

Warren Corridor Conservation Area: Wildlife Movement Patterns & Use Recommendations

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1 Introduction

In 2015 and 2016, the Warren Conservation Commission requested Arrowwood Environmental conduct an ecological inventory and assessment of the Warren Corridor Conservation Area (WCCA). A reporting of those findings is available under separate cover (Warren Corridor Conservation Area: Ecological Inventory and Assessment, October 26, 2016).

A regionwide lack of snow resulted in poor wildlife tracking conditions during the winter of 2015/2016. In 2016, the Warren Conservation Commission requested Arrowwood continue their research on the WCCA with the aim of documenting and analyzing wildlife movement patterns on and around the parcel.

The use of remotely-triggered game cameras and winter tracking activities have allowed Arrowwood to identify species of wildlife and areas with a high concentration of tracks on the WCCA parcel. Larger species identified include:



adult and cub black bears, white-tailed deer, moose (although no evidence of recent use), Eastern coyote, red and grey fox, bobcat, fisher, long-tail weasel, mink, river otter, porcupine, raccoon, striped skunk, turkey, and ruffed grouse.

A number of specific wildlife habitat elements on the WCCA parcel have been identified during the 2015-2017 studies, including: deer wintering habitat, riparian habitat for aquatic mammals, a small American beech mast stand, bear dens, broken ledge habitat, wetland and seep habitat, and both a north-south and probable east-west wildlife movement corridor.

2 Project Components & Methodology

Arrowwood Environmental (Arrowwood) conducted an ecological assessment for the town of Warren in 2007-2008 (AE, 2008). In 2014, Arrowwood completed an assessment of several potential wildlife corridors within the Town



of Warren (Arrowwood, 2014). In the 2015/2016 ecological inventory of the WCCA, Arrowwood documented the presence of numerous wide-ranging wildlife species regularly utilizing the parcel, including black bear, white-tailed deer, eastern coyote, fisher, mink, bobcat and river otter.

In 2016/2017, Arrowwood employed two primary techniques to investigate and assess the movement patterns of wildlife within, and into the WCCA parcel-- winter track surveys, and remote camera deployment. Camera deployment was a secondary and ancillary component -- as a robust methodology that utilizes remote cameras to identify and quantify wildlife movement patterns on a parcel this size would have been time and cost prohibitive. Camera placement was used to confirm previously observed wildlife use patterns, and, to explore to the extent possible, the wildlife distribution at various locations on the parcel.

Field Visit Summary Table

Date	Activity	Conditions
Jan 10, 2017	Tracking, Camera deployment	Partly cloudy, 1-4" snow
Feb 2, 2017	Tracking , Camera check	cloudy 6-12" snow, ~mid 20s. Light snow early made tracking difficult
Feb 21, 2017	Tracking, Camera check	partly sunny, warm mid 30s, 4-12" snow
March 6, 2017	Tracking, Camera check	Clear, cold, 1/8" new snow
March 30, 2017	Tracking, Camera re-location	Sunny, 6-12" snow
April 29, 2017	Camera recovery	

Winter track surveys were the primary analysis tool employed to develop an understanding of wildlife use and movement patterns on the WCCA landscape.

In the 2016/17 winter season, snow was sparse until January of 2017, so field visits did not commence until January 10, 2017 and continued until a final site visit on May 29, 2017. Field visits were conducted roughly every 2-3 weeks as



conditions were appropriate. Visits were spaced to allow new snow cover and refreshing of tracks to ensure new observations. The table above summarizes the field visits conducted.

2.1 Winter Wildlife Tracking

Winter wildlife tracking was conducted 5 times in January-March, 2017. Tracking was conducted when snow cover was generally sufficient to allow identification of wildlife tracks by species. In some cases, snow cover was variable and less-than-ideal tracking conditions were present in some locations, such as under dense conifer canopy. All tracking was conducted by Arrowwood biologists experienced in track and sign identification.

Rather than focusing on species identification, the primary goal of tracking exercises was to ascertain patterns of wildlife movement within the WCCA parcel. Toward this end, tracks of any wide ranging mammals (except deer) encountered were followed to document general location and direction of travel. Wildlife was not tracked as it left the WCCA property.

2.2 Wildlife Remote Trigger Camera Deployment

Arrowwood employs remote trigger cameras, commonly referred to as “trail cameras” or “game cameras” for the detection of wildlife present in a local area over the course of time. Cameras are a low impact method of identifying what type of wildlife inhabit a particular area, and to a certain extent, the relative commonness or density of a particular species, guild of species or wildlife in general.

Remote cameras function by pairing a camera with a trigger device such that an animal passing in front of the camera triggers a photo or video. Arrowwood used Bushnell 8MP Trophy Cam HD Trail Cameras for the WCCA study. The Bushnell cameras record 8 megapixel digital images, are triggered by a passive infrared motion sensor and use infrared LED flash for nighttime photos without the disturbance of a visible-light flash. The cameras record date and time for each photo taken.

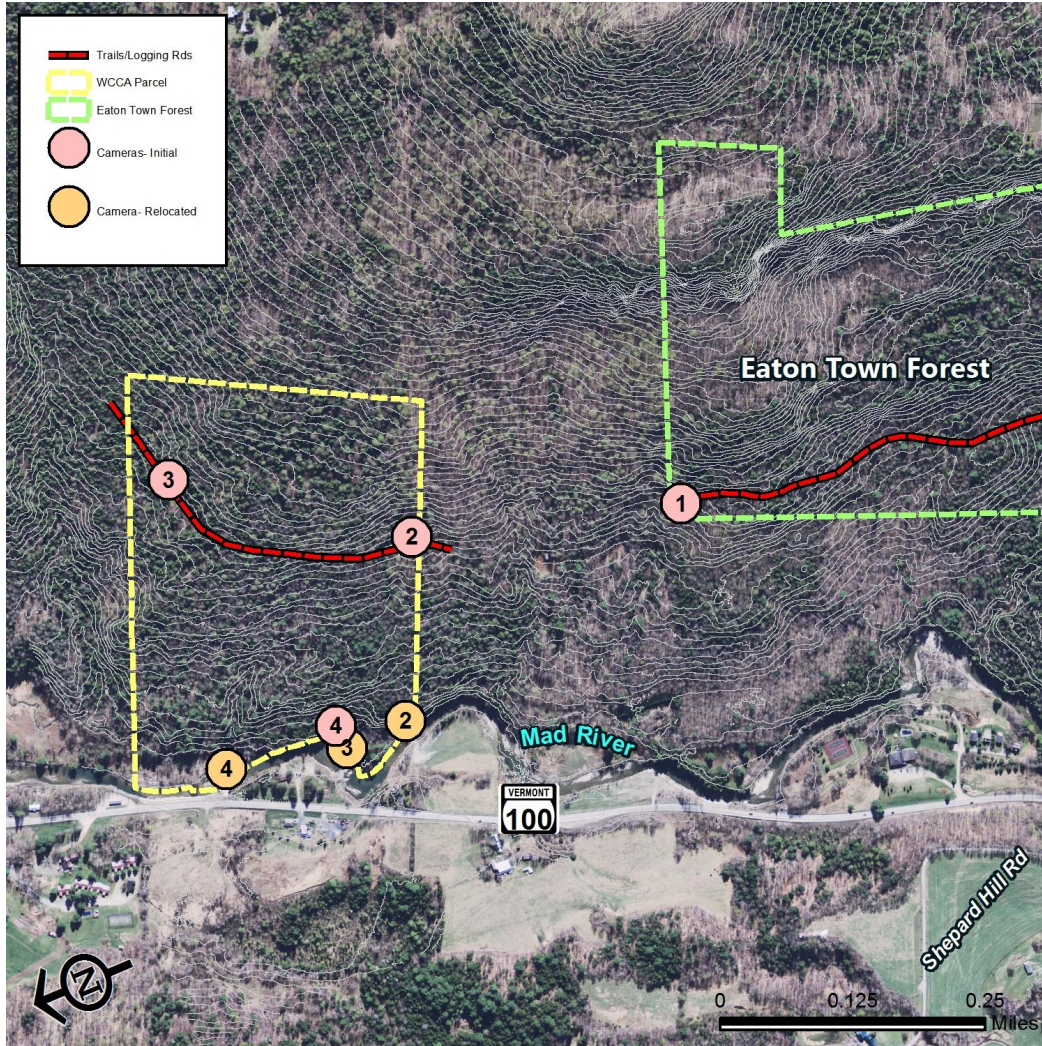




Figure 1. Remote camera attached to tree

For this initial assessment of the WCCA, Arrowwood used both the bait method and incidental trigger method. One camera, located near the Mad River shoreline, was baited with butcher scraps placed in wire mesh bags approximately 12-16' in front of the cameras that were strapped to tree trunks approximately 4' off the ground in order to draw nearby animals in front of the camera. All other camera placements were in areas of observed or suspected wildlife travel and remained unbaited to capture incidental passage of wildlife species utilizing the area





Map of Remote Camera locations

Pictures from the camera's were downloaded several times throughout the season, in each case the SD card containing the images was removed and replaced with a new, empty SD card.

Four cameras were utilized during the course of this assessment. They were placed at discrete locations on January 10, and three were moved to new locations on March 30. The initial camera placement was designed to capture images and video of wildlife utilizing the WCCA logging road and Eaton Forest trail, which are at roughly the same elevation and landscape position. The relocated camera placement was designed to capture images of wildlife utilizing the river corridor at various points along the WCCA river frontage during the months of April and May when tracking was no longer feasible. A single camera was located at the north end of the pedestrian trail on the Eaton Forest parcel, in



order to document differences in wildlife activity between a game trail on an old logging road on the WCCA parcel and the walking trail on the Eaton Forest which sees considerably more human activity.



A coyote moves along the Mad River shoreline

3 Analysis & Discussion

3.1 Camera Wildlife Observations

Cameras were placed in 3 distinct locations throughout the 2016/2017 study window. Two cameras were located at the north and south ends of an old logging road crossing the WCCA parcel (upland cameras). One camera was placed at the north end of the Eaton Forest trail (Eaton camera). One camera was initially placed near the river and baited, while later in the season, three unbaited cameras were placed along the river shore.

For analysis, camera photo and video events were categorized by subject (species) and date and time of day (day, night, crepuscular- either dawn or dusk). Events that overlap in any category were not counted- for example, 2 images of deer during the day on a single date were considered one event.

Upland Cameras

The upland cameras recorded video feeds of any wildlife crossing their path along the old logging road. These cameras were in place from Jan. 10- March 30. These cameras primarily captured white-tailed deer which were utilizing the surrounding hemlock-dominated forest extensively throughout the 2016-2017

winter. On several occasions Eastern coyote were detected on the upland cameras, either traveling along the old road, or in one case, sitting in front of the camera. The results here were consistent with observed track patterns in the upland hemlock areas. Deer use in this area is very heavy during the winter months. The cameras confirmed that the entire area is a well used and important deer winter habitat.

Sixty percent and 62% of the video events at cameras 2 and 3 respectively were recorded during the daytime, with the remaining roughly 40% at night.

Eaton Camera

The Eaton Camera (1) was in place for the entirety of the study- Jan. 10-April 29. The Eaton camera recorded images of deer, coyote, turkeys and a black bear. In addition, approximately 15% of camera events were people or dogs using the trail.

At this site, during the same date window that the Upland cameras were active (1/10-3/30), only 21% of the wildlife events were recorded during the day, with the remainder at night or crepuscular hours. This suggests that the presence of the trail may be having an impact on when wildlife are comfortable using the area as compared to the relatively undisturbed WCCA parcel just to the north.

Upland/Eaton Wildlife Camera Events*
1/10-3/30 2017

Time of Day	Camera 2- North end of WCCA Log		Camera 3- South end of WCCA Log		Camera 1- Eaton Trail	
	# events	% of total	# events	% of total	# events	% of total
crepuscular	4	13%	3	12%	4	21%
day	20	63%	15	60%	4	21%
night	8	25%	7	28%	11	58%
Total	32	100%	25	100%	19	100%

*event" defined as a unique species/date/time of day. I.e. multiple photos of deer during daylight hours on a single date = 1 event

Finally, of note, never was a wildlife event triggered within 2 days of a human/dog event. That is to say, wildlife did not appear on camera until at least 2 days after people or dogs were documented in the area. While the dataset is not



robust enough to draw significant conclusions, there may be a connection between human use of the trail and wildlife comfort in the area.

River Corridor Cameras

The River corridor cameras were in 2 categories:

1. Baited camera (4) near center of parcel, in place Jan. 10 - March 30. This camera detected: coyote, deer, red fox, and mink utilizing the game trail along the rivershore. None of the camera captures occurred during active investigation of the bait by animals, but instead appeared to be pictures of animals during normal landscape movements.



Deer move across the Mad River

2. Unbaited cameras (2),(3), & (4) located along the river shore, aimed parallel to the river, in place March 30 - April 29.
 - a. Camera 2, near southern property line. This camera had numerous false triggers due to wind-blown vegetation and snowmelt runoff in a small stream. The camera was aimed at a riverbank location with repeated wildlife use observed during tracking activities. This camera detected: deer, coyote and fisher. This camera confirmed wildlife use of a corridor parallel

to the river at the south end of the WCCA parcel, but did not confirm wildlife crossing the river at this location.

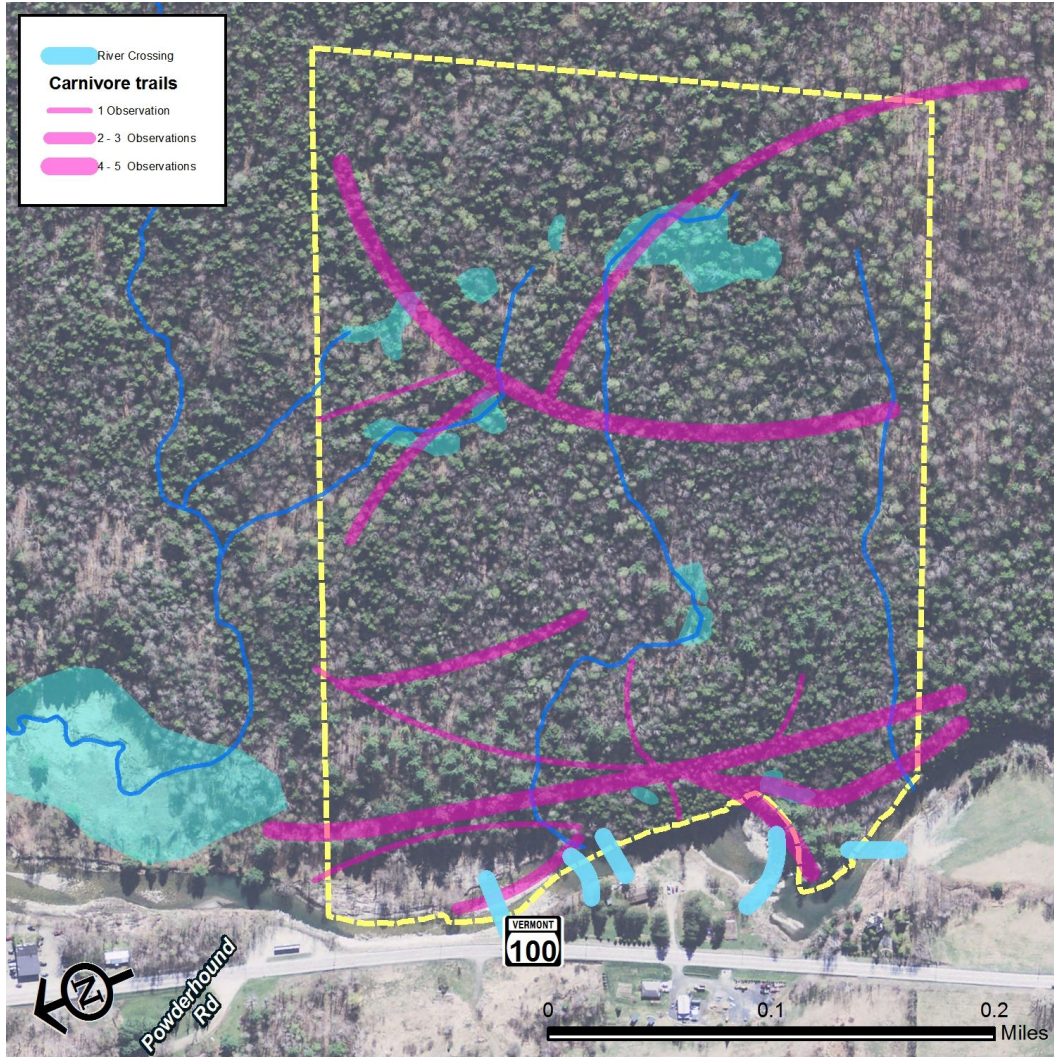
- b. Camera 3, located at the bend in the river on a gravel bar, aimed along the bar in a westerly (upstream) direction. This camera detected deer and coyote that may have been crossing the river at this location- both were observed close to the water's edge, but not in the water.
- c. Camera 4, located at the north end of a long gravel bar and flood chute near the northern property boundary. For a period of its placement, the gravel bar in this camera's field of view was flooded by high water. This camera also captured deer and coyote. In most cases, animals appeared to be traveling along the river (parallel), but in a couple of photos deer were moving to or from the river's edge potentially indicating a crossing location.

3.2 Wildlife Movement Patterns

Both spatial and temporal patterns emerged from the wildlife investigation on the WCCA parcel and in 2017 the nearby Eaton property.

There was a considerable amount of wildlife traffic concentrated within the Mad River riparian corridor- within roughly 300' of the river shore, and to a lesser extent on the actual river shore. Both camera and snow tracking exercises revealed that coyotes were extensively utilizing the WCCA Mad River riparian corridor.



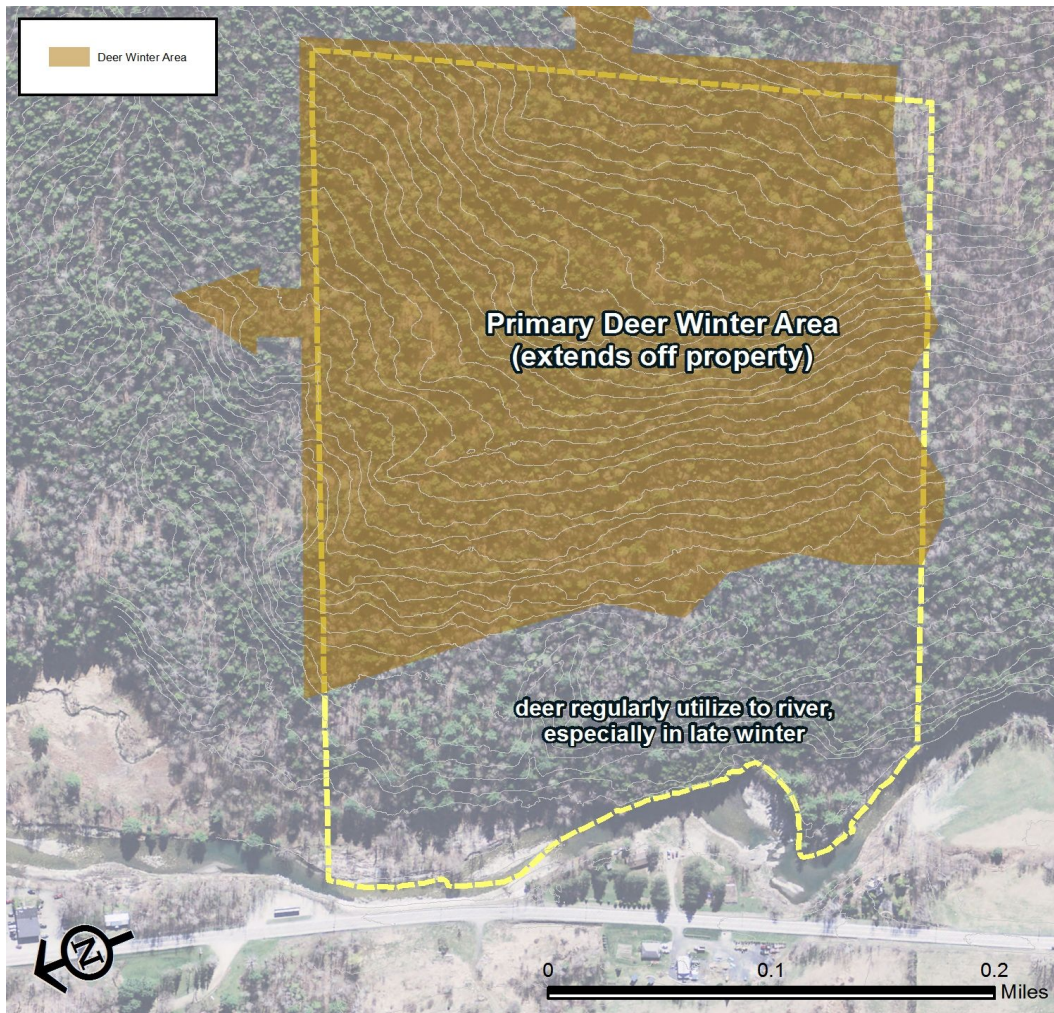


Wildlife travel patterns observed on WCCA during 2016-2017 winter tracking

Camera and tracking data revealed that the Mad River itself was also a focus of river otter and mink activity. There was also some limited mink activity along east-west streams on the WCCA property and otter noted repeatedly traveling east/west on a stream just north of the property. There were also several winter observations of wildlife moving across the ice that had formed on the Mad River. Animals crossing the ice appeared to use much of the southern half of the eastern shoreline where the tree canopy extends all the way to the waters edge. However, animals tended to cross to and from more isolated and specific points on the western shoreline. These western target points appeared to be places with less slope, existing culverts and/or more canopy cover. No crossing was

observed along the rip-rapped bank of Route 100 along the northern portion of the parcel, for example.

There was occasional wildlife movement out of the Mad River riparian corridor to forests to the east. This movement tends to be focused in stream valleys or at breaks in the ledges.



Approximate area of observed deer winter habitat on WCCA

During mid-winter when deep snow cover was present, deer movements were often more restricted and the animals concentrated their movements along communal trails. These trails were located in several scattered locations throughout the hemlock and the mixed hemlock- northern hardwood forests. In addition to communal trails, tracks indicated that movement throughout the forest

was often dispersed in many directions, perhaps owing to a large population of deer using the habitat, and/or an indication of its excellent function.

The most concentrated mid-winter deer use tended to be focused in the north/central and eastern portions of the WCCA parcel. However, deer that were concentrated heavily in the upland hemlock and mixed-hemlock forest on the WCCA and adjoining parcels tended to move downhill closer to the Mad River later in the winter. In fact, as winter progressed, many deer moved out of forest cover to riverine wetlands and the floodplains where shrubs and other food sources could be accessed.

3.3 Recommendations

A proposal for a footbridge across the Mad River, and a connecting trail along the southern property boundary connecting the existing Mad River Trail to the Eaton Town Forest has been made by members of the community. Arrowwood was asked by the Warren Conservation Commission to consider potential impacts to wildlife and wildlife habitat that could arise from the presence of a pedestrian bridge and trail on the WCCA property.

In evaluating the potential impacts of the bridge and trail on the WCCA parcel Arrowwood utilized a Leopold Matrix (Leopold et al., 1971), a commonly used method in the field of impact assessment. This simple Leopold matrix contains 2 axes, the first axis a list of the wildlife habitats and functions provided by the WCCA property, and the second is a list of different potential activities that are likely to occur as a result of the construction of a bridge over the Mad River and a trail along the southern portion of the property. The matrix ranks the degree of the negative or detrimental impact upon each habitat element of a range of potential human activities on the parcel resulting from the construction of the bridge and trail. An estimated impact of “0” denotes no impact, “1” a minor impact, “2” moderate, and “3” denotes a high potential negative impact.

The rankings result in a qualitative assessment of the potential impacts upon the known, or likely wildlife habitats on the WCCA property. Each activity and its potential negative impact was discussed and agreed upon by consensus by the authors. This consensus regarding the degree of potential impacts of each human



activity was based on extensive field experience, numerous visits to the WCCA parcel, and familiarity with the scientific literature regarding human activities (mainly recreational activities but also the impacts resulting from the disturbances accompanying construction activities).

The following assumptions were made when evaluating potential impacts to wildlife and habitat functions on the WCCA parcel:

- Current WCCA Habitat and Landscape Conditions/Observations
 - Parcel is remote, difficult to access, very few human visitors
 - Generally steep slopes
 - High diversity of cover conditions include ledges, significant conifer cover, stream valleys, seepage wetlands
- Assumed likely impacts after footbridge and trail construction
 - Significant increase in human presence and noise at the bridge and river corridor
 - Increased human presence in the woods, especially on trail
 - Significant increase in dogs, and likely, at least periodically or more, to be free-roaming throughout parcel
 - Potential increase in other pet/domestic animals such as cats
 - Increased amounts of human trash present
 - Potential presence of camp fires and overnight campers
 - Increase in hunting and trapping due to improved public access
 - Some level of increased soil compaction resulting from hikers and bikers on concentrated trail
 - Some loss of canopy cover at the river's edge for bridge installation
 - The numbers of through-hikers (those staying on trail and moving through quickly) are expected to be minimal; the number of day walkers, (some with dog) is expected to significantly increase



FUNCTIONS	IMPACTS/USES							more ↑ affected ↓ less
	Walkers w/ Pets	Construction Short Term	Bridge, increased human activity at river crossing	Mountain Biking year-round	X-C Ski/Snowshoe	Hunting/Trapping due to easy access	Hiking, on-trail non-winter	
Deer Winter Habitat & Function	3	2	2	3	3	1	2	
North/South Movement Corridor	3	3	3	2	2	1	1	
Bear Dens/Denning Comfort	3	2	3	1	1	2	1	
Riparian Corridor/Aquatic Mammals	2	3	2	2	1	1	1	
East/West Movement Corridor	2	2	2	1	1	1	1	
Ledge Habitat (bobcat, porcupine, sm mammals)	2	2	2	1	1	2	1	
American Beech Stands	1	1	1	1	1	2	1	
Seeps, Wetlands	1	0	0	2	1	1	1	

greater ← impact → lesser

Wildlife Functional Impact Matrix- Likely impact rankings resulting from bridge/ trail

As the Habitat Impact Matrix illustrates the greatest potential negative impact is likely to be upon the deer wintering habitat, the north-south wildlife movement corridor, the bear den(s), and the aquatic mammal habitat at the edge of the Mad River. The potential negative impacts to these habitats from the bridge and /or the multi-use trails is often high. This of course assumes that dogs will be introduced in these woods and an increase in the presence of people and their activities will occur at and near the new bridge across the Mad River. A lesser, but still potentially significant negative impact is forecast for the beech stand, ledge habitat, east-west wildlife movement corridor, and the onsite wetlands and seeps.

In it's current condition, the WCCA parcel is best characterized as a wildlife haven. The species diversity documented over just 2 years of winter work covers all of Vermont's "charismatic megafauna", most notably shy, forest dwelling species such as black bear, fisher and bobcat. The parcel is significantly isolated from regular human disturbance, save the traffic noise from Route 100. Wildlife appear to have acclimatized to the noise and recognize the lack of disturbance as a bear den was documented within 700' of the Route 100. On the west, the river



is an important feature in the protection of the habitat quality here as it keeps all but the most insistent human visitors at bay.

From the north, east and south, the WCCA parcel is central in a large forested island, fortunate to be held by a few single landowners. This island appears to function both as a corridor for wildlife moving between the Roxbury and Green Mountain ranges and core habitat in it's own right.

The river and large land holdings have helped maintain little human impact in the past 100 years or so to the benefit of wildlife. Such habitat characteristics are quite uncommon on the Vermont landscape of today and are increasingly important as forestland is carved up into smaller and smaller holdings elsewhere.

Based on our analysis, represented by the matrix above, we believe the proposed footbridge and connecting trail would pose a significant and meaningful impact on the wildlife function currently provided by the WCCA parcel. The remoteness and sanctuary would all but disappear when people can park on Route 100 and be in the heart of the parcel within minutes. The bridge will require significant construction and will impact the shoreline and riparian habitat quality. With people come dogs, which can have perhaps the most dramatic impact on secluded wildlife. At the very least, wildlife utilizing the parcel are likely to undergo changes in behavior- as we see at the north end of the Eaton parcel, or begin avoiding the area all together. We expect the frequency of activity and diversity of species would very likely diminish.

It is because of these potential negative impacts on significant wildlife habitat elements that we recommend that the bridge and trail system not be built on the WCCA parcel. The protection of this parcel and the major wildlife and habitat function it provides is within the control of the Town of Warren. While other options are likely to exist for trail development along the banks of the Mad River, the WCCA is a place where Warren would benefit by taking the long view and maintaining this piece of forest for the wild inhabitants that benefit the community by their presence. We encourage Warren to hold this parcel as a reserve, and consider ways to expand holdings within this forested island haven.



References

Arrowwood Environmental, Warren Corridor Conservation Area: Ecological Inventory and Assessment. Warren, Vt. October 26, 2016.

Arrowwood Environmental, Wildlife Corridor Field Analysis. Warren, Vermont. October 24, 2014.

Arrowwood Environmental, Natural Heritage Element Inventory and Assessment for Warren, Vermont. April 28, 2008.

R. Knight and K. Gutzwiller., 1995. Wildlife and Recreationist. Coexistence Through Management and Research. Island Press.

M. Ferguson and L. Keith. 1982. Influence of nordic skiing on distribution of moose and elk in Elk Island National Park, Alberta. Canadian Field Naturalist. 96(1) pg. 69-78

E. Cassirer , D. Freddy, and E Ables. 1992. Elk responses to disturbance by cross-country skiers in Yellowstone National Park. Wildlife Society Bulletin. 2

Leopold, Luna B.; Clarke, Frank E.; Hanshaw, Bruce B.; Balsley, James R. (1971). [A Procedure for Evaluating Environmental Impact](#). Geological Survey Circular 645. Washington: U.S. Geological Survey.0(4): 375-381.

