Critical Paths for Wildlife:
Adirondack to Green Mountain Habitat Linkage Analysis for Wide Ranging Mammals

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Introduction

The goal of this project was to delineate wildlife crossings to allow for the targeting of road crossing barrier mitigation strategies for habitat connectivity from the Adirondack Mountains of New York to the Green Mountains of Vermont across the Southern Lake Champlain Valley. This goal was achieved by evaluating 15 wildlife crossing zones that were identified by wide-ranging mammal connectivity modeling within a GIS (Geographic Information Systems) framework (Figure 1). Zones were assessed with field research, and wildlife tracking data was collected over a course of three field visits (once in winter and twice in spring) to each crossing zone. Analysis of these data prioritized crossing zones, identified key crossing locations within each zone, and discovered crossing zones most in need of enhancement activities for wildlife movements.

This information provides The Nature Conservancy with the best scientific evidence of locations of key crossing areas along these road segments within the study area: Route 7, Route 22a, Route 30, Route 144, and Route 4. Knowledge of these crossing zones will inform strategies that increase human safety and the permeability of these sites to wildlife through conservation, road mitigation, and other roadside improvements.
Figure 1. Wildlife crossing zones that were identified by wide-ranging mammal connectivity modeling.
Methods

Winter survey (January)

Crossing zones were visited 48 hours after moderate snow events <12”’. The surveyor walked along both sides of the road looking for wildlife tracks or signs. Effort was made to search for signs beyond the road’s edge up to 15 meters away, because snowplow spray made it difficult to detect tracks at the road’s edge. GPS data points were collected each time a mammal species tracks or sign intersected the road, these data points were created into a shapefile for use in ArcGIS upon completion of the survey. The surveyor only recorded a species track that was fresh since the last snowfall, unless the maker of the sign or track was unmistakable regardless of the age of the sign.

Early and mid-late spring surveys (April and May)

Similar to the winter survey, the surveyor walked both edges of the road looking for wildlife sign and tracks. Sign included: runways, wallows, rubs on tree trunks, browsing sign, bark stripping, scat, hair. Wet areas along muddy stream banks and streams running through culverts were also checked for tracks. In addition, general habitat features such as slope, forest cover type, wetlands, and rock outcrops will be described qualitatively. GPS coordinates were collected for man-made road features including culverts, oversized bridge spans, and guardrails. Factors that contributed to motorist safety will be assessed, and the speed limit, whether or not wildlife-crossing signs were posted, and distance a motorist can see (line-of-sight) as they approach the zone was documented.

Data Analysis

The following equation was used to calculate a number crossings index (CI) for each species per 100 m of crossing zone: CI = Ni/L (100), where number of crossings index = the number of intercepts of species i divided by L the length of the zone times 100. A relative number of crossings index (RCI) was calculated for bobcat, fisher, and white-tailed deer so that it can be used to compare the percent each species was documented within each zone. This index was calculated by
dividing the crossings index for a given species by the sum of the crossing index for that species: RCI = CI / ∑CI.

Maps were generated for each crossing zone that displayed important habitat features within each zone, as well as, depicting where individual species crossed the road. White-tailed deer crossings were displayed on every map, along with a carnivore species of concern (bobcat or fisher). If either of these carnivore species were not detected another carnivore was selected. Detailed zone descriptions follow each zone map, and they were created from field observations and GIS analysis. The zone details sections includes information on: human infrastructure, development, hydrology, topography, wildlife habitat, conservation lands, species present, and motorist line of sight, safety, and signage. A summary of each zone provides input on management recommendations and prioritization of key crossing locations within each zone.
Results

Winter surveys were conducted in the middle of January. Early spring surveys were conducted at the beginning of April, and the mid-late spring surveys were completed at the beginning of May. Table 1 illustrates the number of times a species was detected within each zone. Almost all of the non-hoofed mammals were detected during the winter survey. White-tailed deer was the primary species that was detected during the spring surveys. Roadkill that was observed during the survey was also included in the table.

Table 1. Species observed and the number of times each was detected at each zone for all three survey time periods (winter, early spring, and mid-late spring).

<table>
<thead>
<tr>
<th>Zone</th>
<th>Z1</th>
<th>Z2</th>
<th>Z3</th>
<th>Z4</th>
<th>Z5</th>
<th>Z6</th>
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A number of crossings index was calculated for each species per 100 m of crossing zone (Table 2), and a relative number of crossings index was calculated for bobcat, fisher, and white-tailed deer, so that it can be used to compare the percent each species was documented within each zone (Table 3).
Table 2. Number of wildlife crossings per 100 (m) of zone.

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Table 3. Relative number of crossings of bobcat, fisher and white-tailed deer.

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<th>Zone</th>
<th>Bobcat</th>
<th>Fisher</th>
<th>White-tailed Deer</th>
</tr>
</thead>
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</table>

The following section provides descriptions of each zone. It includes a zone map, zone detail, and a summary of prioritization recommendations.
Zone 1: Wallingford, VT, Route 7
Length: 2.05 mi

- Bobcat
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Guardrail
- Railroad Track
- Roads
- Streams
- VT Wetlands Inventory
- Deer Yard
- Conservation Land

Large box culvert at the southern end of the zone.
Crossing zone 1

Route 7
Town: Wallingford, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 2.05 mi

Zone Details

Human infrastructure and development

1. There were twenty-one buildings along this section of road. Buildings were in clusters at the northern and southern end of the zone. They were more spread out in the middle of the zone. There was a long stretch of undeveloped roadway between the buildings located at the southern and middle section of the zone.

2. Fences were not present within this zone.

3. Guardrails were present in the southern section of the zone on both sides of the road, and in the southern/middle section of the zone on the west side of the road. Just north of there, there was another guardrail on the east side of the road. There were guardrails on the east side of the road in the middle and northern sections of the zone.

4. There were no major transmission lines that intersected the zone.

5. Railroad tracks paralleled the east side of the road and were close to the road edge in the middle of the zone.

6. Three town roads, two on the west side and one on the east side were located at the southern end of the zone.

7. There were five underpasses within this zone. A large box culvert (6’ wide x 4 high) was located at the southern end of zone, a medium round culvert was at the middle of the zone, and three large box culverts were at the northern end of the zone.

Hydrology and topography
1. Five streams crossed this zone from west to east. They flowed into the Otter Creek, which flanked the east side of the zone. Two of the streams were located at the southern end of the zone, two were located in the middle, and another stream was located at the northern end.

2. Fourteen wetland habitats were found adjacent to the zone. Eleven medium to large wetlands were found to the east side of the zone, while three small wetlands were found on the west side.

3. The topography of the zone sloped moderately to the east and it was generally flat on the east side of the zone.

4. Roadside topography of interest. The northern section of the zone along the west edge of the zone had a large rock outcropping. Much of the middle portion of the zone was generally flat. The southern portion of the zone was variable throughout. It had some steep to moderately steep sections as well as some flat.

Wildlife Habitat

1. A previously documented deer wintering yard was located about 200m to the northwest of the zone, and another yard, which paralleled the entire eastern side of the zone, was approximately 500-1500m away from the zone at different sections of the road.

2. The southern portion of the zone was mostly forested on either side of the road; there were also some shrub thickets along the stream corridors.

3. The southern/middle portion of the zone has a clearing behind trees along the western edge. It was forested on the eastern edge.

4. The middle of the zone had sections of forest and thicket, but it was interspersed with small clearings.

5. The northern/middle section of the zone was fairly open, and it had some east to west hedgerows that intersect the road.

6. The northern section of the road, south of the rock outcrop, was mostly clear except for a small section of forest to the west. The east side of the road abutted a section of the otter creek riparian corridor, but then it was mostly field south of there.
7. A few apple trees were located at the southern and middle sections of the road.

**Conservation lands**

1. A small portion of the Green Mountain National Forest paralleled the east side of the road at the southern end of the zone.

**Species present**

1. Fifty-five wildlife crossings were documented during the winter survey (1/11/10). Six mammal species were encountered: bobcat (n=19), coyote (n=4), red fox (n=4), white-tailed deer (n=12), small weasel species (ermine or long-tailed weasel) (n=1), and unknown fox species (red or gray fox) (n=5). Bobcats were found in clustered locations of high activity in the northern, middle, and southern portions of the zone. Coyotes were documented in the northern, middle, and southern portion of the zone. Red foxes were encountered more towards the northern and middle portion of the zone. White-tailed deer were detected throughout the middle and southern portion of the zone. The small weasel was documented using a culvert as an underpass within the middle of the road.

2. Eleven wildlife crossings were documented during the early and late spring surveys, seven of which were white-tailed deer in the southern/middle portion of the zone. One carnivore trail likely used by bobcats was encountered in the southern/middle portion of the zone. This trail was located where there were multiple bobcat observations during the winter survey. Opossum and groundhogs were found using the northern most box culvert. A gray fox was detected in the middle of the zone.

3. Roadkill documented during survey - one raccoon at the southern/middle portion of the zone.

4. Historic roadkill - one moose at the northern portion of the zone.

5. Reported wildlife observations: None

**Motorist line of sight, safety, and signs**
1. The speed limit was 50 mph within the northern and middle section of the zone, and 40 mph within the southern section.

2. Line of sight was short as a motorist approached the zone from the north, but then became long after going past the rock outcrop. Line of sight remained medium to long until the southern portion of the zone. The southern portion of the zone had a short line of sight, and was a very windy section of road.

3. There were no wildlife or deer crossing signs at either end of the zone

4. The shoulder was wide at the northern end of the zone and became narrow toward the middle, and remained that way throughout the remainder of the southern portion of the zone.

**Summary, management recommendations, and prioritization**

The southern half of this zone should be prioritized over the northern half. There was a long stretch of undeveloped roadway within the southern and middle section of this zone. Guardrails were present in some portions of this section, but they did not overlap with the majority of bobcat crossing locations. The abundance of bobcat road crossing within this section of road may have to do with the forest and thicket habitat found there. A narrow shoulder also brought these habitats closer to the roads edge.

White-tailed deer were also detected throughout the southern half of the zone. Their presence may pose a threat to human safety, because this section of road had many curves, which obstructed a driver’s line of sight. There were no wildlife or deer crossing signs at either end this section, so posting these signs would be a good step to enhance human and wildlife safety. The speed limit was 40 mph within this section as compared to 50 mph within the rest of the zone, so the reduction of speed may also heighten a driver’s awareness to wildlife within the road.

A large box culvert was located at the southern end of zone, however any enhancements to the culvert to accommodate wildlife should be a low priority, since the culvert was surrounded by roads to the west of Route 7. These roads should be taken into consideration if the culvert were to be modified in the future. The southern section of the
zone also had a small portion of the Green Mountain National Forest that paralleled the east side of the road, so the US Forest Service may be an important stakeholder in the management of this zone. However, wildlife crossings were mostly concentrated just north of this road section. Crossings in the northern half of the zone were mostly located along narrow stream corridors and hedgerows. There was more development and open space in this section. Working with landowners to increase public awareness of the importance of these habitat features may be beneficial to enhancing wildlife movements at these locations.
Zone 2: Pittsford, VT, Route 7
Length: 0.55 mi

- Unknown Fox (Gray)
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Fence
- Roads
- Transmission Lines

Roadside conditions in middle section of the zone.

Roadside conditions in northern section of the zone.
Crossing zone 2

Route 7
Town: Pittsford, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.54 mi

Zone Details

Human infrastructure and development

1. There were three buildings along this section of road. One was located at the northern end of the zone, and two at the southern end of the zone.
2. Six barbed wire fences were adjacent to the road's edge. Between each fence there were small openings, a little more than the width of a vehicle, except for a larger opening at the southern end of the zone.
3. There were no guardrails within this section of road.
4. A transmission line paralleled the eastern edge of the zone at a distance between 100-200m away from the road.
5. Railroad tracks were located 1km to the western edge of the zone.
6. No roads intersected the zone.
7. There was a small box culvert and a small round culvert located at the southern end of the zone.

Hydrology and topography

1. No streams intersected this zone.
2. Four wetland habitats were found within 500m of the western edge of the zone.
3. The general topography of the zone sloped moderately to the west, which then flattened out on the west side of the road.
4. Roadside topography of interest- some section of the north and eastern portion of the zone sloped steeply towards the roads edge. The bank also sloped steeply away from the road along the west side of the road.

Wildlife Habitat
1. A previously documented deer wintering yard was located about 500m from the southeastern portion of the zone.

2. The northeast section of the zone supported a pine forest. There was a small section pine forest in the northwest section of the zone, but almost the whole western side of the zone was a hay field with small hedgerows that paralleled the road. The southeast portion of the zone was also a field.

**Conservation lands**

1. No conserved lands intersected this zone.

**Species present**

1. Twenty-four wildlife crossings were documented during the winter survey (1/15/10). Four mammal species were encountered: coyote (n=1), red fox (n=1), white-tailed deer (n=16), and unknown fox species (red or gray fox) (n=5). One flock of wild turkeys also crossed the road. The red fox and coyote were documented in the middle or the zone. Fox tracks (likely gray fox) were located at the northern end of the zone. White-tailed deer were detected throughout the northern/middle and southern portion of the zone. Many of their crossing locations were between gaps in the fence but some jumped over.

2. Four wildlife crossings of white-tailed deer were documented during the early and late spring surveys. These crossings were in the middle of the zone going over a fence.

3. Roadkill documented during survey – None

4. Historic roadkill - None

5. Reported wildlife observations: None

**Motorist line of sight, safety, and signs**

1. The speed limit was 50 mph throughout the zone

2. Line of sight was medium throughout the length of the zone. The road was fairly straight.

3. There were no wildlife or deer crossing signs at either end of the zone
4. The shoulder was narrow throughout the length of the zone

**Summary, management recommendations, and prioritization**

The northern two-thirds of the zone should be prioritized over the southern third. The northern two-thirds supported a pine forest on the eastern side of the zone, but most of the whole western side of the road was hay field with small hedgerows that paralleled the road. Six barbed wire fences were adjacent to the roads edge, but between each fence there were small openings, a little more than the width of a vehicle. White-tailed deer crossed the road between gaps in the fence, but some of their crossings were over the fence. There were no wildlife or deer crossing signs at either end this section. The shoulder was narrow throughout the length of the zone, and the forest and thicket habitat was close to the roads edge, which may increase the risk of deer vehicle collisions, so posting deer crossing signs would be a good step to enhance human and wildlife safety.

Gray fox was found crossing at the far northern end of the zone, but no other elusive carnivores like bobcat or fisher were detected within this zone. To increase wildlife permeability throughout the northern two-thirds of the zone, more forested habitat would need to be established on the western side of the road, and the barbed wire fences should be removed. The recommendations would need to be brought to the attention to the various landowners involved in this type of habitat modification. These recommendations would increase the ability of wildlife to move across the road, which might also increase the risk of wildlife vehicle collisions. Reducing the speed limit and posting crossing signs would be necessary to counteract the potential negative effects to human safety.
Zone 3: Pittsford, VT, Route 7
Length: 0.25 mi

- Bobcat
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Fence
- Guardrail
- Roads
- Transmission Lines
- Streams
- VT Wetlands Inventory

Large box culvert at southern section of the zone.
Crossing zone 3

Route 7
Town: Pittsford, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.25 mi

Zone Details

Human infrastructure and development

1. There were four buildings along this section of road. Three of the buildings were on the east side of the road. A building was located in each section (southern, middle, and northern) of the zone. The fourth building was set back from the road in the southwest corner of the zone.

2. A fence paralleled the middle/northwest portion of the zone at a distance of 25m from the roads edge. Another fence was perpendicular to the roads edge toward the west. This fence separated the wetland environment to the south from the field to the north.

3. Guardrails were found on both sides of the road in the southern section of the road.

4. A transmission line paralleled the eastern edge of the zone at a distance of 200m, and another line was located 1km to the western edge of the zone.

5. Railroad tracks were located 1km to the western edge of the zone.

6. One road intersected the northern section of the zone from the east, and there was a large parking area on the west side of the road in the middle of the zone.

7. Underpasses- There was a large box culvert (3’wide x 6’ high) in the southern portion of the zone.

Hydrology and topography

1. One stream crossed the southern section of the zone from east to west.
2. Two medium-sized wetland habitats were found adjacent to both sides of the roads edge in the southern section of the zone, and a large wetland was found 250m to the western edge of the zone.
3. The topography slightly sloped to the west, but primarily it was flat throughout the length of the zone
4. Roadside topography of interest- the section of road on either side of the guardrails slopped steeply away from the roads edge.

Wildlife Habitat

1. There were no previously documented deer wintering yards within 1km of the zone.
2. Most of the western side of the zone was fairly open habitat. It included the wetland habitat in the southern section of the zone and the field in the middle and northern section. A small portion of forest/thicket approached the roads edge in the northern section of the road.
3. The southeastern portion of the zone was forested along the stream corridor and wetland, while the middle and northern sections were open habitat.

Conservation lands

1. A wildlife management area was located to the west of the zone.

Species present

1. Two wildlife crossings were documented during the winter survey (1/15/10). Two mammal species were encountered: bobcat (n=1) and white-tailed deer (n=1). The bobcat was detected crossing the northern/middle portion of the zone where the shrub habitat approached the road. The white-tailed deer was documented just south of where the bobcat was located.
2. Three wildlife crossings of white-tailed deer were documented during the early and late spring surveys. These crossings were in the middle of the zone going over the fence to the west.
3. Roadkill documented during survey – None
4. Historic roadkill - None
6. Reported wildlife observations: None

**Motorist line of sight, safety, and signs**

1. The speed limit was 50 mph throughout the zone.
2. Line of sight was medium throughout the length of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone
4. The shoulder was narrow throughout the length of the zone.

**Summary, management recommendations, and prioritization**

This zone was primarily in a developed section of road. There was a wildlife management area located to the west of the zone, but most of it was fairly open habitat. It included wetland habitat to the south and field in the middle and northern section. A small portion of forest/thicket approached the roads edge in the northern section of the road, and a bobcat was detected using this cover to cross the road. White-tailed deer were also documented crossing near this shrub habitat. A fence paralleled the middle/northwest portion of the zone, and most of the wildlife crossings were either over the fence or just north of it.

A stream crossed the southern section of the zone from east to west through a large box culvert. The eastern side of the road was forested along the stream corridor, but the western side was open wetland habitat. A fence was perpendicular to the roads edge toward the west, and it separated the wetland environment to the south from the field to the north. The box culvert at this section of the road could become an effective wildlife underpass by either modifying the existing structure to provide a dry shelf for wildlife to walk over the stream, or replacing the structure with an extended bridge. Removal of the perpendicular fence would allow greater access to this location, and shrub/forest plantings along the western stream corridor would connect the location to the forested habitat further to the west. Wildlife that was crossing at the northern end of the zone could be funneled to the southern end of the zone with directional fencing. An appropriate sized bridge span could accommodate the moments of large mammals such as deer. Making this
location safer for humans and wildlife by creating a safe passage for wildlife under the road.
Zone 4: Brandon, VT, Route 7
Length: 0.4 mi

Roadside conditions at the northern section of the zone.
Crossing zone 4

Route 7
Town: Brandon, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.4 mi

Zone Details

Human infrastructure and development

1. There was one building in the northeast section of the zone.
2. A fence paralleled the middle portion of the zone on the western side of the road.
3. No Guardrails were found at this site.
4. A transmission line paralleled the eastern edge of the zone at a distance of 100m, and another line was located 1.5km to the western edge of the zone.
5. Railroad tracks were located 1.5km to the western edge of the zone.
6. One private driveway intersected the middle section of the zone from the east.
7. Underpasses- There were three small round culverts in this zone. Two were in the southern section of the zone, and the other was in the north/middle section. One medium-sized box culvert was located in the middle of the zone.

Hydrology and topography

1. One stream crossed the middle of the zone from the west.
2. One large wetland was located 300m from the western edge of the zone.
3. The topography sloped to the west.
4. Roadside topography of interest- western edge of the road sloped steeply to the west in some sections of the zone.

Wildlife Habitat

1. There was a previously documented deer wintering yard 300m in the north west section of the zone, and another yard was located about 800m to the east of the zone.
2. The middle/southern portion of the east side of the zone was primarily a pine forest. North of this area was a house and a scrub/shrub/pine forest.

3. Most of the western side of the zone was fairly open habitat from the north to the southern/middle section of the zone. There were some fields and shrub thickets within this area. The southern section on the west side supported a pine forest with a shrub understory.

**Conservation lands**

1. No conservation lands were adjacent to this zone

**Species present**

1. Twenty-eight wildlife crossings were documented during the winter survey (1/15/10). Four mammal species were encountered: coyote (n=1), gray fox (n=6), white-tailed deer (n=17), and unknown fox species (red or gray fox) (n=4). White-tailed deer, gray fox, and a possible red fox were detected throughout the zone except for the northern/middle section of the zone. The coyote was detected at the southern end of the zone.

2. Seven wildlife crossings of white-tailed deer were during the early and late spring surveys. These crossings were in the middle/southern section of the zone.

3. Roadkill documented during survey – opossum (n=1), white-tailed deer (n=1).

4. Historic roadkill - None

5. Reported wildlife observations: A local resident had seen fisher, moose, and black bear cross this section of road.

**Motorist line of sight, safety, and signs**

1. The speed limit was 50 mph throughout the zone

2. Line of sight was medium throughout the length of the zone.

3. The zone had deer crossing signs for next 1 ½ miles posted at ether end of the zone.

4. The shoulder was moderately wide throughout the length of the zone.
Summary, management recommendations, and prioritization

There was little development adjacent to this road section, although a fence paralleled the northern two-thirds of the zone on the west side of the road. This fence influenced the movements of wildlife, for many of the observations of wildlife crossing within this zone were within the southern one-third of the zone. Roadside habitat along this section of the zone was also forested on both sides of the road. White-tailed deer did much of their crossing within this section, and a local resident had observed fisher, moose, and black bear cross the road at this location.

This zone had deer crossing signs posted at ether end, which indicated that there had been problems at this location before. Motorist safety should continue to be addressed at this location, by either reducing the speed limit from 50 mph to 40 mph and/or erecting signage equipped with flashing lights that trigger when an animal enters the road, or posting “fatality signs” updated with the number of human fatalities that result from animal/vehicle collisions. Removal of the fence on the western side of the road may make it easier for wildlife to cross the entire length of the road, however this recommendation might also increase the risk of animal/vehicle collisions. So, reducing the speed limit, posting the suggested crossing signs, and public education would need to occur as well.
Zone 5: Sudbury, VT, Route. 30
Length: 0.8 mi

- Fisher
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Guardrail
- Roads
- Streams
- VT Wetlands Inventory
- Deer Yard

Roadside conditions in the southern section of the zone.
Crossing zone 5

Route 30
Town: Sudbury, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.82 mi

Zone Details

Human infrastructure and development

1. Five buildings were found within this zone. Three were found in the northwest section of the zone, and two of them were set far back from the road. The other two buildings were on the southeast side of the road. One was on the roads edge, while the other was set far back from the road.
2. There were no fences along this section of road.
3. One guardrail was found in the northwest section of the zone.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. No minor roads intersected the zone.
7. Underpasses- A small culvert was located in the middle of the zone, and a medium-sized round culvert was located at the southern end of the zone.

Hydrology and topography

1. One stream intersected the southern part of the zone from the east, and another stream paralleled the southern portion of the zone. This stream flowed south.
2. Two small wetlands were adjacent to the southeast portion of the zone, while another small wetland was located 500m to the west of these. Two small wetlands were located 500m from the southeast portion of the zone.
3. The northern section of the zone sloped steeply toward the northwest. The middle section of the zone sloped moderately toward the west. The southern portion of the zone sloped moderately to the southwest.
4. Roadside topography of interest- Very steep slope towards the west in the northern portion of the zone.

Wildlife Habitat

1. There was a previously documented deer wintering yard 150 m to the east of the northern section of the zone
2. The entire length of the zone was forested, except for a small portion in the middle of the zone where a residential house was located. The northern section was primarily coniferous (pine and hemlock trees). The middle section was mostly hardwood with beech trees. The southern portion of the zone was a mixed forest supporting pine, oak, hickory, and maple trees.

Conservation lands

1. No conservation lands were adjacent to this zone

Species present

1. Twenty-nine wildlife crossings were documented during the winter survey (1/15/10). Six mammal species were encountered: fisher (n=2), porcupine (n=1), coyote (n=1), gray fox (n=1), red fox (n=7), white-tailed deer (n=9), and unknown fox species (red or gray fox) (n=8). A male fisher was detected at the northern/middle portion of the zone, while a female fisher was encountered at the southern end of the zone. The porcupine was crossing under the road using the small culvert in the middle of the zone. White-tailed deer and red fox were detected within the middle and southern portion of the zone. The coyote was detected at the southern end of the zone. The gray fox and unknown fox (likely gray) were detected within the middle and northern portion of the zone.
2. Eight wildlife crossings of white-tailed deer were documented during the early and late spring surveys. These crossings were in the middle/southern section of the zone.
3. Roadkill documented during survey – none
4. Historic roadkill – Deer (n=1) at the northern end of the zone
5. Reported wildlife observations: A local resident had seen bobcat, gray fox, and fisher cross this section of road, but has not seen black bear or moose.
6. Live observation- a muskrat was observed at the roadside wetlands in the southern portion of the zone.

**Motorist line of sight, safety, and signs**

1. The speed limit was 50 mph throughout the zone
2. Line of sight was medium at both the northern and southern end of the zone, but become short towards the middle of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone
4. There was a narrow shoulder throughout the length of the zone. There was a small pull off in the middle of the zone.

**Summary, management recommendations, and prioritization**

The southern two-thirds of this zone should be prioritized over the northern one-third, because the northern section sloped steeply to the west and a guardrail bordered the western edge, both of which made this section difficult for wildlife to cross. The entire length of the zone was forested with either coniferous and/or hardwood trees, and a previously documented deer wintering yard was located 150 m to the east of the northern section of the zone. Fisher, porcupine, white-tailed deer, red fox, coyote, and possibly gray fox were detected within the southern two-thirds of the zone. A local resident had also seen a bobcat cross this section of road. Lack of development, forested habitat close to the roads edge, and narrow shoulders contributed to the presence of sensitive species like fisher to cross this section of road. Wildlife crossing signs at either end of the zone may cause motorists to slow down as they approach the zone, which would make this section of road safer for humans and wildlife.
Zone 6: Hubbardton & Sudbury, VT, Route. 30
Length: 0.65 mi

- Gray Fox
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Roads

Roadside conditions in the middle (above) and northern (below) sections of the zone.
Crossing zone 6

Route 30
Town: Sudbury & Hubbardton
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.65 mi

Zone Details

Human infrastructure and development

1. Two buildings were found adjacent to this zone. They were found on either side of the middle of the zone
2. Fences were not present along this section of road.
3. Guardrails were not present along this section of road.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. One road intersected the middle of the zone from the west.
7. Underpasses- no culverts were located in this section of the road.

Hydrology and topography

1. A small stream paralleled the southwest section of the zone.
2. A medium-sized wetland was located 250m to the west of the northwest section of the zone, and a small wetland area was located on the west side of the southern/middle section of the zone.
3. Echo Lake was located 250m to the southeast of the zone, and Lake Hortonia was located 500m to the northwest.
4. The northern section of the zone sloped moderately toward the west. The middle section of the zone sloped gently toward the west. The southern portion of the zone sloped gently to the south.
5. Roadside topography of interest- none

Wildlife Habitat
1. There was a previously documented deer wintering yard 600m to the east of the southern section of the zone.

2. The southern portion of the zone, south of camp road, was forested, however the northern half of east side had been logged in this section. North of camp road there was a field on the west side of the road in the middle of the zone, but the majority of both sides of the road was a mixed hardwood/pine forest.

**Conservation lands**

1. No conservation lands were adjacent to this zone.

**Species present**

1. Thirty wildlife crossings were documented during the winter survey (1/15/10). Five mammal species were encountered: mink (n=1), coyote (n=1), gray fox (n=4), red fox (n=4), white-tailed deer (n=7), and unknown fox species (red or gray fox) (n=14). The mink was detected at the southern/middle section of the zone at the small wetland habitat. White-tailed deer were found in the middle of the zone, but were more concentrated in the northern section of the zone. The coyote was detected at the southern end of the zone. Gray fox, red fox, and unknown fox tracks were detected throughout the length of the zone, but were more concentrated in the southern section of the zone.

2. Twenty-three wildlife crossings of white-tailed deer were during the early and late spring surveys. One crossing was in the middle of the zone, and the others were concentrated at the northern and southern section of the zone.

3. Roadkill documented during survey – none

4. Historic roadkill – none

5. Reported wildlife observations: none

**Motorist line of sight, safety, and sign**

1. The speed limit was 50 mph throughout the zone
2. Line of sight was long at the northern and southern sections of the zone, but there was one section of road in the northern/middle of the zone that had a short line of sight at the curve in the road.

3. There were no wildlife or deer crossing signs at either end of the zone

4. There was a narrow shoulder throughout the length of the zone.

**Summary, management recommendations, and prioritization**

The majority of wildlife crossings within this zone were at the northern and southern end of the zone. The middle of the zone was more developed, and there was less wildlife crossing there. Both sides of the road in the northern section were mixed hardwood/pine forest. White-tailed deer crossings were concentrated in the northern section of the zone, but were more spread out in the southern section of the zone. The shoulder was narrow throughout the length of the zone, and the forest and thicket habitat was close to the roads edge, which may increase the risk of deer vehicle collisions, so posting deer crossing signs would be a good step to enhance human and wildlife safety.

Mink, coyote, gray fox and red fox were detected at the southern end of the zone. So this area does support the movement of various mid-sized carnivores. The eastern side of the road in this section was recently logged, so as the forest regenerates there may be more wildlife found adjacent to the road in this section. Deer activity may increase in the logged area, so motorists should be aware of wildlife as the approach this zone, and deer crossing signs would be appropriate at either end of the zone.
Zone 7: Hubbardton, VT, Route. 30
Length: 0.2 mi

- Gray Fox
- Deer
  - Buildings
  - Small Culvert
  - Medium Culvert
  - Large Culvert
- Crossing Zone
- Roads
- Streams
- VT Wetlands Inventory
- Deer Yard
- Lakes and Ponds

Large culvert in the middle of the zone.
Crossing zone 7

Route 30
Town: Hubbardton, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.2 mi

Zone Details

Human infrastructure and development
1. No buildings were directly adjacent to this zone.
2. Fences were not present along this section of road.
3. Guardrails were not present along this section of road.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. One road intersected the northern section of the zone from the west, and an old logging road intersected the southern end of the zone from the east.
7. Underpasses- Three culverts were located in this section of the road. A medium-sized round culvert was in the northern section, a large round culvert (4’ wide) was in the middle section, and a small round culvert was in the southern section.
8. A noisy dog kennel was located 150m to the northwest of the zone.

Hydrology and topography
1. A stream intersected the middle of the zone from east to west.
2. A forested wetland paralleled the southern/middle section of the zone.
3. Echo Lake was located 100m to the north of the zone, and Lake Beebe was located 100m to the south.
4. The zone was generally flat throughout its entire length.
5. Roadside topography of interest- none

Wildlife Habitat
1. A portion of a previously documented deer wintering yard intercepted the southern portion of the zone.

2. The wetland stream corridor made up much of the habitat on the northeast and southwest sections of the zone. The southeast section of the zone was forested, and the northwest section was also forested.

**Conservation lands**

1. No conservation lands were adjacent to this zone.

**Species present**

1. Thirteen wildlife crossings were documented during the winter survey (1/15/10). Four mammal species were encountered: gray fox (n=6), white-tailed deer (n=3), small weasel species (ermine or long-tailed weasel) (n=1), and unknown fox species (red or gray fox) (n=1). A flock of wild turkeys crossed the northern and southern section of the zone. The small weasel species was detected crossing through the large culvert in the middle of the zone. White-tailed deer were found at the southern end of the zone. Gray fox tracks were detected at the southern and middle sections of the zone.

2. Three wildlife crossings of white-tailed deer were documented during the early and late spring surveys. One crossing was in the middle of the zone, and the other two were at southern end of the zone.

3. Roadkill documented during survey – none

4. Historic roadkill – none

5. Reported wildlife observations: none

**Motorist line of sight, safety, and sign**

1. The speed limit was 50 mph throughout the zone

2. Line of sight was long throughout the zone, but it was short at the curve in the road when approaching the zone from the south.

3. There were no wildlife or deer crossing signs at either end of the zone.

4. There was a narrow shoulder throughout the length of the zone.
Summary, management recommendations, and prioritization

There was little development adjacent to this zone, because the majority of the habitat was forested wetland on both sides of the road. The zone was generally flat throughout its entire length. The southern half of the zone, south of the stream and large culvert, held all the wildlife crossing within the zone. A portion of a previously documented deer wintering yard intercepted the southern portion of the zone, and this species was also documented crossing the road at this location. Gray fox and wild turkeys also crossed near this location. The line of sight was short at the southern end when approaching the zone from the south. A deer wintering yard touched the roads edge at the location of a curve in the road, which created a short line of sight for a driver. In order to prevent possible deer/vehicle collisions; deer crossing signs at either end of the zone would be appropriate strategy to warn motorists of a potential collision.
Zone 8: Hubbardton, VT, Route 30
Length: 0.83 mi

- Fisher
- Deer
  - Buildings
  - Small Culvert
  - Medium Culvert
  - Large Culvert
- Crossing Zone
- Fence
- Roads
- Streams
- Deer Yard

Roadside conditions in the middle section of the zone.
Crossing zone 8

Route 30
Town: Hubbardton, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.83 mi

Zone Details

Human infrastructure and development

1. There were four buildings along this section of road. Three of the buildings were on the east side of the road. A building was located in the middle of the zone and two were at the southern end. The fourth building was located in the northwest section of the zone.
2. One short stretch of fence was located on the east side of the northern section of the zone.
3. Guardrails were not present along this section of road.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. One road intersected the northern section of the zone from the west.
7. Underpasses- a small round culvert was located in the northern section of the zone.

Hydrology and topography

1. A stream paralleled the eastern edge of the zone from the middle of the zone to the south.
2. A small wetland was located 250m to the west of the middle of the zone.
3. A small pond was located just north of the residential home in the middle of the zone on the east side of the road.
4. The entire middle and southern sections of the zone were in a gulf that descended steeply to the south. The northern section had a moderate slope to the north.
5. Roadside topography of interest-the middle/southern section of the zone was extremely steep uphill on both sides of the road.

Wildlife Habitat

1. A previously documented deer wintering yard paralleled the southeast portion of the zone.

2. The entire middle and southern sections of the zone were forested (hemlock and mixed hardwoods). The northern section of the zone had a field on the east side of the zone and shrub thickets on the west side.

Conservation lands

1. No conservation lands were adjacent to this zone.

Species present

1. Twenty-one wildlife crossings were documented during the winter survey (1/15/10). Five mammal species were encountered: fisher (n=1), red fox (n=4), white-tailed deer (n=10), small weasel species (ermine or long-tailed weasel) (n=2), and unknown fox species (red or gray fox) (n=4). The fisher was detected crossing at the middle of the zone. The small weasel species was detected crossing at the southern end of the zone. White-tailed deer were found in concentrated areas at the southern, middle, and northern end of the zone. Red fox tracks were detected at the southern, middle, and northern sections of the zone. The unknown fox species (likely gray) was detected within the northern portion of the zone.

2. Ten crossings of white-tailed deer were documented during the early and late spring surveys. Crossings were found at the southern, middle, and northern end of the zone at nearly the same locations as the winter survey.

3. Roadkill documented during survey – raccoon in the middle of the zone

4. Historic roadkill – none

5. Reported wildlife observations: none
**Motorist line of sight, safety, and sign**

1. The speed limit was 50 mph throughout the zone
2. The line of sight was medium in the northern section of the zone, but it was short within the southern section.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a narrow shoulder throughout the length of the zone.

**Summary, management recommendations, and prioritization**

The middle section of the zone had greater movements of wildlife in concentrated areas than other areas along the road, and it should be of slightly higher priority than other locations within the zone. A fisher was detected crossing this area, and this species may have crossed there because of the coniferous cover that was close to the roads edge. The road descended steeply to the south in the southern half of the zone, and the sides of the road were extremely steep uphill. These topographic features may make it difficult for certain wildlife to cross at this location, however a small weasel was documented there, and a road-killed raccoon was also found within this area. A previously documented deer wintering yard paralleled the southeast portion of the zone, and deer were observed crossing the far southern end of the zone towards the yard during the winter survey, however they were also observed in the middle and northern section of the zone as well. The speed limit was 50 mph throughout the zone, and decreasing the speed limit to 40 mph might make a difference in preventing animal/vehicle collisions at this site especially in the southern and middle portions of the zone where the line of sight was short. Deer crossing signs at either end of the zone would also be appropriate strategy to warn motorists of a potential collision.
Zone 9: Hubbardton & Benson, VT, Route 144
Length: 0.42

- Fisher
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Crossing Zone
- Fence
- Roads
- Streams
- VT Wetlands Inventory

Roadside conditions in the east/middle section of the zone.
Crossing zone 9

Route 144
Town: Hubbardton & Benson, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.42 mi

Zone Details

Human infrastructure and development

1. Two buildings were found adjacent to this zone. One building was to the west on the south side of the zone, and the other was on the east side to the north of the zone.
2. A small fence was present in the middle of the zone on the north side of the road.
3. Guardrails were not present along this section of road.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. No roads intersected the zone.
7. Underpasses- a medium sized round culvert was found in the middle of the zone, and smaller culverts were located to the east and west of it.
8. The residential home at the east end of the zone had a few noisy dogs.

Hydrology and topography

1. A stream paralleled the south edge of the zone and wetland streams intersected the road at the culverts.
2. Wetlands were on either side of the road in middle of the zone.
3. The zone was primarily flat.
4. Roadside topography of interest- none

Wildlife Habitat

1. There were no previously documented deer wintering yards near the zone.
2. The eastern half of the zone was a scrub/shrub wetland with some open wetland mixed in. The western/middle section of the zone supported a pine forest with a shrub understory, while the south side was a mix of shrubs. The western portion of the zone was open habitat.

Conservation lands
1. No conservation lands were adjacent to the zone, but there was a Vermont Landtrust land located 500m to the west.

Species present
1. Thirty-one wildlife crossings were documented during the winter survey (1/15/10). Six mammal species were encountered: fisher (n=1), coyote (n=2), gray fox (n=8), White-tailed deer (n=14), small weasel species (ermine or long-tailed weasel) (n=2), and unknown fox species (red or gray fox) (n=3). The fisher was detected crossing the zone at the eastern middle section of the zone near the edge of the wetland habitat in the shrub thicket. Small weasel species were detected at the middle section of the zone using the medium-sized culvert, and also at two locations at the western end of the zone. White-tailed deer were found in the western/middle and eastern end of the zone. The coyote was detected at the western/middle section of the zone. Gray fox tracks were detected at the eastern and western ends of the zone. Unknown fox species (likely red fox) was detected in the middle of the zone.
2. One crossing of white-tailed deer was documented during the late spring survey at the western/middle section of the zone.
3. Roadkill documented during survey – none
4. Historic roadkill – none
5. Reported wildlife observations: none

Motorist line of sight, safety, and sign
1. The speed limit was 35 mph throughout the zone.
2. Line of sight was short throughout the length of the zone. The road had many curves.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a narrow shoulder throughout the length of the zone.

Summary, management recommendations, and prioritization

The entire length of the zone should be prioritized except for the portion in the town of Benson, which was mostly open habitat. There was little development near this zone, and a mixture of open and scrub/shrub wetland was on either side of the road in middle of the zone. The zone was primarily flat, which made it easy for wildlife to move across the road. Most of the open wetland was avoided by medium to large-sized mammals, but it was of great importance to other wildlife species. Medium to large-sized mammals crossed the roads on either side of the open wetland thought the thickets and forests that bordered it. A fisher was detected crossing the road along the shrub edge, and so were deer, coyote, and gray fox. The speed limit was 35 mph throughout the zone, since there was a short line of sight created, many curves in the road, and a narrow shoulder. Posting wildlife crossing signs and educating the public about this zone will make this zone safer for humans and wildlife.
Zone 10: Benson, VT, Route 22A
Length: 1.4 mi

- Bobcat
- Deer
  - Buildings
  - Small Culvert
  - Medium Culvert
  - Large Culvert
- Guardrail
- Crossing Zone
- Roads
- Streams
- VT Wetlands Inventory
- Deer Yard
- Conservation Land

Large culvert at the southern end of the zone.
Crossing zone 10

Route 22A  
Town: Benson, VT  
County: Rutland  
RPC: Rutland regional  
AOT District: 3  
Length 1.4 mi

Zone Details

Human infrastructure and development

1. One building was located at the northern end of the zone on the east side of the road.
2. Fences were not present along this section of road.
3. Guardrails were present on the west side of the zone in the northern section of the zone, and on both sides of the road at the stream crossing in the southern section of the zone.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. One road intersected the southern section of the zone from the west.
7. Underpasses- a large box culvert (6’ wide by 4’ high) was located in the southern section of the zone, and four medium-sized culverts were located in the northern section of the zone

Hydrology and topography

1. A stream intersected the southern section of the zone from the west.
2. Ten wetland habitats were adjacent to the zone. Five small to medium-sized wetlands were on the east side of the zone, while four small to medium-sized wetlands and one large wetland were found on the west side.
3. The topography was generally flat throughout the zone, but it generally sloped to the west.
4. Roadside topography of interest- none.
Wildlife Habitat

1. Previously documented deer wintering yards were on either side of the road. One was 200m to the northeast of the zone, and the other was 300m to the west of the zone.

2. The northeast section of the zone was a mixed forest while the west side of the road was a wetland field. The middle portion of the zone was a mixed forest type on both sides of the road except where the two wetlands were located on the west side of the road. The southern section of the zone was a mixed forest on the west side of the road and an open wetland on the east side.

Conservation lands

1. The Ponds Wood Wildlife Management Area was directly adjacent to the east side of the zone, except for two small sections of land towards the middle of the zone.

Species present

1. Thirteen wildlife crossings were documented during the winter survey (1/15/10). Four mammal species were encountered: bobcat (n=1), coyote (n=4), white-tailed deer (n=4), and an unknown fox species (red or gray fox) (n=3). A flock of wild turkeys was also detected at the middle of the zone. The bobcat was detected crossing at the middle of the zone. Coyotes were detected crossing at the southern/middle and north end of the zone. White-tailed deer were found at the southern and middle end of the zone. The unknown fox tracks were detected within the northern/middle and middle portion of the zone.

2. Three wildlife crossings were documented during the early and late spring surveys. Bobcat (n=1) and white-tailed deer (n=1) were detected in the middle of the zone. Beaver sign was found at the stream crossing in the southern section of the zone, and a number of muskrat lodgers were found south of there in the wetland to the east.

3. Roadkill documented during survey – a porcupine was found at the northern end of the zone.

4. Historic roadkill – none
5. Reported wildlife observations: none

Motorist line of sight, safety, and sign

1. The speed limit was 50 mph throughout the zone
2. The line of sight was medium in the middle section of the zone, but it was long at the northern and southern ends of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a narrow shoulder throughout the length of the zone.

Summary, management recommendations, and prioritization

There was no development throughout the entire length of the zone, and the Ponds Wood Wildlife Management Area was directly adjacent to the east side of the zone. Wildlife crossings were predominately in the southern half of the zone where forested habitat was found between open wetlands. Bobcat, coyote, and white-tailed deer were detected at these types of locations in the southern half of the zone. Beaver and muskrat lodges were located in the wetlands. A large box culvert was located in the southern section of the zone, which should facilitate the movements of aquatic and semi-aquatic species. The entire zone should be prioritized even though more wildlife was found in the southern half. To increase wildlife permeability throughout the northern half of the zone more forested habitat would need to be established on the western side of the road. The landowners involved would need to be contacted with these recommendations. These recommendations would increase the ability of wildlife to move across the road, which might also increase the risk of wildlife vehicle collisions. Reducing the speed limit and posting wildlife crossing signs may make this section of road safer for humans and wildlife.
Zone 11: West Haven, VT, Route 22A
Length: 0.7 mi

- Bobcat
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Guardrail
- Crossing Zone
- Roads
- Streams
- Conservation Land

Roadside conditions at the southern/middle section of the zone.
Crossing zone 11

Route 22A
Town: West Haven, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 0.7 mi

Zone Details

Human infrastructure and development

1. One building was located at the southern end of the zone to the east of the road.
2. Fences were not present along this section of road.
3. Guardrails were present on the west side of the road in the northern section of the zone.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. A road paralleled the middle and southern portion of the zone 75m to the east of the zone.
7. Underpasses- a medium sized round culvert was located at the middle of the zone, and another was located just north of there at the stream crossing.

Hydrology and topography

1. A stream intersected the northern/middle section of the zone from the east, and another stream paralleled the middle section of the zone to the west.
2. No wetland habitats were adjacent to the zone.
3. The topography was generally flat at the southern and middle portion of the zone, and it was moderately steep towards the northwest at the northern end of the zone.
4. Roadside topography of interest- a rock outcropping was located at the southwest portion of the zone. The northwest portion of the zone was very steep towards the west.

Wildlife Habitat

1. No deer wintering yards were previously documented near the zone.
2. The entire zone was generally forested with a mix of shrubs, pine, and hardwoods, except for the field in the northwest portion of the zone.

Conservation lands
1. No conservation lands were directly adjacent to the zone, but Vermont Landtrust land was located 300m to the southwest of the zone and The Nature Conservancy conserved a parcel of land about 200m to the north.

Species present
1. Twelve wildlife crossings were documented during the winter survey (1/15/10). Two mammal species were encountered: bobcat (n=4), and White-tailed deer (n=7). A flock of wild turkeys was also detected at the middle of the zone. Bobcat and white-tailed deer were detected crossing the middle of the zone south of the guardrail.
2. No wildlife crossings were documented during the early and late spring surveys, but many white-tailed deer tracks were found adjacent to the road near the culvert and stream at the middle of the zone.
3. Roadkill documented during survey – none
4. Historic roadkill – none
5. Reported wildlife observations: none

Motorist line of sight, safety, and sign
1. The speed limit was 50 mph throughout the zone
2. The line of sight was medium in the middle section of the zone when approaching the curve, and it was long at the northern and southern ends of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a wide shoulder throughout the length of the zone.
5. Route 22A was three lanes wide at the southern and middle section of the zone.
Summary, management recommendations, and prioritization

The southern two-thirds of the zone should be prioritized over the northern one-third, because the northern section sloped steeply to the west and a guardrail bordered the western edge, both of which made this section difficult for wildlife to cross. Although, a stream intersected the northern/middle section of the zone, and many white-tailed deer tracks were found near it; they were not found crossing the road at this location. Instead white-tailed deer and bobcat were detected crossing the road at the middle of the zone south of the guardrail. The topography was generally flat in this section, but a large rock outcropping was found in the southwest portion of the zone, so most of the wildlife crossings were funneled towards the middle of the zone. The roadside habitat in the middle of the zone was forested with a mix of shrubs, pine, and hardwoods. There was a wide shoulder throughout the length of the zone, and Route 22A was three lanes wide at the southern and middle section of the zone, which made this section of road a wide expanse for wildlife to cross. The line of sight was also medium in the middle section of the zone when approaching the curve from either direction. So, posting wildlife crossing signs may make this section of road safer for humans and wildlife.
Zone 12: Poultney, Vt, Route 30
Length: 1 mi

- Fisher
- Bobcat
- Deer
  - Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Guardrail
- Crossing Zone
- Fence
- Roads
- Streams
- VT Wetlands Inventory
- Deer Yard

Roadside conditions at the northern section of the zone.
Crossing zone 12

Route 30
Town: Poultney, VT
County: Rutland
RPC: Rutland regional
AOT District: 3
Length 1 mi

Zone Details

Human infrastructure and development

1. Ten buildings were distributed evenly throughout the length of the zone.
2. Fences were found on both sides of the road in the southern section of the zone, and another fence was located on the east side of the road in the northern section of the zone.
3. Two Guardrails were present in the northern section of the zone. One was on the west side of the road and the other to the north of it on the east side of the road at the stream crossing.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. Two roads intersected the southern middle section of the zone from the east.
7. Underpasses- four culverts were found within this zone. A large culvert (4’ wide) was located at the north end of the zone, however this culvert had a grate covering the entrance. Medium-sized culvert at the southern end, and two small culverts within the northern/middle section.

Hydrology and topography

1. A stream paralleled almost the entire length of the western edge of the zone and flowed under the road at the northern end of the zone. Another stream intersected the zone from the east at the middle/northern section of the zone.
2. A medium-sized wetland intersected the middle portion of the zone and paralleled the southern/middle section of the zone, and another wetland was found 200m to
the west. A small wetland was located 200m to the east of the northern/middle section of the zone.

3. A small pond was documented in the middle of the zone on the east side of the road.

4. The topography was generally flat throughout the southern and middle sections of the zone. The northern section of the zone sloped towards the west.

5. Roadside topography of interest- the roadside was steep towards the west within some portions of the northern section of the zone.

Wildlife Habitat

1. A previously documented deer wintering yard was located 50m to the west of the northern section of the zone.

2. The southern section of the zone was primarily open habitat with some shrubs along the side of the road. The middle section was also open with patches of forest and shrubs mixed in. The northern section was mostly forested with coniferous trees along both sides of the road except for a small clearing around the residential homes at the north end of the zone.

Conservation lands

1. Buczek Marsh Wildlife Management Area was 600m to the west of the road in the southern section of the zone.

Species present

1. Forty-four wildlife crossings were documented during the winter survey (1/11/10). Six mammal species were encountered: bobcat (n=3), fisher (n=1), mink (n=1), coyote (n=2), white-tailed deer (n=24), and red fox (n=13). Bobcats and coyotes were detected crossing at the middle of the zone at the wetland and at the southern end near the stream. Fisher was detected crossing at the north end of the zone near the stream. Mink was detected crossing from the pond to the stream near the middle of the zone. White-tailed deer were found in concentrated areas at the southern and northern ends of the zone with a few crossing in the middle.
Red fox tracks were detected throughout the southern and middle portion of the zone.

2. Twelve wildlife crossings were documented during the early and late spring surveys. Gray fox (n=1) was detected at the northern end of the zone. White-tailed deer (n=9) were detected in similar locations as the winter survey. One unknown fox scat was found at the middle of the zone. Two flocks of wild turkeys crossed the northern section of the zone.

3. Roadkill documented during survey – none

4. Historic roadkill – white-tailed deer at the intersection of the roads near the middle of the zone.

5. Reported wildlife observations: none

Motorist line of sight, safety, and sign

1. The speed limit was 40 mph throughout the zone

2. The line of sight was medium in the middle section of the zone, and was short at the northern and southern end of the zone.

3. There were no wildlife or deer crossing signs at either end of the zone. There was a sign that indicated this section of road was windy for the next 6 miles when headed to the south.

4. There was a narrow shoulder throughout the length of the zone.

Summary, management recommendations, and prioritization

Various wildlife species crossed the road throughout the entire length of the zone. White-tailed deer were found to cross throughout the entire length of the zone, and their presence may pose a threat to human safety, because this section of road had many curves, which obstructed a driver's line of sight. There were no wildlife or deer crossing signs at either end this section, so posting these signs would be a good step to enhance human and wildlife safety. The speed limit was 40 mph within this section, so this may heighten a driver's awareness to wildlife within the road. A previously documented deer wintering yard was located 50m to the west of the northern section of the zone, and this section of road had a high concentration of deer crossings.
Bobcat was documented three times within the zone, twice at a wetland in the middle of the zone and once at the northern end of the zone. Fisher was also documented at the northern end of the zone. The northern section of the zone should be a focused priority for wildlife within the zone. Since two elusive carnivores (bobcat and fisher) were documented there. Deer, coyote and gray fox also used this location. Coniferous cover was close to the roads edge on both sides of the road at this location, so that may have contributed to the number of different species using this area. A stream also passed under the road at his location through a large culvert, however the culvert was covered with a grate, making it impenetrable to medium-sized mammals. Removing the grate and/or modifying the culvert to accommodate wildlife movements may allow safe passage under the road for semi-aquatic species like river otter, mink, beaver, and muskrat. Posting wildlife crossing signs, educating the public, contacting landowners about this section of the zone will make this location an important corridor for wildlife movements.
Zone 13: Low Hampton, NY, Route 22A
Length: 0.5 mi

- Bobcat
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Guardrail
- Crossing Zone
- Roads
- NY Wetlands Inventory

Roadside conditions at the southern (above) and northern (below) sections of the zone.
Crossing zone 13

Route 22A
Town: Low Hampton, NY
County: Washington
Length 0.5 mi

Zone Details

Human infrastructure and development

1. No buildings were found within this zone.
2. A fence was located on the west side of the road in the southern section of the zone.
3. A Guardrail was present on the west side of the road in the northern and middle section of the zone. A smaller section of guardrails were present on both sides of the road in the middle of the zone, and another section of guardrail was located on the east side of the road to the south.
4. No major transmission lines paralleled or intersected the zone.
5. No railroad tracks paralleled or intersected the zone.
6. No road intersected the zone. A road located 275m to the west of the zone paralleled the northern portion of the zone.
7. Underpasses- a medium sized culvert was located at the middle of the zone, and a small culvert was located in the southern/middle section of the zone.

Hydrology and topography

1. No major streams intersected this section of road.
2. A small/medium-sized wetland was located 200m to the west of the northern section of the zone.
3. The topography was generally flat throughout the southern section of the zone. The middle section sloped steeply to the east, and the northern section of the zone slopes towards north.
4. Roadside topography of interest- a rock outcrop was located towards the middle of the zone.
**Wildlife Habitat**

1. Deer wintering yard data was not available.
2. The entire length of the zone was forested. Hardwood trees (primarily Oak) were found on both sides of the road in the southern and middle portion of the zone. The northern portion of the zone was a mixed forest.

**Conservation lands**

1. No conservation lands were adjacent to the zone.

**Species present**

1. Twenty-four wildlife crossings were documented during the winter survey (1/11/10). Three mammal species were encountered: bobcat (n=3), coyote (n=3), and white-tailed deer (n=18). Bobcats were detected crossing at the northern, middle/northern and southern section of the zone. Coyotes were detected crossing the zone at southern and middle sections of the zone. White-tailed deer were found throughout the entire length of the zone.
6. Fifteen crossings of white-tailed deer were documented during the early and late spring surveys in the southern portion of the zone.
7. Roadkill documented during survey – porcupine at the northern end of the zone
8. Historic roadkill – data not available
9. Reported wildlife observations: a local resident reported lots of white-tailed deer crossings within this section of road, and he suggested that deer crossing signs should be placed at either end of the zone.

**Motorist line of sight, safety, and sign**

1. The speed limit was 50 mph throughout the zone
2. The line of sight was long at the southern and northern section of the zone, but it was short at the curve in the road at the middle of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a medium width shoulder throughout the length of the zone.
Summary, management recommendations, and prioritization

The entire length of the zone should be a prioritized, because a number of wildlife species crossed this area including three different bobcat-crossing locations. White-tailed deer were found crossing this location in greater abundance (4.8 deer crossings per 100 m) than any other zone within the study area. There was no development adjacent to the zone and the zone was forested on both sides of the road for its entire length. The topography was also generally flat throughout the southern half of the zone making it easier for wildlife to move across the road. Deer crossings were concentrated at this section, and a local resident had seen a number of road-killed deer within this zone. Reducing the speed limit from 50 mph to 40 mph and posting deer crossing signs may make this section of road safer for humans and wildlife. The landowners adjacent to the zone should also be informed about the importance of this location to wildlife movements, and public awareness should be heightened.
Zone 14: Whitehall & Fort Ann, NY, Route 4
Length: 2.4 mi

- Coyote
- Deer
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Guardrail
- Crossing Zone
- Fence
- Roads
- Streams

Large culvert at north end of the zone.
**Crossing zone 14**

Route 4  
Town: Whitehall & Fort Ann, NY  
County: Washington  
Length 2.4 mi

**Zone Details**

*Human infrastructure and development*

1. A number of buildings were distributed throughout the zone.
2. Two fences were found adjacent to the road. One was located in the southern/middle portion of the zone, and the other was found in the northern/middle portion. There was a smaller section of fence located across the road from the northern/middle fence.
3. Seven small sections of guardrail were present on both sides of the road. Three sections of guardrails were located within the northern portion of the zone, and another four were located within the northern/middle section of the zone. The southern end of the zone had two long stretch’s of guardrails on the east side of the road and one small section of guardrail on the west side.
4. No major transmission lines paralleled or intersected the zone.
5. Railroad track paralleled the eastern edge of the zone a distances between 20m in the southern portion of the zone and 400m in the northern portion.
6. Six roads intersected the zone. There were three on each side of the zone. One was located in the middle the zone from the west, and the others were located in the southern/middle section of the zone.
8. Underpasses- ten culverts were within this section of road. Eight of them were located at the same locations as the guardrail sections mentioned previously. The two other culverts were located in the middle and southern portion of the zone. Eight of the culverts were medium to small in size, except for a large culvert (5’ wide) at the northern end of the zone and a large box culvert located within the northern middle section of the zone.
**Hydrology and topography**

1. A medium-sized stream intersected the northern/middle portion of the zone, and many small streams intersected the road at culvert locations. Streams flowed from west to east. A large stream/river paralleled the whole eastern side of the zone at distances between 200m and 600m.

2. A number of wetlands were adjacent to the zone around culvert locations, and to the east of the road.

3. The topography was generally flat throughout the entire length of the zone.

4. Roadside topography of interest - a large rock outcropping was located along much of the southern end of the zone.

**Wildlife Habitat**

1. Deer wintering yard data was not available.

2. Fields, shrublands, and hedgerows made up the habitat of the northern, middle, and southern/middle section of the zone. Forested habitat touched the road in small sections primarily form the west. The southern end of the zone had a small section of the zone that had forest on both sides of the road.

**Conservation lands**

1. No conservation lands were adjacent to the zone.

**Species present**

1. 18 wildlife crossings were documented during the winter survey (1/11/10). Three mammal species were encountered: red fox (n=11), coyote (n=3), and white-tailed deer (n=3). Red foxes were detected crossing at the middle and southern sections of the zone. Coyotes were detected crossing the zone at southern, middle and northern sections of the zone. White-tailed deer were found in the southern section of the zone. One flock of wild turkeys crossed the southern section of the zone.

2. One crossing of a raccoon was documented during the early spring survey in the southern portion of the zone at the culverts.
3. Roadkill documented during survey – porcupine (n=2) at the northern and southern end of the zone.
4. Historic roadkill – data not available
5. Reported wildlife observations: none

**Motorist line of sight, safety, and sign**

1. The speed limit was 55 mph throughout the zone
2. Line of sight was medium throughout the northern and middle section of the zone, and was long in southern section.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. Narrow shoulder throughout the northern and middle section of the zone. There was a wide shoulder in the southern section

**Summary, management recommendations, and prioritization**

Wildlife detected crossing this section of road were primarily common species (red fox, coyote and white-tailed deer), and the crossings were not that frequent. This section of road may pose a difficult barrier for elusive mammals (bobcat and fisher) to move across, because the majority of the habitat on the east side of the road was open. The speed limit was also 55 mph on this busy section of road. Prioritizing key locations cannot be supported by wildlife data within this zone, and further monitoring of this zone may provide more insight into where the key crossing locations are. The three culvert locations at the north end of the zone and the large culvert at the stream corridor towards the middle of the zone warrant further investigation as potential crossing areas. If they prove to accommodate the movement of wildlife either over or under the road, then the appropriate signage and/or reducing the speed limit may enhance the safety of wildlife within this busy stretch of road. Roadside habitat modifications (tree and shrub plantings) around the culverts that connect to forested habitat further to the east may be valuable in providing habitat. Contacting landowners and increasing public awareness may aid in the goal of establishing better habitat connectivity within this zone.
Zone 15: Fort Ann, NY, Route 4
Length: 1 mi

- Coyote
- Gray Fox
- Buildings
- Small Culvert
- Medium Culvert
- Large Culvert
- Guardrail
- Crossing Zone
- Roads
- Streams
- Lakes and Ponds

Large culvert at middle section of the zone.
Crossing zone 15

Route 4
Town: Fort Ann, NY
County: Washington
Length 1 mi

Zone Details

Human infrastructure and development

1. One building was located on the west side of the road in the southern section of the zone.
2. Fences were not present within the zone.
3. Guardrails were present on both sides of the road at the northern end of the zone. There were three small sections of guardrails on the west side of the road near the middle and southern middle of the zone, and there was on long section of guardrail on the east side of the road in the southern/middle section of the zone.
4. Transmission lines intersected southern portion of the zone from east to west.
5. Railroad tracks paralleled the eastern side of the zone a distances between 100m and 300m.
6. Two roads intersect this zone. They are located at either end the zone, and cross through it.
7. Underpasses- a large underpass was in the northern end of the zone, but its details could not be obtained due to its difficult location. A large culvert (5’ wide) was located at the northern middle section of the zone, and another large culvert (6’ wide) was located at the southern/middle portion of the zone. A small culvert was located at the southern end of the zone, and a medium sized culvert was located just north of there. Two medium-sized culverts were located in the middle of the zone.

Hydrology and topography

5. One stream entered into a large body of water that intersected the northern section of the zone from the west. This body of water paralleled the eastern side of the
road for the middle and northern section of the zone. A large stream/river paralleled the whole eastern side of the zone at distances between 200m and 600m. Smaller streams also intersected the zone at the locations of the large culverts mentioned in the previous section.

6. Wetlands were located on the eastern side of the zone for almost its entire length except for the middle portion of the zone.

7. The topography was generally flat throughout the entire length of the zone.

8. Roadside topography of interest- none

Wildlife Habitat

1. Deer wintering yard data was not available.

2. The southern end of the zone was fairly open. The middle section was forested on both sides of the road with hardwoods and pines. This forest type continued into the northern section of the zone on the east side of the road, but the west side was more open habitat.

Conservation lands

1. No conservation lands were adjacent to the zone

Species present

1. 5 wildlife crossings were documented during the winter survey (1/11/10). Three mammal species were encountered: red fox (n=1), coyote (n=2), and gray fox (n=2). Red foxes and gray foxes were detected crossing at the northern section of the zone. Coyotes were detected crossing the middle section of the zone.

2. No wildlife crossings were documented during the early and late spring surveys, but white-tailed deer tracks were found near two of the culverts mentioned previously. However, the tracks did not enter the culverts.

3. Roadkill documented during survey – none

4. Historic roadkill – data not available

5. Reported wildlife observations: none
Motorist line of sight, safety, and sign

1. The speed limit was 55 mph throughout the zone.
2. The line of sight was long throughout the entire length of the zone.
3. There were no wildlife or deer crossing signs at either end of the zone.
4. There was a wide shoulder throughout the entire length of the zone.

Summary, management recommendations, and prioritization

Wildlife detected crossing the zone was not that frequent. This section of road may pose a difficult barrier for some mammals to move across, because the majority of the habitat on the east side of the road was open water. The southern half of the zone may provide better habitat connectivity for terrestrial mammals, but prioritizing key locations cannot be supported by wildlife data within this zone, and further monitoring of this zone may provide more insight into where the key crossing locations are. If key locations are documented, then the appropriate signage and/or reducing the speed limit may enhance the safety of wildlife within this busy stretch of road.
Discussion and Conclusion

Zones were prioritized as high, medium, or low under two categories: (1) importance to wildlife movement and (2) need of wildlife permeability enhancement activities (Table 4). Ranking was based an evaluation of the winter and spring wildlife road crossing data in relationship to available GIS layers such as: topography, conserved lands, wetlands inventory, and core habitat. The major criteria used to prioritize crossing zones focused on areas that showed high species use and diversity during the surveys, as well as, core habitat connection with undeveloped land on either side of the road. Zones that were prioritized for permeability enhancement often posed a threat to human safety (animal/vehicle collision), inhibited the movements of wildlife, and/or could benefit from specific management activities to maintain or increase wildlife use. Crossing zones that presented opportunities for outreach and partnerships were also considered during the prioritization process.

Table 4. Zones prioritized by their importance to wildlife movement and need of permeability enhancement activity
Prioritized zones are listed below with the road section and town(s) they were found within.

**Prioritization of most important crossing areas for wildlife movements**

**High Priority**

Zone 1: Wallingford, VT, Route 7  
Zone 4: Brandon, VT, Route 7  
Zone 5: Sudbury, VT, Route 30  
Zone 6: Sudbury & Hubbardton, VT, Route 30  
Zone 9: Hubbardton & Benson, VT, Route 144  
Zone 10: Benson, VT, Route 22a  
Zone 11: West Haven, VT, Route 22a  
Zone 12: Poultney, VT, Route 30  
Zone 13: Low Hampton, NY, Route 22a

**Medium Priority**

Zone 2: Pittsford, VT, Route 7  
Zone 3: Pittsford, VT, Route 7  
Zone 7: Hubbardton, VT, Route 30  
Zone 8: Hubbardton, VT, Route 30

**Low Priority**

Zone 14: Whitehall & Fort Ann, NY, Route 4  
Zone 15: Fort Ann, NY, Route 4

**Prioritization of crossing areas most in need of wildlife permeability enchantment activities**

**High Priority**

Zone 1: Wallingford, VT, Route 7  
Zone 2: Pittsford, VT, Route 7  
Zone 3: Pittsford, VT, Route 7  
Zone 4: Brandon, VT, Route 7  
Zone 12: Poultney, VT, Route 30  
Zone 13: Low Hampton, NY, Route 22a  
Zone 14: Whitehall & Fort Ann, NY, Route 4

**Medium Priority**

Zone 6: Sudbury & Hubbardton, VT, Route 30  
Zone 7: Hubbardton, VT, Route 30  
Zone 11: West Haven, VT, Route 22a
Zones 1, 4, 12, and 13 were ranked as high priority for their importance to wildlife movement and high priority for their need of permeability enhancement activities. Zones 1, 12, and 13 were found in the southern half of the study area (Figure 2), and they begin to establish a route from the Adirondack Mountains of New York to the Green Mountains of Vermont. A critical component to making this connection will be determining the location of a key-crossing zone along Route 4 within or near the vicinity of Zone 14, which was ranked as a low priority to wildlife movements and high priority for permeability enhancements. Future research should focus on locating a crossing zone along Route 4.

Potential links from the Adirondack Mountains to the Green Mountains in the northern half of the study area may be through high priority wildlife movement Zones 4, 5, and 10 or Zones 4, 6, and 11. Zone 9, runs east to west along Route 144 and could be included in the linkage design because it allowed wildlife to move from Zones 6 to 10 or from Zones 5 to 11 (Figure 2). These zones, except for Zone 4, ranked medium to low in their need for wildlife permeability enhancement activities, so the link may be fairly well established, other than more public awareness. However, Zone 4 was in need of permeability enhancement, so attention should be given to this location. All of these zones were located within Vermont; more research needs to be conducted in New York within the northern portion of the study area to determine the location of key crossing zones for habitat connectivity.

Monitoring these crossing zones before and after any enhancement activates will continue to inform future strategies that increase wildlife permeability and human safety.
Figure 2. Potential links from Adirondack Mountains to Green Mountains through high priority wildlife movement crossings zones.