Surveys and Monitoring for the Hiawatha National Forest: FY 2017 Progress Report

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Cover photograph: Lakeside Daisy in newly discovered habitat southeast of road side population, HNF East Unit, 1 June, 2017. Photo by David Cuthrell.

Table of Contents

List of Tables

List of Appendices

Niagara Habitat Monitoring – for rare snails, ferns and placement of data loggers (East Unit)

Vegetation monitoring, as outlined in Alternative 2 of the Niagara EIS, was initiated to develop the methodology needed to understand the changes that may occur in karst feature habitat due to vegetation management. Specifically, this monitoring was designed to address microhabitat conditions within karst feature habitat and how those conditions may be affected by vegetation management with respect to changes in light intensity, ground temperature, relative humidity, and moss cover between treated and untreated sites.

After reviewing the monitoring plan sites were selected for sampling with the assistance of HNF staff. Sampling plots were circular and 1/10 of an acre (11.3 m radius; James and Shugart 1970). Sampling included the collection of overall plot level and three, 1 m^2 plots along the cliff/boulder face where rare ferns typically would be growing or rare land snails were likely to occur (Figure 1). Measurements collected at the overall plot level focused on forest structure and species composition. Tree density and composition was measured in two categories: tree (dbh ≥ 3.5 inches) and subcanopy (dbh < 3.5 inches). Other overall plot level measurements included percent canopy closure, plant species lists and coarse woody debris (CWD) qualitative assessment. Percent canopy closure was estimated along the cardinal directions from the plot center. Ocular tube readings of canopy conditions were taken at paced intervals (~1 m) five times in each cardinal direction. The ratio of hits to misses in the ocular tube gave the percentage canopy cover for that plot.

Figure 1. Option 2 Site 7, vegetation plot C. Left photo on 23 July 2014; right photo on 7 August 2017.

To address the changes that may occur after the different forest treatments, during the summer of 2017 (August 7-9) we conducted vegetation sampling at a total of 16 sites: 8 Option 2 sites and the 8 Control sites. In conjunction with the vegetation sampling, we placed data loggers at the same 16 sites and at the 8 Reference sites. Two data loggers were placed at each site at the plot center. One data logger placed at the top of the cliff or boulder recorded temperature and light intensity while a second data logger placed at the base recorded both temperature and relative humidity. All data loggers were placed in the field during July (17-18) and all were collected on 15 September 2017. Data has been offloaded from the devices and are currently being summarized for preliminary analysis.

We continue to compile temperature, humidity, and light intensity data gathered by data loggers during 2012 through 2017 into a database to facilitate future analyses. Because the data loggers export information in different formats depending on type (i.e., temperature and relative humidity vs. temperature and light intensity), substantial data manipulation is necessary to produce a consistent format for data summarization and analysis. In addition, all of the vegetation monitoring data from 2012-2016 has now been entered into a large excel database and we have begun analysis (Appendix I).

Raptor Nest Checks and Productivity Surveys (East Unit)

Both the Red-shouldered Hawk (*Buteo lineatus*, state threatened) and Northern Goshawk (*Accipiter gentilis*, special concern) are Regional Forester Sensitive Species (RFSS) with known nesting occurrences within the east and west units of the Hiawatha National Forest (HNF). During the 2017 surveys a total of 59 nests or old nesting territories (East Unit,) were checked by MNFI staff for breeding use, with a subset of those (active or possibly active nests) visited a second time for nest productivity.

In the East Unit, we visited 59 nests to check for breeding use. Initial nest checks and conspecific call broadcasts were conducted during the span of April 24 – May 19. During the first visit 25 active or potentially active (i.e., decorated nest but adult not observed) Red-shouldered Hawk nests and 5 Northern Goshawk nests during their first round of surveys. Staff from MNFI revisited all 30 active and potentially active nests in June to assess nest success and productivity. Productivity surveys during 2017 were completed on June 19-23 using a telescoping fiberglass pole and video camera (GoPro Hero) to inspect nests. Four of the five active Northern Goshawk nests found during the first round of surveys were successful, with a total of 7 chicks fledged. We observed 80% (18/25) of the Red-shouldered Hawk nests to be successful and counted 45 chicks total (1.80 young per active nest, 2.50 young per successful nest) (Table 1).

Overall Red-shouldered Hawk nest success appeared to be in line with previous years (Figure 2), and up from 2016, with a total number of 45 chicks produced (1.80 young per active nest, 2.50 young per successful nest) (Table 1). The trend appears to be stable to slightly increasing for the HNF, East Unit since 2006 (Appendix II).

Table 1. 2017 Season Summary of nesting raptors in the Hiawatha National Forest.

Raptor Species	Active Nests	Successful Nests	Number of young	young/ active	young/ successful	% active nests successful
RSHA	**25**	**18**	**45**	**1. 80**	**2.50**	**72 %**
East	25	18	45	1.80	2.50	72 %
West	?	?	?	?	?	?
NOGO	**5**	**4**	**7**	**1.40**	**1.75**	**80 %**
East	5	4	7	1.40	1.75	80 %
West	?	?	?	?	?	?

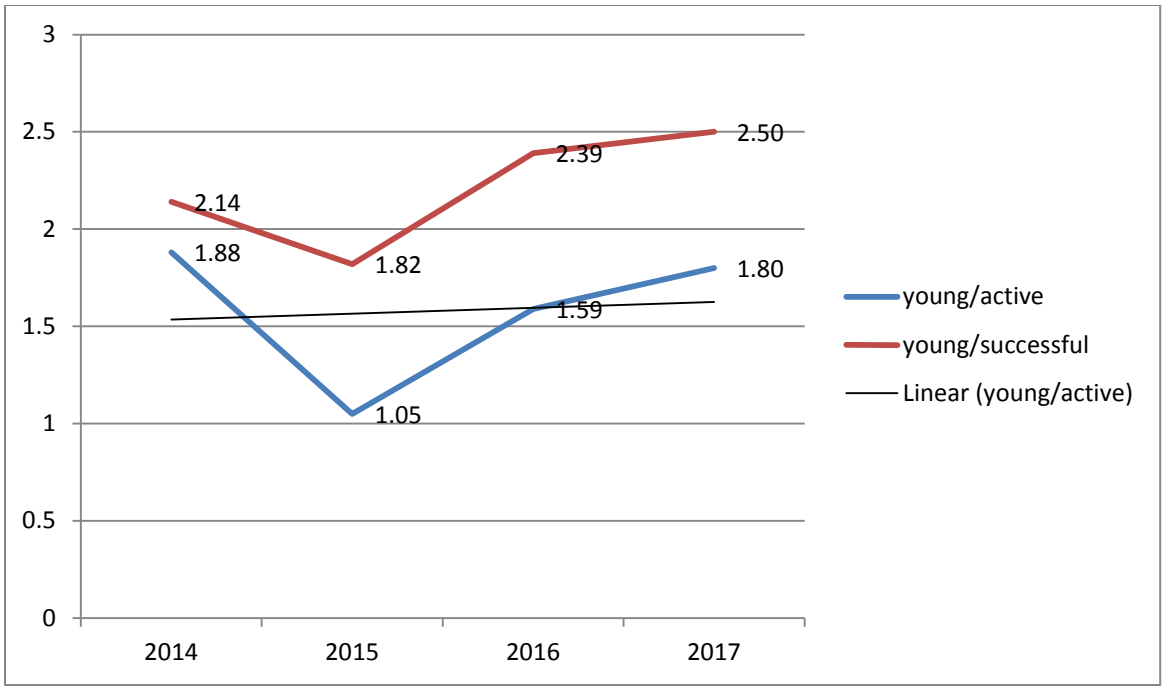

Figure 2. RSHA productivity 2012-2017 on the Hiawatha National Forest, East Unit.

Recommendations for Future Work

The raptor nest monitoring data set is approaching two decades and therefore we recommend continuing this level of field work in 2018. We also recommend publishing the results of the data set in a peer reviewed journal, such as the Journal of Raptor Research. This may help determine, or better define, the overall goal or objective of the monitoring program. A separate meeting should occur with folks interested from MNFI and the HNF and an outline for the publication, a possible journal selected, and plan for further action.

Also, if a goal is to find additional Northern Goshawk nesting territories within the HNF, we recommend doing surveys for Northern Goshawks during the courtship phase, which for northern Michigan, is likely from 1 March through 7 April. Recent studies (Roberson et al. 2005) suggest this may be the best time to survey for this species. In addition to confining our searches and call playbacks to old nesting sites, we could do some wider encompassing searches in those nesting territories. Alternatively surveys could be conducted during the fledgling-dependency phases (approximately 25 June – 20 July).

Yellow Rail Surveys (East Unit)

Yellow Rail (*Coturnicops noveboracensis*) is a state threatened species and has been identified as a species of greatest conservation need (SGCN) and a focal species for Waterbird Habitat Conservation Strategy of the Upper Mississippi River and Great Lakes Region Joint Venture. In 2017, MNFI conducted surveys in areas identified by the USFS as having potential habitat for Yellow Rail. Survey points were

randomly placed within potential habitat (i.e., open, sedge-dominated wetlands) that could be reasonably accessed at night (i.e., ≤ 500 m of adjacent upland). Points were separated by at least 400 m (Conway 2011) and were surveyed between one-half hour after sunset and 3:00 AM during 31 May – 3 June 2017. We conducted 10 min point counts consisting of a 5-min passive listening period, followed by three 1-min broadcast periods, and then another 2-min passive listening period. The 1-min broadcast period consisted of 30 sec of Yellow Rail calls followed by 30 sec of silence.

We surveyed 33 points in two wetland areas identified as high priorities, due to the presence of potential habitat and planned prescribed burns, and four nearby medium priority sites (Figure 3). Points were only visited once to maximize the number of points and areas surveyed. No Yellow Rails were detected during surveys. Five American Bitterns (*Botaurus lentiginosus*, state special concern) were observed at 4 (12%) of the 33 points. Three of the American Bittern detections were heard at long distances, so the locations could not be pinpointed; however, two observations occurred within 100 m of the survey points and were added to the Natural Heritage Database as a new element occurrence (EO ID 21471).

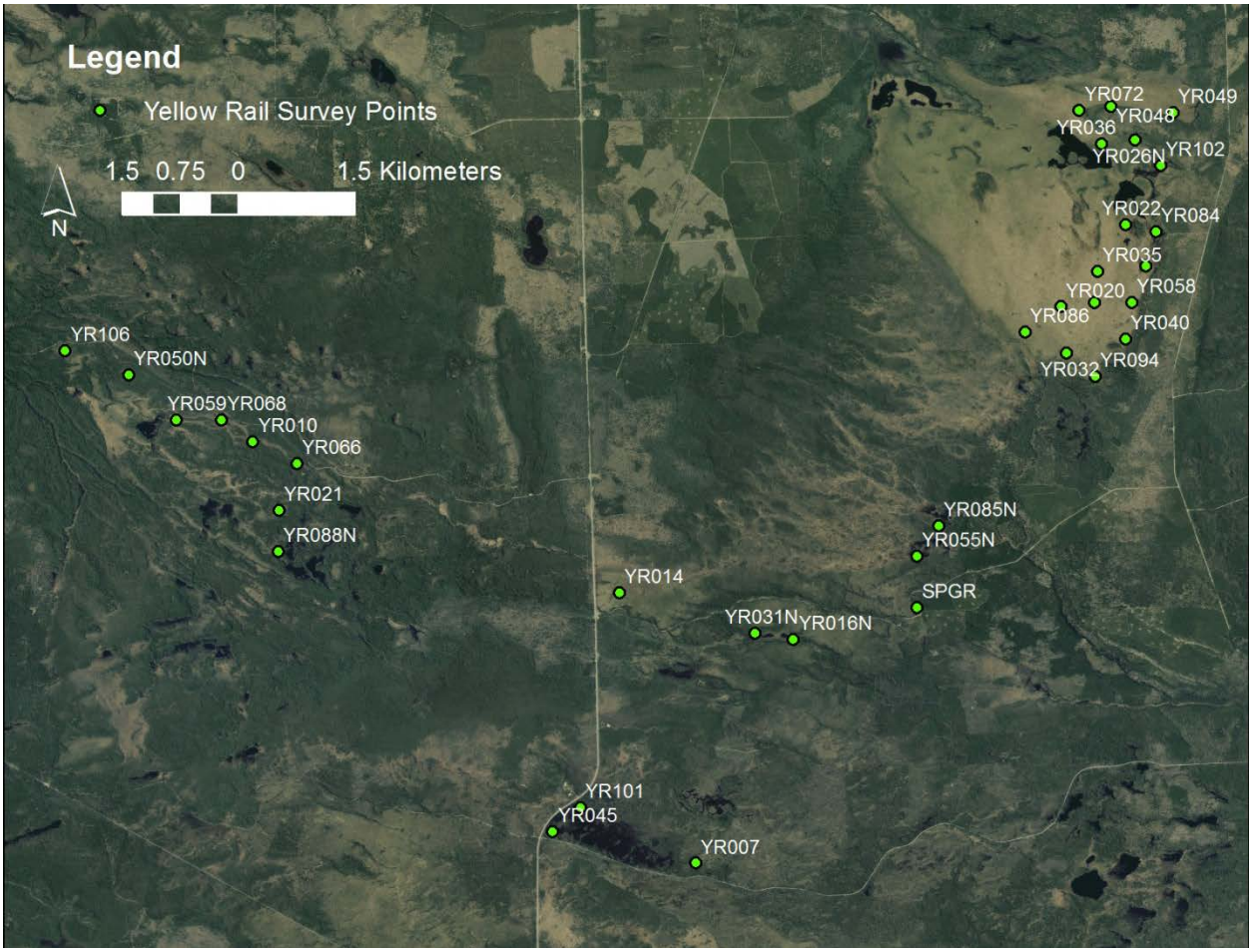

Figure 3. Points visited during Yellow Rail surveys conducted within Hiawatha National Forest in 2017.

Recommendations for Future Work

Sites not surveyed for Yellow Rail in 2017 should be surveyed in the future, especially those located on or near the Great Lakes. Because Yellow Rail are difficult to detect and can change breeding sites regularly based on habitat conditions, we recommend developing a long-term survey strategy that includes multiple visits to potential sites per year.

Coastal Wetlands (West Unit)

Three areas were targeted for surveys identifying natural communities and invasive plant species along the Great Lakes shoreline. All of these areas have had previous MNFI community and species surveys. The 2017 surveys focused on the identification of exotic plant populations as well as the identification of natural communities that may be too small to receive recognition as an element occurrence, or that occur as inclusions in a larger community type. In addition, some effort was made to make survey points representative of dominant species to assist with establishment of photo signatures. The three wetland complexes visited were 1) Nahma – Sandtown area and the mouth of the Sturgeon River, 2) Ogontz Bay and the mouth of the Ogontz River, and 3) the Wedens Bay area of the Stonington Peninsula.

Exotic phragmites (*Phragmites australis* subsp. *australis*) populations in the Nahma – Sandtown area had been treated with herbicides prior to the survey. No large areas of exotic Phragmites were encountered, however many large areas of the non-invasive, native reed (*Phragmites australis* subsp. *americanus*) were identified in the area. Further monitoring is recommended to identify the re-emergence of exotic Phragmites from existing runners. Natural wetland communities in the area are dominated by poor fen and northern shrub thicket. Large stretches of the beach are bordered with rich fen vegetation. This community extent has been severely crowded and reduced by rising lake levels.

Ogontz Bay supports large areas of exotic phragmites along with a significant population of native reed. This site contains many locations where the two sub-species are growing adjacent to each other. Exotic phragmites populations tend to be dense and can grow quite large in area and in height. From a distance, large exotic phragmites populations look like small dark green hills. Native populations can cover large areas but are typically less dense and include a mixture of other native species. The site also contains large areas of narrow-leaved cat-tail (*Typha angustifolia*). Areas inland of the tree line are largely free of exotic plant populations although there is an area of disturbed old dunes near the mouth of the Ogontz River that contains a large percentage of exotic species mixed with native vegetation.

We found large areas of exotic phragmites, as well as smaller, native populations in Wedens Bay on the Stonington Peninsula. The eastern end of the site also included narrow-leaved cat-tail populations. A narrow band of rich fen was frequent but severely constrained in width. Some of the known populations of dwarf lake iris (*Iris lacustris,* EOID3132) were confirmed. Sections four and nine were not surveyed due to time limitations. Wetland communities inland from the lake shore are unusual in being altered by strip cutting while leaving significant areas of large cedar trees.

Groundwater Dependent Ecosystem Inventories and Natural Classification (East and West Units)

Six Ground Water Dependent Ecosystem areas were surveyed. Two of them, Camp Faunce and Shingleton received only cursory surveys as much of the habitat has been surveyed in previous years or on different projects. More extensive survey efforts were undertaken at Betchler Lakes Peatlands, Wilwin, Murphy Creek/Eight Mile, and Cooks Camp.

Betchler Lakes surveys were concentrated along the southern third of the site where extensive areas of northern forest, poor conifer swamp and northern shrub thicket follow headwater drainages and exit the site in Hemlock Creek and the beginning of the Pine River. This area is interspersed with areas of tamarack and jack pine muskeg and small to medium sized poor fens. The southwestern portion transitions into a 100 to 200 acre bog-muskeg complex. Survey lines crossed the southern edge of the large muskeg – bog complex surrounding Betchler Lakes where true ombrotrophic bog conditions develop. A new population of the clubmoss (*Spinulum candanse*, EOID21371) was found growing through sphagnum and leatherleaf shrub along the edge of a small sand island of boreal forest. In addition a very small population of alga pondweed (*Potamogeton confervoides,* EOID 21370) was located in Arbutus Lake in the northeast edge of the site. The open water areas in the northern sections of the muskeg – bog complex were not surveyed nor were the surrounding peatlands.

Surveys covered much of the Wilwin area and found a highly interlaced complex of rich and poor conifer swamp and northern shrub thicket dominate in most of the area. The southwesterly portion included larger portions of bog- muskeg complex. Extensive beaver pond development occurs along the principle branches off Naugle Creek. Poor fen is frequent but often small in area and one area of rich northern fen was encountered but has been disturbed in part by ORV use which has resulted in the introduction of a yellow-eyed grass (*Xyris torta*) from the Lower Peninsula or Wisconsin. This is the first record of the species in the UP. Wiegand's sege (*Carex wiegandii*, EOID?) was frequently encountered with occasional areas where it was locally dominant. The sedge (*Carex folliculata*) was another uncommon but locally dominant sedge, especially in the northern portion of the complex. Community surveys were also conducted in a small area southwest of the target area, in conjunction with a rare plant search. The area was directly fed by large springs rising out of limestone and supported similar habitat to the target area.

The Murphy Creek –Eight Mile site appeared to be the most highly altered of all sites visited, with recent logging on much of the site and clear evidence of fires in the area. High water tables with shallow sands over restrictive layers seem to be more prevalent here than at the other survey locations. Boreal forest, poor conifer swamps, shrub swamps and poor fens predominate often in broad, parallel bands. Small areas of large mixed-pine or mixed-conifer occur in the western portion.

The Cooks Camp area wetlands are more predominantly separated from one another by large ancient dunes. Wetlands include large areas of muskeg, interspersed with poor fen. Poor conifer swamps are extensive and in areas with increased groundwater flow are replaced with rich conifer swamps. Boreal forests transition to dry conifer forests. One area of hardwood swamp, on peats over five feet deep, was encountered. Peats in this complex are typically deeper than at other sites often exceeding the six

feet of my probe. Peats at most other sites only rarely exceeded the probe. One population of three-seed sedge (*Carex billingsii*, EOID21369) was found in an area transitional from black spruce muskeg to rich conifer swamp. The sedge (*Carex rostrata*) was also found in a slightly wetter area in the same general vicinity. It is likely that new community element occurrences will be described from this complex.

Recommendations for Future Work

Continued aerial photographic interpretation to identify examples of coastal fen, northern fen, and patterned fen on HNF lands is warranted, followed by natural community surveys of all potential sites. Following completion of peatland surveys, MNFI staff will compile and distribute Forest Service GDE Level I Inventory field forms, vascular plant species lists, and rare species data to Hiawatha NF staff. After a sufficient number of GDE sites have been surveyed, we plan to work with Hiawatha NF staff to implement Level II monitoring protocols at selected sites representative of a diversity of GDE types. Finally, see Slaughter and Cuthrell (2016) for more discussion and recommendations on GDE and associated rare species surveys.

Rare Plant Surveys (East and West Units)

One day was spent unsuccessfully on orchid surveys in the west unit. The determination was made that the season was too far advanced to successfully continue orchid surveys. Resurveys for state threatened dwarf bilberry (*Vaccinium cespitosum*) resulted in the confirmation of two previously known sites (EOID4462 and EOID10006)). Survey of one site resulted in the addition of a new Northern blue butterfly (*Plebejus idas nabokovi,* EOID3289) element occurrence. Although not all known dwarf bilberry locations within the population were confirmed, a number of new locations were added. The second site resulted in a mapping revision which should facilitate easier tracking and monitoring of the population. Additional surveys for Forest Service records based on Don Henson reports were not successful, as none of these sites had been vouchered or included in MNFI records.

Unsuccessful resurveys were also conducted for a state threatened slough grass (*Beckmannia syzigachne*), and a special concern Autumnal water-starwort (*Callitriche hermaphroditica*). Potential habitat for the slough grass remains, although it is small and dynamic, based on slumping clay creek banks along a small, flash flood prone creek. The habitat for the Autumnal star-wort seems intact and all listed associates were located so further survey is recommended here.

Small areas of de novo aquatic plant surveys were conducted and resulted in the location of one new occurrence record for the special concern, alga pond weed (*Potamogeton confervoides,* EOID21370). During Groundwater Dependent Ecosystem surveys one new record for the state special concern clubmoss (*Spinulum candense,* EOID21371) was located in the Betchler Tamarack flats. And one record of the recently described, state special concern three-seed sedge (*Carex billingsii*, EOID21369) was located in the Cooks Camp complex. This survey also noted numerous populations of the special

concern Wiegand's sedge (*Carex wiegandii*, EOID?). And finally, populations of state threatened dwarf lake iris (*Iris lacustris,* EOID3132) were confirmed during the Great Lakes Coastal Wetlands surveys.

Table 2. Rare plant (and animal as part of botanical surveys) element occurrences on HNF in 2017.

Species	EOID	State Status	Old Rank	New Rank	Survey Type
rare orchids	various				*
Carex billingsii	21369	SC	new	?	Qualitative meander
Carex weigandii	**	T	new	?	Qualitative meander
Potamogeton confervoides	21370	SC	new	?	Qualitative meander
Spinulum canadense	21371	SC	new	?	Qualitative meander
Vaccinium cespitosum	4462	T	E	E	Qualitative meander
Vaccinium cespitosum	10006	T	BC	BC	Qualitative meander
Iris lacustris	3132	T	C	C	Qualitative meander
Tetraneuris herbacea	13207	E	BC	BC	Qualitative meander
Botaurus lentiginosus	21327	SC	new	C	Incidental observation
Plebejus idas nabokovi	3289	T	BC	BC	Incidental observation

*Surveys cancelled after reconnaissance found that the species had flowered early in very low numbers due to warm weather. ** still needs to be processed, no EOID assigned yet.

Recommendations for Future Work

We recommend continued surveys of previously documented populations of climate-sensitive and declining species, especially *Calypso bulbosa* and *Amerorchis rotundifolia*, but also *Galium kamtschaticum* and species of boreal fens such as *Carex scirpoidea*, *Empetrum nigrum*, *Erigeron hyssopifolius*, and *Pinguicula vulgaris*.

Terrestrial Snail Identification and Sample Processing (West Unit)

In 2017 MNFI received terrestrial snail samples collected by Hiawatha NF staff. One box of samples contained envelopes with shells sorted by Hiawatha NF staff. There were shells from 16 sites in two blue envelopes. In addition, there was a white padded enveloped with suspected regional forester sensitive species. The second box contained unsorted samples from 11 sites.

Pre-sorted shells, in the blue and white envelopes, were identified using a 10-60x power stereoscope. These shells were difficult to identify to species due to damage, and in some cases were only identified to genus and/or ID was uncertain (Table 3). Unsorted samples, from the second box, were processed to separate shells from plant debris and inorganic material. Dry material was sieved through 8, 4, 2, 1, and 0.25mm sieves with the aid of a 1/2" paint brush. Each fraction was placed in a white enamel pan, and searched through with a 10x power stereoscope, +1.5 glasses, and bright fiber optic lights.

Shells of four different taxa were identified from the pre-sorted blue envelopes (*Discus* sp., *Glyphyalinia indentata* (carved glyph), *Striatura exigua* (ribbed striate), and *Strobilops labyrinthica* (maze pinecone)). Shells in the white envelope were *Striatura exigua* and a young *Strobilops* sp. Only four of the eleven unsorted samples contained shells. Two species were represented (Striatura milium (fine-ribbed striate) and *Strobilops labyrinthica*). None of these are state endangered, threatened, or special concern. All samples containing a large proportion of soil and mineral material had no shells, while the four samples with shells were dominated by plant debris (moss, leaves, pine needles, etc.).

Table 3. Land snail samples collected by Hiawatha National Forest Personnel and processed and identified by MNFI.

Site coordinates		Species	# of Individuals	Note	Package
525950	5088636	Glyphyalinia indentata	1	Shells were difficult to ID because of damage	Blue envelope #1
525928	5088649	Discus sp.	1	"	"
525932	5088689	Strobilops sp.?	1	"	"
525928	5088670	Strobilops sp.?	1	"	"
525926	5088654	Glyphyalinia indentata	1	"	"
"	"	Discus sp.	1	"	"
525963	5088625	?	1	"	"
526143	5088029	Strobilops sp.	1	"	"
"1st site visited"		Glyphyalinia sp.?	1	"	"
"052138"	5087998	Strobilops sp.	1	"	Blue envelope #2
526139	5087932	Glyphyalinia sp.?	1	"	"
526166	5087991	?	1	"	"
526177	5088021	?	1	"	"
526146	5087968	no shell seen in envelope	0	"	"
526176	5088007	Glyphyalinia indentata	1	"	"
525934	5088687	Striatura exigua	1	"	"
525929	5088661	Strobilops labyrinthica	1	"	"
526166	5087991		0	Dirt and moss	White box*
526177	5088021		0	Dirt and some woody debris	"
526137	5088010		0	Dirt	"
526159	5088019		0	Dirt	"
526143	5088029		0	Dirt and plant debris	"
526166	5087991		0	Dirt	"
526176	5088007		0	90% moss	"
526146	5087968	Striatura milium	2	Moss, bark, and twigs	"
"	"	Strobilops labyrinthica	1	"	"
526139	5087982	Striatura milium	5	Plant debris	"
526147	5088018	Striatura milium	2	Plant debris/pine needles	"
526138	5087998	Striatura milium	1	Plant debris	"
"	"	Strobilops labyrinthica	1	"	"

*Dry material was seived through 8, 4, 2, 1, and 0.25mm seives with the aid of a 1/2" paint brush. Each fraction was placed in a white enamal pan, and searched through with a 10x power stereoscope, +1.5 glasses, and bright fiber optic lights.

Statewide Bumble Bee Surveys

Over 66 sites across the upper peninsula of Michigan were inventoried for bumble bees during May, June, August and September 2017. A total of 453 individual bumble bees were collected (at least that many more were observed), processed, and labeled, with identifications pending on most specimens. Eleven species of *Bombus* were recorded during year one (*bimaculatus*, *borealis*, *citrinus*, *fervidus*, *griseocollis*, *impatiens*, *pensylvanicus*, *rufocinctus*, *ternarius*, *terricola*, and *vagans*). This project will continue in 2018 with inventory focusing in the areas of the state where survey gaps remain. Survey sites in 2017 were identified utilizing museum specimen records for two species of bumble bee that have received significant federal attention; the federally endangered rusty-patched bumble bee (*Bombus affinis*) and the federal candidate species, yellow-banded bumble bee (*Bombus terricola*). Once sites were identified, we buffered these points in larger circular polygons and outlined the sites in a Michigan Atlas & Gazetteer. We then drove to those spots during the field season, located large areas of flowering resources, and conducted timed, meander surveys. Survey sites were specifically identified within the HNF (Figure 4) both in the East (6 sites) and West units (6 sites).

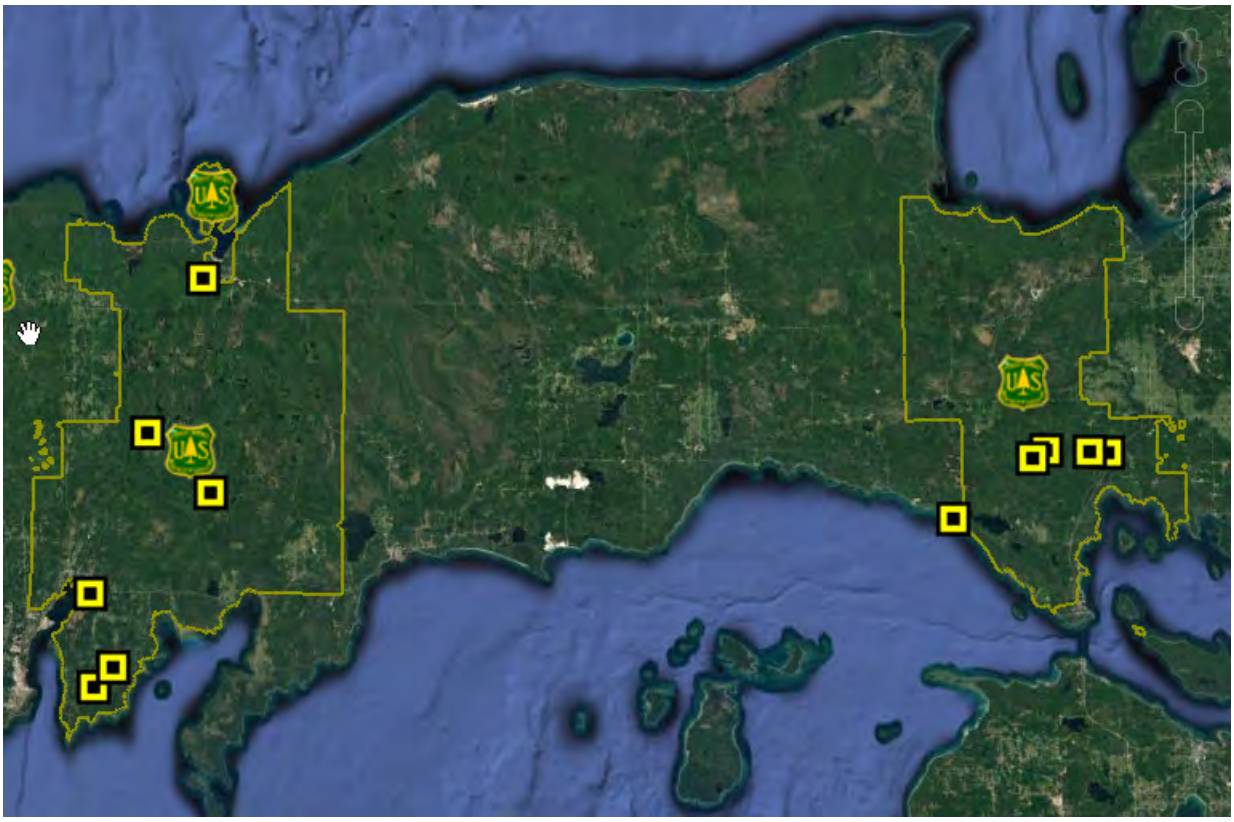

Figure 4. Bumble Bee Survey Sites on the Hiawatha National Forest, August 2017.

At each site visit we recorded a latitude and longitude with handheld GPS units and took photos of representative habitats. Survey start and end times were recorded, as well as start and end temperature, relative humidity, wind speed, and percent cloud cover. For each flowering species in the area surveyed, DAFOR ranks were recorded. Attempts were not made to capture all bumble bees seen

at the site but to collect representatives of different species. All collected bees were held in small plastic or glass vials, and placed into ice coolers, brought back to the lab, placed into a freezer, and vouchered. A total of 66 sites were visited and sampled with this method during the summer of 2017. In addition to natural communities, several road ditches and associated habitats were surveyed. To further elucidate habitat or plant community associations, for each bumble bee vouchered, we recorded information on the plant species from which the bee was collected.

During 2016-17 surveys no locations for the federally endangered rusty-patched bumble bee were found in Michigan. The most significant discovery this year was locating the state special concern and federal candidate, Yellow-banded bumble bee (YBBB) at 15 different sites throughout the Upper Peninsula, including 3 sites (East Lake Road Pipeline, 16 Mile Road, Kenneth Road) within the East Unit of the HNF. Each of those 3 sites were surveyed with 1 hour meander surveys and recorded just 1 YBBB per site. The East Lake Road site was a pipeline corridor with flowering plant diversity including patches of spotted knapweed (*Centaurea*). The 16 Mile Road site was a gravel pit with an abundance of *Centaurea* in full bloom, surrounded by forest. The Kenneth Road site (Figure 5) is described as a pipeline corridor within forest with a diverse community of flowering forbs, *Centaurea* frequent and in full flower.

Figure 5. The 16 Mile Road Site was one of three locations within the HNF (East Unit) that contained the yellow-banded bumble bee, 7 August 2017. (photo by Blake Cahill)

Vernal Pool Mapping and Surveys (East and West Units)

Vernal pool mapping and surveys on Hiawatha National Forest Lands in 2017 focused on two main components. One component focused on revisiting and confirming a subset of the vernal pools/potential vernal pools that had been previously identified and/or surveyed in 2015 and 2016 and surveying additional potential vernal pools that had not been surveyed in 2015 and/or 2016 in the Raco-Eckerman project areas in the East Unit of the Hiawatha National Forest. These surveys focused primarily on potential vernal pools that were mapped in areas that are proposed for management/treatment in the near future. The second component was to investigate the use of radar and lidar to map potential vernal pools in the Plumb-Bruno and Camp Cooks project areas in the West Unit of the Hiawatha National Forest. The potential vernal pools mapped using radar and LiDAR data were compared to the potential vernal pools and verified vernal pools identified and mapped based on aerial photo interpretation and/or field surveys in 2015 and 2016. In addition to vernal pool mapping and surveys, MNFI was asked to conduct a vernal pool training workshop for Hiawatha National Forest staff and other U.S. Forest Service staff in Michigan. MNFI also was asked to present a webinar on vernal pools and our mapping efforts on the Hiawatha NF to hydrologists, soil scientists, ecologists, and other staff in the Forest Service's Eastern Region for one of their monthly conference calls in 2017.

Vernal Pool Surveys in Raco-Eckerman Project Areas

For the vernal pool mapping and field surveys in the Raco-Eckerman project areas, MNFI staff surveyed a total of 85 potential vernal pools in 2017, of which 55 had been mapped using aerial photo interpretation and 30 were encountered in the field. Surveys were conducted in mid-May and late October-early November. Vernal pools/potential vernal pools were only visited once during the 2017 surveys. Survey sites were located in the field using GPS, shapefiles, and the BackCountry Navigator application on a Samsung Galaxy Tablet A. Data on the vernal pools were collected in the field using the BackCountry Navigation application and MNFI vernal pool monitoring data forms. Each vernal pool/potential vernal pool that was surveyed was photographed for documentation.

Surveys in 2017 were able to identify or confirm a total of 55 vernal pools. An additional 22 potential vernal pools need additional information to confirm their status as active vernal pools or other types of wetlands. These include several depressions dominated by leatherleaf, several wetlands that may be classified as intermittent wetland natural community types, and a number of pools that were still wet during fall surveys. Eight of the potential vernal pools surveyed were designated as other wetlands and not vernal pools or were not wet or wetlands at all. Vernal pool indicator species were documented in nine of the vernal pools surveyed in the spring. These included documenting fairy shrimp in five pools, spotted salamander egg masses in seven pools, blue-spotted salamander egg masses in one pool, and wood frogs mating in one pool.

Overall, of the 218 potential vernal pools that were initially mapped in the Raco-Eckerman project areas using air photo interpretation in 2015, 95 have been surveyed to date, and an additional 47 potential vernal pools/vernal pools have been encountered and identified in the field, resulting in a total of a total of 142 potential vernal pools have been surveyed to date in the Raco-Eckerman project areas. Of these,

93 have been identified as vernal pools, 39 are additional potential vernal pools that need additional information to confirm their status, and 10 are not vernal pools.

Vernal Pool Mapping Using Radar and LiDAR

MNFI contracted with Michigan Tech Research Institute (MTRI), a program of Michigan Technological University, to conduct the vernal pool mapping using radar and LiDAR. The mapping focused on and was constrained by, areas within the Plumb-Bruno and Camp Cooks project areas for which appropriate radar and LiDAR data/imagery were available. The LiDAR DEM data used for the mapping had 1.5 m resolution and ~30 cm accuracy. Stochastic Depression Analysis was used to identify isolated depressions using the LiDAR data. An iterative process using LiDAR error was developed to determine if DEM depressions were "real" or results of LiDAR vertical uncertainty. The depression analysis was used in conjunction with available radar (i.e., ALOS PALSAR data) imagery from spring and summer to identify and map potential vernal pools.

MTRI's efforts to map potential vernal pools using LiDAR and radar data produced promising results. A map showing the potential vernal pools identified using this approach is provided in the figure below. MTRI erred on the conservative side in their mapping of potential vernal pools. Comparing these results with potential vernal pools (PVPs) that were mapped using air photo interpretation, about 80% of the PVPs mapped using air photos in the study region were identified using depression analysis. About 60% of those were categorized as being inundated in spring and dry in summer using SAR imagery. Additional radar/SAR imagery would help to identify additional vernal pools and could be used as a remote monitoring technique.

Vernal Pool Training

MNFI staff worked with Hiawatha National Forest staff to conduct a vernal pool training workshop in the East Unit on May 23rd, 2017. The training workshop consisted of an indoor presentation and discussion on vernal pool ecology and management and field visits to several vernal pools for further discussion and to become more familiar with identifying vernal pools and associated indicator species. About 20-25 participants attended the training workshop. Workshop participants included staff from the Hiawatha National Forest, Ottawa National Forest, Huron-Manistee National Forest, and the Michigan Department of Natural Resources.

MNFI also worked with HNF staff to present a webinar on vernal pools to USFS staff in the Eastern Region on August 9th, 2017. About 15 people participated in the webinar. These included hydrologists, soil scientists, ecologists, foresters, and wildlife biologists from various states across the Eastern Region. There was good discussion during both the vernal pool training workshop and the webinar, and both were well-received. The webinar also resulted in identification of other vernal pool mapping efforts in national forests across the Eastern Region and opportunities for information sharing and potential collaboration in the future.

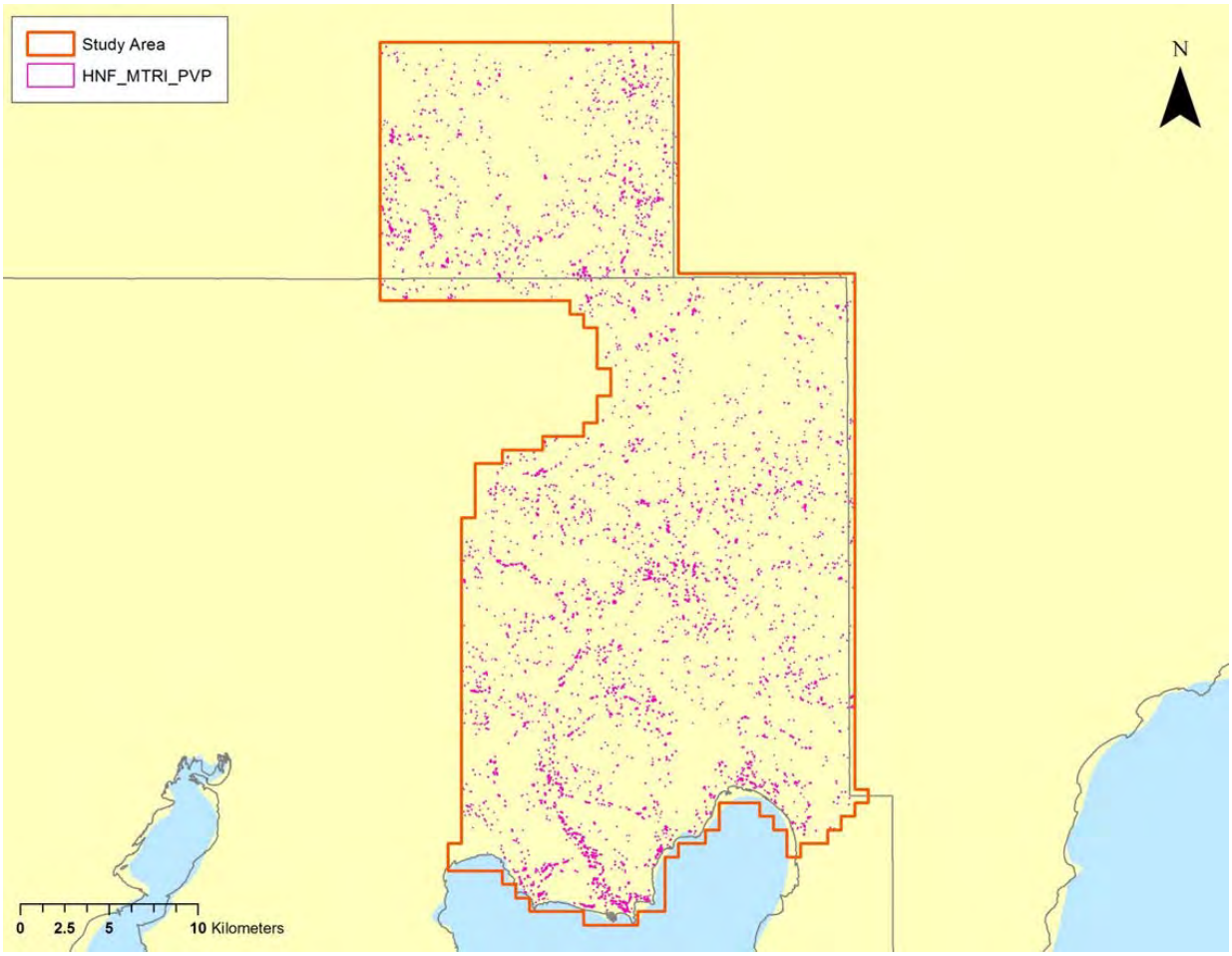

Figure 6. Potential vernal pools mapped (in purple) by MTRI in 2017 using radar and LiDAR imagery in the Plumb-Bruno and Camp Cooks project areas in the West Unit of the Hiawatha National Forest.

Reconcile databases – MNFI/NRIS (East and West Units)

MNFI continues to update the Biotics Database after every field season and we have been making changes to web-based subscription access. This year a total of 21 Element Occurrences from the Hiawatha National Forest were transcribed or added to the MNFI Biotics Database and an additional 49 records were updated. Over the past four years a total of 219 Element Occurrences have either been updated (sometimes the same EOs multiple years) or newly added to the database. Before the next field season we plan to update or newly transcribe several raptor nesting records on the Hiawatha National Forest. As for data we have received from the HNF, most of this data are animal records and exclusively from the East Unit. ***We would appreciate receiving additional plant and records from both Units.*** We are also currently reviewing access requirements/rates with several agencies and groups of data users and have provided the Hiawatha National Forest access at the full shape file level because of your level of financial support to our program.

This data base access is being provided as a direct result of our great working relationship we have established over the past several years and we look forward to continued collaboration on this and future projects!

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We would like to thank the staff from the Hiawatha National Forest for their support on this project ranging from helping with the fieldwork, providing maps, guidance on study design, and of course financial support. We thank Rebecca Rogers, Helen Enander, and Dan Earl (MNFI – Americorps) for help with data base work and improvements; John Paskus and Michael Monfils for help with raptor field work; Mike Sanders with plant sampling field work, and for data compilation. Additionally, we thank Ashley Adkins, Nancy Toben, and Brian Klatt for providing administrative support. Thanks to Bradford Slaughter for identifying rare plant survey targets, and Josh Cohen for ecological oversight as part of match for this project.

Appendix 1

Data logger and vegetation analysis completed for the HNF Niagara Project to date.

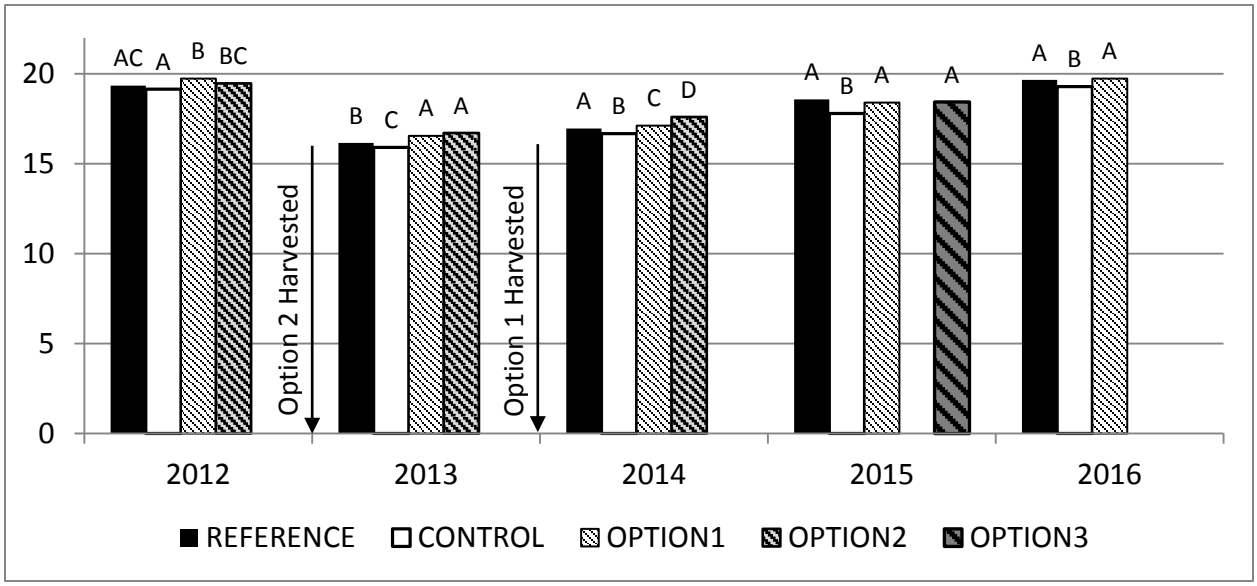


Figure 1. Mean hourly elevated temperature (°C) from mid-July through August by treatment and year in the Hiawatha National Forest. Within a given year, treatments having the same label were not significantly different.

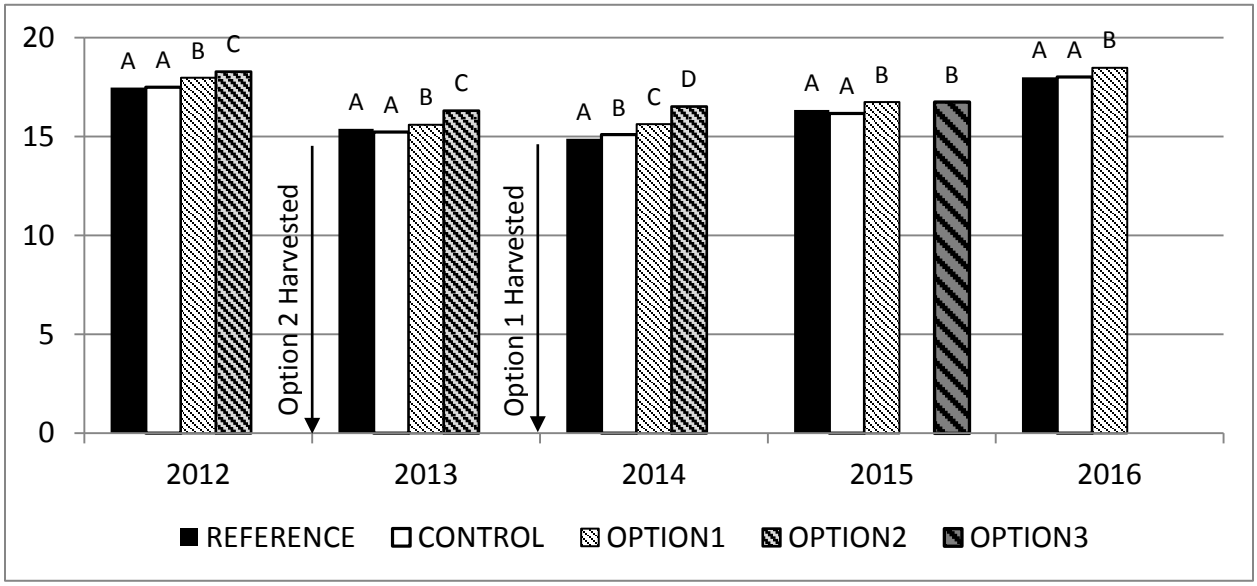


Figure 2. Mean hourly surface temperature (°C) from mid-July through August by treatment and year in the Hiawatha National Forest. Within a given year, treatments having the same label were not significantly different.

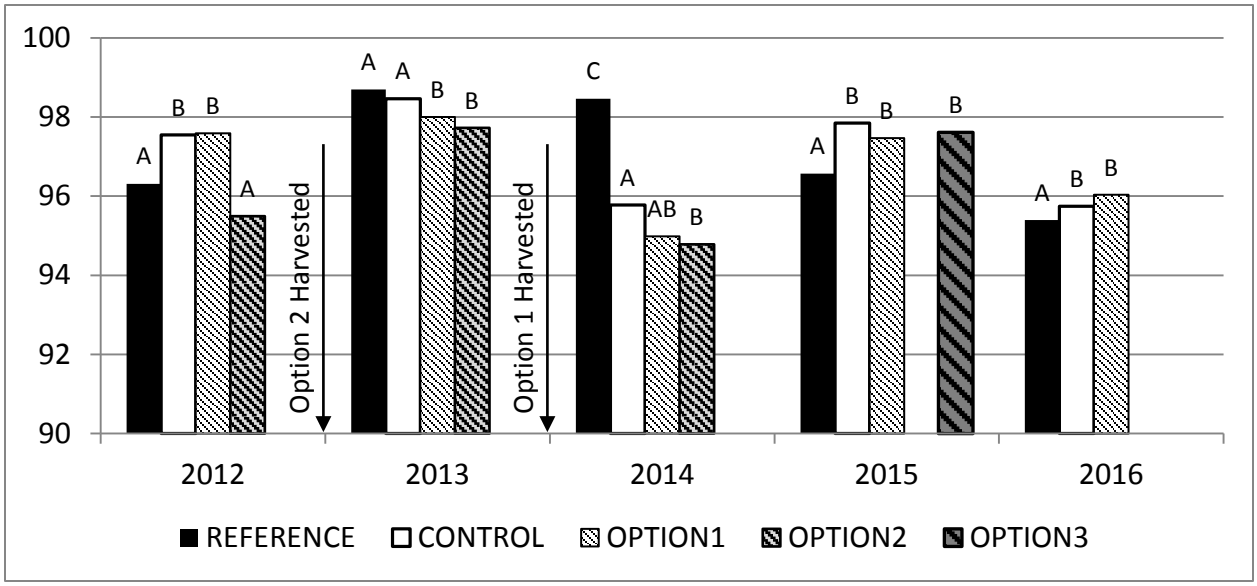


Figure 3. Mean hourly percent humidity from mid-July through August by treatment and year in the Hiawatha National Forest. Within a given year, treatments having the same label were not significantly different.

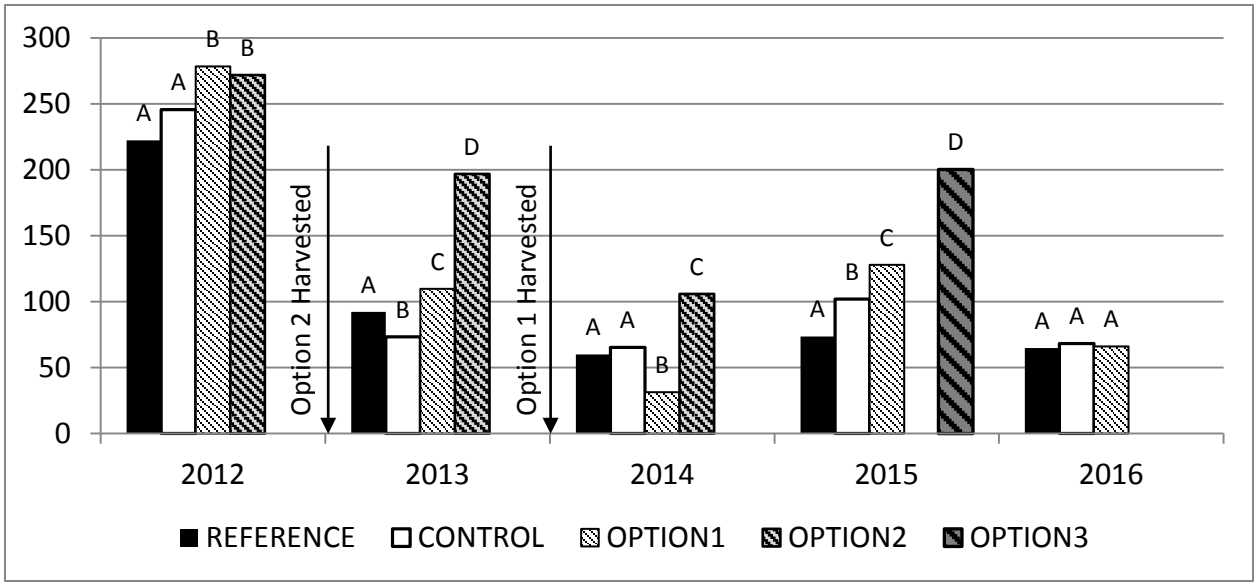


Figure 4. Mean hourly average light intensity (lum/ft^2) from mid-July through August by treatment and year in the Hiawatha National Forest. Within a given year, treatments having the same label were not significantly different.

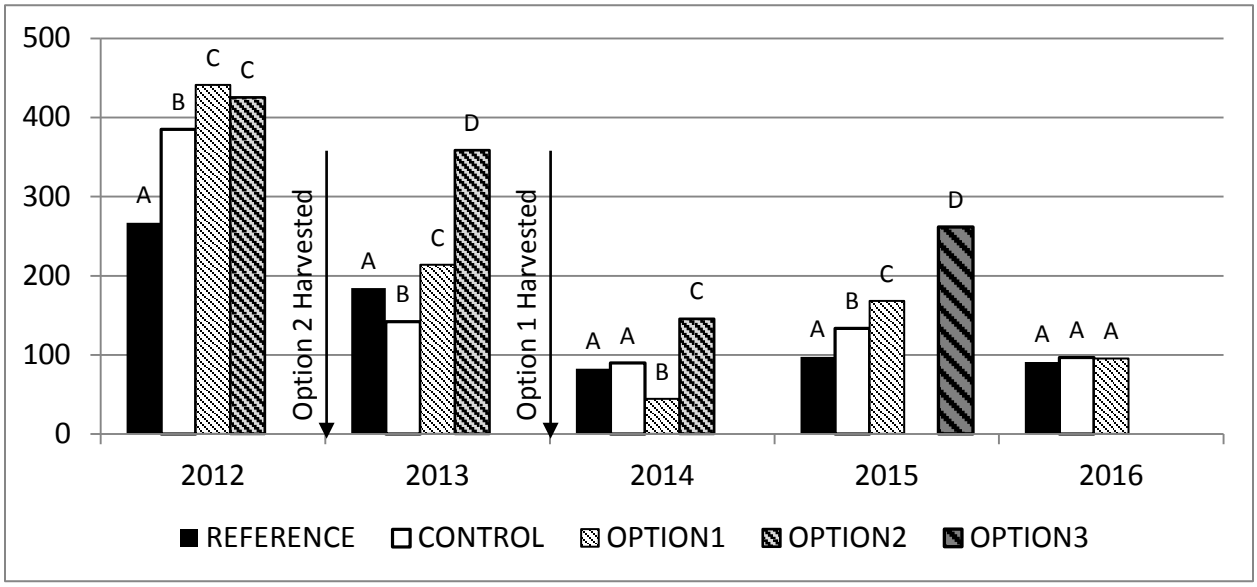


Figure 5. Mean hourly maximum light intensity (lum/ft^2) from mid-July through August by treatment and year in the Hiawatha National Forest. Within a given year, treatments having the same label were not significantly different.

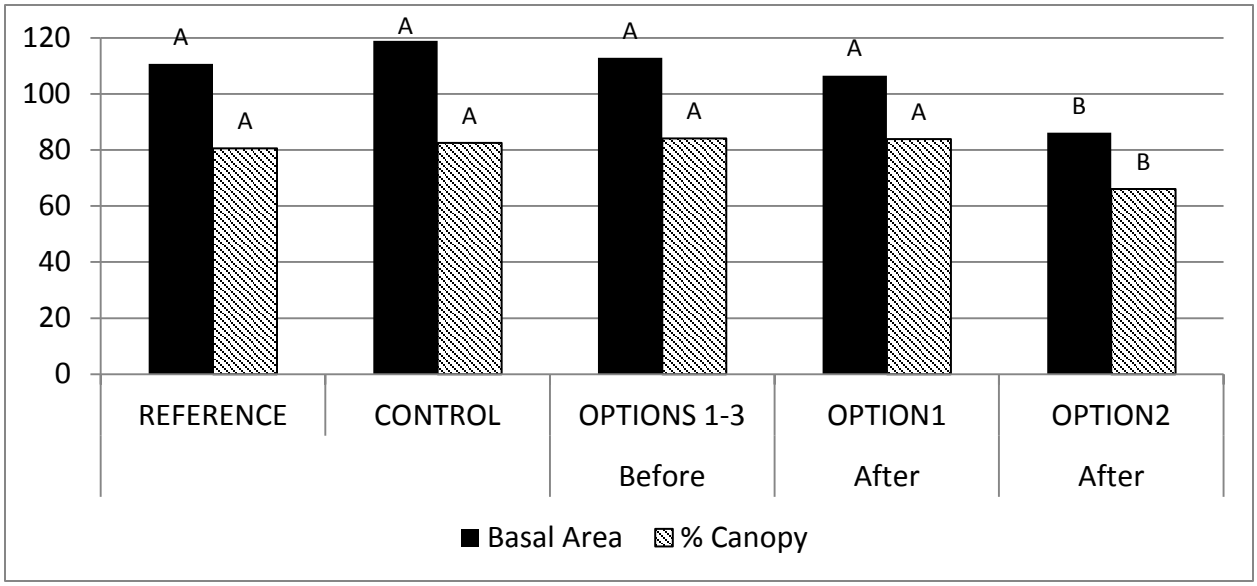


Figure 6. Mean basal area (ft^2/acre) and percent canopy cover by treatment and before and after harvest in the Hiawatha National Forest. For a given variable, means having the same label were not significantly different.

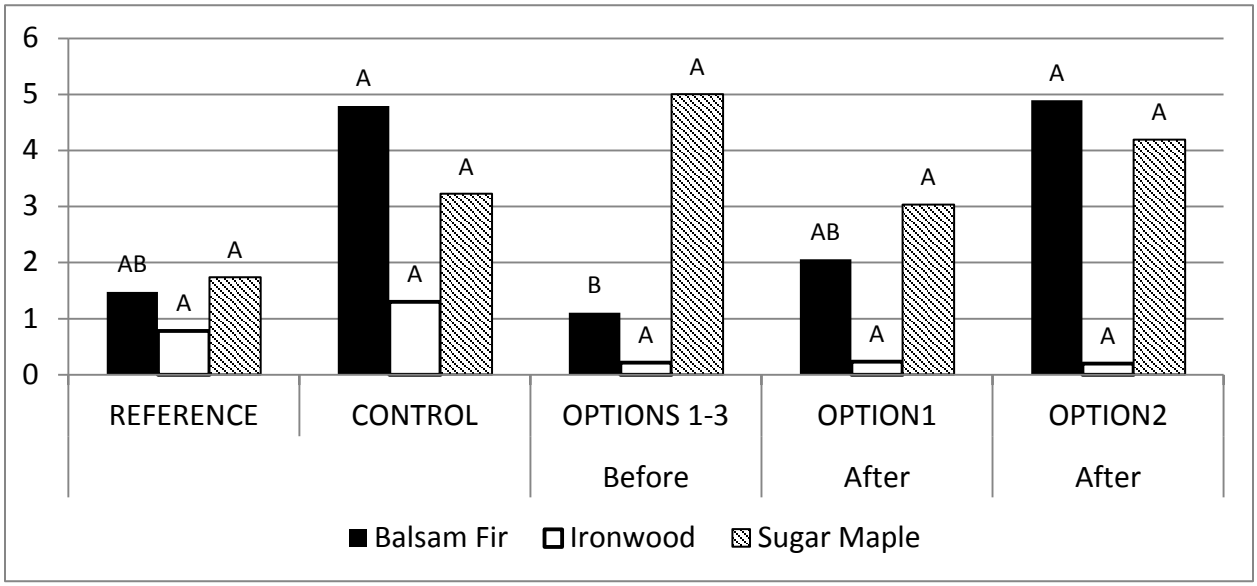


Figure 7. Mean subcanopy density (number/0.1 acre, 11.3-m radius plot) for the three most common species by treatment and before and after harvest in the Hiawatha National Forest. For a given species, means having the same label were not significantly different.

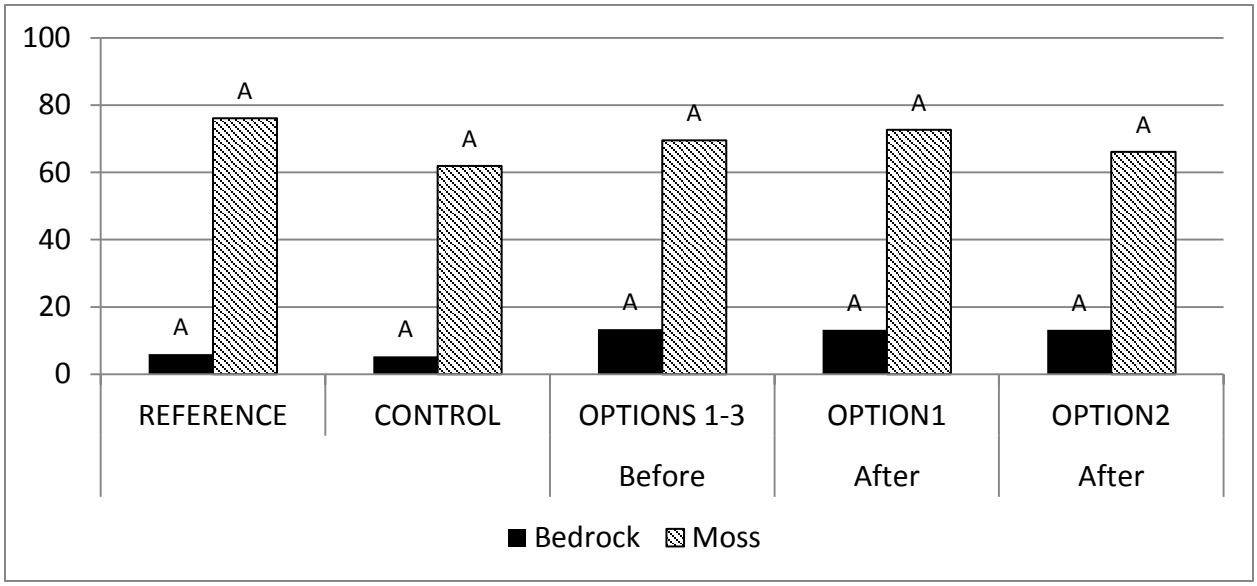
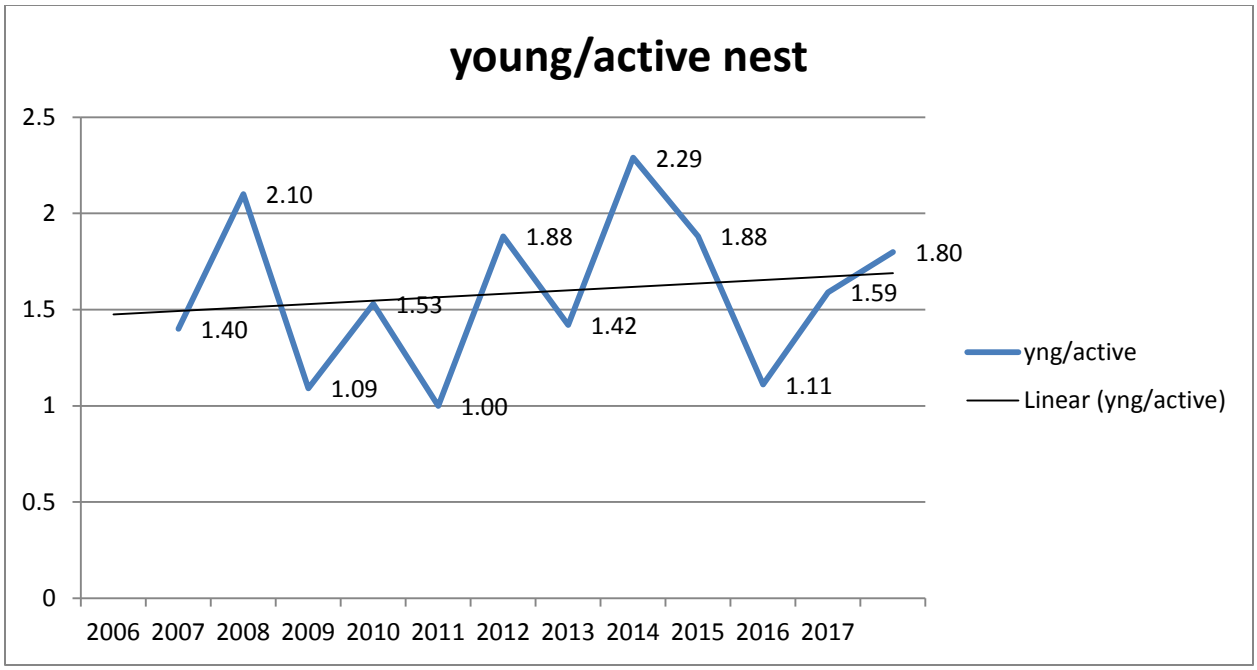
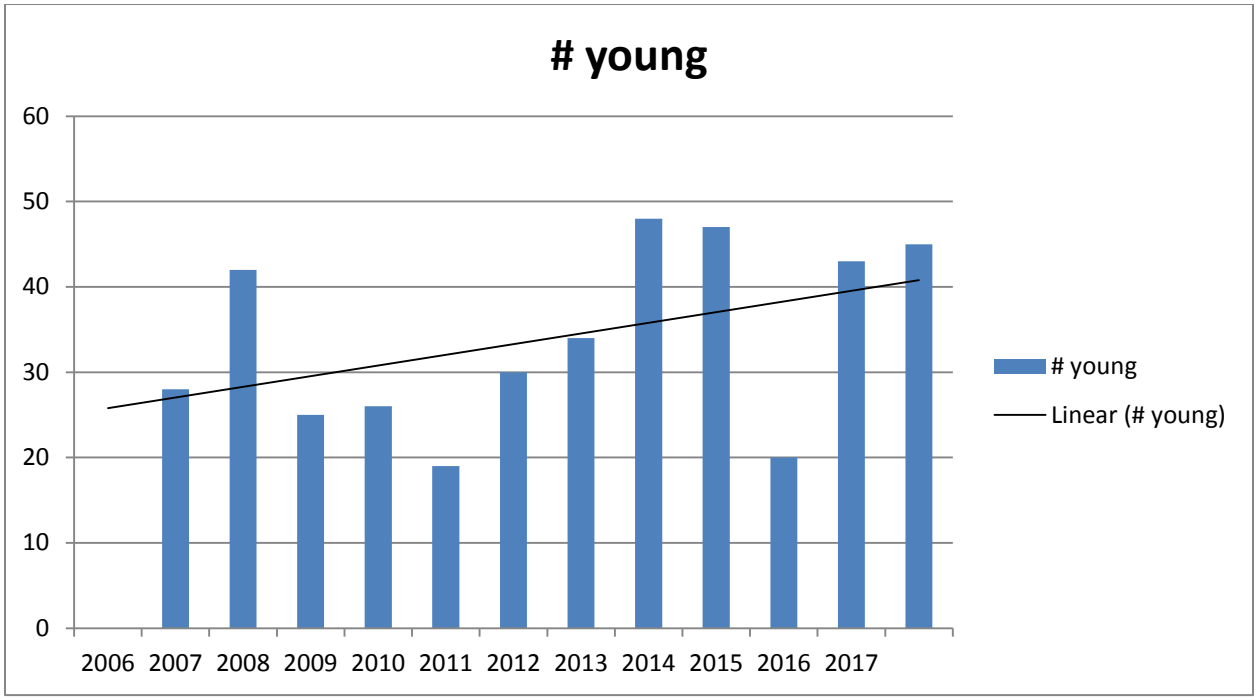


Figure 8. Mean percent cover of bedrock and moss by treatment and before and after harvest in the Hiawatha National Forest. For a given variable, means having the same label were not significantly different.

Appendix II.

Red-shouldered Hawk productivity on the East Unit of the Hiawatha National Forest, 2006-2017.


young/active nest
2.5
2
1.5
1
0.5
0
2.10
2.29
1.88
1.88
1.80
1.59
1.40
1.53
1.42
1.09
1.00
1.11
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
yng/active
Linear (yng/active)


young
60
50
40
30
20
10
0
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
young
Linear (# young)