there is concern that acid rain could alter the ecology of soil invertebrates resulting in adverse impacts to the prey prey base upon which this species depends.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Attempt to narrow down habitat requirements and determine critical habitat needs of the masked shrew.
Research	Basic Life History	Low	Determine basic life history and population demographics
Research	Distribution and Abundance	Medium	Determine distribution and abundance of the masked shrew and maintain a database of known locations.
Monitoring	Population Change	Medium	Analyze habitat conditions and local populations prior to construction of upper elevation wind generating faciiities
Monitoring	Monitor Threats	Medium	Monitor know populations, e.g. Camels Hump spruce-fir zone, to detect any significant population changes related to climate change

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	High	Conduct research to determine impact of warming, especially as it relates to drying of habitats	Amount of forest habitat protected	UVM, Middlebury, Johnson State College	SWG
Compatible Resource Use	High	Minimize habitat fragmentation	Amount of forest habitat protected from development	VFPR, GMP, UVM, TNC	EQIP, SWG
Standards	Medium	Minimize fragmentation (the permanent conversion of habitat as a result of development) between populations in core habitats. Maintain habitat mosaic	Number of travel corridors identified and protected	UVM, Middlebury, Johnson State College	SWG
Standards	Medium	Determine appropriate management strategies to improve and conserve habitat	Number of habitats identified and protected.	VFPR, USFS, Coverts	SWG

Common Name: **Cinereus or Masked Shrew**
Scientific Name: **Sorex cinereus**
Species Group: **Mammal**

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Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5
State Rank: S3
Extirpated in VT? no

Global Trend:
State Trend: unknown
Regional SGCN? yes

Assessment Narrative:

There is very limited information regarding the water shrew in Vermont. Fifty seven specimens have been taken since 1915 from 21 different localities throughout the state including two specimens collected since 2008 as part of the effort to develop a statewide small mammal atlas. Historic records of this species' occurrence in the state indicate that there may be limited at risk populations.
The species is listed as a high priority because not a lot is known about it in the state and because of its very specific habitat requirements. Although there is no evidence of a decline in the state at this time, a number of potential limiting factors have been identified including changes in natural water flow regimes resulting from climate change, dams/flow regulation, inadequate riparian buffers, atmospheric deposition and acid rain, loss of habitat, and potential loss of prey base. Furthermore, there are taxonomic uncertainties and speculation exist that it may actually be more than one species.

Distribution

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The water shrew is found in undercut banks of streams and beaver dams. It is assumed that wooded buffers on streams are desirable and there is a recognition that wooded wetlands and streams are utilized more often than cattail dominated wetlands. Mesic forests are believed to be important. Although the water shrew has been trapped on dry creekbeds, it may prefer streams that flow year-round. DeGraaf (2001) suggests that coniferous forests are preferred over deciduous forests. Whitiker & Hamilton (1998) found this species on mud flats of sluggish backwaters. It is believed that habitats adjacent to water, particularly fast cold streams, may hold the largest populations. Critical habitat appears to be undercut banks of streams and possibly beaver dams.

Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Floodplain Forests

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Aquatic: Fluvial

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Inadequate Disturbance Regime

Impacts of Roads or Transportation Systems

Description of habitat threat(s): Alteration or conversion of riparian buffers as a result of certain forest management and development practices could degrade key habitat requirements of the water shrew and impact its survival and productivity. Similarly, alterations of natural water flow regimes resulting from climate change could pose significant impacts on the species. The lack of baseline data on the distribution, abundance and basic life-history of water shrews in Vermont prevents a comprehensive assessment of the threats facing the species.

Non-Habitat Threats:

Pollution

Loss of Prey Base

Description of non-habitat threat(s): It is believed that the species' prey base could be impacted by the effects of acid rain.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	Assess habitat at historical sites and sample for species.
Research	Basic Life History	High	Sample stomach contents to determine prey preferences.
Research	Distribution and Abundance	High	Develop baseline data on distribution and abundance
Research	Threats and Their Significance	High	Identify key limiting factors to this species.
Research	Population Genetics	High	Determine the extent of gene flow in the state.
Research	Taxonomy	High	Determine whether or not this is a single species.

Common Name: **Water Shrew**
Scientific Name: **Sorex palustris**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Minimize trail or road intrusion into wetlands or riparian buffers.	Miles of riparian buffers and acres of wetlands intact and protected	NRCS, USFWS, VLT, FSA, Coverts	EQIP, SWG, CREP,
Habitat Restoration	High	Enhance or restore degraded wetlands and repair buffers	Number of habitats maintained or improved	NRCS, DEC Wetlands, VT Rivers Conservancy	SWG, EQIP
Habitat Restoration	High	Identify and maintain rich wetland habitats and stream buffers.	Number of habitats identified and maintained	FVPR, NRCS, VLT, Coverts	EQIP, SWG

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Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S4
Extirpated in VT? no

Global Trend:
State Trend: unknown
Regional SGCN? Yes

Assessment Narrative:

The smoky shrew is listed as a Regional Species of Greatest Conservation Need (RSGCN) among the 13 Northeastern states. Although the status of the smoky shrew in Vermont is poorly understood, the few records of its occurrence in the state indicate that the species is more limited in numbers than masked shrews. Compared with other relatively abundant shrews, the smoky shrew has more specific habitat requirements.

Distribution

Confident everywhere but Taconic Mountains and the Vermont Valley where it is unknown

Distribution by Biophysical Region:

Champlain Valley	Unknown	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The smoky shrew often occupies damp, boulder-strewn, upland woods (DeGraff and Yamasaki 2001). It is found in cool mesic forests, often conifer, that are shady with deep, loose, leaf litter and is often associated with higher elevation sites with damp, moss covered rocks. Smoky shrews are also typically found along streams with moss covered banks (DeGraff and Yamasaki 2001). The dietary niche of the smoky shrew is broader than that of other shrews. Although it is 80 % insectivorous, it will also eat earthworms, spiders, snails, salamanders, small mammals, and birds. (Brannon 2000). The smoky shrew uses tunnels made by other animals for nesting as well as beneath stumps and rotten logs. It is also known to use downed woody debris for cover and foraging. Loose damp leaf litter may be critical to habitat use.

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

Habitat Types:

Outcrops and Alpine

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Softwood Swamps

Seeps and Pools

Open Peatlands

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Early Succession Northern Hardwoods

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Description of habitat threat(s): The conversion of forest to non-forest habitat is thought to be a potential impact on smoky shrews. Similarly, the construction of upper elevation wind energy facilities causes major habitat conversion from areas of moist, boulder strewn, and loose humus conditions favored by these shrews to dry warm sites, including roadways, avoided by them.

Non-Habitat Threats:

Competition

Pollution

Loss of Prey Base

Description of non-habitat threat(s): Competition and predation from other shrews (Blarina brevicanda) may be a problem.
Acid rain may reduce invertebrate prey base.

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Determine critical habitat needs in Vermont. Narrow the habitat requirements. Are there areas within available habitats where species are concentrated.
Research	Basic Life History	Low	Determine the basic life history requirements.
Research	Distribution and Abundance	Medium	Determine distribution and abundance in Vermont.
Research	Threats and Their Significance	Medium	Determine the significance of potential impacts resulting from wind industry developments and other disturbances of preferred habitats, competition with other shrews, and pollution.
Monitoring	Population Change	Low	Monitor population changes in high elevation sites planned for wind energy development before and after construction.
Monitoring	Habitat Change	Low	Monitor changes to and availability of identified critical habitats in Vermont.
Monitoring	Range Shifts	Medium	Monitor distribution and abundance in Vermont to assess range shifts.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Protect stream buffers sufficient to maintain a mesic environment	Miles of riparian buffers intact and protected	NRCS, VLT, Coverts	EQIP, SWG
Habitat Restoration	High	Maintain prey base	Identification of prey use, abundance and distribution	UVM, Middlebury, Johnson State College	SWG
Compatible Resource Use	Medium	Identify and maintain rich mesic habitats	Number of habitats identified and maintained	Vermont Forest and Parks Dept., USFS, Coverts	SWG

Common Name: **Smoky Shrew**
Scientific Name: **Sorex fumeus**
Species Group: **Mammal**

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Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4
Global Trend:
State Rank: S2
State Trend: unknown
Extirpated in VT? No
Regional SGCN? yes

Assessment Narrative:

The long-tailed shrew (rock shrew) is listed as a Regional Species of Greatest Conservation Need (RSGCN) among the 13 Northeastern states. It is further listed as an S2 species in Vermont. The long-tailed shrew is currently listed as a C-2 species by the USFWS indicating the species may be endangered or threatened but insufficient information is currently available to allow preparation of rules for listing the species. The total number of known occurrences in the state is 32 (Tumosa 2001, Chipman 1994, Kilpatrick and Benoit 2011, VT Natural Heritage database). Eleven specimens of the long-tailed shrew were obtained between 2008 and 2011 as part of the development of a small mammal atlas in Vermont. Two of the specimens collected during this effort provided the first records of existence in the Northeastern Highlands Biophysical Region and in Orange County. Eleven specimens were collected prior to 1940, one specimen was taken on Camels Hump in 1968, six specimens were obtained between 1972 and 1989, and three long-tailed shrews were captured at sites in the Northern Green Mountains biophysical region in 1994.

It is believed that the long-tail shrew occurs in limited, localized, at-risk populations however current data is to limited to fully assess the species' status. In Vermont, the species is also believed to be primarily associated with talus slopes and is only occasionally found in association with mountain streams and never in large forest openings such as clearcuts (Kilpatrick and Benoit 2011).

Distribution

The long-tailed shrew was historically found in the prominent talus habitat located along the western slopes of the Southern Green Mountains in Mendon and Wallingford (Rutland County) and was further documented to occur on Camel's Hump (Chittenden and Washington Counties) however no recent records of their occurrence in these locations exist. More recently, the species has been reported from the talus dominated habitats found on Mount Mansfield (Chittenden and Lamoille Counties), Wheeler Mountain (Caledonia County), West Mountain (Essex County) and Mount Ascutney (Windsor County). The long-tailed shrew has also been reported from the Champlain Hills since 1990 and was documented in the towns of Jericho and Vershire.

Distribution by Biophysical Region:

Champlain Valley	Not Probable	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Not Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Historic Records Only
Northern VT Piedmont	Confident	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☐

The long-tailed shrew prefers cold, mesic forests and is typically found in close proximity to streams having undercut banks. The species often inhabits cool, talus slopes and moss covered boulders and logs. It is believed that moss covered rocks and logs provide critical shade and protective cover. Similarly, forested talus slopes are also believed to be an important habitat feature where long-tailed shrews spend most of their time in the labyrinth of spaces between rocks about a foot beneath the surface (Kirkland 1981). Although generally associated with coniferous forests, the long-tailed shrew may also be found in deciduous and mixed forest types. May be associated with rock vole.

Habitat Types:

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Incompatible Recreation

Climate Change

Description of habitat threat(s): Ski trails and associated structures could impact the habitat of the long-tailed shrew. Conversion of habitat as a result of quarrying activities could also destroy critical rocky, talus habitat.
Climate Change may significantly warm and dry the moist talus slopes favored by these shrews. In addition, the upper elevation development of wind energy facilities could result in the conversion of suitable long-tailed shrew habitat to a more open, bare rock and/or grass dominated habitat.

Non-Habitat Threats:

Genetics

Pollution

Loss of Prey Base

Description of non-habitat threat(s): Change in prey base due to acid rain deposition at high elevations. Shrews feed on invertebrates and therefore may accumulate pesticides and heavy metals in body tissue (Tumosa 2001). Mining, mercury deposition, and the application of sewage sludge can all negatively affect long-tailed shrews due to a build up ot toxins in the body. Furthermore, because the species is believed to occur in limited, localized, at-risk populations, there is a risk of reduced survival and fecundity due to inbreeding depression.

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	Identify habitats critical for the perpetuation of the species
Research	Basic Life History	High	Determine home range and other life history needs.
Research	Distribution and Abundance	High	1) Determine distribution and abundance in a multi year monitoring effort. 2) Re-census historical habitats and survey in other likely habitats. 3) Map confirmed habitats.
Research	Threats and Their Significance	High	Determine significane of environmental toxicity on preferred prey base and survival.
Research	Population Genetics	High	Determine the isolation of existing populations and the need for the protection of movement corridors.
Monitoring	Population Change	Medium	Determine current status of the population and monitor changes to this population through the future.
Monitoring	Habitat Change	High	Monitor populations near or adjacent to high elevation development to determine long range changes.
Monitoring	Range Shifts	High	Monitor current populations to determine any change due to climate change.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Ensure that ski trail development and maintainance and energy development follows best management practices.	Number of habitats protected	VFPR, GMP, Ski Areas	SWG
Privately-Owned Protected Areas	High	Minimize fragmentation (the permanent conversion of habitats as a result of development) between populations in core habitats	Number of travel corridors identified and protected.	TNC, VLT, Coverts, VHCB, VFPR	SWG, VHCB
Habitat Restoration	High	Determine appropriate management strategies to improve and conserve habitat.	Number of Habitats identified and protected	TNC, University of Vermont, Middlebury College, VFPR	SWG

Common Name: **Long-tailed or Rock Shrew**
Scientific Name: **Sorex dispar**
Species Group: **Mammal**

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Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5
State Rank: S2
Extirpated in VT? no

Global Trend:
State Trend: Unknown
Regional SGCN? No

Assessment Narrative:

The pygmy shrew is listed as an S2 species in Vermont. The species appears to be rare in the state based on the scarcity of occurrence records though this could be due to survey methods. The pygmy shrew is hard to catch and difficult to identify so it may be more abundant than records would suggest. Very little is known about the historic population of this species in Vermont.

Distribution

Very few records of occurrence of pygmy shrews exist in Vermont. Furthermore, the species was not detected during a state wide small mammal survey conducted between 2008 and 2010 (Kilpatrrick and Benoit, 2011).

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Probable
Champlain Hills	Confident	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Habitat requirements of the pygmy shrew are relatively unknown. It is believed that mesic forests and fields are used but it has also been recorded in swamps and marshes. Critical habitat is often listed as boreal forests where wet and dry areas occur together. Disturbed sites and cultivated areas with leaf litter and downed logs may also be important habitats for pygmy shrews. The species is believed to require moist leaf mold near water (DeGraff and Yamasaki, 2001) and is typically found within 100 yards of water. There is no evidence in the literature that it prefers any particular forest age class. It was found in 4 different age classes of cove hardwood stands in southern Appalachia (Ford et al. 1996 in Tumosa 2001).

Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

Habitat Types:

Northern Hardwood

Hardwood Swamps

Marshes and Sedge Meadows

Early Succession Boreal Hardwoods

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Succession

Habitat Alteration

Description of habitat threat(s): The distribution and abundance of pygmy shrews in Vermont, as well as the species' specific habitat requirements, are poorly understood. Therefore, additional information is required before a comprehensive threat assessment can be completed.

Non-Habitat Threats:

Loss of Prey Base

Description of non-habitat threat(s): It is speculated that changes to habit resulting from succession, alteration and/or conversion could result in the diminishment of the species' prey base.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	Collect baseline data on habitat use and identify critical habitats
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance

Common Name: **Pygmy Shrew**
Scientific Name: **Sorex hoyi**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Protect, through voluntary management practices, habitat from wetland, to grassland to forest.	Monitoring and demonstrating use of these habitats	NRCS, VLT, Coverts, Consulting Foresters	EQIP, SWG,
Habitat Restoration	Medium	Restore any missing habitats identified above.	Shrew restoration and use of restored habitats.	UVM, Middlebury, Johnson State College	SWG
Compatible Resource Use	Medium	Identify and maintain a mosaic of habitats	Number of habitats identified and maintained	VFPR., USFS, Coverts	SWG
Research	High	Determine habitat requirements and distribution	Development and adoption of habitat guidelines for the species	UVM, VFWD	SWG

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Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regional SGCN?** Yes

Assessment Narrative:

The hairy-tailed mole is listed as a Regional Species of Greatest Conservation Need (RSGCN) among the 13 Northeastern states.
Believed to be relatively common, but population status and trends are unknown. The Vermont Small Mammal Atlas verified distributional records in Orleans, Essex, Chittenden, Caledonia, Addison, Washington, Windsor, and Windham counties based on results of surveys (for herps), incidental pick up or photographs of dead specimens, and from voucher specimens at the Zadock Thomson Natural History Collection at the UCMM (Kilpatrick and Benoit 2011). Little is known about this species' status and habitat requirements. Loss of habitat with sandy and sandy loam soils is a concern

Distribution

The Vermont Small Mammal Atlas verified distributional records in Orleans, Essex, Chittenden, Caledonia, Addison, Washington, Windsor, and Windham counties based on results of surveys (for herps), incidental pick up or photographs of dead specimens, and from voucher specimens at the Zadock Thomson Natural History Collection at the University of Vermont (Kilpatrick and Benoit 2011).

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Historic Records Only
Northern Green Mtns	Probable	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Historic Records Only
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☐

Found in all places with well-drained sandy loam soils (e.g. agricultural fields and older forests). Open deciduous woodlands with thick humus are preferred. Hairy tailed moles are also adapted to second growth stands, old fields, and hedgerows. They prefer well-drained, light, moist soil with well-mixed organic matter and minerals and avoid soils that are hard, dry, or with a large clay content. Species is not restricted to any one habitat type or successional stage (Hallett 1978).

Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Current Threats

Habitat Threats:

Conversion of Habitat

Unknown Habitat Threats

Description of habitat threat(s): Conversion of required habitats to houses, roads or other development may negatively impact the species..

Non-Habitat Threats:

Trampling or Direct Impacts

Description of non-habitat threat(s): Because of human/mole conflicts proximity to humans can result in decline. The application of pesticides/rodenticides may also cause localized population declines, particularly in orchards. The status of the species in forested habitats is unknown.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Collect baseline data on habitat requirements.
Research	Distribution and Abundance	Medium	Collect baseline data on distribution and abundance.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Develop guidelines for pest control professionals for the non-lethal control of the species	Number of trained pest control professionals	Agricultural Extension, Pest Control Professionals	SWG
Research	Medium	Monitor distribution and abundance of species	Distribution map	Agricultural Extension, UVM, Pest Control Professionals	SWG

Common Name: **Hairy-tailed Mole**
Scientific Name: **Parascalops breweri**
Species Group: **Mammal**

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Common Name: **Little Brown Bat/Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G3
Global Trend:
State Rank: S1
State Trend: Stable
Extirpated in VT? No
Regional SGCN? Yes

Assessment Narrative:

The Little Brown Bat/Myotis has been identified as a Very High Concern Regional Species of Greatest Conservation Need. Before White-nose Syndrome, the little brown bat was considered to be relatively common and was one of the most frequently captured bat species in state-wide surveys. The Little Brown Bat/Myotis relies heavily on human dwellings as maternity sites and less frequently uses trees. Both maternity colony habitat and winter hibernacula are vulnerable and at risk. Every year bats lose hundreds of possible building roosts as a result of exclusion and eviction or the actual removal of old barns and other structures. Although Little Brown Bats/Myotis are known to hibernate in slightly greater than 20 sites in Vermont, the vast majority of the population hibernates in a single cave. This species is also impacted by the removal or killing of bats in structures, as well as recreational spelunking in hibernacula. Little brown myotis have experienced population declines of 90% in Vermont due to White-nose Syndrome (Darling and Smith 2011) and have experienced similar or greater mortality rates region-wide (Turner et al. 2011). The state-wide population is a fraction of what it once was and concentrated gatherings of bats at maternity colonies are particularly vulnerable to incidental mortality as evidenced by citizen reports of up to 23 bats found dead in a furnace in one summer after they flew down the chimney, probably in search of a warm roost. Trend information is needed on this species in the years following White-nose Syndrome to determine whether populations will recover from the disease.

Distribution

Distribution, including both maternity colonies and dispersed males, was historically statewide from spring through early fall before the massive population declines caused by White-nose Syndrome (WNS). Little Brown Bats/Myotis migrate to their winter hibernacula both in Vermont and in neighboring states such as New York. This species has been histrically documented at nearly every known bat hibernacula in the state. In the years following WNS, maternity colonies appear to be concentrated in the greater Champlain Valley and northern Taconic Mountains and a few in the Southern Vermont Peidmont, though males and non-reproductive females likely still exist state-wide according to acoustic survey data.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Little Brown Bat/Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

During the winter Little Brown Bats/Myotis hibernate in caves with a constant temperature of 40 degrees F and a relative humidity of 80% (Banfield 1974: 42 in DeGraff and Yamasaki, 2001). Little Brown Bats/Myotis often hibernate in large clusters. To prevent dehydration they awaken every ten to fourteen days to consume water. This is thought to act as a buffer against water loss, enabling longer hibernation between arousals (Sanders 2004). During the summer the Little Brown Bat/Myotis often inhabits attics where the temperature may average 100 degrees (Chenger 2004). Females form large nursery colonies that numbered in the hundreds or even thousands of individuals before White-nose Syndrome. Capture data and citizen reports indicate that males spend the summer months scattered around the state, either solitary or in small bachelor groups in buildings or trees. Colonies usually exist close to water because little brown bats seem to prefer to forage over water. When foraging, the bats may repeat a set hunting pattern within a few miles of the roost (Chenger 2004). Little brown bats eat moths, wasps, gnats, crane flies, and beetles. Young are born in May, June, or early July. Average litter size is one (Davis and Hitchcock 1965).

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Hardwood Swamps

Marshes and Sedge Meadows

Shrub Swamps

Subterranean

Building or Structure

Mine

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Wet Swales and Ditches

Powerlines/RR/Roadsides

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Incompatible Recreation

Common Name: **Little Brown Bat/Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Description of habitat threat(s): Disturbance in hibernacula reduces fat reserves and negatively affects reproduction and survivability. In addition, every year Little Brown Bats/Myotis lose hundreds of possible building roosts due to exclusion or the actual destruction of buildings. Direct killing of bats is common due to human fears about rabies, bat bites and histoplasmosis.

Non-Habitat Threats:

Genetics

Disease

Description of non-habitat threat(s): The Little Brown Bat/Myotis has suffered population declines upwards of 90 in Vermont and the Northeast (Turner et al. 2014) and White Nose Syndrome continues to be a threat. Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	Continue the maternity colony location and monitoring program to plot changes in distribution, abundance, and population size in the years following White-nose Syndrome.
Research	Threats and Their Significance	Medium	Research and quantify the effect of evicting from or incidentally taking maternity colonies in structures on reproductive success.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Medium	Research the effectiveness of bat houses for maternity colonies evicted and excluded from buildings.
Monitoring	Population Change	High	Monitor changes in popluation size in the years following White-nose Syndrome.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Investigate observed post-WNS range shifts from state-wide occurences of maternity colonies to concentrations in the Champlain Valley.
Monitoring	Monitor Threats	High	Monitor the continued population effects of White-nose Syndrome and cooperate on research about individual survivors.

Common Name: **Little Brown Bat/Myotis**
Scientific Name: **Myotis lucifugus**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Technical Assistance, Training, Learning Networks	High	Train nuisance wildlife control operators (NWCOs) in proper bat exclusion techniques. Work with homeowners/landowners to safely exclude bats and erect bat houses for displaced colonies.	Implemement Best Management Practices and train nuisance wildlife control operators.	Wildlife Rehabilitators, NWCO's, Homeowners associations	USFWS, PR
Habitat Restoration	High	Maintain at least 20 maternity colony sites and a minimum of 10,000 adult females.	Number of maternity sites and bats protected	Coverts, Vermont Woodlands Magazine, NWF, UVM, Mammals subcommittee of ESA,	SWG, PR USFWS, WNS
Habitat Restoration	High	Protect hibernacula containing 100 or more little brown bats	Number of hibernacula protected	Vermont Cavers Assoc., UVM, TNC, VLT, Coverts	USFWS, TNC, VLT

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Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G2
Global Trend:
State Rank: S1
State Trend: Stable
Extirpated in VT? No
Regional SGCN? Yes

Assessment Narrative:

The Indiana bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. Indiana bats are listed as endangered in Vermont. They have declined range wide by 60% since monitoring began in the 1960's. Historic numbers were estimated at 800,000 in the late 1960's and by 1997 the range wide population was down to 350,000 (USFWS, 1999 in Sanders, 2004). Surveys in the 2000's indicated that regionally the population was rebounding and may have been increasing until the deadly fungal disease, White-nose Syndrome (WNS), was found in the state. Nationally, declines could have been related to disturbance in hibernacula and more recently in the northeast this species has suffered mass mortality from WNS (Turner 2011). Limited dispersal may be a problem for pregnant females. Vermont is the only New England state known to harbor maternity colonies. Radio-transmittered Indiana bats roosting in the Champlain Valley come from hibernacula in New York (Sanders, 2004). Because the majority of Vermont's summer population is believed to hibernate in a single abandoned mine in Essex County, New York, they are especially vulnerable to disturbance and disease transmission. In Vermont in the1940-50s, Indiana bats were reported in the 1000s in hibernacula. Historic hibernacula included the Plymouth Caves, Nickwacket Cave, Dorset Cave, and the Ely Copper Mine. Currently, Vermont has two hibernacula used by Indiana bats: Brandon Silver Mine (3 bats in 2011) and Little Skinner Hollow (53 bats in 2013). This species has high interannual fidelity to roost sites and is vulnerable to habitat fragmentation.

Distribution

The Indiana bat is distributed throughout the lower Champlain valley and northern Taconic Mountains duiring the summer, with populations concentrated around roost trees and maternity colony sites. Small numbers of this species hibernate in Vermont, though most of the Champlain Valley population is knows to hibernate across the Lake in a large abandoned mine in NY state. Hibernacula: Brandon Silver Mine, owned by The Nature Conservancy (TNC); Dorset Cave, gated and owned by TNC. Skinner Hollow, unprotected and privately owned. private ownership. Nickwackett Cave, gated and privately owned.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Not Probable
Champlain Hills	Not Probable	**Vermont Valley**	Not Probable
Northern Green Mtns	Not Probable	**Southern Green Mtns**	Historic Record(s) Only
Northern VT Piedmont	Historic Record(s) Only	**Taconic Mtns**	Confident
Northeastern Highlands	Not Probable		

Distribution by Watershed:

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

Maternity roosts are in large diameter shaggy hardwoods with sloughing bark (maple, shagbark hickory, poplar) or snags. Indiana bats roost under loose or peeling bark or in crevices and require nearby water (within a few hundred meters) to forage over. Colonies typically select one or more primary roost tree that receives direct sunlight for most of the day. Additional alternate roost trees may be shaded or in the open. During the winter months Indiana bats hibernate and require caves with a specific microclimate. Cave conditions that include cool, stable temperatures are preferred. Roost sites that are below 10 degrees Celsius when they arrive and 3-6 degrees in mid-winter allow for population increases (Tuttle and Kennedy, 2002 in Tumosa, 2003). Relative humidity above 78% but below saturation is also important. It appears that there is fidelity to the hibernaculum. Indiana bats in Kentucky travel over 300 miles to maternity areas in Michigan (Kurta and Murray, 2000 in the Vermont bat conservation plan). They have also been documented flying over 20 miles in one hour during migration (Sanders and Chenger, 2001in the Vermont bat conservation plan). Indiana bats are insectivorous, eating mostly flies, moths, beetles, and caddis flies. Mosquitoes, midges, bees and other flying insects are also consumed (USFWS, 1999 in Tumosa, 2001). During the swarming period, the area within 0-2 miles of the hibernaculum is critical for foraging and night roosting; 2-5 miles is important, and 5-10 miles gets used but not as frequently. Connectivity between habitats may be important but is poorly understood.

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Seeps and Pools

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Subterranean

Mine

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Powerlines/RR/Roadsides

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Habitat Alteration

Incompatible Recreation

Climate Change

Description of habitat threat(s): Disturbance of winter hibernacula is a significant problem to Indiana bats. These bats have been documented to lose 15-20% of their body weight during hibernation in an undisturbed hibernaculum (Johnson et al. 1997, in Sanders, 2004). Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al. 1990, Thomas 1995). Changes in temperature and light, as well as direct contact, can cause a bat to awaken and deplete stored fat reserves. Alterations to cave and mine openings can change the microclimate of a hibernacula and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Maternity roosts can house several hundred individual bats. Felling of a maternity roost tree can impact the survival of both adults and young. Development within close proximity of hibernacula, particularly along travel corridors could also be detrimental to survival. Destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003).

Non-Habitat Threats:

Genetics

Disease

Loss of Prey Base

Description of non-habitat threat(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	Refine knowledge of maternity roost tree characteristics.
Research	Basic Life History	Medium	1) Determine the summer range of bats that use VT hibernacula. 2) Assess the degree of local recruitment to determine if are Vermont populations reproducing.
Research	Distribution and Abundance	Medium	Monitor changes in distribution and abundance in the years following White-nose Syndrome.
Research	Threats and Their Significance	Low	Determine what other factors besides habitat loss and White-nose Syndrome influence population trends.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	High	Learn more about the role of Vermont hibernacula in the region
Monitoring	Population Change	High	Monitor population trends in the years following White-nose Syndrome to determine if the species continues to decline.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	High	Investigate range shifts associated with summer habitat and roost tree loss in the Champlain Valley.
Monitoring	Monitor Threats	High	Monitor the continued population effects of White-nose Syndrome and cooperate on research about individual survivors.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Privately-Owned Protected Areas	High	Protect at least four USFWS Level I or II hibernacula in Vermont or New York	Number of hibernacula protected.	UVM, USFS, Cavers Organizations, TNC, NY DEC	SWG, USFWS, NYDEC
Protected Area Management	Medium	Maintain and protect all maternity roost trees that support over 100 adults. Conserve summer foraging habitat that supports 2500 adults.	Number of roost trees identified and protected. Acres of foraging habitat conserved.	UVM, Coverts, Cavers, TNC, NY DEC,	SWG, USFWS, NYDEC
Research	Medium	Collect distribution and abundance data through the Northamerican Bat Monitoring Project (NABat) to contribute to range-wide trend information over time.	Number of NABat randomized grid cells surveyed each year.	USGS, USFWS refuges, USFS, National Parks, FPR	ENDG, PR, USFWS

Common Name: **Indiana Bat**
Scientific Name: **Myotis sodalis**
Species Group: **Mammal**

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Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G1G3 **Global Trend:**
State Rank: S1 **State Trend:** unknown
Extirpated in VT? No **Regional SGCN?** yes

Assessment Narrative:

The small-footed bat occurs throughout southeast Canada and the eastern United States, but is found in very low numbers. Regionally it seems to be at risk. In New England, this bat is listed as threatened in Vermont, endangered in New Hampshire, and a species of concern in Maine, Massachusetts, and Connecticut as well as in New York State. The small-footed bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. There is a general lack of information about this species. It is found in small numbers (i.e., 2-50 bats) in the major caves in Vermont, with one larger population of 110 individuals observed at Pike Hill Mine in 2013. This bat may be particularly susceptible to disturbance and is known to be associated with dams, exposed cliff faces, and talus during the summer. Three small-footed bats were caught in mist nets in 2003 at the Union Village Dam, North Hartland dam, and Townshend dam (a female, male, and female respectively) by a contractor for the US Army Corp of Engineers (Chenger 2003). Though infrequently captured in the summer and noted for their ability to detect and avoid mist nets, records exist from over a dozen towns around the state. Small-footed bats are susceptible to White-nose Syndrome, but have demonstrated relatively low population declines, as evidenced by regional hibernacula data (Turner et al. 2011). The USFWS was petitioned to evaluate this species for federal listing but concluded in 2013 that the listing was not warranted (USFWS 2013).

Distribution

The small-footed bat is widely, though sparsely, distributed throughout the state, as evidenced by mist net captures from around the state, and is likely associated with dams, exposed cliff faces, and talus. This species is documented at hibernacula in Brandon, Sudbury, Manchester, Stockbridge, Vershire, and Corinth.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

In both winter and summer the small-footed bat is closely associated with rocky habitat such as caves, cliffs, talus piles, quarry faces, and rock outcrops. It hibernates in very cold sites, often in the entrance areas of caves and mines sometimes using small cracks or piles of breakdown on cave and mine floors. Hibernacula surveys probably undercount the species. They may also hibernate in talus piles and cliffs that have deep crevices;

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

however, the extent of this behavior in Vermont is unknown. No maternity sites have been found in Vermont, however, in other states they use barns and buildings, cliffs and bridges, but are primarily found under exfoliating tree bark (Sanders 2004). Changer (2004) documented small-footed bats using crevices in rocks and large rip-rap on a manmade dam face in New Hampshire. A radio-transmittered small-footed bat was found to use power line corridors (Kilpatrick, pers com). Areas that promote an abundance of insects are crucial to small-footed bat survival (Tomosa, 2003). Beaver ponds with abundant snags may provide roosting and foraging sites. Micro Habitat: outcrops

Habitat Types:

Cliffs and Talus

Northern Hardwood

Oak-Pine Northern Hardwood

Wet Shores

Subterranean

Building or Structure

Mine

Powerlines/RR/Roadsides

Other Cultural

Aquatic: Fluvial

Aquatic: Lacustrine

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Impacts of Roads or Transportation Systems

Incompatible Recreation

Climate Change

Description of habitat threat(s): These bats may be more susceptible to disturbance in the hibernacula. Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al., 1990; Thomas, 1995; Martin et al, 1966). Changes in temperature and light, as well as, direct contact can cause a bat to awaken and deplete stored fat reserves. Alterations to cave mine openings can change the microclimate of a mine and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Little is known about the summer habitat requirements of this bat but destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003). Maternity roosts may be present in rock outcroppings along roadsides and could therefore be susceptible to habitat disturbance or alteration during highway work. Warm winters and drought conditions are likely to increase bat body temperatures and corresponding metabolic demands which may influence survivability and reproduction.

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Non-Habitat Threats:

Genetics

Reproductive Traits

Loss of Metapopulation Structure

Unknown Non-Habitat Threats

Disease

Loss of Prey Base

Description of non-habitat threat(s): Insecticides and pesticides have been implicated in the deline of several bat species (Belwood 1998 in Tumosa 2003). Environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	1) Determine summer habitat utilization from known hibernacula in NY and Vershire in a telemetry study and 2) research the use of transportation corridor rock outcroppings
Research	Basic Life History	Low	
Research	Distribution and Abundance	High	1) estimate the statewide population by evaluating population densities in summer and winter habitat. 2) Document estimated populations of reproductive females.
Research	Threats and Their Significance	Medium	Research the impacts of transportation corridor naintenance activities on rock outcroppings used by this species.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	Medium	1) Monitor distribution and abundance to determine critical summer and winter habitats as well as population status. 2) Develop a monitoring plan to document the number of reproductive females.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Monitor changes in summer and winter habitat use in the aftermath of White-nose Syndrome and possible effects from population declines of other Myotis species.
Monitoring	Monitor Threats	Medium	Monitor changes in hibernating populations in sites that are gated to limit human entry versus open to visitation.

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	High	Protect all VT hibernacula with 5 or more small-footed bats.	Number of hibernacula protected	TNC, VLT, Coverts	TNC, VLT, Forest Legacy, VHCB, USFWS
Research	Medium	Locate summer maternity roost sites and define roost characteristics.	Number of summer roost sites located.	GMNF, USFWS Refuges, VTRANS, Private quarry owners, CRAG Vermont	PR, USFWS

Common Name: **Small-footed Bat**
Scientific Name: **Myotis leibii**
Species Group: **Mammal**

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Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G2G3 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regional SGCN?** Yes

Assessment Narrative:

The Northern Long-eared Bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need and was listed as Federally Threatened on April 2, 2015. This species is extremely vulnerable to White-nose Syndrome, with state-wide surveys indicating declines of 93-100% from this disease (Darling and Smith 2011) and regional hibernacula declines of 98% (Turner et al. 2011). This species is in serious danger of extirpation in Vermont and extinction across its range as the disease continues to spread each winter (Frick et al. 2012 and USFWS 2013). Loss of maternity roosts could be a concern. Little information exists regarding summer roosting needs in VT, although neighboring NH has documented northern long-eared bats using a variety of tree species in close proximity, switching roosts frequently, and using trees that have a larger DBH than the average size in the stand (Sasse 1996). Recreational spelunking could also affect winter survivability. Information is needed on population trends and recruitment to determine if Vermont still has a reproductively viable population of this species.

Distribution

Distribution is statewide as recorded through captures, and hibernacula and acoustic surveys. However, this species has suffered drastic population declines due to White-nose Sydrome and their current distribution is not well known.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Northern Long-eared Bats hibernate in parts of caves and mines that are relatively cool and moist where the air is still. Hibernation may begin in August and may last for 8-9 months in northern latitudes. In the summer Northern Long-eared Bats roost by day in buildings and under tree bark, shutters, bat houses and bridges. At night they use caves to roost. They tend to be more solitary than other bats (Chenger 2004). They are gleaners and Northern long-eared bats forage in forested hillsides rather than in stream associated woodlands and consume a variety of night flying insects. They are well suited to forest interior habitats. Micro Habitat: roost sites

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Habitat Types:

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Northern Hardwoods

Early Succession Upland Oak

Subterranean

Mine

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Aquatic: Fluvial

Aquatic: Lacustrine

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Incompatible Recreation

Description of habitat threat(s): Disturbance of hibernating bats causes them to awaken and forces them to use additional limited energy reserves (Sanders, 2004). Arousal can use up enough fat to sustain a bat for 10-30 days (Thomas et al. 1990, Thomas 1995). Changes in temperature and light, as well as, direct contact can cause a bat to awaken and deplete stored fat reserves. Alterations to cave mine openings can change the microclimate of a mine and affect bat survival. Loss of maternity roosts may also be a problem to survivability of young. Felling of a maternity roost tree can impact the survival of both adults and young. Development/roads within close proximity of hibernacula, particularly along travel corridors could also be detrimental to survival. Destruction/development of summer habitats are likely to negatively affect bats if potential roost sites and foraging areas are altered (Tumosa 2003).

Non-Habitat Threats:

Genetics

Disease

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Description of non-habitat threat(s): The Northern Long-eared Bat has suffered population declines of 90-99% in Vermont and the northeast (Turner et al. 2014) and White Nose Syndrome continues to be a threat. Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine summer habitat and roost tree characteristics.
Research	Basic Life History	High	Determine the spring migratory distance of bats emerging from hibernation and traveling to their summer range.
Research	Distribution and Abundance	High	Investigate the current distribution and abundance of this species in the years following White-nose Syndrome.
Research	Threats and Their Significance	High	Determine which threats secondary to White-nose Syndrome are the most detrimental to the small remaining population.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	High	Monitor population trends in the years following White-nose Syndrome.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	High	Investigate possible range shifts to prime summer or winter habitat in the years following White-nose Syndrome when population size and competition for habitat are extremely low.
Monitoring	Monitor Threats	High	Monitor the continued population effects of White-nose Syndrome and cooperate on research about individual survivors.

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Privately-Owned Protected Areas	High	Protect all hibernacula containing northern long-eared bats in line with Federal threatened listing.	Number of hibernacula protected	UVM, Middlebury College, Vt. Cavers Assoc, VLT, TNC	SWG, TNC, USFWS
Creating Privately-Owned Protected Areas	High	Protect all roost trees documented as used by northern long-eared bats in line with Federal threatened listing.	Number of roost trees protected	UVM, Middlebury College, Vt., VLT, TNC, Woodland Owners Association	SWG, ENDG, WNS, TNC, USFWS

Common Name: **Northern Long-eared Bat**
Scientific Name: **Myotis septentrionalis**
Species Group: **Mammal**

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Species Group: **Mammal**

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Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S2B **State Trend:** Unknown
Extirpated in VT? no **Regional SGCN?** Yes

Assessment Narrative:

Status of this bat is unknown but presumed to be much lower than historical levels. Many factors could be influencing the decline. Silver-haired bats migrate along the eastern seaboard in winter and could encounter factors that affect its survival. In some parts of the country it is associated with late successional forests with a snag density of more than 21 snags/ hectare. Loss of forest habitat throughout the 1800's probably contributed to the decline of this bat in New England. Other factors such as pesticides, availability of prey, and loss of maternity roosts could also be influencing the status of this bat. The silver-haired bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. Once the most common bat in the region in the 1800s it has experienced a significant decline throughout the Northeast. This species is currently considered rare and difficult to monitor. The silver-haired bat is documented as the shortest-lived (i.e., average 2 years, maximum 12 years), possibly indicating that this species is more sensitive to changes than other bat species. Silver-haired bats are the second most-commonly reported species found dead below turbines in Vermont's operating wind facilities (Sheffield, Lowell, and Georgia) during surveys conducted between April and October. Wind energy development is an increasing threat to this species, especially during fall migration (Leclair et al. 2009).

Distribution

One capture record exists for this species in Springfield and a maternity roost was found in a building in Chittenden. Data from mortality surveys below operating wind turbines in Sheffield, Lowel, and Georgia have provided new occurance data for this migratory species, as well as acoustic data around the state from 2010 to 2014. Silver-haired bats are assumed to be widespread but very little is known about how abundant or how evenly distributed they are in Vermont. This species migrates south for the winter.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

Silver-haired bats will range up to 5km from roost tree to forage areas. In summer, they roost under the bark of late-successional and old-growth boreal forests and perhaps along woodland edges. They forage in forest openings, including clear cuts, and over water and sometimes roost in buildings. In other parts of the country

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
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they are associated with late successional forests with snag densities of 21 snags/hectare. They form maternity colonies almost exclusively in tree cavities and will periodically switch roosts throughout the maternity season. Like big brown bats, the silver-haired bats feed on many insect pest species such as flies, midges, leafhoppers, moths, mosquitoes, beetles, crane flies, lacewings caddis flies, ants, crickets, and spiders.

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Building or Structure

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Habitat Alteration

Description of habitat threat(s): Conversion of forest habitat as a result of rural development that leads to loss of mature and older forests used as roosting habitat. Because silver-haired bats are migratory, they could be limited by wind and radio towers as well as powerlines. Wind energy development causes significant direct mortality to this species through colisions with turnbine blades and barotrauma. Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to

Common Name: **Silver-haired Bat**
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predation.

Non-Habitat Threats:

Genetics

Disease

Description of non-habitat threat(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats. Silver-haired bats are also susceptible to a virulent strain of rabies. This normally solitary species is more vulnerable to population impacts when concentrated in the spring and fall migration.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Determine habitat requirements in Vermont.
Research	Basic Life History	Low	Research the possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution, abundance in Vermont.
Research	Threats and Their Significance	High	Collect mortality data from wind energy facilities.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	Research the effects of pesticides on mortality and reproductive success.
Monitoring	Population Change	High	Monitor changes in abundance after the onset of operating wind turbines in the Northeast.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Monitor changes in migratory patterns after habitat conversion of ridgelines and direct mortality due to wind development.
Monitoring	Monitor Threats	High	Research migratory patterns and impacts from power lines, wind towers, and road mortality

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Design, standardize, and implement mitigation guidelines, such as curtailment regimes, to decrease the threat of and direct take from wind energy development in Vermont.	Percentage of operating wind turbines that meet minimum mitigation guidelines.	Bat Wind Energy Cooperative, USFWS, USFS, Wind energy companies	Wind industry, USFWS, ENDG

Common Name: **Silver-haired Bat**
Scientific Name: **Lasionycteris noctivagans**
Species Group: **Mammal**

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Common Name: **Tri-colored bat**
Scientific Name: **Perimyotis subflavus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G3 **Global Trend:**
State Rank: S1 **State Trend:** Declining
Extirpated in VT? No **Regional SGCN?** Yes

Assessment Narrative:

The tri-colored bat is one of six species that overwinter in Vermont. This species occurs in small numbers in Vermont hibernacula and is only infrequently captured in mist net surveys. Its small size and multiple young (i.e., two, versus one for most bats) makes it more vulnerable. The tri-colored bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. This species was formerly known as the eastern pipistrelle, Pipistrellus subflavus (Menu 1984). Little is known about the tri-colored bat in Vermont, where this species is near the northern edge of its summer range (Whitaker 1998). It appears uncommon based on available survey data. Historic summer captures total less than 10 and many hibernacula surveys reveal 2-6 individuals roosting solitarily. By 2011, White-nose Syndrome had caused regional population declines for this species upwards of 75% (Turner et al. 2011) in hibernacula surveys. Tri-colored bats are extremely vulnerable to WNS. Fungal infection rates during late hibernation reach nearly 100% and fungal loads in this species are among the highest documented (Langwig et al. 2014). The tricolored bat was added to Vermont's endangered species list in 2012. The concentration of this species in caves and mines to hibernate makes them particularly vulnerable to human disturbance.

Distribution

Distribution is probably statewide but sparse. Capture records, hibernacula survey records, or acoustic recordings exist from most regions, though little is known about how evenly distributed they are in Vermont. Tri-colored bats have been documented in small numbers in the majority of known hibernacula. However, seven of the hibernacula with tri-colored bats documented before White-nose Syndrome (WNS) revelaed none of this species in post-WNS surveys.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Probable
Champlain Hills	Probable	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

The Tri-colored bat forages over wetlands, riparian areas, and forest edges, ingesting ants, moths, small beetles, mosquitoes and other insects. Possibly uses trees for maternity roosts, although in Vermont, the Tri-colored bat has not been found with other tree roosting bats. In Indiana they are found in sugar maple and American elms, as well as tulip and sycamore trees. Tri-colored bat is also found in the dead foliage of oaks.

Common Name: **Tri-colored bat**
Scientific Name: **Perimyotis subflavus**
Species Group: **Mammal**

They hibernate in caves mines and rock crevices where humidity is high and temperatures are around 10 to 15 degrees centigrade.

Habitat Types:

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Wet Shores

Early Succession Boreal Hardwoods

Early Succession Northern Hardwoods

Early Succession Upland Oak

Subterranean

Mine

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Incompatible Recreation

Description of habitat threat(s): Hibernating bats are limited by degradation, destruction and disturbance of hibernacula (caves and mines). Bats disturbed within the hibernacula use significant stores of fat each time they are awakened. If awakened enough times, bats can deplete their fat reserves and not have enough energy resources to complete spring migration, survive post emergence periods of bad weather or initiate and successfully complete gestation. In some cases, awakening hibernating bats can directly lead to their death. Closure of mines or caves in winter, when bats are present, would lead to the destruction of the entire colony. Slight alterations in cave/mine microclimate as a result of modifications to the opening etc. could also negatively impact hibernating bats. Removal of trees which serve as bat roosts, especially those serving as maternity roosts can directly kill entire colonies of bats. Wind energy turbines located on ridge tops have been found to directly kill bats as well..

Non-Habitat Threats:

Genetics

Loss of Metapopulation Structure

Common Name: **Tri-colored bat**
Scientific Name: **Perimyotis subflavus**
Species Group: **Mammal**

Disease

Description of non-habitat threat(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon levels of the pesticide in the tissue, as well as, the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements.
Research	Basic Life History	Low	Research possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance
Research	Threats and Their Significance	High	Research what threats secondary to White-nose Syndrome are the most detrimental to the small remaining population.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	
Monitoring	Population Change	High	Monitor population trends in the years following White-nose Syndrome to determine if the species continues to decline.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Investigate the characteristics of hibernacula still occupied by this species post-White-nose Syndrome versus abandoned sites.
Monitoring	Monitor Threats	High	Monitor the continued population effects of White-nose Syndrome and cooperate on research about individual survivors.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Creating Privately-Owned Protected Areas	High	Protect all hibernacula containing more than 5 tri-colored bats.	Number of hibernacula protected	UVM, USFS, Cavers Organizations, TNC, Private landowners	ENDG, USFWS

Common Name: **Tri-colored bat**
Scientific Name: **Perimyotis subflavus**
Species Group: **Mammal**

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Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
Global Trend:
State Rank: S4
State Trend: Stable
Extirpated in VT? no
Regional SGCN? Yes

Assessment Narrative:

The Big Brown Bat has been identified as a High Concern Regional Species of Greatest Conservation Need. Because Big Brown Bat maternity sites are most often in human structures such as barns, sheds, houses, and churches, they are frequently in conflict with people. At best, they may be excluded from these structures, forcing a split into several smaller maternity sites. At worst, they may be exterminated by pest control agents or homeowners. This species is also vulnerable to the effects of White-nose Syndrome (WNS), though it has not seen the same drastic declines in Vermont or the northeast as some other hibernating species (Turner et al. 2011). Big Brown Bats are among the first bats to give birth and often have 2 offspring. Before WNS, little brown bat colonies were nearly twice as common as Big Brown Bat colonies in New England (D.S. Reynolds and T. H. Kunz, unpub. data, 1999). Because of the 90% declines of the little brown bat (another structure-dwelling species) experienced from WNS, the VFWD conducted extensive surveys of citizen-reported bat colonies in buildings between 2011 and 2014. By 2014 that ratio had reversed and Big Brown Bats made up 249 of the 283 structure-dwelling maternity colonies identified by the VFWD. Big Brown Bats are commonly captured during mist net surveys and are among the most commonly detected species in acoustic surveys done by neighboring states (Carl Herzog, NYDEC and Kate Moran, CTDEEP, personal communication). However, Big Brown Bats are difficult to survey during the winter because not only do they overwinter in caves and mines, but they also hibernate in structures, cliffs, and wood piles, where they are more difficult to detect. The actual population size of this species in VT is unknown but their long-term conservation is important as they may be one of the few species able to thrive after WNS has spread across the rest of North America and threatened the viability of many other hibernating species.

Distribution

Distribution is statewide as recorded through captures, citizen reports of bats in buildings, wind turbine mortality data, and acoustic survey data. During the winter, the Big Brown Bat is found in small numbers in about half the known bat hibernacula in Vermont, but also hibernates in structures around the state.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

In summer, Big Brown Bats roost in the attics of churches, houses, and old abandoned structures and deciduous tree cavities. In winter they hibernate in very cold areas (cave entrances and cliff faces) often with temperatures very close to and sometimes below freezing. This is the only bat species in VT known to hibernate in buildings. These low temperatures allow them to drastically slow their metabolism (Sanders 2004). Right now, Big Brown Bats hibernate in fewer than 20 sites in Vermont. Big Brown Bats consume beetles, ants, flies, mosquitoes, mayflies, stoneflies, and other insects. They emerge from their summer roost at dusk and fly a steady, nearly straight course to foraging areas (Chenger, 2004). There may be fidelity to the feeding grounds and some bats use the same grounds night after night. Little is known about where the majority of these bat winter, though reports of 1-6 bats hibernating in buildings are increasingly frequent as citizen reporting of bat activity has increased since White-nose Syndrome.

Habitat Types:

Cliffs and Talus

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Pine and Hemlock

Early Succession Upland Oak

Subterranean

Building or Structure

Mine

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Wet Swales and Ditches

Powerlines/RR/Roadsides

Aquatic: Fluvial

Aquatic: Lacustrine

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Description of habitat threat(s): Every year Big Brown Bats lose hundreds of possible building roosts due to exclusion or the actual destruction of buildings. Direct killing of bats is common due to human fears about rabies, bat bites and histoplasmosis. In addition, alterations or impacts to winter hibernacula also limits the future of this bat.

Non-Habitat Threats:

Genetics

Disease

Description of non-habitat threat(s): Big Brown Bats are one of 6 species in Vermont that are susceptible to White-nose Syndrome, though direct mortality for this species has been lower than for other susceptible species (Turner et al. 2011). The long-term and reproductive effects of this disease are unknown. Citizen reports of abandoned, dying, and dead young found below bat houses, and building roosts increased in VT and other Northeast states in 2012-2014 and is yet unexplained. Big Brown Bats are threatened by direct take when roosting in buildings during the summer and winter due to human fears of bats and rabies, as well as routine building maintenance (e.g., roof replacement), weatherization, and pest control activities. Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon levels of the pesticide in the tissue, as well as, the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At low levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats.

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Investigate the importance of human-made structures for hibernation.
Research	Basic Life History	Low	
Research	Distribution and Abundance	Medium	Document and map summer maternity colonies and human-made structures used for hibernation.
Research	Threats and Their Significance	Medium	Research long-term population effects of White-nose Syndrome
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	Track changes in abundance, distribution, and colony size over time by locating and monitoring summer maternity colonies
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Investigate the increased use of colony locations (structures) or foraging areas previously dominated by little brown bats and other species in the genus Myotis that have declines drastically since White-nose Syndrome.
Monitoring	Monitor Threats	Medium	Monitor long-term population changes in the years following White-nose Syndrome

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Habitat Restoration		Protect hibernacula that are found to contain 30 or more big brown bats	Number of hibernacula protected	Vermont Cavers Association, TNC, VLT, USFS, ACE, Coverts	SWG, USFWS
Habitat Restoration		Maintain at least 50 maternity sites and a minimum of 5,000 adult female individuals in Vermont	Number of maternity sites protected	NRCS, Coverts, USFWS, ACE, VLT, TNC	USFWS, NRCS, EQIP,
Technical Assistance, Training, Learning Networks		Train nuisance wildlife control operators (NWCOs) in proper bat exclusion techniques. Work with homeowners/landowners to safely exclude bats and erect bat houses for displaced colonies.	Implemement Best Management Practices and train nuisance wildlife control operators.	Wildlife Rehabilitators, NWCO's, Homeowners associations	USFWS, PR

Common Name: **Big Brown Bat**
Scientific Name: **Eptesicus fuscus**
Species Group: **Mammal**

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Kurta, A. & Baker, R.H. 1990. Eptesicus fuscus. Mammalian Species. 356:1-10

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5
Global Trend:
State Rank: S4B
State Trend: unknown
Extirpated in VT? no
Regional SGCN? Yes

Assessment Narrative:

Eastern Red Bats spends the winter in the southern U.S. or Mexico. They migrate back and forth along the Eastern seaboard. A study in New York (Fisher 1896) reported red bats to be the second most common bat and reports from the late 1800's and early 1900's talk about "great flights of them during the whole day" (Mearns, 1898). This bat has a larger litter size than most other bats, ranging from one to five young. The Eastern Red Bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. Once one of the most abundant bats in many parts of their range, Eastern Red Bats appear to have declined dramatically over the last 100 years. Little was known about the Vermont population based on traditional survey methods. However, since the development of wind energy facilities in Vermont, data from fatality monitoring below operating turbines has added to population distribution information. Eastern Red Bats are the third most-commonly reported species found dead below turbines in Vermont's operating wind facilities (Sheffield, Lowell, and Georgia) during surveys conducted between April and October. Wind energy development is an increasing threat to this species, especially during fall migration. In addition, this species may be vulnerable to climate change as violent spring and autumn thunderstorms reportedly account for a large percentage of Eastern Red Bat deaths to migrating individuals and to females that are hesitant to separate from young during the birthing season (Leclaire et al. 2009).

Distribution

Capture records exist from around the state. Data from mortality surveys below operating wind turbines in Sheffield, Lowel, and Georgia have provided new occurance data for this migratory species, as well as acoustic data from 2010 to 2014. The eastern red bat appears to be widespread throughout Vermont, though very little is known about how abundant or how evenly distributed they are in the state. This species migrates south for the winter.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Probable
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

The eastern red bat is a solitary rooster which often hangs by one foot from branches in the foliage appearing as dead leaves in the crown of the tree. It prefers older forests with dense canopy foliage and open understory as well as hedgerows with elms and eastern red cedar stands. They are fast flyers that forage in open areas along hedgerows and field edges. Eastern red bats are also frequently observed foraging around lights in rural and suburban areas. The eastern red bats migrate south to Gulf states to hibernate. Tree bats such as the red, silver-haired, and hoary are the least studied of the bats and little is known about their status or habitat needs in Vermont. Eastern red bats feed on moths, crickets, flies, mosquitoes, beetles, cicadas, and other insects. Micro Habitat: red cedar

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Hardwood Swamps

Seeps and Pools

Shrub Swamps

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Powerlines/RR/Roadsides

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Habitat Alteration

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Climate Change

Description of habitat threat(s): Problems include conversion/degradation of forest habitat, as well as, rural development leading to loss of mature forest. Loss of American elms, a major roost tree, may be a continuing factor in the decline of the red bat. Because red bats are migratory, they could be limited by wind and radio towers as well as powerlines. Wind energy development causes significant direct mortality to this species through colisions with turnbine blades and barotrauma. this species may be vulnerable to climate change as violent spring and autumn thunderstorms reportedly account for a large percentage of eastern red bat deaths to migrating individuals and to females that are hesitant to separate from young during the birthing season (LeCLaire et al. 2009). Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to predation.

Non-Habitat Threats:

Genetics

Disease

Loss of Prey Base

Description of non-habitat threat(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats. This normally solitary species is more vulnerable to population impacts when concentrated in the spring and fall migration.

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements
Research	Basic Life History	Low	Research possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance in Vermont
Research	Threats and Their Significance	High	Collect mortality data from wind energy facilities.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	Research the effects of pesticides on mortality and reproductive success.
Monitoring	Population Change	High	Monitor changes in abundance after the onset of operating wind turbines in the Northeast.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Monitor changes in migratory patterns after habitat conversion of ridgelines and direct mortality due to wind development.
Monitoring	Monitor Threats	High	Research migratory patterns and impacts from power lines, wind towers, and road mortality

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Design, standardize, and implement mitigation guidelines, such as curtailment regimes, to decrease the threat of and direct take from wind energy development in Vermont.	Percentage of operating wind turbines that meet minimum mitigation guidelines.	Bat Wind Energy Cooperative, USFWS, USFS, Wind energy companies	Wind industry, USFWS, ENDG

Common Name: **Eastern Red Bat**
Scientific Name: **Lasiurus borealis**
Species Group: **Mammal**

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Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S3B **State Trend:** unknown
Extirpated in VT? no **Regional SGCN?** Yes

Assessment Narrative:

Hoary Bats are the largest bats of northeastern North America. The range-wide population has declined significantly since 1900. Historically, few records existed for this species in Vermont, due largely to the difficulty in capturing this fast, high-flying species in nets. Due to their solitary nature, we know the least about the three tree bat species in Vermont (red, hoary, and silver-haired). However, capture records, combined with more recent acoustic survey and wind mortality data indicate that this species is wide-spread throughout Vermont. The Hoary Bat has been identified as a Very High Concern Regional Species of Greatest Conservation Need. Add statements about wind mortality. Hoary Bats are the most commonly reported species found dead below turbines in Vermont's operating wind facilities (Sheffield, Lowell, and Georgia) during surveys conducted between April and October. Wind energy development is an increasing threat to this species, especially during fall migration (Leclaire et al. 2009).

Distribution

Capture records from Thetford, Springfield, Orwell, Brandon, Salisbury, and historic record from Rutland. Data from mortality surveys below operating wind turbines in Sheffield, Lowel, and Georgia have provided new occurance data for this migratory species, as well as acoustic data around the state from 2010 to 2014. The Hoary Bat appears to be widespread throughout Vermont, though very little is known about how abundant or how evenly distributed they are in the state. This species migrates south for the winter.

Distribution by Biophysical Region:

Champlain Valley	Historic Record(s) Only	**Southern VT Piedmont**	Not Probable
Champlain Hills	Not Probable	**Vermont Valley**	Not Probable
Northern Green Mtns	Not Probable	**Southern Green Mtns**	Not Probable
Northern VT Piedmont	Probable	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

In the summer, during the day, Hoary Bats may stay concealed in the foliage of trees, well-concealed but with an open understory, generally 10 to 17 feet above the ground and often on the edge of a clearing. They emerge after dark to feed and may make round trips of up to 24 miles to forage. They forage over wetlands, openings, lakes and edges. They are fast flyers. Northern populations make long seasonal migrations to and from warmer winter habitats in the southern United States or Mexico. The sexes are segregated throughout most of the summer range. Foods include moths, true bugs, mosquitoes, and other insects. Hoary Bats have two young in mid-May through June or July. Females are solitary roosters and roost exclusively in trees. They may roost in

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

the same tree in subsequent years.

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Powerlines/RR/Roadsides

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Energy Infrastructure and Development

Habitat Alteration

Description of habitat threat(s): Problems include conversion/degradation of forest habitat, as well as rural development leading to loss of mature forest. Because Hoary Bats are migratory, they could be impacted by wind and radio towers as well as powerlines. Wind energy development causes significant direct mortality to this species through colisions with turnbine blades and barotrauma. Predators include several kinds of birds including blue jays therefore increased suburbanization could increase loss to predation

Non-Habitat Threats:

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

Genetics

Disease

Description of non-habitat threat(s): Pesticides and environmental poisons have had negative impacts on, and increased the mortality rates of, bat populations. Bats store some lipophilic pesticides in brown adipose fat tissues. These stores are released as bats use their fat reserves during hibernation. Depending upon tissue levels of the pesticide, as well as the amount of fat used over a given time period, bats can be exposed to both chronic and acute poisoning which can result in death. At lower levels, chronic poisoning may raise a bat's metabolism, burning the limited fat resources more quickly and possibly causing them to starve to death. In addition, broad spectrum insecticides can deplete insect diversity and limit the food sources available for bats. This normally solitary species is more vulnerable to population impacts when concentrated in the spring and fall migration.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Collect baseline data on habitat requirements.
Research	Basic Life History	Low	Research the possibility of food competition and partitioning between red, hoary, silver-haired and eastern pipistrelle bats.
Research	Distribution and Abundance	High	Collect baseline data on distribution and abundance in Vermont
Research	Threats and Their Significance	High	Collect mortality data from wind energy facilities.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Research	Other Research	Low	Research the effects of pesticides on mortality and reproductive success.
Monitoring	Population Change	High	Monitor changes in abundance after the onset of operating wind turbines in the Northeast.
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Medium	Monitor changes in migratory patterns after habitat conversion of ridgelines and direct mortality due to wind development.
Monitoring	Monitor Threats	High	Research migratory patterns and impacts from power lines, wind towers, and road mortality

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Design, standardize, and implement mitigation guidelines, such as curtailment regimes, to decrease the threat of and direct take from wind energy development in Vermont.	Percentage of operating wind turbines that meet minimum mitigation guidelines.	Bat Wind Energy Cooperative, USFWS, USFS, Wind energy companies	Wind industry, USFWS, ENDG

Common Name: **Hoary Bat**
Scientific Name: **Lasiurus cinereus**
Species Group: **Mammal**

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Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4 **Global Trend:**
State Rank: SU **State Trend:** Unknown
Extirpated in VT? no **Regional SGCN?** yes

Assessment Narrative:

The New England cottontail is rare, possibly extirpated in Vermont. The New England Cottontail is the only rabbit native to the northeastern United States east of the Hudson River Valley of New York including New England. It's range has contracted by an estimated 86% since 1960. Outside of Vermont, only five smaller populations occupy its historic New England range. The cottontail is recognized as a SGCN in the Wildlife Action Plans of all New England States and New York. In 2006 it was designated a candidate for listing under the federal Endangered Species Act

The New England Cottontail is listed as a Regional Species of Greatest Conservation Need among the 13 Northeastern states. A regional effort has been mounted to restore the New England Cottontail ((http://www.newenglandcottontail.org/).

The New England cottontail was abundant in Vermont prior to the 1940s, however, the species was last documented in the state in 1946. Widespread introductions of the eastern cottontail (Sylvilagus floridanus) and habitat changes have resulted in apparent competition and possibly hybridization with eastern cottontails. Despite concerted trapping efforts in Vermont, no evidence of New England cottontails has been found since 1991.

Distribution

Distribution by Biophysical Region:

Champlain Valley	Historic Records Only	**Southern VT Piedmont**	Historic Records Only
Champlain Hills	Not Probable	**Vermont Valley**	Historic Records Only
Northern Green Mtns	Not Probable	**Southern Green Mtns**	Historic Records Only
Northern VT Piedmont	Historic Records Only	**Taconic Mtns**	Historic Records Only
Northeastern Highlands	Not Probable		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☐

New England cottontails are associated with many types of vegetation but are most often found in early successional old fields, 10-25 years post-disturbance with high stem density (9000-10,000 stems/hectare). It is critical that patches of dense hardwood and softwood shrubs, seedlings and saplings at least .5 meters tall and less than 7.5 meters in diameter be closely spaced to facilitate usage. Connectivity between patches is also important. Isolated patches are much less frequently used (Tumosa 2001). New England cottontails seldom

Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

venture far from dense cover and in winter will inhabit larger patches (greater than 10 ha) (DeGraff and Yamasaki, 2001). They cannot colonize areas already inhabitant by Eastern cottontail. Home ranges can be linear along riparian areas, roadsides etc.

Habitat Types:

Early Succession Boreal Hardwoods

Early Succession Pine and Hemlock

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Succession

Habitat Alteration

Habitat Fragmentation

Invasion by Exotic Species

Description of habitat threat(s): Fragmentation and isolation of patches results in lower survival rates and skewed sex ratios and increases vulnerability to extirpation due to chance events (natureserve.org). Habitat patches less than 3 acres in size increases the risk of predation. Decline in patch size (less than 15-75 ha) and increase in juxtaposition (greater than 500m) reduces survivability of New England cottontails. Loss of 10-25 year post-disturbance habitat due to conversion, succession and fragmentation also negatively influences New England cottontail recovery. Competition from eastern cottontail is also a problem. The eastern cottontail will occupy a habitat first and exclude NE Cottontail.

Non-Habitat Threats:

Competition

Description of non-habitat threat(s): Competition with eastern cottontail is widely recognized as a limiting factor for New England cottontail populations.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine habitat requirements in Vermont.
Research	Distribution and Abundance	Medium	Continue to monitor for occurrence in likely Vermont habitats.
Research	Taxonomy	Medium	Genetically test trapped rabbits to determine distribution of floridanus vs. transitionalis
Monitoring	Monitor Threats	Medium	Monitor changes in early successional habitats in regards to size, age, and juxtapositon

Common Name: **New England Cottontail**
Scientific Name: **Sylvilagus transitionalis**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	High	Support the implementation of the Conservation Strategy for the New England Cottontail (Fuller and Tur 2012)		Other New England states, VLT, TNC, USFWS	SWG, PR
Ex-Situ Conservation		Identify regional refugia until habitat can be developed w/in a state. Maintain isolated populations until a long-term plan is developed.	Number of isolated populations conserved. Number of regional refugia conserved.	Other New England states, VLT, TNC, USFWS	SWG, PR

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Common Name: **Snowshoe Hare**
Scientific Name: **Lepus americanus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S5
Extirpated in VT? No

Global Trend:
State Trend: Declining
Regional SGCN? no

Assessment Narrative:

The Snowshoe Hare experiences cyclical population changes on a10-year period mostly in the northern parts of its range. Populations near the southern limits of its range, including Vermont, are believed to be less cyclical. Early successional softwood and mixed softwood- hardwood patches are critical habitats. Dense softwood and hardwood understory cover is highly important as it provides feeding, escape, and thermal cover for hares (Carreker 1985, Litvaitis et al. 1985). Forest succession and an overall decrease in active forest management practices in recent decades (Morin et al. 2014) has led to a reduction in suitable habitat and a decline in the state and regional Snowshoe Hare populations. Furthermore, changes in the climate that produce anomalously warm temperatures and decreased snowfall may diminish the hares' competitive advantages leading to higher predation rates and chronic declines in hare abundance (Schmitz et al. 2003). Consequently, lower hare populations may affect other wildlife species that rely on abundant hare populations as a source of prey (Chapman and Feldhamer 1982). The Snowshoe Hare is a keystone species in the northern transitional and boreal forest. If it should disappear, many species of predators would go with it and the structure of the plant community would be altered substantially (Krebs et al. 2001).

Distribution

The Snowshoe Hare was formerly found throughout Vermont with highest populations found in the mountains and lowland swamps (Foote 1946). Clearing of the land for agriculture and the introduction of the eastern cottontail have reduced hare habitat and populations especially in the Champlain and Connecticut River Valleys where hares currently exist only in larger forested blocks away from agriculture and development. The species is currently more commonly found in the Green Mountains, Taconic Mountains, and the northeastern part of the state. Hare populations generally increase from south to north in the state.

Distribution by Biophysical Region:

Champlain Valley	Probable	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Prefers large expanses of forest habitat,with low brushy cover and needs diverse forest size/age classes for feeding and cover.

Common Name: **Snowshoe Hare**
Scientific Name: **Lepus americanus**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Hardwood Swamps

Softwood Swamps

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Current Threats

Habitat Threats:

Habitat Succession

Climate Change

Description of habitat threat(s): The natural succession of forests, particularly with respect to an observed decrease in active forest management across the region, is believed to be the leading cause of snowshoe hare population declines (DeGraaf & Yamasaki 2001). The availability of suitable cover and sufficient quantities of preferred browse plays an important role in hare productivity and survival (DeGraaf & Yamasaki 2001). Although the potential effects of climate change on this species are poorly understood, it is widely speculated that a warming climate could impact the species' ability to persist due to decreased snowfall and commensurate shifts in predator communities.

Description of non-habitat threat(s):

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	High	Collect Snowshoe Hare baseline data on the distribution and abundance in Vermont.
Research	Threats and Their Significance	Medium	Evaluate current forest management trends in Vermont and assess implications for Snowshoe Hare.
Research	Other Research	Medium	Evaluate uneven aged forest management techniques to determine if the habitat needs for snowshoe hare can be achieved and at what population density.
Monitoring	Population Change	Medium	Develop and implement a hare monitoring protocol in the state for evaluating population trends over time
Monitoring	Habitat Change	High	Periodically perform quantitative assessments of hare habitat in Vermont in order to detect trends and evaluate effectiveness of conservation strategies.
Monitoring	Range Shifts	Low	Develop and implement a protocol for monitoring range shifts in carnivores as a result of a changing climate.
Monitoring	Monitor Threats	Low	

Common Name: **Snowshoe Hare**
Scientific Name: **Lepus americanus**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	Medium	Determine snowshoe hare population goal in the state that can sustain Canada Lynx and other carnivores and recreational hunting.		USFWS, WMI, UVM	PR
Policy & Regulations	High	Support and cooperate with regional efforts to curb the effects of climate change via the development and implementation of appropriate policy and regulations.			
Publically-Owned Protected Areas	High	Use even age management methods to increase young softwood and young mixed softwood/hardwood forests on state and federal lands.	Number of acres of early successional habitat in VT Forest Inventory Analysis (USFS).	ANR, USFS, USFWS, Coverts, RGS, WMI	PR,SWG
Conservation Payments/Financial Incentives	High	Encourage private landowners to use even age management methods to increase young softwood and young mixed softwood/hardwood forests through incentive programs (e.g., Current Use, USDA Wildlife Habitat programs).	Number of acres of early successional habitat in VT Forest Inventory Analysis (USFS).	ANR, USFS, USFWS, NRCS, Coverts, RGS, WMI, private landowners	PR, NRCS

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Common Name: **Southern Flying Squirrel**
Scientific Name: **Glaucomys volans**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S4
Extirpated in VT? no

Global Trend:
State Trend: stable
Regional SGCN? no

Assessment Narrative:

Species is listed as S4 and is apparently secure but little is known about this species or population trends in the state. Generally less is known about flying squirrels than other squirrels because of their nocturnal habits. Southern flying squirrels are expanding their range northward and have recently been documented from the Northeastern Highlands (Kilpatrick and Benoit 2011). Although the number of sites where the northern and southern flying squirrels occur in sympatry in the state are limited (Kilpatrick and Benoit 2011), increase competition for nest sites (tree cavities) may occur. While it is expected that the southern flying squirrel will dominate in these situations (Wells-Gosling and Heaney 1984), limited empirical data from field studies are available.

Distribution

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Probable
Northern Green Mtns	Probable	**Southern Green Mtns**	Confident
Northern VT Piedmont	Probable	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

In the eastern United States the southern flying squirrel is usually found at lower elevations in deciduous forests (Dolan and Carter 1977). In the northern areas of its range it also inhabits mixed woodlands of hardwoods and conifers, particularly where hardwoods predominate (Dolan and Carter 1977). Individuals and family groups require several nests; a primary nest (usually a tree cavity) that is used more or less continuously and several secondary nests (often stick nest) that serve as sheltered stations for feeding and defecating (Muul 1968). The availability of nest sites may be a limiting factor of population size (Muul 1968).

Habitat Types:

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Common Name: **Southern Flying Squirrel**
Scientific Name: **Glaucomys volans**
Species Group: **Mammal**

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Climate Change

Description of habitat threat(s): Although little is known about the potential habitat related threats to this species, it is believed southern flying squirrels are vulnerable to the degradation of preferred habitats resulting from climate change, forest pests, and forestry practices. Habitat threats of this nature are of particular concern with respect to the availability of sufficient quantities of large diameter deciduous trees with cavities suitable for use as nesting sites.

Non-Habitat Threats:

Trampling or Direct Impacts

Description of non-habitat threat(s): Southern flying squirrels are known to occupy residential structures with some frequency. Pest control professionals often respond to complaints of nuisance squirrel behavior via lethal control measures.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Determine distribution and abundance by conducting targeted surveys and through collaboration with pest control professionals
Monitoring	Population Change	Medium	Monitor for changes in population by periodically assessing the species distribution and abundance

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Develop guidelines for pest control professionals for the non-lethal control of the species	Change in the number of trained pest control professionals	Pest Control Professionals	SWG
Standards	Medium	Develop guidelines for retention of suitable cavity trees on public and private forest land	Change in the number of suitable cavity trees retained	VFPR	SWG
Research	High	Monitor distribution and abundance of species	Distribution map	UVM, Pest Control Professionals	SWG

Common Name: **Southern Flying Squirrel**
Scientific Name: **Glaucomys volans**
Species Group: **Mammal**

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Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S4
Extirpated in VT? no

Global Trend:
State Trend: stable
Regional SGCN? no

Assessment Narrative:

The Northern Flying Squirrel has a state rarity rank of apparently secure (S4) but little is known about its biology, population and threats within the state. Northern flying squirrels are cavity nesters that frequently nest in woodpecker holes (Wells-Gosling and Heaney 1984). Although they also use non-cavity stick nests, these exposed structures are unsuitable as winter nests, requiring the utilization of cavities during winter months (Cowan 1936). Experimental studies (Weigl 1977) have shown that the smaller southern flying squirrel (Glaucomys volans) is dominant and more aggressive sometimes displacing northern flying squirrels from nest boxes. The northern range expansion of the southern flying squirrel may have several negative impacts on populations of northern flying squirrels. The southern flying squirrel may have a greater ability to locate and dominate tree cavities thus displacing northern flying squirrels from hardwood forest (Wells-Gosling and Heaney 1984). Furthermore, in areas where the two species are sympatric, the earlier breeding southern flying squirrel may have an advantage by being the first to occupy tree cavities as nest sites for their young (Wells-Gosling and Heaney 1984). Additionally, southern flying squirrels have a parasite (Strongyloides sp.) that appears to be debilitating or lethal to northern flying squirrels (Weigl 1977). Finally, the dietary requirements of northern flying squirrels are not understood. These squirrels cannot be maintained on a diet of spruce seed (Brink and Dean 1966). Fungi and lichens may be the predominant or only foods eaten at certain times of the year (Cowan 1936, Connor 1960, McKeever 1960, Wrigley 1969, Maser et al. 1978, Mowrey et al. 1981, Maser et al. 1985, Mayer et al. 2005)

Distribution

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Historic Records
Northern Green Mtns	Confident	**Southern Green Mtns**	Probable
Northern VT Piedmont	Confident	**Taconic Mtns**	Historic Records
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Known to inhabit a wide variety of woodland habitats including spruce-fir and mixed hemlocks and adjacent mature hardwoods (Weigl 1978). Under experimental conditions, Weigl (1978) found that northern flying squirrels would select for either deciduous or coniferous habitat whereas the southern flying squirrel strongly selected deciduous habitat. Given the southern flying squirrels ability to displace northern flying squirrels from

Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

tree cavities, northern flying squirrels are likely displaced from hardwood forest in areas where the two species are sympatric. Northern flying squirrels require mature trees with cavities for winter nest sites (Cowan 1936). The species feeds on hypogeous fungi in the summer and arboreal lichens and hypogenous fungi in the winter (DeGraff et al, 1986, Rosentreter et al. 1997, Curran et al. 2000, Vernes et al. 2004).

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Climate Change

Description of habitat threat(s):

Non-Habitat Threats:

Competition

Description of non-habitat threat(s): Predicted changes in the climate may allow the southern flying squirrel population to shift northward thereby increasing competition with northern flying squirrels. Increased competition for suitable nesting cavities may be amongst the most significant impact resulting from climate change particularly with respect to the outright loss of nest cavities and/or the displacement from the use of nest cavities. Climate change may also limit northern flying squirrel populations by influencing the abundance of key dietary requirements such as lichen and fungi.

Increased sympatry with southern flying squirrels may result in the spread of parasites to northern flying squirrels. Although the intestinal nematode, Strongylorides robustus, infects both southern and northern flying squirrels, it is more prevalent in southern flying squirrels (Wetzel and Weigl 1994) and appears to be more deleterious to northern flying squirrels (Pauli et al. 2004).

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Monitor distribution and abundance of this species.
Research	Threats and Their Significance	Medium	Determine the prevalence of the Strongylorides robustus parasite in flying squirrel populations in Vermont
Monitoring	Range Shifts	High	Monitor changes in the distribution of flying squirrels to determine the degree of sympatry.

Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Develop guidelines for retention of suitable cavity trees on public and private forest land.	Change in the number of suitable cavity trees retained	VFPR	SWG, PR
Research	High	Monitor distribution and abundance of species	Distribution maps	UVM	SWG, PR

Common Name: **Northern Flying Squirrel**
Scientific Name: **Glaucomys sabrinus**
Species Group: **Mammal**

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Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4
Global Trend:
State Rank: S2
State Trend: unknown
Extirpated in VT? no
Regional SGCN? No

Assessment Narrative:

Ranked as S2 in Vermont and considered a species of special concern. Talus slopes are the species' refugal habitat. In some locations, rock voles may be found in early successional forest habitat (Kirkland 1977; Martell and Radvanyi 1977) and krumholtz. There is uncertainty as to why the population fluctuates so much and there are relatively few known populations. The relatively narrow habitat requirements of this species make it vulnerable to habitat alterations. Furthermore, because rock voles occur in disjunct populations, it is dependent upon movement corridors. It is also speculated that these disjunct populations could be negatively impacted by landscape changes that favor the meadow vole (Microtus pennsylvanicus) which is a suspected competitor of the rock vole.

Distribution

There are a number of historic records indicating the species' existence and distribution in the state. These records include: 20 specimens from Island Pond at 1400' elevation (1937-1940); two specimens from Brighton on the talus slopes of NW Bluff Mountain (1953); one specimen from near Smugglers cave, Mt. Mansfield (1954); four specimens from Nebraska Notch, Mt. Mansfield (1958-1959); and two specimens (one male and one female) from Nebraska Notch, Mt Mansfield (1966). More contemporary records of the rock vole in Vermont include: Whenlock WMA (Chipman, 1994); West Mountain WMA (Kilpatrick, 2001); East Mountain, East Haven (Kilpatrick, 2005), and East Charleston (Kilpatrick, pers. comm.). The Vermont Small Mammal Atlas also recorded six specimens from four sites in Essex and Caledonia counties between 2008 and 2010 (Kilpatrick and Benoit 2011). Unknown populations were verified inhabiting talus slopes on Brousseau Mountain (Averill, Essex Co.), Umpire Mountain (Victory, Essex Co.) and Wheeler Mountain (Sutton, Caledonia Co.) and the population from West Mountain WMA was verified to still exist (Kilpatrick and Benoit 2011).

Distribution by Biophysical Region:

Champlain Valley	Not Probable	**Southern VT Piedmont**	Not Probable
Champlain Hills	Historic Records Only	**Vermont Valley**	Not Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Not Probable
Northern VT Piedmont	Probable	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

Occurs in disjunct populations that are not genetically differentiated so movement corridors may be important. This species is very habitat selective. They use moist talus habitats among mossy rocks and logs in spruce/ fir and northern hardwood forests, cedar swamps, and krummholz. May be naturally rare due to habitat specificity. Rock vole has been reported in three-five year old clearcuts with slash however, not in Vermont. Critical habitat includes cool, moist talus and mossy rocks usually with a stream or other surface water in the immediate vicinity.

Habitat Types:

Cliffs and Talus

Spruce Fir Northern Hardwood

Softwood Swamps

Current Threats

Habitat Threats:

Habitat Alteration

Description of habitat threat(s): Mesic aspect of habitat is important so the loss of forest cover may dry out the site. Loss of connectivity may be a problem. Habitat is isolated and local populations may go extinct. Repopulation may require habitat corridors of coniferous forests that connect optimal habitats. Activities that destroy or degrade talus habitat would impact rock vole populations.

Non-Habitat Threats:

Competition

Description of non-habitat threat(s): Competition from meadow mouse as a result of habitat conversion, particularly near talus areas, could limit the rock vole. Metapopulation structure is not clearly understood but local populations appear to go extinct and then are repopulated. In Massachusetts and West Virginia populations were negatively affected by high levels of deer over the long term (Healey and Brooks 1988).

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4
State Rank: S2
Extirpated in VT? no

Global Trend:
State Trend: unknown
Regional SGCN? No

Assessment Narrative:

Ranked as S2 in Vermont and considered a species of special concern. Talus slopes are the species' refugal habitat. In some locations, rock voles may be found in early successional forest habitat (Kirkland 1977; Martell and Radvanyi 1977) and krumholtz. There is uncertainty as to why the population fluctuates so much and there are relatively few known populations. The relatively narrow habitat requirements of this species make it vulnerable to habitat alterations. Furthermore, because rock voles occur in disjunct populations, it is dependent upon movement corridors. It is also speculated that these disjunct populations could be negatively impacted by landscape changes that favor the meadow vole (Microtus pennsylvanicus) which is a suspected competitor of the rock vole.

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Distribution by Biophysical Region:

Champlain Valley	Not Probable	**Southern VT Piedmont**	Not Probable
Champlain Hills	Historic Records Only	**Vermont Valley**	Not Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Not Probable
Northern VT Piedmont	Probable	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

Occurs in disjunct populations that are not genetically differentiated so movement corridors may be important. This species is very habitat selective. They use moist talus habitats among mossy rocks and logs in spruce/ fir and northern hardwood forests, cedar swamps, and krummholz. May be naturally rare due to habitat specificity. Rock vole has been reported in three-five year old clearcuts with slash however, not in Vermont. Critical habitat includes cool, moist talus and mossy rocks usually with a stream or other surface water in the immediate vicinity.

Habitat Types:

Cliffs and Talus

Spruce Fir Northern Hardwood

Softwood Swamps

Current Threats

Habitat Threats:

Habitat Alteration

Description of habitat threat(s): Mesic aspect of habitat is important so the loss of forest cover may dry out the site. Loss of connectivity may be a problem. Habitat is isolated and local populations may go extinct. Repopulation may require habitat corridors of coniferous forests that connect optimal habitats. Activities that destroy or degrade talus habitat would impact rock vole populations.

Non-Habitat Threats:

Competition

Description of non-habitat threat(s): Competition from meadow mouse as a result of habitat conversion, particularly near talus areas, could limit the rock vole. Metapopulation structure is not clearly understood but local populations appear to go extinct and then are repopulated. In Massachusetts and West Virginia populations were negatively affected by high levels of deer over the long term (Healey and Brooks 1988).

Common Name: **Rock Vole**
Scientific Name: **Microtus chrotorrhinus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Basic Life History	Medium	Telemeter to determine home range movements
Research	Distribution and Abundance	High	Determine distribution and abundance as well as corridor needs
Research	Population Genetics	Medium	Research genetics to determine changes in population structure and size.
Research	Other Research	High	Determine appropriate management strategies to improve and conserve habitat.
Monitoring	Population Change	Medium	In a multi year monitoring effort, re-census historical habitats and survey in other likely habitats and map confirmed habitats.
Monitoring	Monitor Threats	Medium	Monitor encroachment by medow mice.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	Medium	Minimize permanent fragmentation between populations.	Amount of habitat between populations protected or conserved.	UVM	SWG

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Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S3 **State Trend:** unknown
Extirpated in VT? no **Regional SGCN?** no

Assessment Narrative:

The woodland vole is frequently considered a pest in agricultural settings (especially in apple orchards) though much of the reported damage is the result of meadow voles (Microtus pennsylvanicus). Despite appearing to do well in agricultural landscapes, little is known about this species outside this setting or in its native habitat. Fewer than 50 specimens have been collected in the state and is known historically from very few localities .

Distribution

Known historically from very few localities including the flanks of Ide Mountain, West Lyndon Center (Miller, 1964); Island Pond (Miller, 1964); Sherburne (Osgood, 1936); and from Colchester and Duxbury (Kilpatrick, pers. com). Woodland voles occur in orchards in Putney, Mendon, and Bennigton (Kilpatrick, 1979). The Vermont Small Mammal Atlas obtained two specimens from two localities in Orleans and Windsor counties from 2008 to 2010; one was trapped in the Skitchewaug WMA (species verified by DNA sequencing) and another collected from a garden in Charleston (Kilpatrick and Benoit 2011). Records were also verified from Addison County and Chittenden County (Kilpatrick and Benoit 2011).

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Probable
Northern Green Mtns	Probable	**Southern Green Mtns**	Probable
Northern VT Piedmont	Confident	**Taconic Mtns**	Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☐

Defining habitat characteristic of the woodland vole is well-drained sandy loam soils. Found in all places with these soils (e.g. agricultural fields and older forests). Favors well-drained upland forests, grasslands, meadows, or orchards but can be found in marshes and swamps (DeGraff and Yamasaki, 2001). May require a ground cover of leaves or duff or grass. Forages primarily below ground digging tunnel systems 3 inches to 12 inches below ground. Nests are found under dead and down material, rocks, or in burrows. They are active throughout the year and eat tubers, roots and bulbs, seeds, nuts fruits, bark and leaves (DeGraff and Yamasaki, 2001). Can be a problem in orchards.. Prefers large expanses of forest and grassland habitats,

Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Lawns, Gardens, and Row Crops

Current Threats

Habitat Threats:

Unknown Habitat Threats

Description of habitat threat(s): Habitat requirements unknown.

Non-Habitat Threats:

Trampling or Direct Impacts

Pollution

Description of non-habitat threat(s): Because of human/vole conflicts, the application of rodenticides may cause a decline of this species in orchards and other developed lands. The status of the wooland vole in forested habitats is unknown.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Develop baseline data on habitat requirements outside of agricultural areas.
Research	Distribution and Abundance	Medium	Develop baseline data on distribution and abundance outside of agricultural areas.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Standards	Medium	Develop guidelines for pest control professionals for the non-lethal control of the species.	Number of trained pest control professionals	Agricultural extension, Pest Control Professionals	SWG

Common Name: **Woodland Vole**
Scientific Name: **Microtus pinetorum**
Species Group: **Mammal**

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Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
Global Trend:
State Rank: S5
State Trend: Declining
Extirpated in VT? no
Regional SGCN? no

Assessment Narrative:

The muskrat has traditionally been one of the most heavily exploited furbearers in North America owing to its abundance, relative ease of capture and highly prized fur (Boutin and Birkenholz 1987). Across its range today, most jurisdictions, including Vermont, maintain regulated trapping and hunting seasons for the species. The muskrat plays an important ecological role serving as a significant prey source for a variety of predators including raptors, river otter and American mink (Holmengen et al 2009). In recent decades, anecdotal evidence indicates a nationwide decline in muskrat populations. Such noted declines have been most prominent in the northeast. Despite much knowledge regarding the biology and management of muskrats, little empirical evidence exists indicating either the magnitude of such declines and/or any possible contributing factors (Roberts and Crimmins 2010).

Distribution

Muskrat harvest records in Vermont indicate well established populations in all major watersheds.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Known Watersheds
Middle Connecticut
West
Waits
Upper Connecticut-Mascoma
Black-Ottauquechee
Deerfield
Hudson-Hoosic
Mettawee River
Lake Champlain
Lamoille River
Missisquoi River
Otter Creek
Passumpsic

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

St. Francois River
Upper Connecticut
White
Winooski River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Muskrats occupy almost every type of freshwater aquatic habitat in eastern North America (Boutin and Birkenholz 1987). Muskrat have flexible habitat requirements as long as there is permanent water and protection through burrows and vegetated lodges. Highest population densities exist where emergent vegetation is at a 1:1 ratio to open water.

Habitat Types:

Marshes and Sedge Meadows

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Invasion by Exotic Species

Unknown Habitat Threats

Description of habitat threat(s): Although the specific effects of habitat alteration on muskrats are poorly understood, the anthropogenic degradation of muskrat habitat is widely recognized as a potential contributing factor to the decline of populations throughout the region. Increased sedimentation and stream flashiness resulting from poorly planned land management and/or excessive development could, for example, alter the ratio of open water to emergent vegetation within watersheds to the detriment of muskrats. Similarly, human activities resulting in the spread of invasive plant species, such as phragmites, can cause a reduction in the abundance and diversity of native taxa, including muskrats, by creating monotypic stands.

Non-Habitat Threats:

Genetics

Loss of Relationship with Other Species

Predation or Herbivory

Description of non-habitat threat(s): Previous studies of contaminant levels in muskrats have shown that muskrats bioaccumulate heavy metals (Halbrook et al. 1993, Stevens et al. 1997). While the direct

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

effects of such contaminants on muskrats remain uncertain, there is continued concern that the long-term persistence of such contaminents in the environment could limit muskrat populations. While the significance and magnitude of other non-habitat threats are poorly understood, it is speculated that changes in predatory communities, diseases and alterations of natural water cycles all potentially contribute to observed declines in muskrat populations regionally.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Continue closely monitoring the distribution and abundance in Vermont
Research	Threats and Their Significance	High	Determine what factors may be influencing population declines, focusing in particular on pollution and habitat degradation.
Research	Other Research	Medium	Conduct a cause specific mortality study to aid in the identifiction of significant mortality factors in Vermont.
Monitoring	Monitor Threats	Medium	Monitor the accumulation of contaminants such as heavy metals and PCBs in the tissues of muskrats throughout all watersheds in Vermont.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	High	Determine causes of observed declines in regional muskrat populations	Number of hypotheses evaluated	UVM, AFWA	SWG, PR
Policy & Regulations	Medium	Support and cooperate with regional efforts to curb pollution via the development and implementation of appropriate policy and regulations	Reduction in the prevalence of contaminants in Vermont's water bodies	DEC, EPA	
Compliance & Enforcement	High	Enforce existing laws with respect to water quality protection	Increased compliance with existing laws	DEC, EPA	
Compliance & Enforcement	High	Enforce existing laws with respect to riparian and wetland habitat protection	Area and/or linear distance of riparian and wetland habitat protected	DEC, EPA, USACE	
Invasive Species Control & Prevention	Medium	Identify and restore muskrat habitat impaired by invasive plants, and develop and implement measures aimed at preventing further introduction of such species	Acreage of habitat restored and number of preventative measures adopted		

Common Name: **Muskrat**
Scientific Name: **Ondatra zibethicus**
Species Group: **Mammal**

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Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S3
Extirpated in VT? no

Global Trend:
State Trend: Fluctuating
Regional SGCN? yes

Assessment Narrative:

Although the southern bog lemming is relatively rare in collections, it is by no means an uncommon animal (Whitaker and Hamilton 1998). A number of historical records are available primarily for southern Vermont (Kirk 1916, Osgood 1938, Godin 1977). When combined with recent records (Brooks et al. 1998, Kilpatrick 2003, Decher and Kilpatrick 2005, Kilpatrick and Benoit 2011) some 268 specimens of the southern bog lemming confirm the occurrence at over 35 different localities throughout the state (see Kilpatrick and Benoit 2011). The species is believed to exist in scattered colonies that often inhabit only a small portion of the suitable habitat. Although little is known about potential threats to this species in Vermont, it is believed southern bog lemmings are vulnerable to changes in habitat, competition with meadow voles and to a variety of disease and parasites.

The southern bog lemming is listed as a Regional Species of Greatest Conservation Need (RSGCN) among the 13 Northeastern states.

Distribution

The southern bog lemming is known from throughout the state with the exception of Grand Isle, Franklin, and Orange Counties

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Historical Records
Champlain Hills	Confident	**Vermont Valley**	Historical Records
Northern Green Mtns	Confident	**Southern Green Mtns**	Historical Records
Northern VT Piedmont	Probable	**Taconic Mtns**	Historical Records
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

The southern bog lemming uses a wide variety of habitats in addition to sphagnum bogs, including wet meadows and marshes, grassy openings in woods, and among mossy boulders in spruce forests (Linzey 1983). In Southern Canada, New York and New England most captures are associated with sphagnum bogs or heavily forested areas (Coventry 1942, Goodwin 1932, Hamilton 1941). The southern bog lemming will use clearcuts and other small forest openings with adequate ground cover (Kirkland 1977). Recent small mammal surveys in Vermont (Kilpatrick and Benoit 2011) found southern bog lemming among small rock outcrop in a mesic spruce forest and in a red pine plantation. Doutt et al. (1973) suggested that the major feature common to Synaptomys habitats was that they were marginal for Microtus and Linzey (1981, 1984) documented

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

competitive exclusion of Synaptomys by Microtus in southwestern Virginia. Southern bog lemmings have been collected from hairy-tailed mole burrows (Eadie 1939).

Habitat Types:

Outcrops and Alpine

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Softwood Swamps

Open Peatlands

Marshes and Sedge Meadows

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Climate Change

Description of habitat threat(s): Although little has been documented about the potential habitat related threats to this species, it is believed southern bog lemmings are vulnerable to the degradation of preferred habitats resulting from climate change, forest succession, and/or direct human impacts. Habitat threats are of particular concern with respect to a potentially drying climate and the direct loss of sphagnum bogs.

Non-Habitat Threats:

Disease

Competition

Description of non-habitat threat(s): Competition from Microtus (meadow vole) in sites where habitat has been altered and/or forest succession has favored this species. Southern bog lemmings carry a heavy ectoparasite parasite load (Wassel et al. 1978) and several endoparasites have been confirmed (Erickson 1938, Whitaker and Adalis 1971).

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	Medium	Determine baseline information
Research	Distribution and Abundance	High	Determine baseline information
Monitoring	Population Change	High	1) Begin low-level monitoring in appropriate habitats to determine distribution, abundance, and population status and trends. 2) Better understand distribution, abundance and changes in population.

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	High	Monitor distribution and abundance of species	Distribution maps	UVM	SWG, PR

Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

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Common Name: **Southern Bog Lemming**
Scientific Name: **Synaptomys cooperi**
Species Group: **Mammal**

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Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G4
Global Trend:
State Rank: SU
State Trend: Unknown
Extirpated in VT? no
Regional SGCN? No

Assessment Narrative:

Although there are no historical or recent records of the northern bog lemming in Vermont, records are know from surrounding states including a recent specimen from Whiteface Mountain, NY (Sanderson 1988), and three specimens from New Hampshire including two from Coos Co., from Fabyans near the base of Mt Washington (Preble 1899) and Bean's Purchase (Yamasaki 1997) and one from Mt Moosilauke, Grafton Co. (Clough and Albright 1987). Five specimens have been verified from Maine from two localities in Piscataquis Co., one being Mt Katahdin and the other a low elevation site near the western border of Baxter State Park (Clough and Albright 1987). Additional specimens are known from Quebec (Cross 1938, Banfield 1974). The northern bog lemming is among the rarest mammals in New England and eastern Canada and is likely vulnerable to local extirpation (Banfield 1974). The subterranean habits of bog lemmings (Banfield 1974, Godin 1977, Degraff and Yamasaki 2001) likely results in infrequent captures of these rodents by traditional collecting methods. This, combined with the difficulty in identification (Clough and Albright 1987), probably contributes substantially to the rarity of northern bog lemmings in surveys and collections of small mammals. A recent small mammal survey in New Hampshire (Yamaski 1997) employing methods to increase the captures of several rare small mammal species captured a single northern bog lemming at one of the 108 sites surveyed. No northern bog lemmings were captured at the 51 sites recently surveyed in Vermont and none were identified among the southern bog lemming specimens examined (Kilpatrick and Benoit 2011). Despite a lack of evidence of the species in the state, Vermont appears to have viable habitat.

Distribution

Distribution by Biophysical Region:

Champlain Valley	Unknown	**Southern VT Piedmont**	Unknown
Champlain Hills	Unknown	**Vermont Valley**	Unknown
Northern Green Mtns	Unknown	**Southern Green Mtns**	Unknown
Northern VT Piedmont	Unknown	**Taconic Mtns**	Unknown
Northeastern Highlands	Unknown		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

The northern bog lemming has been taken at high elevation sites (3700 - 4500 ft.) in spruce-fir forest with dense herbaceous and mossy understory and in alpine sedge meadows containing sphagnum and surrounded by dense spruce-fir Krummholtz (Clough and Albright 1987). At least two records are known from relatively low elevations (1300 - 1600 ft.) in New Hampshire from habitats ranging from a stand of spruce-budworm

Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

killed spruce-fir forest with a shrub and ground layer consisting of a dense covering of raspberry, ferns, and sedges, and having sphagnum moss in scattered damp places (Clough and Albright 1987) to a wet meadow and mossy streamside (Preble 1898). Habitat requirements included moist loose soils of leaf mold with sphagnum present (Banfield 1974, DeGraff and Yamasaki, 2001). Northern bog lemmings feed on grasses and sedges and use burrows several inches below the ground (Banfield 1974). They are active year round, in summer constructing spherical nest of dried grasses in burrows and in winter nesting on the ground (Banfield 1974).

Habitat Types:

Outcrops and Alpine

Spruce Fir Northern Hardwood

Softwood Swamps

Open Peatlands

Current Threats

Habitat Threats:

Conversion of Habitat

Impacts of Roads or Transportation Systems

Climate Change

Description of habitat threat(s): Two hypotheses for the rarity of this species have been proposed by Clough and Albright (1987); northern bog lemmings require a habitat that is scarce and/or the species cannot coexist with other species of small mammals. Neither hypothesis is strongly supported by the available data. However, habitat conversion that results in the elimination of peat lands, sphagnum bogs and moist wooded areas with a solid floor of thick sphagnum could be a problem for the northern bog lemming. Climate change that results in increasing temperatures, could result in dryer habitats that would allow the meadow vole population to increase and thereby compete and displace northern bog lemmings. Development of roads, trails and powerlines could also provide access for meadow vole populations and result in increased competition with the northern bog lemming.

Non-Habitat Threats:

Competition

Description of non-habitat threat(s): Habitat changes that benefit the meadow vole could result in increased competition that negatively affects the northern bog lemming.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	Determine habitat requirements. Map appropriate habitat.
Research	Distribution and Abundance	High	Conduct a dedicated search for northern bog lemming using species specific methods (pit fall traps and drift fences) in sphagnum-dominated vegetative communities.
Monitoring	Range Shifts	Medium	

Common Name: **Northern bog lemming**
Scientific Name: **Synaptomys borealis**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Research	Medium	Conduct targeted surveys for northern bog lemmings.	Distribution map	UVM	SWG
Research	High	Determine habitat requirements	Map appropriate habitats	UVM	SWG

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Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G4
Global Trend:
State Rank: SX
State Trend: N/A
Extirpated in VT? Yes
Regional SGCN? No

Assessment Narrative:

Believed to be extirpated in Vermont and the rest of New England. Based on bounty records, wolves were historically common in Vermont but were eliminated from the state by the mid to late 1800's as the result of a $20.00 bounty and habitat changes. There is uncertainty regarding the genetic ancestry of the wolves that inhabited the northeastern United States historically, including Vermont (Wilson et al. 2003, Koblmuller et al. 2009, Kays et al. 2009). Rigorous DNA analysis of additional historic samples from Vermont and the northeastern United States may help clarify this issue.

The wolf is currently considered extirpated in the Northeast but populations exist in southern Canada with potential for migrants to arrive in Vermont within next 20 years. However, the St. Lawrence River and adjacent agricultural/urban/suburban environments in southern Quebec and Ontario may pose substantial barriers. Additionally, dispersal rates for wolves in southern Ontario and Quebec appear to be relatively low and canids are harvested heavily in these regions, which will likely reduce the number of wolves successfully dispersing into New England (Wydeven et al. 1998). The ability of coyote hunters in the northeast to effectively discern wolves from coyotes in the field may also influence the likelihood of natural wolf recolonization. Recovery/reintroduction efforts are complicated by taxonomic uncertainty about the wolf or wolves that historically occupied the region, by public attitudes towards wolves, and by potential interactions with the eastern coyote. Regardless, populations of gray wolves, eastern wolves, and wolves of mixed ancestry in Ontario and Quebec are within plausible dispersal distance of Vermont (Wydeven et al. 1998, Fuller et al. 2003). Thus, it is possible that eastern and/or gray wolves enter Vermont periodically and the potential for natural recolonization of the state exists

Distribution

It is believed that wolves existed throughout Vermont prior to European settlement. This belief is supported by bounty records which clearly indicate the existence of wolves in nearly all biophysical regions of the state.

Distribution by Biophysical Region:

Champlain Valley	Historic Records Only	**Southern VT Piedmont**	Historic Records Only
Champlain Hills	Historic Records Only	**Vermont Valley**	Historic Records Only
Northern Green Mtns	Historic Records Only	**Southern Green Mtns**	Historic Records Only
Northern VT Piedmont	Historic Records Only	**Taconic Mtns**	Historic Records Only
Northeastern Highlands	Historic Records Only		

Distribution by Watershed:

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Wolves are considered to be habitat generalists and usually select habitat to maximize predation success rather than for specific vegetation characteristics per se (e.g., Mech et al. 2003). Much of the suitable habitat for wolves in Vermont is likely forested, however wolves would be likely to occupy any patches of undeveloped terrestrial habitat that support adequate prey densities and where they are protected from human-caused mortality. Although wolves use a variety of habitat types across their range, they tend to occupy relatively contiguous patches of forests in remote areas with relatively low human and road densities (Mladenoff et al. 1995, Benson et al. 2012). Wolves require an adequate prey base to persist. Deer, moose, and beaver would likely be the main prey for wolves in Vermont Mladenoff and Sickley (1998) and Harrison and Chapin (1998) estimated that approximately 53, 500 to 58, 500 km2 of suitable habitat remains in northern New England. Mladenoff and Sickley (1998) further suggested that this habitat could support 702 to 1439 wolves. Harrison and Chapin (1998) suggested that 2470 km2 and 1430 km2 of suitable "core" and "dispersal" habitat, respectively, existed in Vermont based on road densities, human densities, and available forested habitat. Fuller et al. (2003) recommended that the smallest demographically viable wolf population might include 2-3 adjacent packs of 4 wolves each that were 40-60 km from other wolves. Thus, the 950 km2 of suitable core habitat estimated to exist in Vermont might support approximately 8 packs of 4 wolves at average ungulate densities (8 deer/ km2) with wolf territories of approximately 300 km2 (Fuller et al. 2003). Some of the core habitat identified by Harrison and Chapin (1998) is somewhat isolated in the central and southwestern portions of the state which might limit connectivity between patches. However, there is considerable evidence of wolves crossing highways and areas used intensively by humans in both Europe and North America (Merrill and Mech 2000, reviewed by Boitani 2003) suggesting that wolves might be able to successfully navigate the fragmented New England landscape. Mech (2006) found that Mladenoff and Sickely's predictive model for wolf recolonization in Wisconsin (and potentially for the Northeast) failed to account for the wolf's adaptability and capacity to colonize areas deemed <50% probable, including 22% of colonized areas with low probability. Additionally, Harrison and Chapin (1998) noted that much of the core habitat in Vermont is in the northeastern portion of the state and is contiguous with an expansive area of suitable habitat in New Hampshire, Maine, and Quebec meaning that wolves in Vermont could be connected with a larger regional population should recolonization occur. Territory size and density of wolves are strongly influenced by the availability of prey. Mean territory size is larger (>1000 km2) and smaller (< 200 km2) in areas with lower and greater prey densities, respectively (Mech and Boitani 2003, Fuller et al. 2003). Thus, the estimates for wolf numbers and territory sizes would likely shift depending on the local densities of deer and moose in areas of suitable habitat within Vermont. Regional corridors and habitat linkages are critical to maintaining wolves in potentially fragmented landscapes. Three important elements to wolf population viability are adequate prey, absence of excessive human exploitation, and relatively undeveloped blocks of habitat (Fritts and Carbyn 1995; Fuller 1997; Haight et al. 1998 in Parson 2003).

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Habitat Types:

Upland Shores

Outcrops and Alpine

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Transportation Systems

Description of habitat threat(s): Human activity associated with roads, vehicles, and houses seem to negatively influence use of an area by wolves. Conversion of forest and other natural habitat to non-forest (development and agriculture) also negatively affects wolf densities. Wolves cannot survive without adequate prey, adequate protection, and adequate public support (Theberge et al, 1996 in Tumosa 2003). Connectivity with other wolf packs in the region is important to recovery of wolves in the northeast. Potential core habitat in southern Vermont appears to be disconnected from core habitat in northeastern Vermont (Harrison and Chapin 1998).

Non-Habitat Threats:

Genetics

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Competition

Parasites

Harvest or Collection

Loss of Prey Base

Trampling or Direct Impacts

Description of non-habitat threat(s): Competition/hybridization with eastern coyotes may influence the probability of successful wolf recolonization of Vermont. Eastern wolves readily hybridize with eastern coyotes where they come into contact (e.g., Rutledge et al. 2010, Benson et al. 2012, Monzon et al. 2014). Hybridization would likely be rampant in Vermont between recolonizing eastern wolves (which would be at low density) and coyotes (which would be much more abundant). Conversely, gray wolves and admixed gray wolves such as those inhabiting Minnesota, Wisconsin, and Michigan have not been documented to hybridize with coyotes in the wild (e.g., Wheeldon et al. 2010). Thus, dispersing gray wolves from Quebec and Ontario may have a higher probability of avoiding genetic swamping from eastern coyotes and establishing a viable population in Vermont. The eastern coyote is now the dominant large canid predator in the Northeast and it is not clear how the existing coyote population would respond to the establishment of a wolf population. A better understanding of the ecological role of the eastern coyote in Vermont would help clarify the extent to which these smaller canids are able to occupy the ecological niche of wolves.

Thiel (1985) found that when wolves were persecuted by humans in Wisconsin populations did not persist where road densities exceeded approximately 1km/km2. However, with sufficient protection from human-caused mortality wolves have been documented persisting at road densities greater than 1km/km2 as public attitudes about wolves shifted (Mech 1989, Fuller et al. 1992, reviewed in Fuller et al. 2003). Thus, protection from hunting and trapping mortality may facilitate viable wolf populations in fragmented habitat with higher human population and road densities.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Document and map the distribution of large wild canids based on DNA analysis.
Research	Population Genetics	High	Determine the genetics of large wild canids in Vermont and monitor wolf colonization events.
Research	Taxonomy	High	Determine the species of wolf historically found in Vermont.
Research	Other Research	High	Determine public attitudes towards wolves in Vermont and New England
Monitoring	Other Monitoring Needs	High	Monitor wolf colonization events

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	High	Determine public attitudes towards wolf recovery possibly by partnering with University researchers to conduct a rigorous evaluation of public opinions.		NWF, Keeping Track, Sportsmen's Federation, University researchers, wildlife educators	USFWS, SWG
Policy & Regulations	Medium	Develop statewide protocol to guide state/federal wildlife management actions in response to wolf immigration. Results of the species restoration strategy may provide information that can be used to reevalute the rank for this strategy in the future.	Degree to which partners adopt the protocols	USFWS, USFS, NWF, VTFSC, Agency of Agriculture, NRCS, Farm Bureau, RPCs, Law Enforcement,	USFWS, SWG
Species Restoration	High	Evaluate VT large canid ancestry via DNA analysis/ morphology to monitor possible recolonization. Obtain tissue samples and morphological measurements from large canids trapped, shot, hit by cars, or otherwise observed in VT.		NWF, Keeping Track, Sportsmen's Federation, VTA,	NWF, USFWS, SWG
Compatible Resource Use	Medium	Develop and distribute outreach and educational materials to help hunters and trappers better distinguish between coyotes for wolves.	Literature, web-videos, public presentations, informational signs, media articles are all necessary for increased public awareness.	USFWs, VFWD, hunting and trapping organizations	VFWD, USFWS

Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

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Common Name: **Wolf**
Scientific Name: **Canis sp?**
Species Group: **Mammal**

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Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Stable
Extirpated in VT? No **Regional SGCN?** no

Assessment Narrative:

Gray foxes are widespread throughout Vermont and occupy most major habitat types including forests, shrublands, agricultural areas, and the margins of urban environments. Despite being relatively common, little is known about basic characteristics of the species in the state, including distribution, demographics, diet and space use behavior, and interactions with other species. Similarly, little is known about threats facing the species. Gray foxes elsewhere are negatively impacted by competition from larger carnivores such as red foxes, coyotes, and bobcats, and diseases such as rabies and canine distemper. Gray foxes also appear to be expanding their range northward into Quebec.

Distribution

Gray Fox harvest records indicate a widespread distribution of the species in Vermont with records of occurrence in all biophysical regions.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Few studies have been undertaken on gray foxes regionally in New England and even range-wide, despite their widespread distribution and perception as a common species (Fuller and Cypher 2004). Studies elsewhere indicate that foxes occur in densities that range from 0.4/km2 (California) to 1.5/km2 (Florida), and that foxes occupy home ranges that vary in size from 75 ha (West Virginia) to 653 ha (Alabama) (Fritzell and Haroldson 1982, Fuller and Cypher 2004). In Vermont, a radio-telemetry study indicated that average gray fox home range size was 4.43 km2 in the Champlain Valley (n=5, 2 females/3 males, Ingle 1990). Gray foxes in this study occurred primarily in hardwood forested areas and avoided open habitats. Basic demographic estimates, such as density and population size, and home range/habitat use characteristics have not been adequately quantified in Vermont. Gray foxes elsewhere associate mainly with deciduous forest, but use other forest types, shrublands, agricultural lands, fields, and farmlands, and the margins of urban environments (Fritzell and Haroldson 1982). They typically use successional forests, habitat mosaics and managed woodlands.

Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Habitat Alteration

Unknown Habitat Threats

Description of habitat threat(s): Unknown, but distribution and abundance appears to be linked to forest habitats. Changes in forest cover, especially deciduous forest, due to development (e.g., residential housing, roads, urban expansion) may impact the species in Vermont.

Non-Habitat Threats:

Disease

Competition

Description of non-habitat threat(s): Competition and mortality from coyotes, bobcats, and red foxes represent potential threats. These three species have been shown to compete with gray foxes elsewhere (Chamberlain and Leopold 2005, Farias et al. 2005), and may negatively impact the species in Vermont. Diseases such as rabies and distemper represents another potential concern (Fuller and Cypher 2004).

Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S5 **State Trend:** Stable
Extirpated in VT? No **Regional SGCN?** no

Assessment Narrative:

Gray foxes are widespread throughout Vermont and occupy most major habitat types including forests, shrublands, agricultural areas, and the margins of urban environments. Despite being relatively common, little is known about basic characteristics of the species in the state, including distribution, demographics, diet and space use behavior, and interactions with other species. Similarly, little is known about threats facing the species. Gray foxes elsewhere are negatively impacted by competition from larger carnivores such as red foxes, coyotes, and bobcats, and diseases such as rabies and canine distemper. Gray foxes also appear to be expanding their range northward into Quebec.

Distribution

Gray Fox harvest records indicate a widespread distribution of the species in Vermont with records of occurrence in all biophysical regions.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Few studies have been undertaken on gray foxes regionally in New England and even range-wide, despite their widespread distribution and perception as a common species (Fuller and Cypher 2004). Studies elsewhere indicate that foxes occur in densities that range from 0.4/km2 (California) to 1.5/km2 (Florida), and that foxes occupy home ranges that vary in size from 75 ha (West Virginia) to 653 ha (Alabama) (Fritzell and Haroldson 1982, Fuller and Cypher 2004). In Vermont, a radio-telemetry study indicated that average gray fox home range size was 4.43 km2 in the Champlain Valley (n=5, 2 females/3 males, Ingle 1990). Gray foxes in this study occurred primarily in hardwood forested areas and avoided open habitats. Basic demographic estimates, such as density and population size, and home range/habitat use characteristics have not been adequately quantified in Vermont. Gray foxes elsewhere associate mainly with deciduous forest, but use other forest types, shrublands, agricultural lands, fields, and farmlands, and the margins of urban environments (Fritzell and Haroldson 1982). They typically use successional forests, habitat mosaics and managed woodlands.

Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Seeps and Pools

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Current Threats

Habitat Threats:

Habitat Alteration

Unknown Habitat Threats

Description of habitat threat(s): Unknown, but distribution and abundance appears to be linked to forest habitats. Changes in forest cover, especially deciduous forest, due to development (e.g., residential housing, roads, urban expansion) may impact the species in Vermont.

Non-Habitat Threats:

Disease

Competition

Description of non-habitat threat(s): Competition and mortality from coyotes, bobcats, and red foxes represent potential threats. These three species have been shown to compete with gray foxes elsewhere (Chamberlain and Leopold 2005, Farias et al. 2005), and may negatively impact the species in Vermont. Diseases such as rabies and distemper represents another potential concern (Fuller and Cypher 2004).

Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Medium	Identify important habitats and quantify patterns of habitat selection.
Research	Basic Life History	Medium	Estimate home range characteristics.
Research	Distribution and Abundance	High	Refine distribution and abundance data.
Research	Threats and Their Significance	Medium	1) Examine how habitat alteration impacts distribution and abundance. 2) Determine the effects of zoontic diseases (distemper and rabies). 3) Determine effects of competition with coyotes and other sympatric carnivores such as fisher.
Monitoring	Range Shifts	Medium	Determine possible range shifts and population changes due to climate change.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Promote less development of high quality habitats.	Amount of high quality habitat protected or conserved	VTrans, Town Planning Commissions, Town and Regional Cons Comms, VLT, Keeping Track	SWG, Vtrans

Common Name: **Gray Fox**
Scientific Name: **Urocyon cinereoargenteus**
Species Group: **Mammal**

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Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5 **Global Trend:**
State Rank: S1 **State Trend:** Increasing
Extirpated in VT? Unknown **Regional SGCN?** Yes

Assessment Narrative:

Despite having been previously extirpated from Vermont, recent evidence indicates the presence of two distinct populations of American marten in the state (VFWD unpublished data). Although little is known regarding their full extent and distribution, these populations are likely at risk due to their presumed small size and limited distribution. Relative to most other forest-associated mammals, marten have large spatial requirements, low population densities and specific habitat needs (Buskirk and Ruggerio 1994) making populations particularly vulnerable to factors influencing habitat suitability. Forest management practices that fail to consider marten habitat requirements, for example, may result in a decrease in marten density and productivity over the landscape (Gosse et al. 2005, Payer and Harrison 1999, Johnson et al. 2009, Fuller and Harrison 2005). Furthermore, interspecific relations with sympatric carnivores such as fisher and red fox are widely hypothesized to be limiting factors for marten population recovery and expansion (Krohn et al 2004, Siren 2009). Vermont furbearer harvest data indicate widespread and abundant populations of many competing carnivores throughout the state (VFWD unpublished data). Last, the strong correlation between marten occurrence and the annual accumulation of suitable snow depths makes the persistence of this species in Vermont vulnerable to changes in the climate (Krohn 2012, Kelly 2005, Siren 2009, and Carroll 2007).

Distribution

Although believed to have occurred throughout the state prior to European contact, American marten were extirpated from Vermont in the 1800's due to excessive land clearing and unregulated trapping. Since 2000, a total of 25 marten occurrences have been confirmed in Vermont(VFWD unpublished data). The majority of these were reported from the northeast corner of the state in Essex (13), Caledonia (4) and Orleans (1) counties. The remaining marten were reported from the high elevation towns of the southern Green Mountains in Bennington (4) and Windham (3) counties. Additionally, remote camera surveys conducted in 2012 documented the occurrence of two individual marten in the town of Sunderland (Bennington County).

Distribution by Biophysical Region:

Champlain Valley	Not Probable	**Southern VT Piedmont**	Not Probable
Champlain Hills	Not Probable	**Vermont Valley**	Not Probable
Northern Green Mtns	Probable	**Southern Green Mtns**	Confident
Northern VT Piedmont	Probable	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

In general, American marten are associated with forested habitats that provide overhead cover and complex physical structure near the forest floor (Payer and Harrison 2003, Andruskiw 2008, Godbout and Ouellet 2010). Although these forest characteristics are most closely associated with older seral stages, the use of younger, managed forests by marten has also been well documented where previous harvesting practices have favored the retention of course woody debris, and have maintained residual basal areas greater than 18m2/ha and at least a 30% canopy closure in winter (Thompson et al 2012, Payer and Harrison 2003, Fuller and Harrison 2005). In the northeast, suitable marten habitat is provided by a wide range of forest types including mixed coniferous-deciduous forests and forests dominated by deciduous trees (Kelly 2005, Payer and Harrison 1999). Marten avoid open areas such as those occurring naturally on the landscape (e.g. wetland meadows and stands recently disturbed by fire, Gosse et al. 2005) and those resulting from human activities (e.g. clearcutting and infrastructure development; Payer and Harrison 1999, Siren 2009). Jensen et al (2012) documented a significant demographic response of the marten population to fluctuations in annual mast crop production indicating the importance of mast producing trees as a component of suitable marten habitat. Several studies have documented a close association of annual snow fall rates and occupied marten habitat suggesting a strong preference for deep snow where certain morphological adaptions may give marten competitive advantages over sympatric carnivores (Krohn 2004, Kelly 2005, Carroll 2007).

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Softwood Swamps

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Climate Change

Description of habitat threat(s): Because American marten life history is strongly influenced by adult survival (Buskirk et al. 2012), the recovery and growth of Vermont's marten populations will require favorable environmental conditions over long periods of time. Thus, habitat stochasticity resulting from anticipated changes in the climate (Carroll 2007, Krohn 2012, Kelly 2005), the broadscale implementation of forest management practices that do not adequately account for marten habitat requirments (Thompson et al. 2012, Fuller and Harrison 2005, Payer and Harrison 2003), and further fragmentation of the lanscape (Siren 2009) jeopardizes the persistence of marten in the state.

Non-Habitat Threats:

Harvest or Collection

Competition

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Disease

Predation or Herbivory

Loss of Prey Base

Description of non-habitat threat(s): Competition with, and predation by, sympatric carnivores such as fisher and red fox could negatively influence the distribution and persistence of marten in Vermont (Krohn et al 1995, Kelly 2005, Siren 2009). The effects of climate change will likely exacerbate the adverse impact of interspecific completion on marten as carnivore communities shift northward into marten range and the species' competitive advantages are diminished as a result of lower snowfall accumulations (Carroll 2007, Krohn et al. 2005). Although the incidental take of marten in fisher traps has been documented in Vermont (VFWD unpublished data), it is not currently known to be a limiting factor of the marten population. In fact, the continued harvest and management of competing carnivores could prove to be an overall benefit to marten despite this infrequent take. Although difficult to assess, the impacts of unregulated take and interspecific competition need to be considered where the maintenance of marten populations is a priority.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	High	Perform a habitat suitability analysis of Vermont in order to identify key marten habitats, to help predict distribution of the speices in the state and to facilitate the developemnt of appropriate conservation actions.
Research	Distribution and Abundance	High	Collect baseline data on marten distribution and abundance in Vermont in order to assess the status of the population and develop appropriate conservation strategies.
Research	Threats and Their Significance	Medium	Examine the affects of interspecific competion with fisher and assess how certain habitat features, fisher harvests and snow depths influence this relationship.
Research	Population Genetics	High	Conduct a genetic analysis of marten in Vermont in order to determine the source of the species in the state, particularly of the southern population.
Research	Other Research	High	Assess the effectiveness and practicality of various trap configurations and trapping techniques for minimizing the incidental take of marten.
Monitoring	Population Change	Medium	Develop and implement a plan for monitoring the marten population in Vermont.
Monitoring	Habitat Change	Medium	Develop and implement a plan for monitoring changes in suitable marten habitat resulting from habitat conversions, forest management practices and climate change.
Monitoring	Range Shifts	Low	Monitor range shifts of competing carnivore populations resulting from climate change.

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	Medium	Support and cooperate with larger efforts to curb global climate change.			
Compatible Resource Use	High	Promote forest management practices that provide for the life history requirements of marten	Number of acres of forest land positively influenced	Coverts, UVA, USFS, Industrial forest landowners, VFPR, VLT landowners, Forest Legacy landowners	
Standards	Medium	Develop best management practices for forest management within key marten habitats	The successful development and subsequent dissemination of best management practices	UVM, VFPR	SWG
Standards	High	Develop best management practices for fisher trapping in order to minimize incidental take of marten	Number of trappers employing best management practices and the number of marten taken	Vermont Trappers Association, AFWA, NHFG, MDIFW, NY DEC	Vermont Trappers Association, AFWA, SWG
Compatible Resource Use	High	Continue managing competing carnivores within key marten habitats, particularly fisher, via regulated trapping	Maintenance of healthy furbearer populations	Vermont Trappers Association	
Standards	Medium	Develop and implement guidelines and mitigation strategies for minimizing impacts to key marten habitats from regulated land use activities such as the development of energy infrastructure	Number of acres protected from conversion		

Common Name: **American Marten**
Scientific Name: **Martes americana**
Species Group: **Mammal**

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Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: S3S4 **State Trend:** unknown
Extirpated in VT? no **Regional SGCN?** no

Assessment Narrative:

The distribution and abundance of long-tailed weasels in Vermont are poorly understood and no records of their occurrence were collected during a statewide small mammal survey between 2008 and 2010 (Kilpatrick and Benoit, 2011). Although the extent to which these factors influence the population is poorly understood, the species is vulnerable to current pest control practices and could be potentially impacted by the application of pesticides.

Distribution

Only 22 verified records of the long-tailed weasel are available for Vermont but these confirm a wide spread distibution of this species in Orleans, Essex, Chittenden, Caledonia, Addison, Rutland, Windsor and Bennington counties. No additional records of their occurrence were collected during a state wide small mammal survey between 2008 and 2010 (Kilpatrrick and Benoit, 2011)

Distribution by Biophysical Region:

Champlain Valley	Probable	**Southern VT Piedmont**	Confident
Champlain Hills	Probable	**Vermont Valley**	Probable
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Probable	**Taconic Mtns**	Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

The long-tailed weasel inhabits the broadest range of any of the weasels from low elevations to above treeline across the continent (Novak et al, 1987). They occupy a variety of habitats from forest and shrubs adjacent to stone walls to fields, wetlands and standing water. Where it overlaps with the short-tailed weasel, it may occupy more open habitats while the short-tailed weasel is more common in forested or wetland areas. Areas with high prey density are important. The long-tailed weasel feeds on small mammals such as mice, rabbits, voles and ground nesting birds. Water seems to be a critical factor. Hamilton (1933) reported that they can drink 25cc of water per day and therefore, it may be restricted to habitats in close proximity to standing water. The long-tailed weasel is more of a food generalist than the short-tailed weasel. On average, long-tailed weasels will take 1.5 voles per day (Powell 1973 in Wild Furbearer Mgt 1987). The weasel uses excavated burrows or holes and/or crevices for den sites (DeGraff and Yamasaki, 2001).

Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Marshes and Sedge Meadows

Wet Shores

Early Succession Boreal Hardwoods

Early Succession Northern Hardwoods

Early Succession Upland Oak

Grasslands, Hedgerows, Old Field, Shrub, or Orchard

Aquatic: Man-Made Water Bodies

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Succession

Habitat Alteration

Description of habitat threat(s): Although the full extent and nature of impacts are poorly understood, it is suspected that the conversion of habitat via natural succession or anthropogenic degradation could negatively affect weasel populations.

Non-Habitat Threats:

Predation or Herbivory

Description of non-habitat threat(s): Predation on long-tailed weasels by domestic pets, foxes and raptors could be a factor limiting the distribution and abundance of this species. Similarly, when existing in close proximity to humans, exposure to pest control practices and potential for road kill may be a problem. Weasels could be affected directly and/or indirectly by pesticide use.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Distribution and Abundance	High	Determine abundance, distribution, and status of the Vermont population.
Research	Threats and Their Significance	Medium	Examine how current pest control practices, including the use of pesticides, influence long-tailed weasel populations.
Research	Other Research	Low	Examine how predation, particularly by domestic pets, influecnes long-tailed weasel populations.
Monitoring	Population Change	Medium	Develop and implement a plan for monitoring the long-tailed weasel population in Vermont.
Monitoring	Habitat Change	Medium	Examine how forest succession and anthropogenic changes of the landscape influence long-tailed weasel populations.

Common Name: **Long-tailed Weasel**
Scientific Name: **Mustela frenata**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Awareness Raising and Communications	Medium	Develop outreach materials informing the public of the importance of keeping domestic pets under control	Development and dissemination of outreach materials		
Standards	Medium	Develop Best Management Practices for pest control professionals and landowners to follow for minimizing damage by and lethal control of long-tailed weasels	Development and dissemination of BMPs	NWCOs, Pest Control Professionals	SWG

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Common Name: **Northern River Otter**
Scientific Name: **Lontra canadensis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
Global Trend:
State Rank: S5
State Trend: stable
Extirpated in VT? no
Regional SGCN? no

Assessment Narrative:

The Northern River Otter's pisciviorous diet and high trophic position make it a noteworthy indicator of pollution in aquatic systems (Melquist and Dronkert 1987). Of 20 otter tested for mercury in Vermont in 2001, for example, two had levels higher than that recommended by the EPA (K. Royar, pers. Com). Prey may also be susceptible to pollution and acid rain. Because of their strict aquatic nature, otter populations are susceptible to changes in riverine and lacustrine habitats which alter the physical character of these habitats and/or impact the prey upon which they depend.

Distribution

Otter are annually harvested in every watershed in Vermont during a regulated trapping season.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Known Watersheds

Middle Connecticut
West
Waits
Upper Connecticut-Mascoma
Black-Ottauquechee
Deerfield
Hudson-Hoosic
Mettawee River
Lake Champlain
Lamoille River
Missisquoi River
Otter Creek
Passumpsic
St. Francois River
Upper Connecticut

Common Name: **Northern River Otter**
Scientific Name: **Lontra canadensis**
Species Group: **Mammal**

White
Winooski River

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☐

Otter are adaptable to many different wetland habitats including beaver created wetlands, lakes, streams and ponds. Intact vegetation along the perimeter of streams, lakes and wetlands is an important habitat feature of otter habitat. Beaver bank dens and lodges are also used by otter. Beaver created wetlands provide critical foraging and denning habitat. Log jams resulting from fallen trees also provide shelter and foraging habitat. Otter also require healthy aquatic systems that provide an adequate prey base.

Habitat Types:

Aquatic: Fluvial

Aquatic: Lower CT River

Aquatic: Large Lake Champlain Tribs Below Falls

Aquatic: Lacustrine

Aquatic: Lake Champlain

Current Threats

Habitat Threats:

Habitat Alteration

Sedimentation

Impacts of Roads or Transportation Systems

Description of habitat threat(s): Forested riparian buffers are key components of otter habitat. Loss and/or degradation could influence otter habitat selection and productivity. Historically, otter were limited by human encroachment, habitat destruction, and unregulated harvest. In Vermont, the extirpation of beaver, loss of habitat, and pollution resulted in a much reduced population throughout the 1800's and early 1900's. Otter populations have rebounded with the return of the beaver. Although not strongly supported in recent literature, it is expected that increasing development pressure and pollutants such as mercury could negatively affect future population levels. Despite this potential vulnerability, contemporary harvest records in Vermont indicate a well distributed, abundant population of otter in recent decades. Furthermore, should Vermont's otter population begin experiencing the effects of development, pollution and/or climate stressors, the mechanisms for detecting and addressing such population trends are currently in place.

Non-Habitat Threats:

Pollution

Loss of Prey Base

Description of non-habitat threat(s): Although the effects of pollutants are not believed to be a limiting factor for the otter population in Vermont, contaminants such as PCB's, mercury, and other heavy metals are known to accumulate in the tissue of otter and negatively affect reproduction and survival.

Common Name: **Northern River Otter**
Scientific Name: **Lontra canadensis**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	Medium	Monitor distribution and abundance
Research	Threats and Their Significance	High	Determine the impact of heavy metals and contaminants on otter populations in each watershed.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Privately-Owned Protected Areas		Maintain riparian buffer strips along streams, rivers, lakes, ponds, and wetland habitats.	Number of linear miles of vegetated riparian buffers	Trout Unlimited, NRCS, USFWS, NWTF, DEC, Vt. F&P	SWG, USFWS, NRCS, FSA, CREP
Species Restoration		Provide a suitable prey base.		Trout unlimited, DEC	TU, DEC, USFWS, SWG
Policy & Regulations		Eliminate acid rain and the input of mercury into otter habitat.	Decrease acid, mercury, and heavy metal deposition into Vermont lakes, rivers, and streams	DEC, EPA,	DEC, EPA
Compliance & Enforcement		Enforce the Clean Water Act	Increase the number of bodies of water that meet class A designation	Trout Unlimited, NRCS, USFWS, USFS, Wild Turkey Federation, DEC, Vt. Forests & Parks	EQIP, SWG, EPA, NWTF

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Common Name: **Canada Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: High Priority

Global Rank: G5
Global Trend:
State Rank: S1
State Trend: Fluctuating
Extirpated in VT? yes
Regional SGCN? no

Assessment Narrative:

Recovery of lynx in Vermont may be limited by global climate change (Carroll 2007, Hoving et al. 2005). Although the influence of competition from coyote, fisher, and bobcat, which could also be exacerbated by global climate change (Peers et al. 2013), may not be clearly understood (Ray et.al. 2002), there is some indication that lynx populations existing at the margins of their range may be limited by these sympatric carnivores (Peers et al. 2013, Vashon et al. 2012). Harvest records for fisher, bobcat and coyote in northeast Vermont (VFWD unpublished data) and track surveys conducted within Vermont's two largest blocks of unfragmented suitable lynx habitat (Farrell 2012) indicate well-established populations of these competing carnivores. Suitable lynx habitat in Vermont is limited and occurs in relatively small patches distributed over the northeastern portions of the state. As a result of this habitat condition, the effects of fragmentation could result in the isolation of Vermont's lynx population from populations to the north further jeopardizing its ability to persist in the state (Koehler et al. 2008, Murray et al. 2008). Also, because Canada lynx exhibit strong selection for habitats where snowshoe hares are abundant (Fuller et al. 2007, Vashon et al. 2008, Squires et al. 2010), the suitability of Vermont's currently occupied lynx habitat could change markedly with future changes in landscape-level hare densities and changing habitat associated with forest management; thus, successful conservation of lynx populations in Vermont will require the protection and management of large tracts of snowshoe hare habitat (Simons-Legaard et al. 2013, Murray et al. 2008).

Distribution

Historical records of Canada lynx in Vermont are scarce. Prior to this century, lynx were documented in the state on only four occasions (Windham 1928, St. Albans 1968, Calais 1797 and Addison County 1937: Vermont archived bounty records). Since 2003, nine lynx sightings have been confirmed in Vermont. Eight of the sightings were recorded in Essex County and one in Orleans County (unpublished data, VFWD). Since 2012, Intensive snow track and remote camera surveys have successfully detected lynx in the Nulhegan Basin (Bernier 2011 & 2013). Reproduction was first documented in 2012 in the Nulhegan Basin when the tracks of three lynx, a presumed family group, were observed travelling together in late February (Bernier 2011).

Distribution by Biophysical Region:

Champlain Valley	Historic Records Only	**Southern VT Piedmont**	Not Probable
Champlain Hills	Not Probable	**Vermont Valley**	Not Probable
Northern Green Mtns	Not Probable	**Southern Green Mtns**	Not Probable
Northern VT Piedmont	Probable	**Taconic Mtns**	Not Probable
Northeastern Highlands	Confident		

Distribution by Watershed:

Common Name: **Canada Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☐

Along the southern periphery of their range, lynx prefer a variety of habitat types including mid-successional coniferous forests and edge habitat with moderate to abundant understory cover (Koehler et al. 2008, Maletzke et al. 2008, Vashon et al. 2008b). Lynx tend to avoid open areas and mature forests having little horizontal cover (Vashon et al. 2008b). Lynx select for stands where snowshoe hare are abundant (2.4 hares/ha, Vashon et al. 2008) such as areas of dense softwood in association with 11 - 21 year old regenerating clear-cuts or similarly aged partially harvested stands (Fuller et al. 2007, Simons-Legaard 2013). Organ et al. (2008) identified the "tip up mounds" of blown down trees as features commonly used as natal dens and further found that the presence of within stand structure capable of providing visual obscurity at 5 meters from the den was a significant predictor of den site selection by lynx. Hoving (2005) determined that lynx populations in this region are unlikely to occur in areas of low annual snowfall (<270cm) or areas dominated by deciduous forests.

Habitat Types:

Spruce Fir Northern Hardwood

Early Succession Boreal Conifers

Early Succession Spruce-Fir

Current Threats

Habitat Threats:

Habitat Succession

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Transportation Systems

Climate Change

Description of habitat threat(s): Changes in the climate that result in the reduction of annual snowfall could greatly influence the distribution of lynx in the northeast (Hoving 2005). Decreased snowfall can affect lynx through decreased prey vulnerability and decreased competitive advantage over sympatric carnivores (Carroll 2007). Furthermore, although there is evidence that the degree of diet specialization of lynx in the southern parts of their range is less than in their northern counterparts, the long-term persistence of lynx in Vermont could be limited by the availability of suitable snowshoe hare densities (Roth et al. 2007, Simons-Legaard et al. 2013). Thus, the loss of suitable hare habitat from both natural (i.e. forest succession) and human caused disturbances (i.e. forest management favoring deciduous forest composition) could adversely affect lynx in Vermont. In addition, because the viability of lynx populations in the southern part of their range is suspect in the absence of ingress from northern populations (Murray et al. 2008), the maintenance of landscape connectivity with these northern areas of occupancy is of critical importance. Although Farrell (2012) concluded that lynx connectivity across the northeast is expected to remain stable in the coming decades, the long-term persistence of lynx in Vermont remains dependent upon interstate and international commitments to maintaining these connective habitats (Murray et al. 2007).

Non-Habitat Threats:

Common Name: **Canada Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Loss of Metapopulation Structure

Competition

Predation or Herbivory

Loss of Prey Base

Description of non-habitat threat(s): Peers et al. (2013) determined that lynx are subjected to niche displacement in areas of overlap with bobcat. In Vermont, bobcat harvest data (VFWD unpublished data) and the results of extensive snow track surveys conducted since 2012 (Bernier 2012 & 2013) indicate a well-established, sympatric bobcat population. Furthermore, the effects of climate change could increase the competitive pressure on lynx by altering the distribution and abundance of competing carnivores populations and by decreasing their competitive advantages over these sympatric species (Carroll 2007). In addition, the primary source of mortality of lynx in Maine was predation, especially by fisher, accounting for nearly 42% of lynx deaths (Vashon et al. 2012). Similar to bobcats, harvest data and track survey results also indicate an abundance of fisher within Vermont's most suitable lynx habitats.

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Distribution and Abundance	High	Collect baseline data on lynx distribution and abundance in Vermont in order to assess the status of the population and develop appropriate conservation strategies.
Research	Threats and Their Significance	High	Examine the affects of competition with sympatric carnivores and assess how certain habitat features such as snow depth, managing furbearer populations, and a changing climate may influence this relationship.
Monitoring	Population Change	High	Continue monitoring for the presence of the species in the state.
Monitoring	Habitat Change	Medium	Develop and implement a plan for monitoring changes in suitable lynx habitat resulting from habitat conversions, forest management practices and climate change.
Monitoring	Range Shifts	Low	Monitor range shifts of competing carnivore populations resulting from climate change.
Monitoring	Monitor Threats	Medium	Identify and monitor impacts to key connective corridors serving to link Vermont's lynx population with core populations to the north.

Common Name: **Canada Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Promote forest management practices that provide for the life history requirements of lynx	# of acres of snowshoe hare habitat available within potential lynx range	Vt. Forest and Parks Dept, Industrial forest landowners, Coverts	EQIP, SWG, USFWS
Compatible Resource Use	High	Maintain connectivity of habitat between Maine, New Hampshire, Quebec and Vermont.	# of acres of corridor habitat conserved	TNC, VLT, NHF&G, Conservation Fund, NWF, Keeping Track, Coverts	TNC, VLT, Conservation Fund, USFWS, Forest Legacy
Compatible Resource Use	High	Continue managing competing carnivores within key lynx habitats, particularly fisher, via regulated trapping	Maintenance of healthy furbearer populations	Vermont Trappers Association	
Policy & Regulations	Medium	Support and cooperate with larger efforts to curb global climate change.			

Common Name: **Canada Lynx**
Scientific Name: **Lynx canadensis**
Species Group: **Mammal**

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Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S4
Extirpated in VT? no

Global Trend:
State Trend: Unknown
Regional SGCN? Yes

Assessment Narrative:

The bobcat is apparently common and well distributed throughout Vermont although higher densities appear to exist in the Champlain Valley and the Taconics possibly due to higher prey densities. Bobcats have declined since the middle of the 20th century due to land use changes affecting prey densities and to increasing competition from other carnivores such as fisher and coyote. Statewide population estimates are unknown, but carrying capacity has been estimated.

The bobcat uses a variety of habitats and the relative suitability of habitats in the Vermont landscape have been quantified (see below). Bobcat occurrence appears to be positively related to the amount of mixed forest and forested wetland habitats. Critical habitats, such as those used for denning remain largely unquantified.

Landscape change represents a primary threat to bobcats, especially as they appear to depend on connected expanses of undeveloped habitat. Conversion of natural habitat to housing and other forms of development will most likely affect the distribution and abundance of the species in Vermont. Similarly, the impacts of climate change, particularly with respect to changes in prey and sympatric carnivore distribution and abundance, may present significant challenges to bobcats through the future.

Distribution

Bobcats occupy home ranges that include a variety of habitats. Average home range size for bobcats based on a study in the Champlain Valley was 57.3 km2 (Donovan et al. 2011) Male home ranges (n=10) averaged 70.9 km2 while female home ranges (n=4) averaged 22.9 km2. Based on patterns of use in home ranges, bobcats respond positively to shrub, deciduous forest, coniferous forest, and wetland cover types within 1 km of a location and negatively to roads and mixed forest cover within 1 km of a location. Similar results have been found in New Hampshire with bobcats preferring areas with few roads, limited human development, high stream densities, and steep topography (Broman et al. 2014). Another study conducted repeated surveys throughout Vermont and concluded that bobcat probability of occupancy was positively related to the percentage of both mixed forest and forested wetland habitat within 1 km of survey sites (Long et al. 2011). In Vermont, steep, rocky cliffs may be important as winter refuges and breeding habitat.

The size of the bobcat population is uncertain in Vermont. Donovan et al. (2012) estimated the maximum carrying capacity of females in northwestern Vermont (WMU 1, 1,153 km2) as 42. Using a similar approach, carrying capacity across Vermont has been estimated as 1,150 (835 females, 316 males) (J. Murdoch, pers. comm.).

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☑ General Literature ☑

Bobcats occupy home ranges that include a variety of habitats. Average home range size for bobcats based on a study in the Champlain Valley was 57.3 km2 (Donovan et al. 2011) Male home ranges (n=10) averaged 70.9 km2 while female home ranges (n=4) averaged 22.9 km2. Based on patterns of use in home ranges, bobcats respond positively to shrub, deciduous forest, coniferous forest, and wetland cover types within 1 km of a location and negatively to roads and mixed forest cover within 1 km of a location. Similar results have been found in New Hampshire with bobcats preferring areas with few roads, limited human development, high stream densities, and steep topography (Broman et al. 2014). Another study conducted repeated surveys throughout Vermont and concluded that bobcat probability of occupancy was positively related to the percentage of both mixed forest and forested wetland habitat within 1 km of survey sites (Long et al. 2011). In Vermont, steep, rocky cliffs may be important as winter refuges and breeding habitat.

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Habitat Types:

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Floodplain Forests

Hardwood Swamps

Softwood Swamps

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Early Succession Upland Oak

Early Succession Other Types

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Succession

Habitat Alteration

Habitat Fragmentation

Description of habitat threat(s): Bobcats distribution appears to relate mainly to forest cover and forest wetland habitat, both of which positively influence probability of occurrence in the landscape. Changes to these two habitats and others that offer important resources like rocky ledges for denning represent a primary threat to the species. Conversion of habitats due to development like residential housing and roads or even climate change will most likely affect bobcat distribution and abundance (Bettigole et al. 2014).

Non-Habitat Threats:

Competition

Loss of Prey Base

Description of non-habitat threat(s): Bobcat numbers have declined since coyotes became established in Vermont. The specific impacts of coyotes and other carnivores such as fisher remain largely unstudied in the Northern Forest. Prey species have also declined in some areas due to loss of early successional habitat and have presumably impacted bobcat numbers.

Research and Monitoring Needs

Type	*Need*	*Priority*	*Description*
Research	Habitat Requirements	High	Identify and quantify critical habitats for reproduction, such as rocky, ledge areas.
Research	Distribution and Abundance	High	Determine the location of source and sink populations and identify the habitat parameters associcated with these populations.
Research	Threats and Their Significance	Medium	1) Examine how habitat loss, conversion, and fragmentation impacts distribution and abundance. 2) Determine competition effects with coyotes and other sympatric carnivores such as fisher.
Monitoring	Range Shifts	Medium	Assess possible range shifts and population changes due to climate change.

Common Name: **Bobcat**
Scientific Name: **Lynx rufus**
Species Group: **Mammal**

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Compatible Resource Use	High	Promote less development of high quality habitats.	Amount of high quality habitat protected or conserved	VTrans, Town Planning Commissions, VLT, Regional and Town Cons Comms, Keeping Track	SWG, AOT
Species Restoration	Medium	Provide important prey base	Number of acres of rabbit and hare habitat protected	Coverts, USFS, VWA, Northern, USFS, VFPR, Ruffed Grouse Society	USFWS, Ruffed Grouse Society, EQIP
Species Restoration	Medium	Identify necessary habitats and develop actions for protection	Number of necessary habitats mapped and protected	Coverts, USFS, VWA, VLT, UVM	UVM, VLT, USFS, USFWS

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Common Name: **Eastern Mountain Lion**
Scientific Name: **Puma concolor couguar**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5 **Global Trend:**
State Rank: SH **State Trend:** N/A
Extirpated in VT? yes **Regional SGCN?** No

Assessment Narrative:

The Mountain Lion, also known as Puma, Cougar and Catamount is listed as endangered in Vermont. It is believed to be extirpated in the East (except in southern Florida). The USFWS declared the Eastern cougar (Puma concolor couguar) extinct in 2011 though it remains federally endangered pending delisting. Anecdotal reports of field sightings are fairly frequent; however, both field and incidental evidence is absent. Even in lowest densities, Mountain Lions are hit, shot, snared, wander into towns and cities, and are photographed on cell phones, point & shoot cameras, and random remote wildlife cams. A Black Hills, SD male left field and incidental evidence in four states across 1500 miles before being hit by a car in Milford, CT, June 2011. All North American Mountain Lions are one subspecies genetically, though the taxonomy remains disputed (Culver et al. 2000); which suggests that conservation efforts should be focused on the entire puma Genus. Confirmations of Mountain Lions with both North and South American DNA (former captives or descendants) have been documented in Ontario (Rosatte, 2011), Quebec and New Brunswick (Lang, et al. 2013), There is no evidence of breeding in eastern Canada. The closest breeding colonies to Vermont remain southwest Florida, the Dakotas and Nebraska. Recent research show mountain lions are keystone species for ecosystem functioning (Ripple et al. 2014).

Distribution

Distribution by Biophysical Region:

Champlain Valley	Historic Records Only	**Southern VT Piedmont**	Historic Records Only
Champlain Hills	Historic Records Only	**Vermont Valley**	Historic Records Only
Northern Green Mtns	Historic Records Only	**Southern Green Mtns**	Historic Records Only
Northern VT Piedmont	Historic Records Only	**Taconic Mtns**	Historic Records Only
Northeastern Highlands	Historic Records Only		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☑ Extensive Local Knowledge ☐ Regional Literature ☐ General Literature ☑

Mountain Lions are no longer understood to be wilderness obligates, with the widest range across more habitats, including urban landscapes, of any terrestrial mammal in the western hemisphere. Beier (1993), using simulated population dynamics, estimated that an area of 1,000 to 2,200 square kilometers (372 to 818 square miles, depending on the demographics of a particular population) was needed for a population of 15-20 adult cougars to have a very low risk (<98%) of extinction within 100 years. Area of 600 - 1600 km 2, and smaller (Beier. 1993), might suffice where adequate dispersal corridors allow movement among populations. Smallest documented home range is 39 km2 (Laundre and Loxterman 2006). Mountain Lions are breeding in suburban-

Common Name: **Eastern Mountain Lion**
Scientific Name: **Puma concolor couguar**
Species Group: **Mammal**

exurban-wildland matrix habitat throughout the western US, and have recovered range east to the Dakotas/Nebraska without assistance. Space-use patterns differ little between wildland and residential environments (Kertson et al, 2011), though reproductive behaviors (communication/denning) require greater buffers from development than non-reproductive behaviors (movement/feeding) within the suburban/exurban/wildland matrix (Wilmers et al, 2013) Specific dispersal barriers include roads and nighttime illumination (Beier 1993, 1995); identifying and protecting wildlife corridors can mitigate dispersal mortalities. Male dispersal and settlement patterns based on mating opportunities; fenale patterns based on avoiding other Mountain Lions (Stoner et al. 2013). Mountain Lions are the epitome of a generalist predator (Knopf and Boyce 2014), though they favor and are adapted for medium-sized ungulates. Deer/ Elk wintering habitat is seasonally favored. (Lindzey 1987).

Adirondack Park, an area roughly comparable to the state of Vermont, could support as many as 350 Mountain Lions (Laundre, 2013). Glick (2014) found that the Northeast region east of the Hudson River could support from 322 - 2,535 Mountain Lions.

Habitat Types:

Outcrops and Alpine

Cliffs and Talus

Spruce Fir Northern Hardwood

Northern Hardwood

Oak-Pine Northern Hardwood

Open Peatlands

Marshes and Sedge Meadows

Wet Shores

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Early Succession Upland Oak

Early Succession Other Types

Current Threats

Habitat Threats:

Conversion of Habitat

Habitat Alteration

Habitat Fragmentation

Impacts of Roads or Transportation Systems

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Description of habitat threat(s): Where they still exist, Mountain Lions can be found in a multitude of habitas, ranging from closed forest to semi-open shrublands. Human development/disturbance appears to affect little the use of areas by Mountain Lions as they are found in suburban to exurban environments. Human intolerance to their presence in these areas is the main negative impact on their survival. Prey availability and habitat characteristics can affect Mountain Lion distribution and survival. Loss of habitat connectivity between source populations limits dispersal, range expansion, and genetic variability (Ernest et al. 2003).

Non-Habitat Threats:

Harvest or Collection

Trampling or Direct Impacts

Loss of Prey Base

Description of non-habitat threat(s): Negative human attitudes among certain demographics towards Mountain Lions in regards to human safety and perceived impacts on deer populations can impact successful establishment/ maintenance of Mountain Lion populations in the East Florida public attitude surveys found broad public support for Mountain Lion recovery, including residents of a proposed relocation region and among sportsmen (Duda and Young. 1995; Cramer. 1995). However, a successful test-release of Texas Mountain Lions to southern Georgia/north Florida concluded that resistance from just a handful of inviduals can impede recovery efforts (Belden and McCown. 1996). Pending federal delisting could jeopardize any potential for recolonization if eastern state protections are not established, maintained and enforced,

Research and Monitoring Needs

Type	Need	Priority	Description
Monitoring	Population Change	Medium	Continue current low-level monitoring and incidental Mountain Lion evidence documentation (track, scat, kills, photographs, etc.). Consider active pheromone station monitoring (e.g Lang et al. 2013) to detect VT presence. Collect genetic material for testing.

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Policy & Regulations	High	Pending federal delisting, maintain and enforce state protections of entire puma Genus.			
Research	Medium	Identify areas within state that could support viable Mountain Lion populations (Glick 2014) and develop a state recovery plan.			
Awareness Raising and Communications	High	Determine public attitudes towards Mountain Lion recovery efforts in VT (e.g. McGovern and Kretser 2014); Provide interpretive and public education material about Mountain Lions.			

Common Name: **Eastern Mountain Lion**
Scientific Name: **Puma concolor couguar**
Species Group: **Mammal**

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Common Name: **Moose**
Scientific Name: **Alces alces**
Species Group: **Mammal**

Conservation Assessment

Final Assessment: Medium Priority

Global Rank: G5
State Rank: S5
Extirpated in VT? yes

Global Trend:
State Trend: Declining
Regional SGCN? no

Assessment Narrative:

Moose were extirpated from Vermont by the early 19th century due to forest clearing and no legal protection. Following regrowth of the forest, restoration of beavers, and nearly a century of protection, moose immigrated from New Hampshire in the 1970's and their numbers and distribution in Vermont grew rapidly in the 1980's and 90's. By the time the former WAP was written in 2005, moose numbered over 5,000 animals and were reproducing throughout the state. Moose were recognized in the 2005 WAP as a "special category" species, along with beaver and white-tailed deer, due to their socioeconomic value and potential of having a significant ecological effect on the landscape. SWG funds were not intended to be directed at these three species at that time.

Currently, the statewide moose population is about half of what it was in 2005. Most of this reduction was by design in order to bring numbers in northeastern Vermont down below ecological carrying capacity and allow for adequate regeneration of trees in managed stands. The current population estimate of 2500 moose is below the minimum target of 3,000 as called for in Vermont's 10-year Big Game Management Plan--the state's guide for moose management. Moose health and nutrition as reflected by body weight and ovulation rate has declined, and warmer weather from spring through autumn has likely contributed to higher incidence of parasites, most notably the winter tick and brainworm, and abnormally high levels of heat stress.

Distribution

Highest densities in the Northeastern Highlands and Northern Vermont Piedmont.

Distribution by Biophysical Region:

Champlain Valley	Confident	**Southern VT Piedmont**	Confident
Champlain Hills	Confident	**Vermont Valley**	Confident
Northern Green Mtns	Confident	**Southern Green Mtns**	Confident
Northern VT Piedmont	Confident	**Taconic Mtns**	Confident
Northeastern Highlands	Confident		

Distribution by Watershed:

Habitat Description

Habitat Information is based on the following:

Limited Local Knowledge ☐ Extensive Local Knowledge ☑ Regional Literature ☑ General Literature ☑

Common Name: **Moose**
Scientific Name: **Alces alces**
Species Group: **Mammal**

Habitat Types:

Spruce Fir Northern Hardwood

Northern Hardwood

Hardwood Swamps

Softwood Swamps

Marshes and Sedge Meadows

Shrub Swamps

Early Succession Boreal Conifers

Early Succession Boreal Hardwoods

Early Succession Spruce-Fir

Early Succession Pine and Hemlock

Early Succession Northern Hardwoods

Current Threats

Habitat Threats:

Habitat Fragmentation

Climate Change

Description of habitat threat(s): Fragmentation from ski area and recreational trail expansions; ridgetop windfarms. Heat stress from warming climate.

Non-Habitat Threats:

Parasites

Description of non-habitat threat(s): Increased levels of parasites, most notably Dermacentor albipictus and Paralaphostrongylus tenuis.

Common Name: **Moose**
Scientific Name: **Alces alces**
Species Group: **Mammal**

Research and Monitoring Needs

Type	Need	Priority	Description
Research	Habitat Requirements	Low	
Research	Basic Life History	Low	
Research	Distribution and Abundance	Low	
Research	Threats and Their Significance	High	Health condition and effects from parasites and disease.
Research	Population Genetics	Low	
Research	Taxonomy	Low	
Monitoring	Population Change	High	
Monitoring	Habitat Change	Low	
Monitoring	Range Shifts	Low	
Monitoring	Monitor Threats	High	

Species Strategies

Strategy Type	Strategy Priority	Strategy Description	Performance Measure	Potential Partners	Potential Funding Sources
Species Restoration	Medium	Keep moose densities below 0.75/sq km and deer densities below 10/2.6sq km in order to reduce winter tick and brainworm infection rates.	Reduced levels of winter tick infestation. Reduced incidence of brainworm cases.	USFWS	PR
Habitat Restoration	Medium	Increase amounts of early successional habitat, especially in the Central and Southern Green Mountains.	Improved Moose body weights and ovulation rates	USFWS	SWG, PR

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