Wildlife Corridor Field Analysis

Warren, Vermont

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Introduction

At the request of the Town of Warren, five major potential crossing areas previously identified by Arrowwood Environmental (AE) (*Warren Natural Resource Inventory and Assessment,* 2007-2008) were assessed for wildlife use during the winter of 2013-14. These potential wildlife crossing areas were identified by AE during a broader natural resource inventory utilizing parameters such as the density of development and the proximity of important wildlife habitats.

Background

Wildlife move about the landscape in search of food, mates, water, and available habitats. Some landscape movements by wildlife are seasonal such as the springtime dispersal of young animals away from their natal home ranges or the movement of black bear to mast-bearing American beech forests during the fall months. In order for many wide-ranging species, such as the fisher, moose, black bear and others to persist on the Vermont patchwork of forest, farm, and village, wildlife must move across landscapes often inhospitable with roads, human disruption and danger. These movements are often concentrated in certain areas defined by geography, interspecific competition, by the presence of topographical features such as stream valleys or by the presence of dense protective vegetative cover.

For many species of wildlife such movements are crucial to the long-term propagation of their species. This is especially true as humans spread across Vermont, fragmenting natural habitats, and creating separate sub-populations of species. The landscape connections between these pockets of the larger "meta-populations" are often critical to the long-term viability of the species as a whole, maintaining the necessary genetic variability required for survival. Corridors are the connectivity between the patches of remaining habitat in Warren that are suitable for use by wildlife. As one might expect, different species of wildlife, and even different sexes and age groups within the same species, utilize different types of habitats for movements, with different vegetative characteristics and varying degrees of human presence.

In 2008 AE completed a Natural Resource Inventory for the Town of Warren. Among other features, the Inventory identified "potential" wildlife travel corridors throughout the Town based on the surrounding forest conditions, habitats, fragmentation and human presence. A subset of these potential corridors was targeted by the Warren Conservation Commission (WCC) for further investigation. The WCC attempted to procure landowner permission along the selected corridor study areas and AE was retained to field check the quality of the areas as wildlife corridors and quantify the use by actual wildlife species.

Methodology

During the winter of 2013-14, five previously mapped non-species-specific wildlife corridors were assessed for their wildlife use utilizing two distinct techniques: (1) tracking of wildlife within the road right-of-way (ROW); and (2) photography utilizing baited remotely triggered infra-red cameras.

Each of the potential corridors were initially investigated and characterized during the summer of 2013. A site characterization was conducted at each site, with the following information reviewed:

- Natural communities present
- Surface water: streams, rivers, lakes & ponds
- General topographic conditions
- Wildlife cover conditions
- Presence of humans and human developments
- Condition of the road and road shoulders
- Potential camera locations
- Parcel boundaries and land owners.

Wildlife tracking within the road ROW was conducted at each site four times during the winter and early spring of 2014 by AE ecologists.

Portions of some ROW study areas were investigated on other dates concurrent with other field activities such as camera deployment and checking. Wildlife tracking was timed to occur under the best available conditions, with no new snowfall within the previous 48 hours at a minimum. Snow and crust conditions varied between tracking dates and tracking. Tracking and other site visits are detailed in Table 1 below.

Table 1: Site Visits

Visit Date	Visit Type	East Warren Road	Dump Road	Route 100	Route 100 Bridge	Airport Road	Notes
1/24/2014	Tracking	x	x	x		x	
1/31/2014	Cam deploy	x	x	x	x		3 cam sites
2/19/2014	Cam Check	x	x		x		fresh snow, poor tracking
2/24/2014	Tracking	x	x	x	x	x	no gps some new snow
3/7/2014	Cam Check	x	x		x		deep snow
3/19/2014	Tracking	x	x	x	x	x	all sites
4/4/2014	Tracking	x	x	x	x	x	all sites
4/29/2014	Cam Check	x	x		x		no tracking
6/11/2014	Camera recover	x	x		x		no snow
Total Visits		**9**	**9**	**5**	**8**	**4**	

All wildlife tracks which came into the ROW were recorded and the location mapped with a mapping grade GPS (assumed accuracy+/-30 feet), with the exception of 2-24-2014 when general locations within the corridor were recorded in notes due to GPS malfunction, and later tied to spatial locations.

In general, tracks made by small animals such as rodents, squirrels and birds were not recorded, however larger birds that serve as significant prey species such as ruffed grouse and wild turkey were. An attempt was made to isolate tracks of animals that may have walked parallel to the road entering the ROW at more than one location. Tracking along most of the corridors was limited to the road ROW and because of this a positive identification of all wildlife tracks was not always possible. When a positive identification of a track to species was not possible, professional judgment was used wherever adequate features were available.

Remotely-triggered cameras were installed in wildlife habitat adjacent to three of the five mapped wildlife corridors at locations where landowner permission was secured by the Warren Conservation Commission. Camera locations were selected based on

proximity to the road, the presence of adequate cover to support wildlife movement and where appropriate, the proximity to surface water such as streams or wetlands.

The foregrounds of the cameras' fields of view were baited with meat and fish placed in hardware-cloth baskets and wired to an available tree trunk. Due to the generally cold weather conditions that existed during the winter of 2013-2014, it is likely that the scent cast by the bait only traveled short to mid-distances attracting wildlife that were already in close proximity to the camera locations, rather than drawing from afar.

Cameras were in place from January 31st–June 11th 2014. The cameras were visited at intervals of 2-4 weeks by AE ecologists to check bait conditions, camera operation and battery condition. At camera visits, memory cards were downloaded or swapped and the area was reviewed for tracks and sign of wildlife.

Table 2: Photographed Species Count by Camera

Species	Dump Road	East Warren Road	Route 100 Bridge
Bear	39		
Canid			6
Coyote	51	6	
Deer	92	12	3
Fisher	12	9	9
Fox	3	3	
Grey Fox	58	12	18
LT Weasel	3		
Not ID'd		4	3
Porcupine	12		
Raccoon	3	18	3
Red Fox	21		
Red Squirrel			3
Skunk		16	
Total	**294**	**80**	**45**

**multiple photos of the same individual(s) included*

Results

Each of the five corridor sites is discussed in this section.

Site 1: East Warren Road

The East Warren Road assessment area is located approximately at the intersection of East Warren, Brook and Plunkton Roads. The assessment area is approximately ½ mile long beginning at the Plunkton Road bridge over Freeman Brook, running north onto East Warren Road and ending north of a culverted crossing of a tributary to Freeman Brook.

The area is comprised of a mix of open fields and houses, primarily concentrated toward the center of the study area. Large streams and forest cover are present at both the north and south ends of the study area. Most of the site is relatively flat (at about 1300' elevation), however the stream valleys are steep. The fields generally consist of hay or pasture and lawn, and some are fenced. The riparian vegetation at both streams is a mix of hardwoods (birch, aspen, and ash) and softwoods (white pine). Wildlife habitat on both the east and the west side of the road is moderately fragmented but larger areas of contiguous forestland exist on the west. Both Freeman Brook and its northern tributary extend into large remote forestland in the Northfield Mountains east of the study area. Wildlife may utilize the valleys along these two brooks to move across this otherwise fragmented habitat.

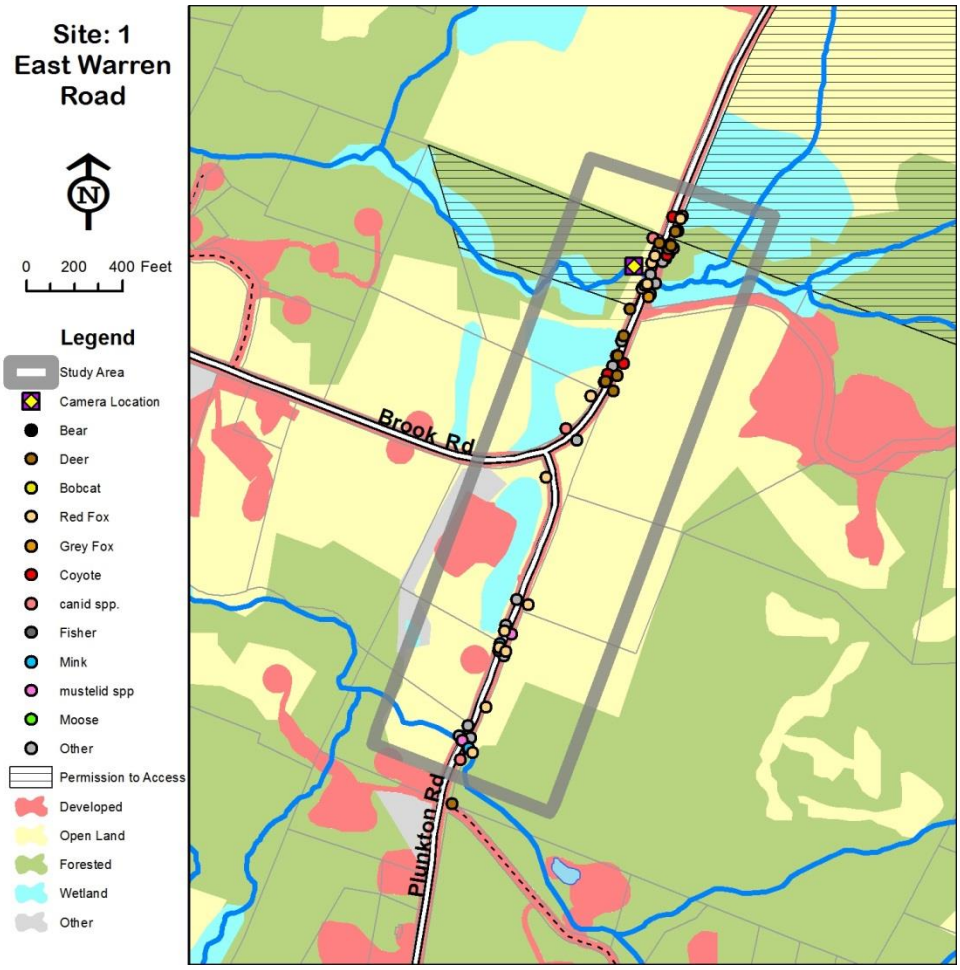


Figure 1: East Warren Road Site

Tracking:

The majority of the wildlife crossings were concentrated either on the streams through the culverts or bridges or within the riparian forest cover near the streams. Mink, weasel, fisher, red and grey fox, deer and eastern coyote crossed in these areas. A concentration of deer crossing the fields is probably due to some apple trees and wind-scoured fields exposing winter food opportunities. This site had the second highest number of recorded tracks of wildlife, and a high level of species diversity.

The following species were identified by track at this site:

- Coyote
- Deer
- Fisher
- Mink
- Red Fox
- Weasel

Camera:

A camera was placed adjacent to the Freeman Brook tributary at the northern end of the assessment area. The stream crosses under the road in a large culvert with deep fill maintaining the road grade. There is a path north and parallel to the stream that appeared to be occasionally frequented by walkers, snowshoer's and their dogs. The camera at the East Warren Road site recorded the following species:

- Coyote
- Deer
- Fisher
- Fox
- Grey Fox
- Skunk
- Raccoon

Mink tracks were noted nearby during camera checks, but apparently never ventured away from the stream channel to be captured on camera.

Figure 2: Fisher at East Warren Road Camera

Recommendations

The East Warren Road site was notable for the wildlife focus at the stream corridors north and south. Multiple roads converging, as well as increased density of residential development toward the central portion of the site reduces its wildlife conveyance value considerably. The northern stream channel is seeing new development near its southern bank, making the forest cover along and north of the stream that much more important. Based on a sign near the road advertising "house site", it would appear that the forest along the north side of the stream may be for sale. If that is the case, new residential development may significantly cut off wildlife travel opportunities here and this could be an ideal site to consider a small conservation project. At a minimum, encouraging any new development to be located out of the woods and away from the stream would provide some level of ongoing refuge for traveling wildlife.

At the south end, the new bridge over Freeman Brook is appropriately sized to allow wildlife travel under the road. Again, the riparian corridor here appears to be a preferred travel route and any protection or conservation in this area will help maintain that function.

Site 2: Dump Road

The Dump Road site starts approximately 800' west of the intersection of Dump Road and Airport Road and continues westerly along unpaved Dump Road for approximately ½ mile.

The area is predominantly surrounded by forest, with small open fields south of the road at the eastern end. Development is limited to a few houses and a horse farm. The site is moderately hilly and gains elevation to the east (centered at about 1300'). The vegetation is mixed, dominated by open hardwood forest, with some white pine to the south and west. There are some small herbaceous wetlands along the road, again on the east end. Mapped deeryards are located to the north and south of the site.

The Dump Road site is situated in close proximity to Warren Village and wildlife habitat near the crossing is fragmented both to the west (Warren Village) and to the east (airport, agricultural lands, and Brook Road). However relatively large forested areas

north and south of Dump Road may contain wildlife that require large areas like bear and moose. Extensive wild forests to the south provide habitat for these species and this area on Dump Road may provide the necessary conditions for wildlife moving both north and south.

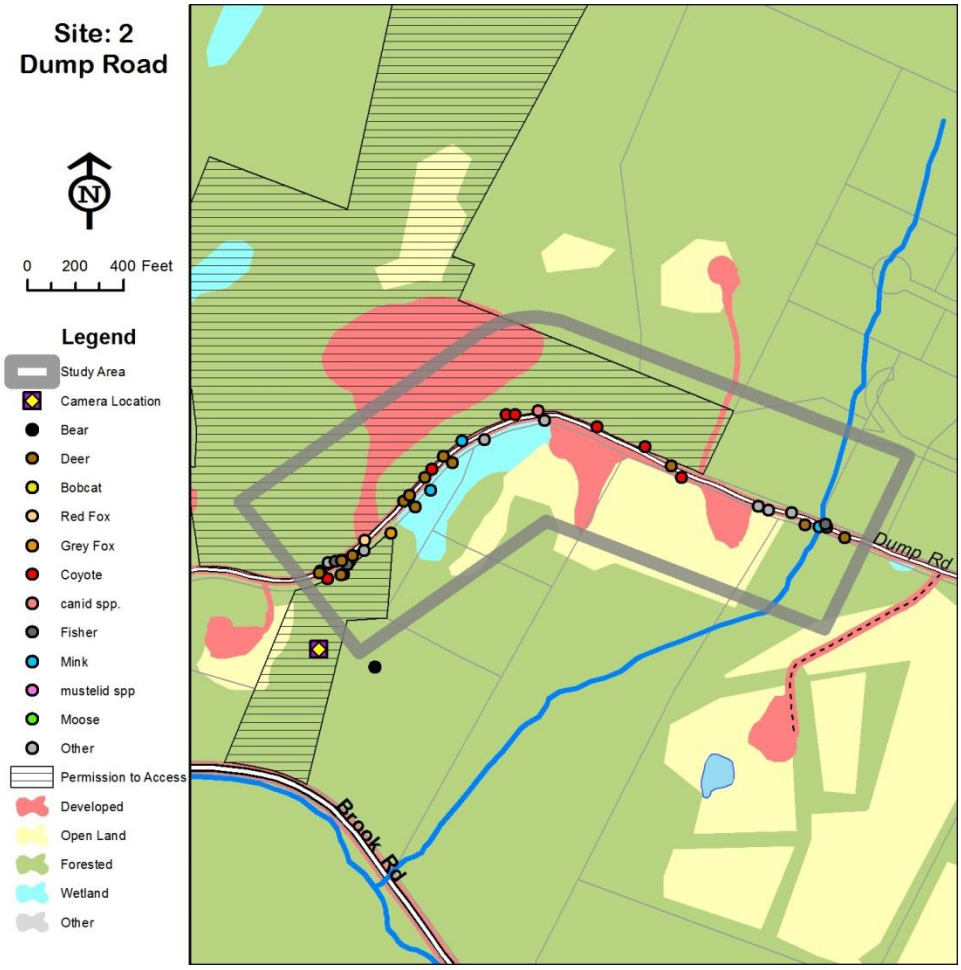


Figure 3: Dump Road Site

Tracking

The Dump Road site had the vast majority of wildlife crossings clustered along the western end of the corridor. Extensive deer and coyote, as well as occasional mink and fisher sign were recorded there. A cluster of small white pine trees near the old dump site and outside the ROW at the west end of the site exhibited extensive use by black bear. Over a dozen of these pines were climbed, most likely by bear cub(s) as evidenced by smaller claw spacing. The trees may have been utilized as a nursery while

bears ate fruit from nearby apple and aspen trees and an extensive patch of blackberry and raspberry as these nearby food sources exhibited signs of bear foraging.

A scattering of crossings occurred throughout the remainder of the study area, with a small concentrated pocket of activity in proximity to a small stream channel near the east end of the site. In total, this site had the second lowest number of tracks of wildlife recorded, but tied for the highest species diversity when all observed wildlife was considered.

The following species were identified by track at this site:

- Coyote
- Deer
- Fisher
- Fox
- Grey Fox
- Skunk
- Raccoon

Camera:

A camera was placed adjacent to the old dump, in the grove of bear-climbed white pine trees at the western end of the assessment area. There is a house nearby, and a domestic dog was occasionally recorded on the camera, however it did not appear to greatly dissuade wildlife use at the camera site. The camera at the Dump Road site recorded the following species:

- Black Bear
- Coyote
- Deer
- Fisher
- Grey Fox
- Long-tailed Weasel
- Porcupine
- Raccoon
- Red Fox

The camera was visited on multiple occasions in the late spring/early summer by bears, including one sow with a cub.

Figure 4: Bear and Cub at Dump Road Camera

Recommendations

The diversity of wildlife at the Dump Road site, especially the wide-ranging mammals such as bear, fisher and coyote suggest, at the west end at least, it is an important wildlife travel corridor. Conservation of land in this area and maintenance of the forest cover will preserve the quality of the corridor for allowing wildlife movement between adjacent forest blocks.

Site 3: Route 100 South

The Route 100 South corridor site is located along Route 100, starting approximately 300' north of Main Street, continuing north for ½ mile. The site is characterized by small amounts of forest and wetland cover in the south, the Mad River to the east, and numerous fields to the north on both sides of Route 100. Elevation at the site is approximately 800'. The fields are relatively narrow and give way to extensive mixed conifer and hardwood forest covered hillsides and wildlands beyond. Low visibility in the wetland areas provides good cover for wildlife approaching the busy road in this area. Mapped deeryards are located nearby both to the east and the west of the road. Extensive areas of mast providing forest are located in the hills to the west of the site.

The Route 100 South site is situated between two very large forested blocks. A small stream, wetlands along the road, and the Mad River valley combine to make this an attractive wildlife crossing area.

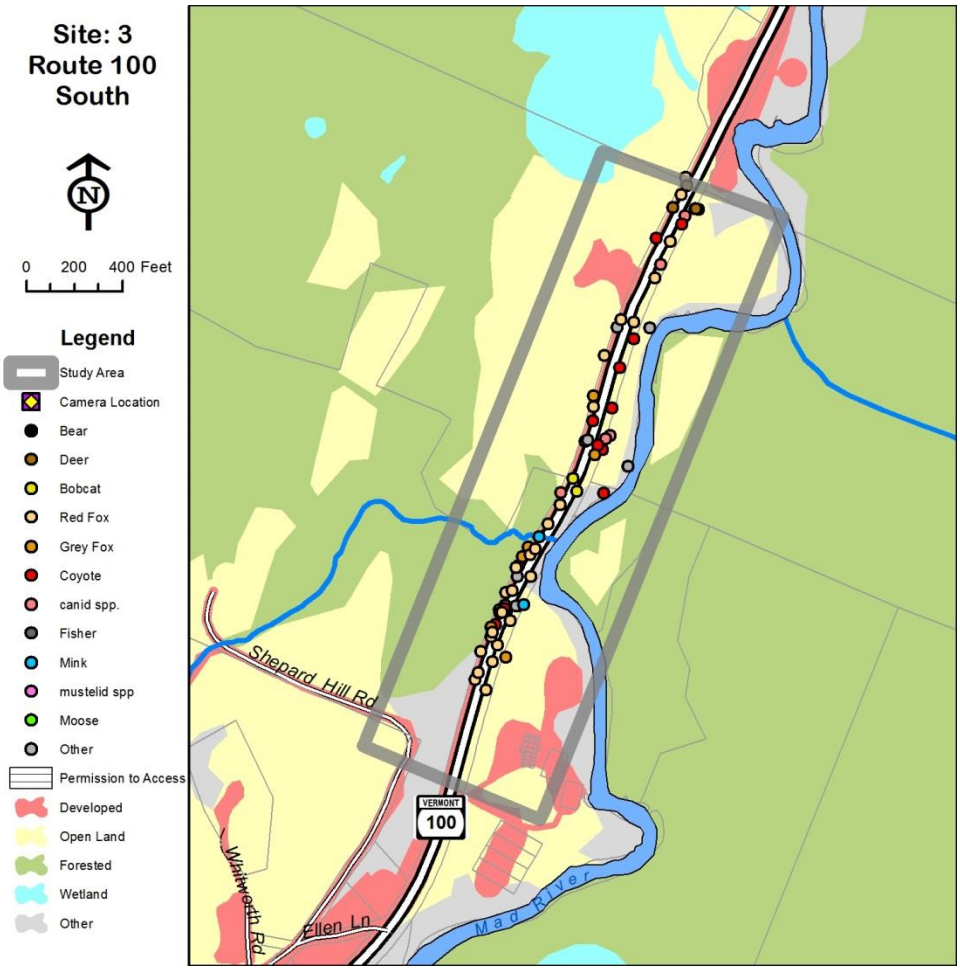


Figure 5: Route 100 South Site

Tracking

The density of wildlife sign was greatest to the south where the Mad River, forests and wetlands are in close proximity to the road. This site had numerous grey and red fox, deer, and coyote sign present, as well as mink and a potential bobcat (track conditions were less than ideal for confident identification). A smattering of deer, coyote and fox activity through the open fields highlights the adaptability of these species to some level of human activity, but it's dwarfed by the busy crossing activity at the southern end of the study area where forest cover, stream, wetland and river converge. This study area

had the highest total of wildlife tracks recorded and tied with the Dump Road site for highest species diversity.

The following species were identified by track at this site:

- Bobcat (partial track)
- Coyote
- Deer
- Fisher
- Grey Fox
- Mink
- Red Fox
- Turkey

Camera:

No camera was placed at this site.

Recommendations

The focus area at the Route 100 South site should be in the southern portion. This narrow point if clearly favored for wildlife moving east to west across Route 100 and to and from the Mad River corridor. That being said, providing bands of forest cover through the open fields either through natural re-vegetation or planting efforts in the central and northern portions of the site may enable more movement opportunity and additional access to the river. A big risk for wildlife crossing at this site is road mortality. Driver awareness signage may be appropriate, and oversizing conveyance structures such as culverts when possible would help provide safer passage for some species.

Site 4: Route 100 Bridge

The Route 100 Bridge site is located along Route 100 at the north end of Town. The site is bisected by a bridge crossing the Mad River, which was in the final stages of construction at the time of the survey. The surrounding area is characterized by open fields and houses and shrub dominated wetlands south and east of the bridge. The site is approximately 800' but the land rises quickly to high hillsides outside the valley. Conifer forests dominate the lower roadsides while extensive northern hardwood forests are common on hillsides away from the road. Within the forested and wetland portions of the site wildlife cover is good due to dense shrubby vegetation (wetland) and predominance of conifers (forests). There are extensive forested areas to the west, while forests are more fragmented to the east. Mast bearing trees and forests are

located to the west of the road on the hillsides. Mapped deeryards are located immediately to the east of the Mad River.

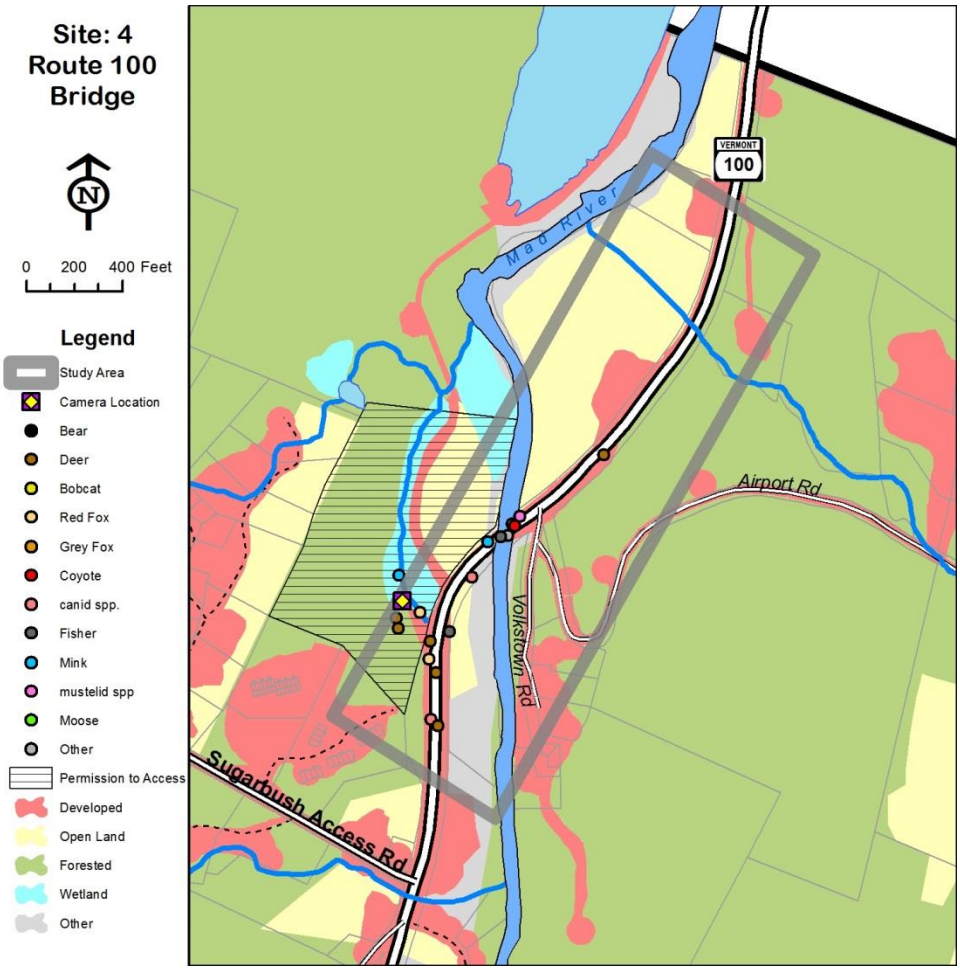


Figure 6: Route 100 Bridge Site

Tracking

The Route 100 Bridge site exhibited some wildlife activity but it was predominantly associated with the river and a nearby shrub swamp. The portion of the site north of the Mad River bridge provided very little evidence of wildlife use, presumably because the wide open fields on the west and steep ledge outcrops on the east are not conducive to wildlife movement. The shrub swamp along the west side of the river, and the Mad River itself appear to assist wildlife migration across Route 100 at this location. The Mad River channel was utilized by mink and fisher, and possibly otter (track unable to be confirmed), while the shrub swamp contained sign of deer and coyote and fox.

This site had the lowest total of wildlife tracks recorded. Relatively heavy road traffic, as well as the increased activity, noise and human presence associated with bridge construction may be limiting the wildlife use of this area. This site had the lowest species diversity, and the lowest number of tracks recorded of the five sites evaluated.

The following species were identified by track at this site:

- Coyote
- Deer
- Fisher
- Mink
- Otter (unconfirmed)
- Red Fox

Camera:

A camera was placed in the shrub swamp just west of the bridge construction parking & staging area along the snowmaking pond access road and adjacent to route 100. The camera at the Route 100 Bridge site recorded the following species:

- Deer
- Fisher
- Grey Fox
- Red Squirrel
- Raccoon

The camera at this site recorded very few individual visits, with the majority occurring in the mid to late spring near the end of the camera deployment period.

Figure 7: Fisher at Route 100 Bridge Camera

Recommendations

The Route 100 Bridge site has some potential as a wildlife corridor. If the areas north of the Mad River bridge and west of Route 100 were re-vegetated, the Mad River and its riparian habitat might serve to facilitate more wildlife movements in the future. The installation of a new pedestrian walkway under the bridge is likely to draw additional people and pets to the area and may continue to deter wildlife use of the bridge as a road crossing opportunity. Forest re-vegetation on the banks and adjacent fields could provide an alternative to wildlife shy of the human activity under the bridge. Care should be taken to not direct wildlife toward the ledge area north and east of the bridge as escape is more difficult and road mortality could increase.

Site 5: Airport Road

The Airport Road site is located along Airport Road starting approximately 0.8 miles from the intersection with Dump Road, extending north ½ mile. The surrounding landscape is dominated by eastern hemlock forest and extensive forest cover. A stream crosses the road in a small valley, and a manmade pond is located near the road at the south end of the site. Wetlands are located around the pond and the stream has

associated forested wetland. Fields are found in the northern and eastern parts of the corridor.

The Airport Road study area is in an area with considerable fragmentation by residential development. To the north, south, and east extensive agricultural land use means less development disturbance, but also diminishes wildlife habitat quality through farming activity and open fields. This site elevation is about 1300' and rises to the north. Mapped deeryards are found on the east and west side of the road. Visibility is high, generally greater than 50' along the length of the corridor.

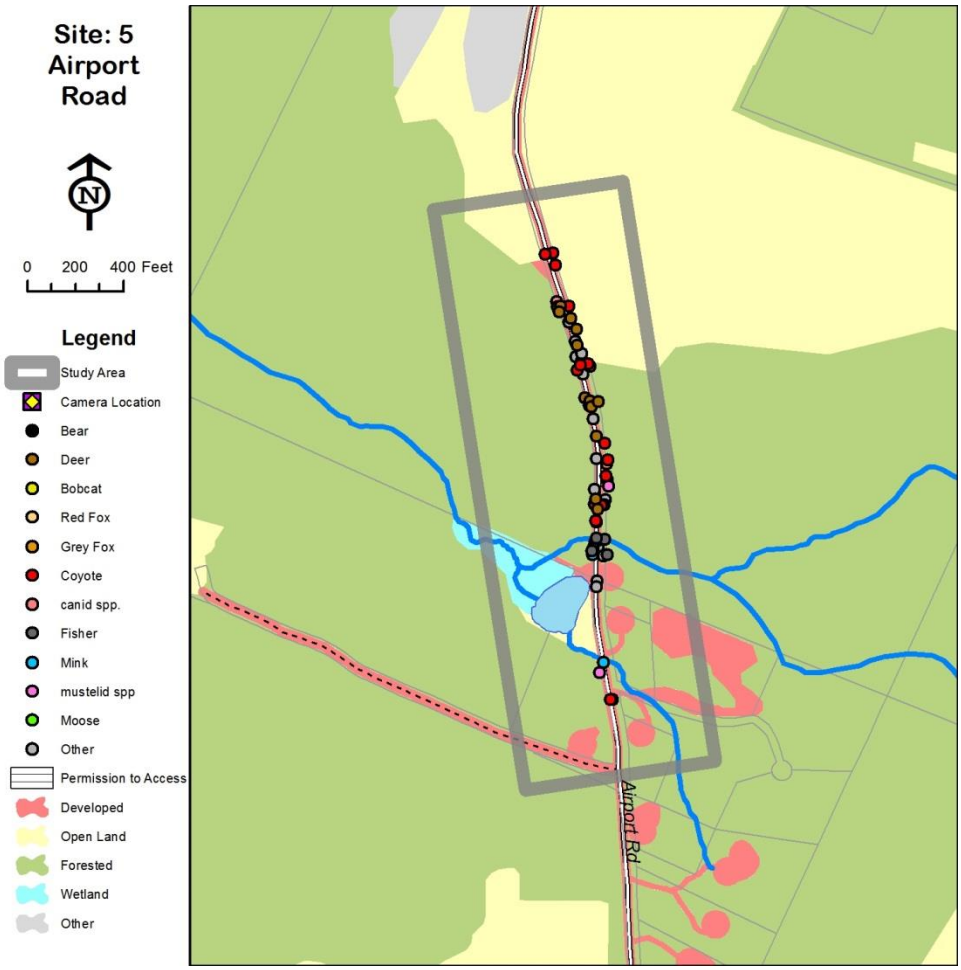


Figure 8: Airport Road Site

Tracking

Wildlife use of this site was spread throughout the heavy cover of the hemlock forest in the central section of the site. Wildlife recorded here was dominated by deer and

coyote perhaps owing to the winter cover favored by deer in the adjacent hemlock forests. Some increase in activity was noted at the stream crossings. More activity was expected at the south end of the site with the pond and wetland. Residential development in this area may be deterring use. The Airport Road site had the third highest level of wildlife tracks observed, owing to heavy deer use, but with primarily deer and coyote present, ranked second to last in species diversity.

The following species were identified by track at this site:

- Coyote
- Deer
- Fisher
- Mink
- Turkey

Camera:

No camera was placed at this site.

Recommendations

The Airport Road site had the largest area of dense forest on both sides of the road of all the sites evaluated. While species diversity was less than other locations, much of the forested area was used for road crossing. It's possible that wildlife permeability is greater in the general area than at other sites studied, meaning animals are spreading out more due to wider availability of quality habitat. This site would benefit from some additional study, in particular a camera placement here could improve the understanding about what wildlife are in the area. The hemlock forest, wetlands and stream corridors here appear worthy of protection efforts and additional information would help confirm this assumption.

Conclusions

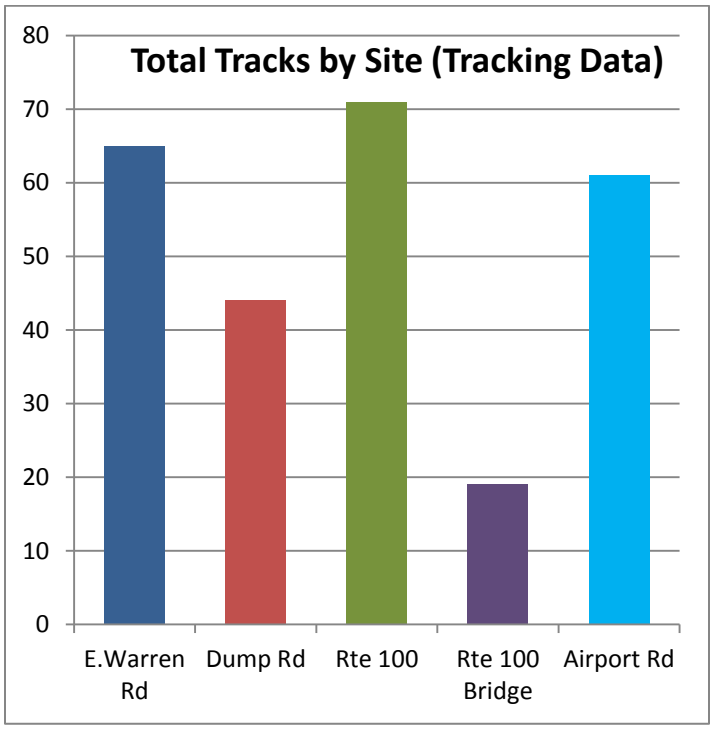
The five potential wildlife crossing areas AE investigated are located generally within the north-central portion of Warren. This section of Warren has a higher degree of wildlife habitat fragmentation, and a greater human presence, than does the southern, western and eastern sections of town. Forest blocks in the north-central section are 300-1000 acres in size while the eastern and western forest areas are measured in tens of thousands of acres. Western Warren contains the forests of the Green Mountains

and in the east, the Northfield Mountains. The southern end of Town is bisected by Route 100 but has little development otherwise and contains large unbroken forests.

The five corridors investigated largely represent potential wildlife corridors within the area most inhabited by humans. Some wildlife is likely surviving solely within these relatively small wooded pockets but most are moving in and out of these areas or dispersing into larger contiguous forests to the east, west, and south. It is likely that wildlife with large home ranges, such as black bear, continue to thrive in Warren because of the presence of these larger forests. However, black bear and other wide-ranging species can still be found within this north-central region owing to their ability to move between forest blocks successfully.

While all five potential wildlife corridors we investigated contained signs of wildlife crossings, fewer total tracks were recorded at the Route 100 Bridge and Dump Road sites than the other three.

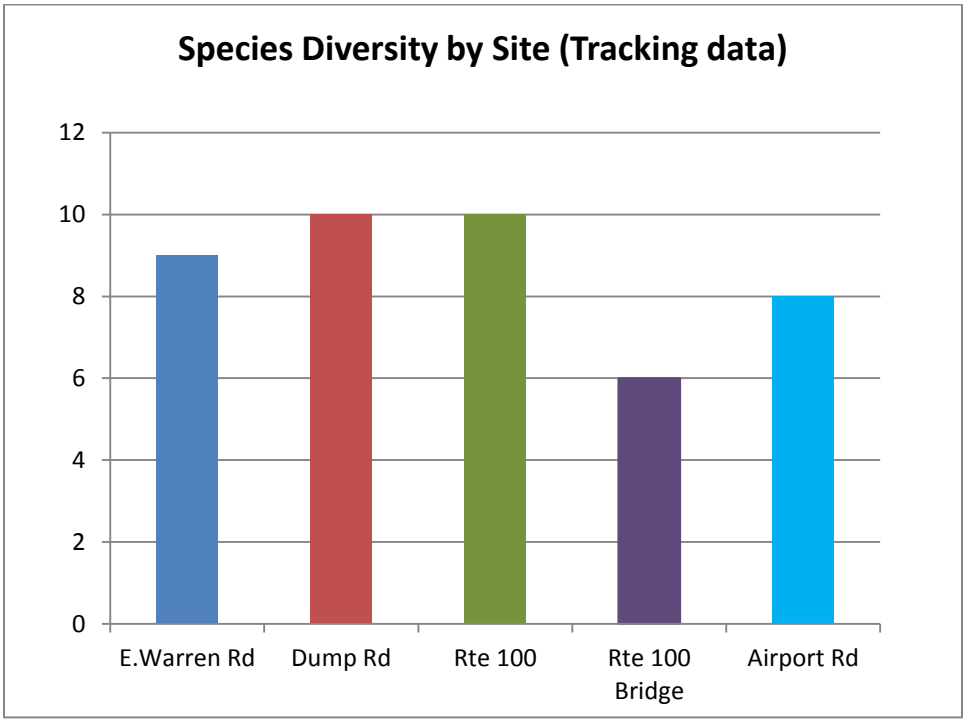
Table 3: Total Track Counts by Site



The Route 100 Bridge site had a correspondingly low species diversity (number of species observed), but the Dump Road site with 2nd lowest track counts had among the

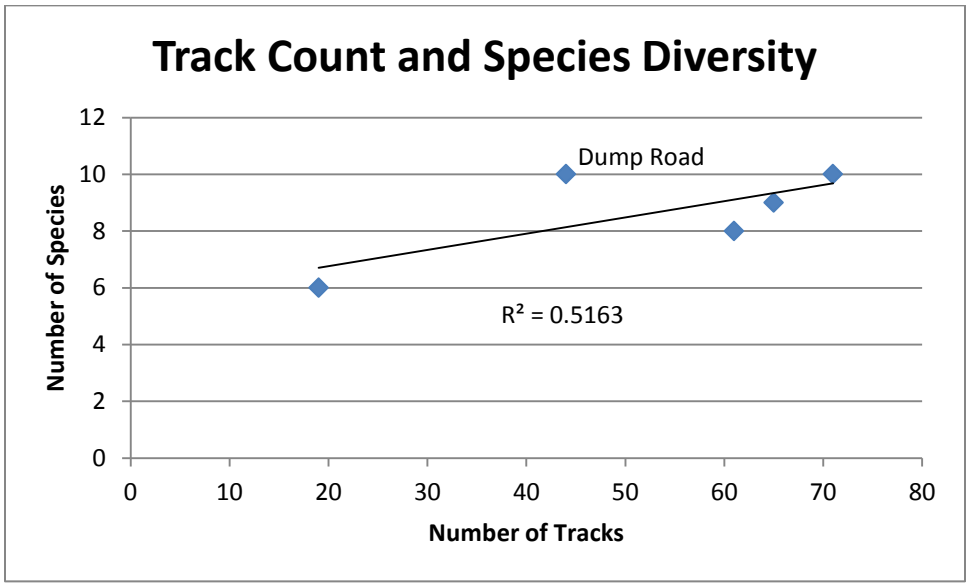
highest species diversity. In fact, when considering the camera data the only sighting of black bear, a prime example of "wide ranging mammal", came from the Dump Road site and data collected suggests the site is used repeatedly by bears.

Table 4: Species Diversity



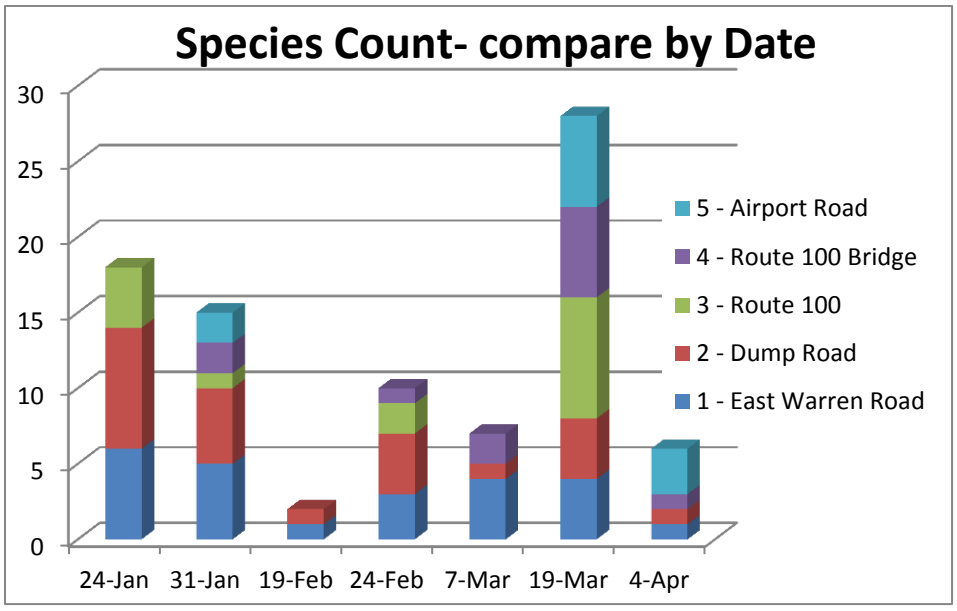
Excluding the Dump Road site, track counts are correlated to species diversity as shown in Table 5 below. However, the Dump Road site is something of an anomaly in this analysis with a high species diversity and corresponding low numbers of tracks recorded. This may be because the site has a diversity of habitat types, or it may indicate a more important wildlife corridor.

Table 5: Track Count and Species Diversity



As would be expected, different tracking visits yielded differing results depending on snow conditions and recent wildlife activity. In general, species numbers observed diminished as the long cold winter of 2013-2014 wore on, with the exception of the March 19th tracking session when exceptional tracking conditions resulted in a major bump in wildlife sign found and fresh snow on February 19th meant many fewer tracks recorded.

Table 6: Species Count by Date, all tracking visits (all sites not always visited)



Because the investigation considered five specific potential crossing areas, we can't conclude that these five areas exhibit more wildlife movement than areas elsewhere in Warren. We can however extrapolate that these areas are being used by wildlife in the course of their landscape movements, that some locations within the study sites are utilized with a greater intensity than others, and that certain landscape features such as the presence of vegetative cover, wetlands, and stream courses enhance this use.

Dense conifer cover provides winter habitat for deer, and protective movements for other animals. As evidenced at the Airport Road site, dense conifer cover on either side of the road provides for increased wildlife activity.

Vegetation along streams is often denser than the surrounding landscape and streams function as wildlife "highways" connecting habitats across the landscape. In addition streams, rivers and wetlands provide critical feeding and denning habitat for wetland dependent wildlife such as mink and otter. Illustrating this point, observed wildlife movement was concentrated at culverts, bridges wetlands and streams at all study sites.

As this corridor investigation was largely limited to winter and early spring wildlife movements, it is also possible that wildlife use within these potential corridors would look differently during the summer and fall months. The geographic distribution of deer, for example alters during the warmer snow-free months and conifer forests become less of a draw for the movements of that species. Similarly, no bear tracks were observed for the simple reason that bears are hibernating during the snow-tracking season. However other studies have shown that bear utilize stream courses and dense vegetation as they move about the landscape, much like the species that were observed in this assessment.

For these wild species to continue to inhabit areas in closer contact to Warren residents, corridors must be retained and, where possible, enhanced. Recommended management practices include land conservation, forest re-vegetation, driver awareness signage, and oversizing stream conveyance structures (such as culverts) to help provide safer passage for wildlife species.