HEAVY METAL CONTAMINATION FROM ILLEGAL BURN PILES IN AN ECOLOGICALLY SENSITIVE SITE IN WEST HAVEN, VERMONT

By

Helen Mango[1], Department of Natural Sciences, Castleton University, Castleton, VT 05735
Mary Droege[2], Department of Natural Sciences, Castleton University, Castleton, VT 05735
J. Murray McHugh[3], The Nature Conservancy, Southern Vermont Office, 348 Bentley Ave., Poultney, VT 05764
Michele Hluchy[4], Geology and Environmental Studies, Alfred University, Alfred, NY 14802
Email addresses: [1]helen.mango@castleton.edu, [2]mary.droege@castleton.edu, [3]mmchugh@tnc.org, [4]fhluchy@alfred.edu

INTRODUCTION

The Nature Conservancy owns and manages the Helen W. Buckner Memorial Preserve in West Haven, Vermont. The 3827-acre preserve has one of the highest levels of biodiversity in the state. It is located on the border of New York State, bounded on the south by the Poultney River and on the west by the South Bay of Lake Champlain (Fig. 1). It is an environmentally sensitive and important tract of land, providing habitat for eleven rare/uncommon animal species (including the timber rattlesnake), eighteen rare/uncommon plant species, and ten rare/uncommon natural community types. It encompasses undeveloped lake shoreline, wetlands along the river, floodplain, Clayplain and upland forest, marshes, and cliffs. It includes Austin Hill, composed of Precambrian (Middle Mesoproterozoic) Adirondack biotite tonalite gneiss, and bounded on the west by Cambrian/Ordovician dolostone and quartzite (Fisher, 1984; Ratcliffe et al., 2011).

Illegally dumped and burned garbage piles have existed for years on the access road (Galick Road) along a stretch of the Poultney River. Analysis of ash and soil samples from different burn piles over several years shows elevated levels of many contaminants, including arsenic, copper, lead, zinc, chromium and cobalt, often exceeding background levels by orders of magnitude. The area is seasonally flooded, resulting in both erosion and deposition. As a result of our research, the Vermont Department of Environmental Conservation (DEC) remediated the most contaminated site and installed a parking area and boat launch (allowing for patrol by state law enforcement). However, dumped and burned garbage continues to be a problem at this site.

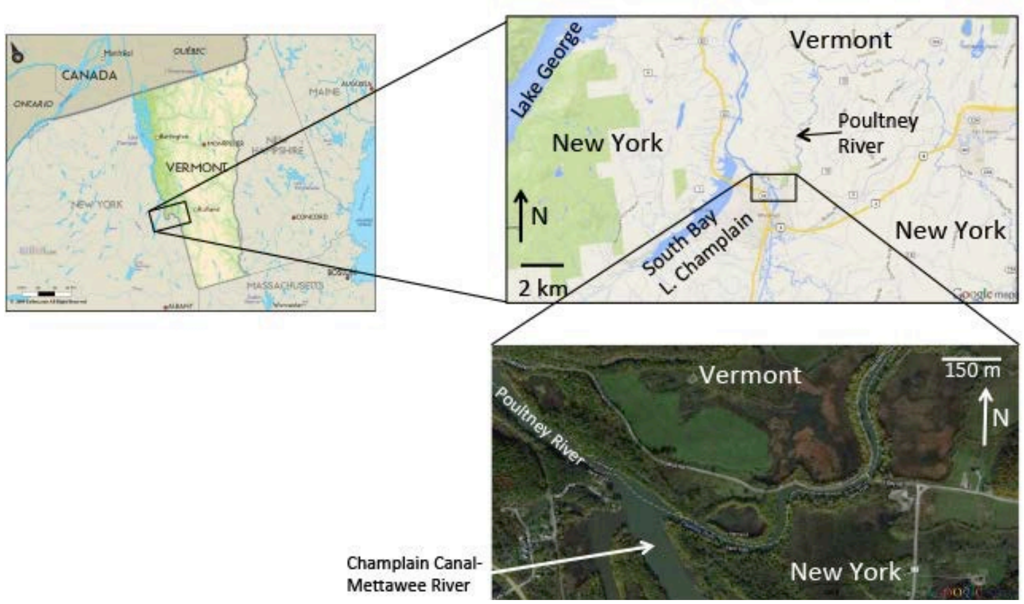

Figure 1. Location maps of the field trip site.

BURN PILE LOCATION AND CONTENTS

Between 2011 and 2017, burn piles at four different locations along Galick Road were sampled and the samples analyzed for a number of elements. Some burn pile sites were sampled multiple times over the years. The location of the burn piles, and the location where "background" samples were taken, are shown in Figure 2.

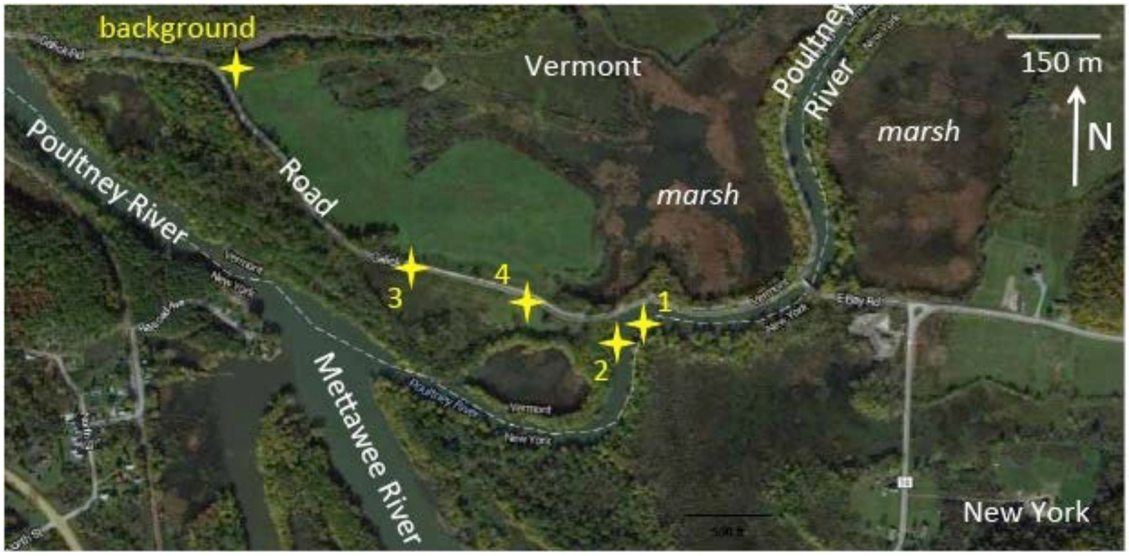

Figure 2. Location of different burn piles and background sampling site.

Sampling and analysis of burn piles began with one grab sample of Burn Pile 1 in 2011. This pile appeared to undergo the most dumping and burning of all the burn piles over the years. Burn Pile 2 was closer to the water's edge, and so was periodically flooded. Burn Piles 3 and 4 were located farther away from where people would congregate, and only appeared to be "active" in 2013. The materials dumped over the years included household trash (from diapers to batteries), junked furniture, construction debris, and commercial waste. There was also refuse related to the bonfires, predominantly beer cans. Table 1 lists the items found over the years of sampling.

Table 1. Burn pile items

Particle board, plywood	Window blinds
Lumber, wallboard	Cardboard
Electronics	Plastic (e.g. tubing, CDs, packaging, PVC)
Batteries	Metals (e.g. nails, food storage cans, wire, scrap)
Kitchen cabinets	Light bulbs
Furniture	General household trash (e.g. diapers, food wrappers)
Mattresses	Smoke detectors

Figure 3 shows Burn Piles 1 and 2, photographed at different times.

(a) (b) (c)

Figure 3. (a) Burn Pile 1 in 2015. (b) Burn Pile 2 in 2014. (c) Burn Pile 1 in 2013.

GEOCHEMICAL ANALYSIS

Ash from the burn piles was sampled, as was soil in the immediate vicinity of the burn piles, at different depths into and beneath the burn piles, and along transects from burn piles down gradient. Background samples were taken in an undisturbed area at the edge of the forest approximately 0.5 mile (0.8 km) from Burn Pile 1 (see Figure 2). All samples were sent to Activation Laboratories, Inc. (Ancaster, Canada) to be analyzed for 50 major, minor and trace elements by INAA and/or ICP, using 16 standards, and duplicates and blanks.

The results for the elements of most interest are summarized in Table 2. The elements of greatest interest in terms of their potential adverse effect on the ecosystem fauna are copper, lead, zinc, arsenic, manganese, and chromium. Elevated concentrations of all these metals are detrimental to animal health (Jaishankar et al., 2014). Mercury is also in this category, but its concentrations everywhere were below detection level, probably because its relatively low boiling point (357°C) allows it to vaporize in bonfires, thus becoming airborne and settling away from the study area. Gold is also included because while it is not a toxic element, it can be indicative of anthropogenic activity.

Table 2. Geochemistry

(a) Background geochemistry sampled twice (all concentrations in ppm unless otherwise noted). Data from Shacklette and Boerngen (1984) are global averages.

Element	2014	2015	Shacklette and Boerngen, 1984
Cu	11	20	30
Pb	16	42	10
Zn	60	102	50
As	2.8	7.4	5
Mn	601	813	600
Cr	67	106	100
Au (ppb)	b.d.	b.d.	5

b.d. = below detection

(b) Burn Pile 1 geochemistry sampled four times (all concentration in ppm unless otherwise noted)

Element	Nov. 2011	Nov. 2013	June 2014	May 2015
Cu	>10,000	7480	424	1010
Pb	4040	>5,000	1270	2690
Zn	2590	12500	7900	16000
As	59	460	147	261
Br	19900	32	14	21
Cr	217	1230	261	556
Mn	2	2170	1260	1500
Au	239 ppb	68 ppb	19 ppb	40 ppb

(c) Nov. 2013 geochemistry (all concentrations in ppm unless otherwise noted)

Element	Burn Pile 2	Burn Pile 3	Burn Pile 4
Cu	211	204	491
Pb	196	122	628
Zn	494	467	4660
As	34	57	b.d.
Mn	1590	685	657
Cr	66	117	64
Au (ppb)	b.d.	152	75

b.d. = below detection

The background samples were taken within approximately 10 m of each other. In 2014 soil was sampled at the edge of a large meadow, just below the sod. In 2015 soil was sampled just within the woods next to the meadow. The results (Table 2 (a)) show that background concentrations of the elements of interest are quite similar to global averages. Therefore we can assume that elevated concentrations are due to anthropogenic activity.

Burn Pile 1 was sampled four times (Table 2 (b)). The original sampling for this project was done on this pile in November 2011. At that time, there were partially burned electronics scattered all over the pile. The pile was sampled again in November 2013, and this time the unburned material looked to be mostly interior construction waste, such as old kitchen cabinets, window blinds, plywood and wallboard. The pile was sampled again in June 2014. Little new material had been added to the pile, and it appeared to have simply weathered since the last sampling. (Likely not much dumping or burning is done in the winter and early spring.) The final sampling of the pile before site remediation took place was in May 2015. At this time, the burn pile contained ordinary household trash that appeared to be fairly fresh. Note: Br included here because of anomalous 2011 value.

Burn Piles 2, 3 and 4 were sampled in 2014. Unburned material was largely composed of household trash and bonfire detritus such as beer cans and food wrappers. Natural wood appeared to be the main fuel source, and there was no evidence of lumber or manufactured wood products. Concentrations of the selected metals were mostly an order of magnitude greater than background levels, although none as high as concentrations in Burn Pile 1. This is likely due to the greater variety of materials found in Burn Pile 1. These piles were not sampled in 2014 or 2015; the site of Burn Pile 2 was underwater in 2014, and in 2015 no pile remained.

Table 3 lists the possible sources of these selected metals. Almost all items in this table were directly observed at different sampling times.

Table 3. Possible sources of selected metals

Au: Electronics, circuitry, appliances, smoke detectors
Cu: Electrical/electronic equipment, plumbing, wood preservative (CCA*)
Pb: Lead paint (pre-1978), solder, plumbing, window blinds, some PVC
Zn: Galvanized metal, furniture/cabinet hardware, cans, batteries, car parts
As: Wood preservative (CCA*), semiconductors, batteries, alloys
Br: Flame retardants for plastics/electronics/textiles
Cr: Wood preservative (CCA* + chromate salts), pigments, steel
Mn: Steel alloys, batteries

*CCA = Chromated copper arsenate; used as fungicide/insecticide in pressure-treated lumber and manufactured wood products

Correlations between elements can help identify the source of the metals. Figure 4 shows excellent correlation between chromium and arsenic, suggesting that chromated copper arsenate (CCA), a fungicide/insecticide used in the manufacture of pressure-treated lumber, is the source of these metals. The correlation with copper is less good, but there are also other sources of copper in the burn pile materials, such as electrical and electronic equipment. Figure 5 shows a good correlation between manganese and zinc, suggesting that batteries may be the source of these metals. Figure 6 shows a good correlation between iron and manganese, which may be due to the abundant presence of food storage cans.

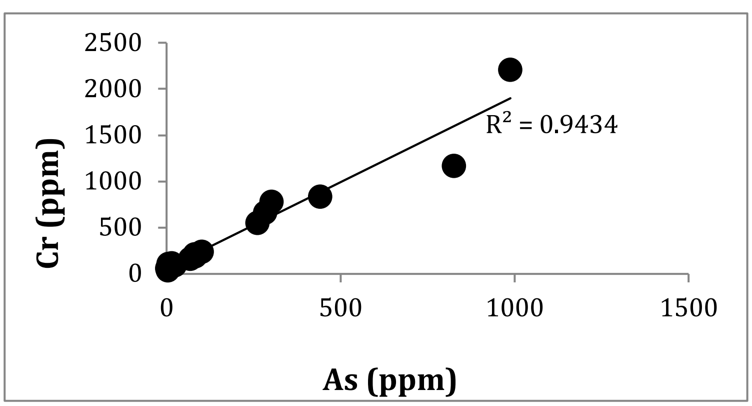

Figure 4a. The good correlation between Cr and As indicates the presence of the wood preservative (CCA), which is used in manufactured wood products.

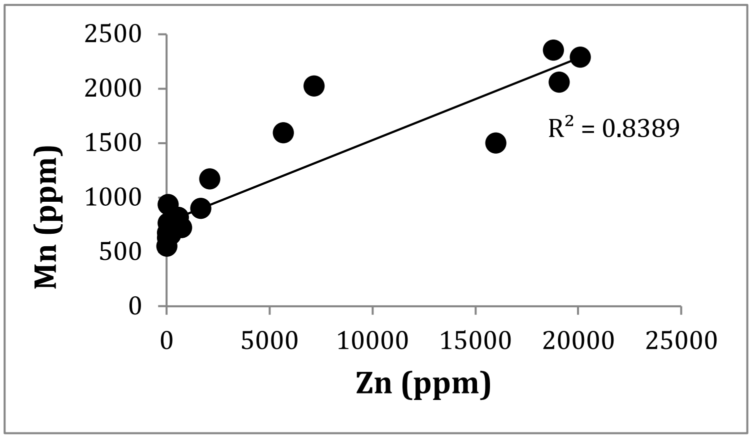

Figure 4b. The correlation between Mn and Zn suggests that batteries are the source of these metals.

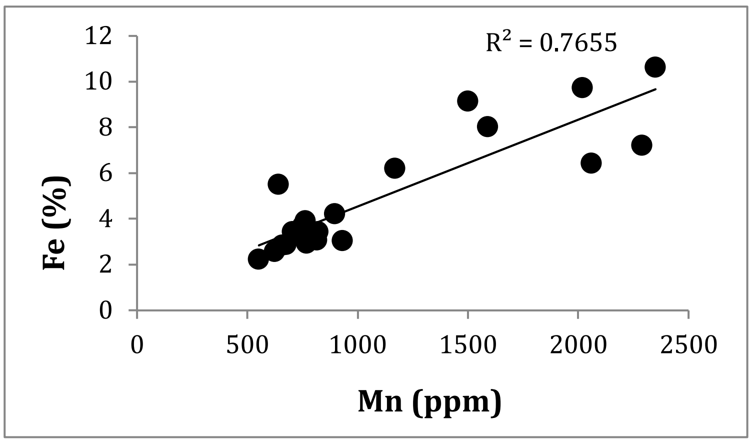

Figure 4c. The correlation between Mn and Fe may be due to the abundance of food storage cans.

Vertical and horizontal sampling along a transect from Burn Pile 1 to the river was accomplished in June, 2015 (Figure 7). Geochemical analysis suggests that contaminants have migrated downward into the underlying soil, as well as laterally towards the river. A 90-cm core from the center of the burn pile shows that metal concentrations are highest from the surface of the pile to a depth of approximately 60 cm down. (Highest values: Pb = 5000 ppm, Zn = 20,000 ppm, As = 1000 ppm, Cu = 4000 ppm, Cr = 2200 ppm and Co = 200 ppm.) This includes ash in the upper 30 cm, and underlying soil beneath the ash. At a distance of 2.1 m from the center of the burn pile in the direction of the river, a core 35 cm long shows metal concentrations highest at the bottom of the core (Pb = 2100 ppm, Zn = 1700 ppm, As = 80 ppm, Cu = 475 ppm, Cr = 215 ppm). A further 2.9 m toward the river, a 40-cm core shows metal contamination spiking at a depth of 15 cm, although at lower concentrations than the previous core. Another 2.5 m toward the river, a 20-cm core shows metal concentrations highest at a depth of 15-20 cm, again at lower amounts than the previous core. This is illustrated in Figure 7. A 30-cm core taken underwater in the riverbed 5 m from the previous core showed no elevated metal concentrations. This suggests that contaminants have migrated away from the burn pile both vertically (presumably by water percolating from the surface) and horizontally (by overland flow, interflow, or both). The different relative concentrations of individual metals from one core to another is the result of differential solubility and transport mechanisms. Contaminants ultimately end up in the river, which flows into Lake Champlain 2 km downstream.

As a result of this study, in 2015 the Vermont Department of Environmental Conservation hired Environmental Compliance Services, Inc., to assess and remediate the site. Four cubic yards of soil was removed and disposed of in a compliant landfill. Clean fill was brought in, and the site of Burn Piles 1 and 2 was re-graded into a boat launch. Boulders were added along the western edge of the site to prevent people from driving off-road along the banks of the river (which had previously been the site of other burn piles). A parking area was created 50 m along the road. The construction of the boat launch and parking area allows the State of Vermont to patrol the area using law enforcement from the Department of Fish and Wildlife. Since then, it appears as though major dumping has largely ceased. Burn piles still exist, but largely consist of natural firewood and minor trash such as beer cans and food wrappers.

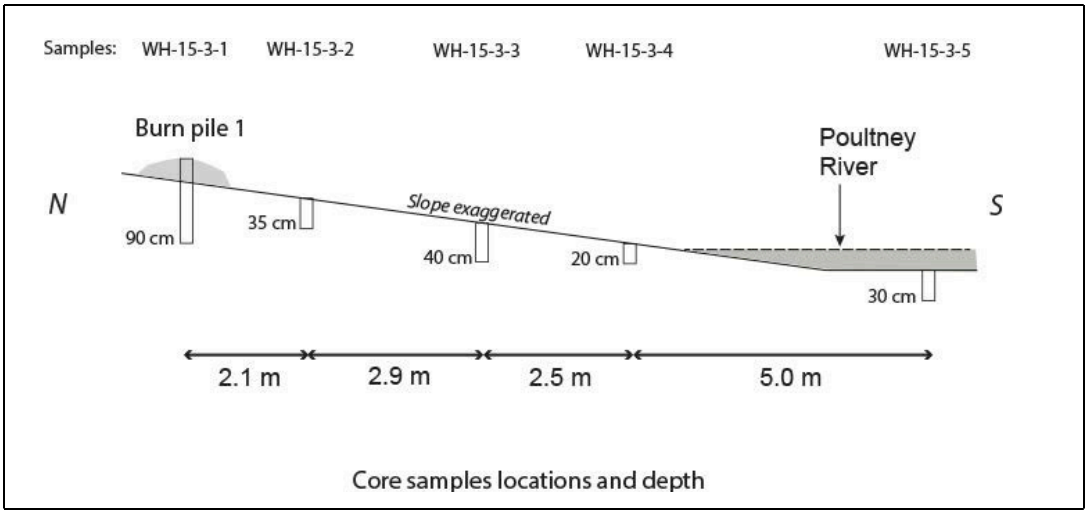

Figure 7. Core depths along a transect from Burn Pile 1 to below the surface of the Poultney River.

CHAMPLAIN VALLEY CLAYPLAIN FOREST

Prior to European settlement, Clayplain forest dominated the clay and silt soils of the Champlain Valley. Approximately 20,000 years ago, continental ice sheets covered the region. As the ice melted and retreated, a series of lakes filled the Champlain Valley. First, freshwater Lake Vermont flooded most of the valley for 1000-2000 years. When the ice's continued retreated extended far enough to the north, an influx of marine water established the smaller Champlain Sea, which covered the lower elevations of the valley for approximately 2,000 years. The clay that southern Lake Champlain residents know so well settled out in the deep still waters of Lake Vermont and the Champlain Sea. About 11,000 years ago, the connection with the Atlantic Ocean was cut off and present day Lake Champlain began to form. The lake bottom, for thousands of years beneath the water, became exposed lake plain. The word "Clayplain" is shortened from "clay-soil lake plain" – the landform on which the current forest grows (Lapin 2002).

The most common trees of the Clayplain forest type are white oak, red maple, white pine, shagbark hickory and white ash. Associated species are hemlock, sugar maple, beech, swamp white oak and bur oak. Both swamp white oak and bur oak are at the northern extensions of their range in the Champlain Valley.

Because of the relatively warm valley climate, gentle topography, and fertile clay soils, the Champlain Valley was cleared early for agriculture and remains today the predominant agricultural region in Vermont. It is estimate that 90% of the original Clayplain forest (on the Vermont side) has been cut down and converted into use for agriculture or development, making it now a very rare and fragmented forest community (Thompson and Sorenson, 2005).

However, in the very southern end of the Champlain Valley in West Haven and Benson, Lapin et al. (2014) found that 25% of the known and mapped clay soils were forested. This has allowed for some of the best Clayplain forest restoration opportunities in the state. Several of these restoration sites are owned and managed by The Nature Conservancy in the Helen W. Buckner Preserve and the Hubbardton River Clayplain Preserve, both in West Haven (Lapin et al., 2014).

TIMBER RATTLESNAKE RESEARCH

Spear et al. (2013) completed a study on timber rattlesnakes in and near the Buckner Preserve in 2011-2012 with the objectives of identifying migration routes and summer foraging habitat, identifying land potentially used by different populations of rattlesnakes to prioritize land protection actions, and determining rattlesnake population status over time. Timber rattlesnakes once ranged widely in eastern North America. In New England today, they are found only in small, isolated populations, and are threatened by human development and illegal hunting. In Vermont, timber rattlesnakes are at the edge of climatic limits, so anthropogenic stressors compound existing natural stressors such as food availability and disease. The timber rattlesnake is currently state-listed as endangered in Vermont. The Buckner Preserve is home to one of only two populations of timber rattlesnakes in Vermont, and there is concern for the survival of the populations considering their relative isolation and the threat of a newly identified fungal disease that has contributed to the severe decline of other New England snake populations. The preserve provides ideal habitat for timber rattlesnakes, which prefer to overwinter in open, rocky areas with southerly aspects; this is limited in Vermont.

For this study, 144 timber rattlesnakes were captured and marked. Radio transmitters were implanted in 17 males, three non-pregnant females and two pregnant females. These snakes were monitored from when they emerged from their hibernacula in the spring until they returned in the fall. They were located an average of 30 times every four days or so.

Distances were measured both as maximum distance from hibernaculum and total distance traveled in the season. The results are given in Table 4.

Table 4. Distances moved by timber rattlesnakes

	Maximum distance from hibernaculum (km)	Total distance traveled (km)
Males	3.56 ± 0.26	11.74 ± 0.91
Females	2.28 ± 0.75	5.09 ± 2.16

The movement of one radio telemetered male timber rattlesnake during one season is show in Figure 8 as a time-series graph. The “outbound migration” consists of a series of long, rapid movements away from the hibernaculum in the spring. The “core area” consists of a period of slower, shorter movements at a relatively stable distance from the hibernaculum during the summer. The “inbound migration” repeats the long, rapid movements back towards the hibernaculum in the fall.

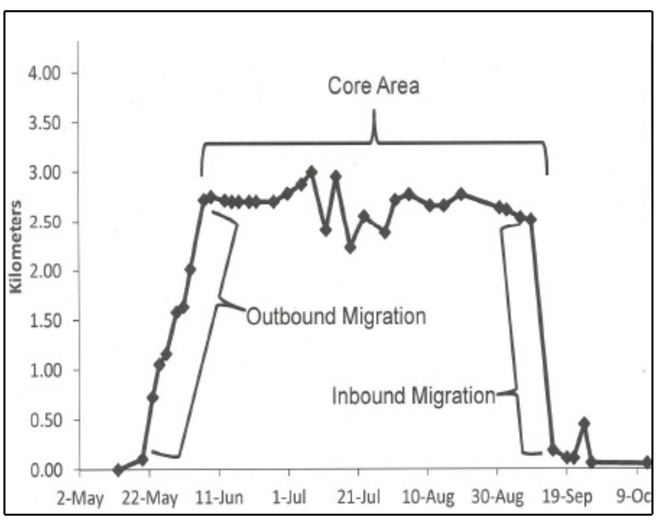

Figure 8. Displacement as a time-series graph for a typical radio-telemetered male rattlesnake.

The snakes used all available habitats in proportion to their availability. (For example, most of the land is forested, so snakes spent most of their summer foraging and mating time on forested land.)

Timber rattlesnake habitat selection:
46% deciduous forest
26% evergreen forest
13% mixed forest
12% wetland
2% agriculture
1% shrub

Most snakes migrated northeast from their hibernacula (Figure 9), spending the summer on private land (which is not protected).

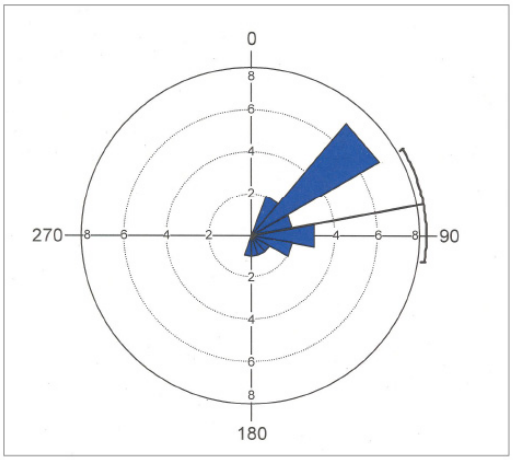

Figure 9. Rose diagram showing the mean bearing of outbound migration for 22 rattlesnakes monitored with radio telemetry in 2011 and 2012.

Additional land protection would therefore provide an enormous benefit for the timber rattlesnake population. It is especially important to prevent the direct mortality of female timber rattlesnakes, because of their slow reproductive output. One approach is the rattlesnake removal program currently underway. On-call trained personnel will go to private property to remove observed rattlesnakes at no cost to the landowner and release them on protected land.

ARCHAEOLOGY

The Galick Farm to the west of Austin Hill is currently the site of archaeological research led by Professor Matthew Moriarty of Castleton University, who reports:

The Buckner Preserve is home to several important Precontact Native American archaeological sites. The largest of these is spread across an area of roughly five acres in and around the Galick Farm. Archaeological investigations at the Galick Site over the last three years have recovered many artifacts, including projectile points, pottery, animal bone, and thousands of flakes from stone tool production. These artifacts were deposited by Native Americans camping at the site over the course of thousands of years, with the earliest activity dating to nearly 12,000 years ago. Native American foragers likely utilized the Galick Farm area as a seasonal base camp for accessing remarkably diverse local plant and animal resources and as a way station for canoe travel between Lake Champlain and the Hudson River Valley just to the south.

REFERENCES

Fisher, D.W., 1984, Bedrock geology of the Glens Falls-Whitehall region, New York, New York State Museum Map and Chart Series, no. 35, 60 p., scale 1:48,000.

Jaishankar, M., Tseten, T., Anbalagan, N., Mathew, B.B. and Beeregowda, K.N., 2014, Toxicity, mechanism and health effects of some heavy metals, Interdisip. Toxicol., vol. 7, no.2, p. 60-72.

Lapin, M., 2002, The Champlain Valley Clayplain Forest: A Landowners Guide, Champlain Valley Clayplain Forest Project, 18 p.

Lapin, M., Doyle, K., Graves, J. and Droege, M., 2004, Clayplain and Floodplain Forest Restoration Plan, Hubbardton River and Lower Poultney River Watershed Vermont and New York, The Nature Conservancy, 47 p.

Ratcliffe, N.M., Stanley, R.S., Gale, M.H., Thompson, P.J. and Walsh, G.J., 2011, Bedrock geologic map of Vermont, USGS Scientific Investigations Series Map 3184, 3 sheets, scale 1:100,000.

Shacklette, H.T. and Boerngen, J.G., 1984, Element concentrations in soils and other surficial materials of the conterminous United States, U.S. Geological Survey Professional Paper 1270, 105 p.

Spear, S., Bauder, J., Blodgett, D., Jenkins, C. and Briggs, K., 2013, The ecology of timber rattlesnakes (*Crotalus horridus*) in Vermont, Vermont Dept. of Fish and Wildlife, Rutland, VT.

Thompson, E.H. and Sorenson, E.R. 2005, Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont, Vermont Department of Fish and Wildlife/The Nature Conservancy, 468 p.

ROAD LOG

Assemble at the parking area/boat launch on Galick Road in West Haven, Vermont. From Lake George, NY, take Rt. 9 south approximately 4 miles to Queensbury. Turn left on Rt. 149 east for 11.7 miles to Fort Ann. Turn left on Rt. 4 north for 10.6 miles to Whitehall. Here, Rt. 4 turns right (at the traffic light), going over the Champlain Canal; stay on Broadway (heading north) for almost half a mile, then turn right on Saunders Street. Go over the Canal and then immediately left on N. Williams St. In 0.6 miles turn left on Doig St. In 0.5 miles turn left onto an unmarked dirt road. This will take you over the Poultney River. Just after the bridge, turn left (this is Galick Rd.). The parking area/boat launch is 0.2 miles from the bridge. Vehicles will be left here and the trip will be completed on foot (about 4.5 miles total walking).

We will meet at 9:00 a.m. Bring a lunch and any snacks and beverages you will need for the day. Whitehall is the closest place to purchase anything. We will probably have a late lunch at the last stop, and end the trip early. There are no formal restroom facilities.

Mileage
0.0 Poultney River boat launch

STOP 1A: SITE OF MAJOR GARBAGE BURN PILES
(Long. 43.569812 N, Lat. -73.395736 W; UTM 4825346.32N, 629544.54E)

This is the site of Burn Piles 1 and 2. Although geochemistry does not lend itself well to field trips, there are several things worth observing here. As a result of this study, the State of Vermont hired a geologic consulting company to assess the site, remove contaminated soil, place boulders to prevent vehicles from driving further along the river bank, re-grade the burn pile site as an official "boat launch" and create the parking area. Making this an official boat launch allowed Fish and Wildlife law enforcement to patrol the area and issue citations. (Previously, it was up to the town of West Haven to supply law enforcement, which, despite the good efforts of the local sheriff, was completely inadequate to keep up with the illegal/questionable use of the site.)

It is highly likely that there will be a reasonably fresh burn pile, and while we might not see the variety of materials that have been dumped and burned in the past, this will give trip participants a sense of the scale of activity. We can also observe the current river level, and look for evidence of flooding (which periodically erodes burn piles, sending their contents and the contaminated soil around and beneath them, directly into the river and shortly thereafter into Lake Champlain.

STOP 1B: CLAY PLAIN SOILS AND REFORESTATION

The Nature Conservancy's Southern Lake Champlain Valley office launched an ambitious 11-year Clayplain forest restoration project in 2004 in multiple sites in West Haven and Benson, Vermont. A decision to use only local seed source lead to the establishment of a small native woody plant nursery called the Champlain Valley Native Plant Nursery. 76,000 native trees and shrubs were planted between 2004 and 2014 on more than 200 acres. Funding was provided by USDA's Wetland Reserve Program, Wildlife Habitat Incentive Program and USFWS Partners For Fish and Wildlife. Survival of the plantings has been mixed, but adjacent to the parking area on Galick Road, which was planted in 2005, survival and growth has been excellent.

0.4 Walk west along Galick Road for 0.4 miles (0.6 km) to the Tim's Trial trailhead.

STOP 2: SITE OF "BACKGROUND" SAMPLES AND VIEW OF CLIFFS AND TALUS SLOPE

This is a very brief stop to indicate the location of the "background" samples used in this study. The trailhead is just in the woods next to a large field that is kept open for field-nesting birds, amphibians, and other wildlife. The 2014 background sample was obtained from the very edge of the field, and the 2015 sample was obtained just into the woods, both approximately 100 m from the road.

A little further along the trail (50 m) is an excellent view of the cliffs of Middle Mesoproterozoic gneiss and the talus slope below.

0.6 At the kiosk, go left to take the trail that goes through the woods along the base of the cliff. The trail to the right goes along the edge of the meadow; we will return by this trail.

0.7 The trail is right next to the cliffs here.

STOP 3: MESOPROTEROZOIC GRANITOID GNEISS/GRANULITE

This is a brief stop to examine the biotite tonalite gneiss. The rock contains mostly quartz and plagioclase feldspar, with the result that where the foliation is subtle the rock could more appropriately be called a granulite. Minor biotite and pyroxene are visible in hand sample and microscopically. Farther along the trail there is an outcrop that exhibits folded foliation. The rock is very hard, creating the cliffs, and weathers in large blocks, creating the talus slopes that provide critical habitat to a number of species, including the timber rattlesnake.

0.8 Right turn leads to meadow trail back to kiosk. Continue north to start of loop. Take left trail up hill.

0.9 Outcrop of gneiss on right.
1.2 Just off the trail to the left is a view to the south and east.

STOP 4: WARD MARSH OVERLOOK

Ward Marsh is visible to the left (east). In addition to the rattlesnake research discussed above, the Buckner Preserve is home to what has recently been recognized as the largest populations of golden-winged warblers, blue-winged warblers and their hybrids in New England. The Nature Conservancy is partnering with Audubon Vermont to monitor the populations and manage areas of the preserve to maintain and improve habitat for these birds.

To the southeast (to the right of Ward Marsh from this vantage point) is Skene Mountain. It consists of Cambrian and Ordovician sedimentary rocks. At the base is Potsdam Sandstone, overlain by Ticonderoga Formation dolostones and above that the Whitehall Formation. The Whitehall Formation consists of interlayered dolostones and limestones; Skene Mountain is capped by the Skene Member, a very hard, massive dolostone.

1.5 Outcrops showing gneissic fabric are plentiful as the trail heads downhill through a hemlock forest.
1.8 Overlook with bench.

STOP 5: LUNCH AND VIEW

This overlook provides an excellent view of the Poultney River near its mouth and the South Bay of Lake Champlain. The hill directly south across the Poultney River is made of Hague Gneiss and quartzite of the Lake George Group. Skene Mountain is visible to the east.

To return to the parking area: Either retrace your steps, or continue along the trail for almost 0.2 miles to where Tim's Trail turns east (a connector trail to the west leads down to the Susan Bacher Trail and the Galick Farm). Follow Tim's Trail for 1.1 miles to where it rejoins the trail back to the kiosk and the road.

Thank you

Bruce...

...and Bill