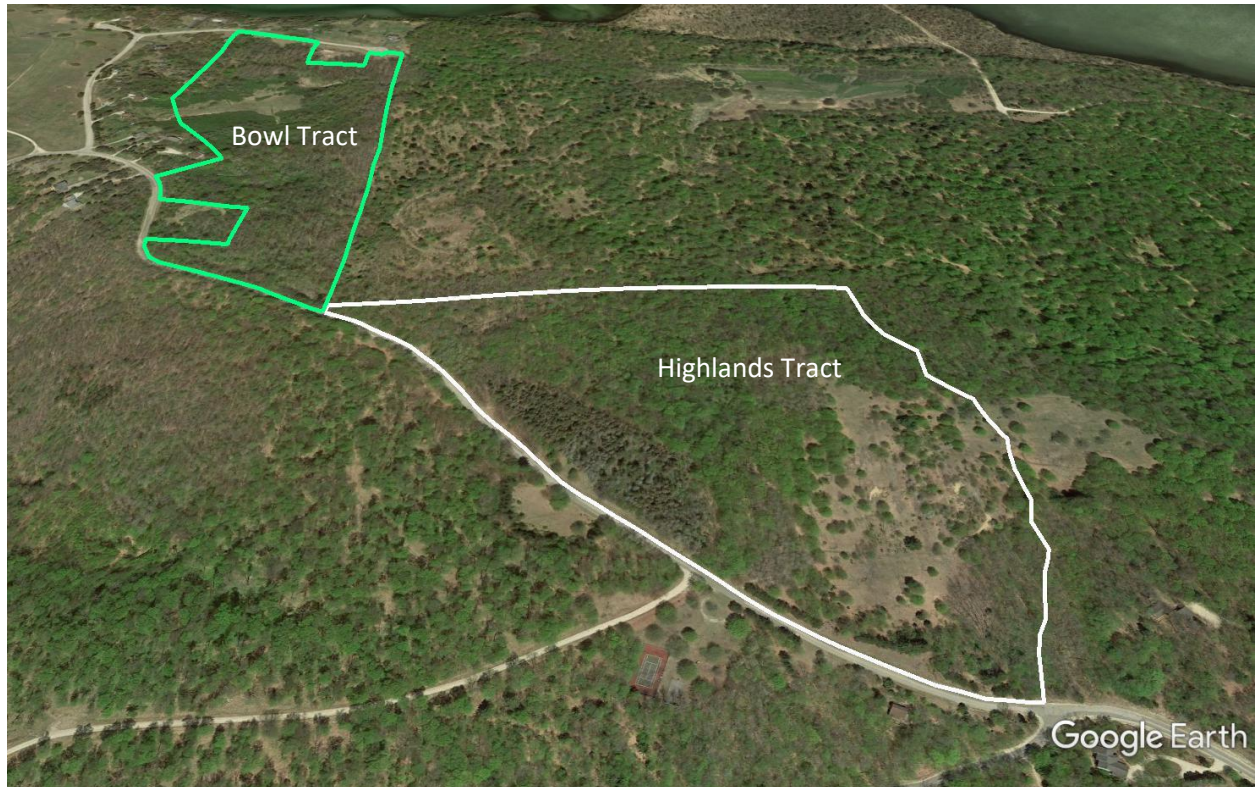


Land Stewardship Plan for Crystal Highlands Association



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Introduction

Goals for the Crystal Highlands Association Highland and Bowl Tracts

The Association has six primary goals for the Highlands and Bowl Tracts; 1) maintain and enhance open meadow space, 2) manage/eliminate problem invasive plant species, especially in the meadows, 3) ensure safe and passable trails, 4) enhance wildlife while discouraging deer overpopulation and bear presence, 5) reduce potential for forest fires, and 6) sustain and enhance biodiversity.

General Property Description

The Highlands and Bowl Tracts of the Crystal Highlands Association are located approximately 5 miles northwest of Beulah, MI (Figure 1). The Highlands Tract is 41 acres in size with about 70% in deciduous forest, 20% in old orchard/field, and 10% in a dying Douglas fir plantation (Figure 2). The 28 acre Bowl Tract includes a small field but is predominantly a mix of deciduous forest and shrubs of invasive honeysuckle with scattered autumn olive (Figure 3). The Bowl Tract is under Conservation Easement with the Grand Traverse Regional Land Conservancy (Appendix 1).



Figure 1. The Highlands and Bowl Tracts are located northwest of Beulah, MI.

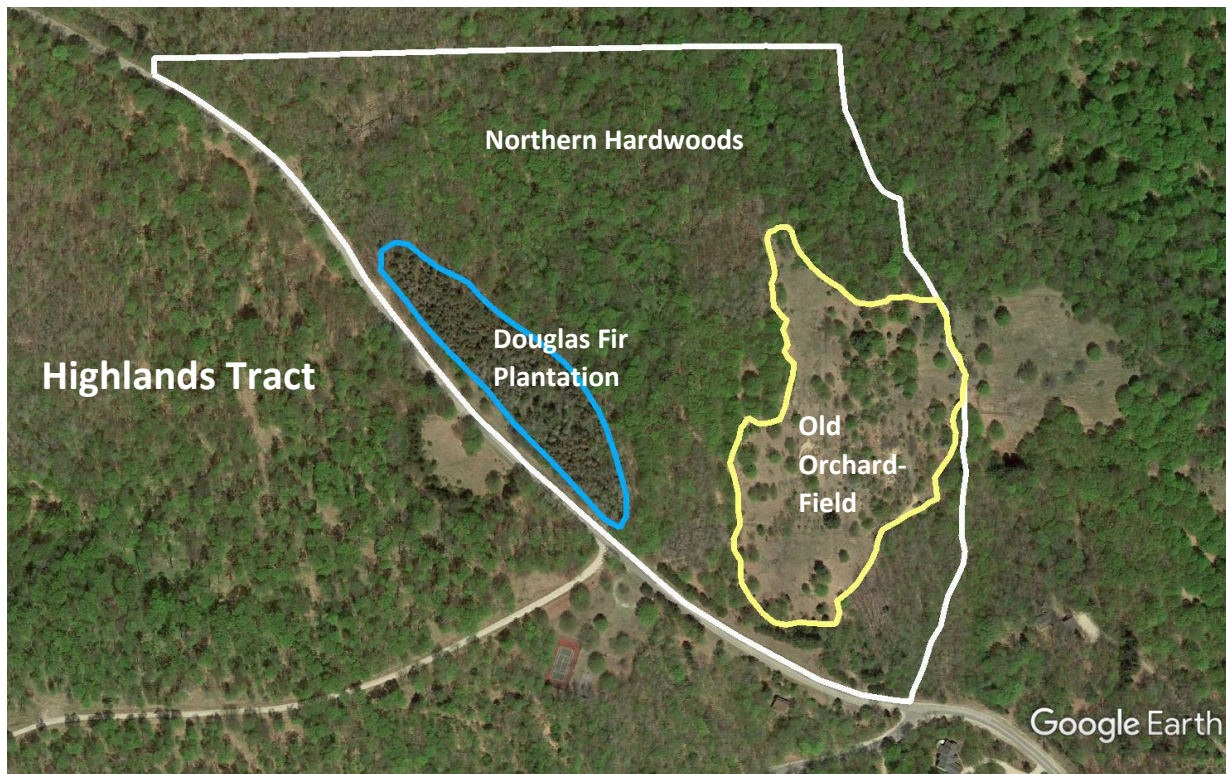


Figure 2. The Highlands Tract (outlined in white) consists predominantly of deciduous forest with old orchard/field (in yellow) and a dying Douglas fir plantation (in blue).

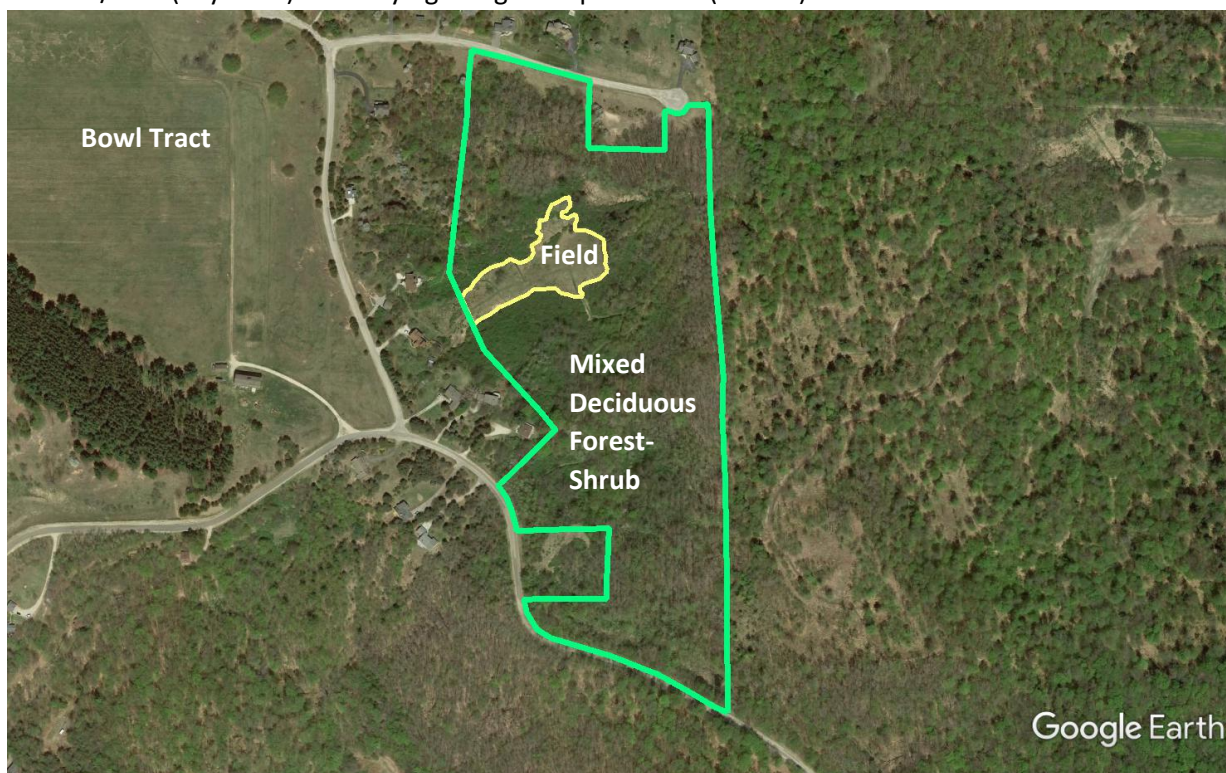


Figure 3. The Bowl Tract (outline in green) consists of a mix of deciduous forest and shrubs of invasive honeysuckle with a small field (in yellow).

Both Tracts fall within the Betsie-Platte sub-basin (HUC 8 04060104) with all of the Bowl Tract and most of the Highlands Tract falling within the Platte Lake-Platte River sub-watershed (HUC 12 040601040206). The Bowl Tract tends to drain to the east (Figure 4) and the northern portion of the Highlands Tract to the northwest (Figure 5) and north (Figure 6). The southernmost boundary of Highlands Tract falls within the Crystal Lake Outlet sub-watershed (HUC 12 04060104305) and drains toward the south (Figure 6). Both tracts are at the top of their perspective watersheds.

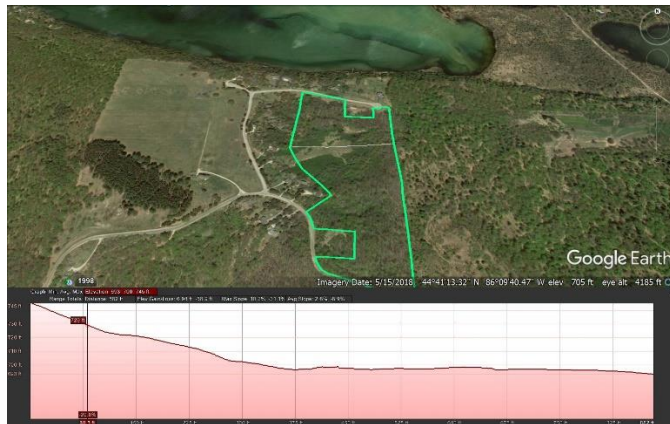


Figure 4. Elevation profile running from west to east for the Bowl Tract.

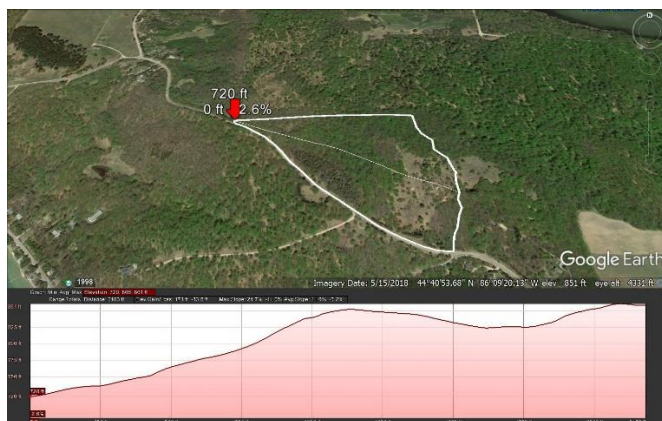


Figure 5. Elevation profile for the Highlands Tract running from the northwest to southeast.

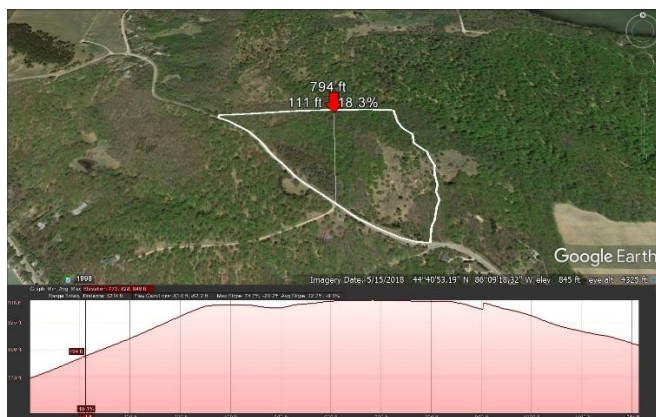


Figure 6. Elevation profile for the Highlands Tract running from north to south.

Planning Process

Representatives of the Crystal Highlands Association met with the Plan Writer during the spring and summer of 2019. Multiple field visits in the spring, summer, and fall were conducted by members of the Association and the Plan Writer. A draft plan was submitted to the Advisory Board for their review prior to submission to the Association, the USDA Natural Resource Conservation Service, and the Grand Traverse Regional Land Conservancy.

Stand Assessment Method

The Plan Writer first compiled information on property boundaries (coverage provided by Crystal Highlands Association), soil types, and vegetative cover types. Basic field assessment data was collected by visual and quantitative surveys on multiple occasions in the summer and fall. Vegetative sampling was conducted in the fall, sampling both over and understory species. Point and fixed area plots were used to gain a rough estimate of forest density, vegetative species composition, diameter distribution, and dead down woody debris for the Highlands Tract only. Other observational data included: insect and disease issues, presence or absence of invasive species, and occurrence of wildlife and their habitats.

Resource Descriptions

Geology

The Highland and Bowl Tracts are located atop the hills on the north shore of Crystal Lake. The topography is hilly consisting of moraines, terraces, and outwash plains.

Soils

The three primary soil types found within the Highlands Tract are Fern-Spinks sands on 6-12% slopes found predominantly in the old orchard/field and Fogg-Benzonia sands and the Molineaux-Remus complex on 18-35% slopes in the forest (Table 1, Figure 7). The three predominant soils types found within the Bowl Tract are the Milnichol fine sands on 0-4% slopes in the low lying areas and the Molineaux-Remus complex on 18-35% slopes and the Spinks-Tekenink sandy substratum complex on 35-50% slopes in the forested and open areas (Figure 7, Table 1). For a detailed soils map and a complete description of each soil type see Appendix 2.

The parent materials for the Fern-Spinks and Fogg-Benzonia sands and the Spinks-Tekenink sandy substratum complex and Molineaux-Remus complex are derived from sandy glacialfluvial deposits associated with moraines. These soil types are well-drained and comprise the majority of the forested and open areas. The Milnichol fine sand parent material is sandy glacial fluvial deposits associated with glacial outwash and lake plains. This soil type is somewhat poorly drained and is found in the low-lying and frequently wet areas of the Bowl Tract.

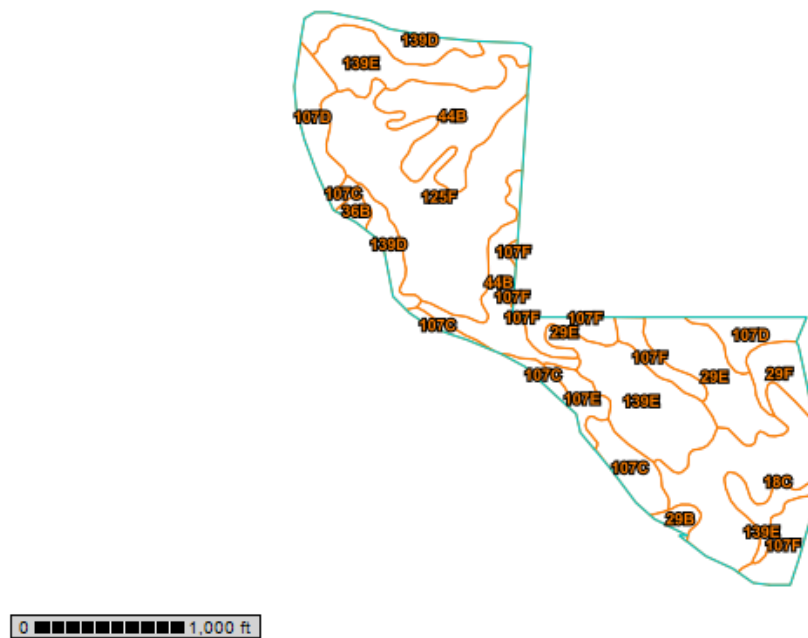


Figure 7. Soils map of the Area of Interest which encompasses both the Bowl and Highlands Tracts of the Crystal Highlands Association (Soil Survey Staff, Natural Resources Conservation Service, and United States Department of Agriculture. Web Soil Survey. Available online at <https://websoilsurvey.sc.egov.usda.gov/>).

Table 1. Soil types found in the Area of Interest (AOI) which includes the Highlands and Bowl Tracts, Crystal Highlands Association, Benzie County (Soil Survey Staff, Natural Resources Conservation Service, and United States Department of Agriculture. Web Soil Survey. Available online at <https://websoilsurvey.sc.egov.usda.gov/>).

Map Unit Symbol	Map Unit Name	Percent Slope	Acres in AOI*	Percent of AOI*
18C	Fern-Spinks sands	6-12%	13.1	11.4%
29B	Fogg-Benzonia sands	0-6%	0.9	0.8%
29E	Fogg-Benzonia sands	18-35%	9.9	8.7%
29F	Fogg-Benzonia sands	35-50%	3.1	2.7%
36B	Fern-Remus complex	0-6%	0.7	0.6%
44B	Milnichol fine sand	0-4%	15.5	13.5%
107C	Benzonia sand	6-12%	5.5	4.8%
107D	Benzonia sand	12-18%	7.0	6.1%
107E	Benzonia sand	18-35%	2.0	1.8%
107F	Benzonia sand	35-50%	5.8	5.0%
125F	Spinks-Tekenink, sandy substratum complex	35-50%	23.8	20.8%
139D	Mollineaux-Remus complex	12-18%	6.1	5.3%
139E	Mollineaux-Remus complex	18-35%	21.1	18.4%
Totals for Area of Interest			114.6	100.0%

*AOI = Area of Interest

Highland Tract Cover Types

The forest comprising the Highland Tract is inherently diverse and is classified as Northern Hardwoods (Figures 2, 8, and 9). The predominant tree species was sugar maple with scattered American beech, big-tooth aspen, basswood, black cherry, northern red oak, and paper birch. Few eastern hemlock trees were observed in the stand. Sugar maple, American beech, and basswood are shade tolerant species while black cherry, northern red oak, and paper birch are shade intolerant. The presence of these shade intolerant species is indicative of past disturbances large enough to allow sunlight to reach the forest floor to enable their regeneration. This could occur through natural disturbance such as wind-throw events, the succession of open habitats to forest, or by past logging activities. The second most dominant tree species in the stand had been white ash. It is assumed that all of the ash trees observed within the plots were killed by the Emerald Ash Borer. The dead ash trees were still standing as snags, hung-up in other trees, or on the ground. Beech-bark disease was present within the stand but many of the affected trees still appeared vigorous. There was no evidence of oak wilt within the stand.



Figure 8. Northern Hardwoods with numerous dead ash. Figure 9. Aspen, indicative of a forest opening.

Regeneration was limited within the stand. The few seedling tree species recorded included sugar maple, ironwood, and American beech. There are two factors which limited regeneration; closed canopy conditions allowing little light to the forest floor and an abundant white-tailed deer population. Deer and deer browse were evident throughout the tract (Figure 10). With the demise of the white ash there are many large and small canopy gaps forming throughout the stand. These openings should allow enough light to reach the forest floor to stimulate regeneration. This regeneration, unless protected will be hindered by the deer.



Figure 10. Browse impacts of deer within the hardwoods.

The other forested area in the Highlands Tract is a Douglas fir plantation (Figure 2). It was most likely established for Christmas trees but has since succumb to disease and/or insects and now the pole size trees are mostly dead (Figure 11).



Figure 11. Dead and dying Douglas fir plantation in the Highland Tract.

The open area in the Highland Tract is a mix of grasses, forbs, trees, and shrubs (Figures 2 and 12). It was most likely once an orchard as there are remnant apple trees and terracing on the steeper slopes. Today it is mostly open field succeeding to forest with a scattered and diverse mix of maple, white pine, aspen, oak, cherry, beech, and serviceberry (Figure 13). Shrub species include staghorn sumac and invasive autumn olive and honeysuckle.



Figure 12. Old Orchard-Field, Highland Tract. Note the deer browse line on trees.



Figure 13. The Old Orchard-Field as it appeared in 1998 and in 2018. Note the grid like pattern on the ground. This is indicative of orchards in the area. Succession to forest is happening both along the edge and interior of the field.

Bowl Tract Cover Types

The forested areas of the Bowl Tract are quite different from the Highlands Tract. The Highlands Tract consists of mature Mesic Northern Hardwoods while the Bowl Tract is a mix of types dependent on site conditions and time since disturbance (Figure 3). Patches of mature Mesic Northern Hardwoods can be found on the higher sites that are better drained while the mid and lower slopes are a mix of younger stands of maple, aspen, ash, black cherry, white birch, basswood, and white pine (Figures 14 and 15). Unlike the Highland Tract, the Bowl Tract is heavily impacted by invasive honeysuckle which fills the understory and most every drainage. There are many ash still alive on the Bowl Tract. Unfortunately, as they are killed by the Emerald Ash Borer the canopy will open even further allowing the honeysuckle to flourish (Figure 16 and 17).

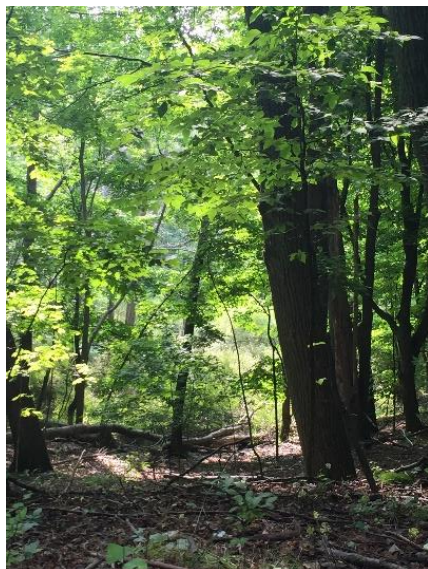


Figure 14. Mature Mesic Northern Hardwood.



Figure 15. Young stand of mixed deciduous trees.



Figure 16. Young ash over-topping honeysuckle. Figure 17. Dead ash no longer shades out honeysuckle.

The Field in the Bowl Tract has been actively maintained over the years and consists of grasses and forbs (Figure 3). There is an abrupt edge between the field and the honeysuckle (Figure 18). It is here where the impact of the honeysuckle is most apparent.



Figure 18. Abrupt edge between the field and the honeysuckle, Bowl Tract.

Water

There are no water features in the Highland Tract, however, the Bowl Tract has multiple water features. There is a small pond and watercourse in the southeast corner of the Bowl Tract near where the two tracts come together (Figure 3 and 19). There is a spring, intermittent watercourses, and a small marsh in and adjoining the field at the northern portion of the tract (Figures 3, 20, and 21).



Figure 19. Pond.



Figure 20. Intermittent stream.



Figure 21. Small marsh.

Wetlands

The Michigan Department of Environmental Quality (DEQ) Wetlands Map Viewer (www.mcgi.state.mi.us/wetlands), indicates that there are no designated wetlands within either the Bowl or Highland Tracts. However, because there is a pond, watercourse, small marsh, and intermittent streams any management activities near or adjacent to these features should follow the Michigan Department of Natural Resources “Sustainable Soil and Water Quality Practices on Forest Land” (https://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf).

Threatened and Endangered Species

A search of the Michigan Natural Features County Element Database resulted in the following list of special status species for Benzie County (Table 2). Potential habitat for 10 special status species exists within the ownership (shaded species in Table 2). One state threatened species, the red-shouldered hawk was found on the property. A hawk was heard near the pond during the active breeding season. Aquatic habitat in close proximity to mature forest is the preferred habitat for this hawk (<https://mnfi.anr.msu.edu/species/description/10942/Red-shouldered-hawk>).

Table 2. Special status species known to occur in Benzie County (source: <https://mnfi.anr.msu.edu/resources/county-element-data>).

Scientific Name	Common Name	Federal Status	State Status	Potential Habitat Occurring within the Tracts
<i>Accipiter gentilis</i>	Northern goshawk		Special Concern	Yes, forested habitats
<i>Alasmidonta viridis</i>	Slippershell		Threatened	No
<i>Ammodramus savannarum</i>	Grasshopper sparrow		Special Concern	Yes, fields
<i>Berula erecta</i>	Cut-leaved water parsnip		Threatened	No
<i>Bombus affinis</i>	Rusty-patched bumble bee	Listed Endangered	Special Concern	Yes, habitat generalist, over winters in rotten wood
<i>Bombus auricomus</i>	Black and gold bumble bee		Special Concern	Unknown, as nothing is known about habitat requirements in Michigan
<i>Bombus pensylvanicus</i>	American bumble bee		Special Concern	Unknown, as nothing is known about habitat requirements in Michigan
<i>Botrychium campestre</i>	Dunewort		Threatened	No
<i>Buteo lineatus</i>	Red-shouldered hawk		Threatened	Yes, present in area

Scientific Name	Common Name	Federal Status	State Status	Potential Habitat Occurring within the Tracts
<i>Calypso bulbosa</i>	Fairy-slipper		Threatened	No
<i>Charadrius melodus</i>	Piping plover	Listed Endangered	Endangered	No
<i>Cirsium pitcher</i>	Pitcher's thistle	Listed Threatened	Threatened	No
<i>Cistothorus palustris</i>	Marsh wren		Special Concern	No
<i>Coregonus artedi</i>	Cisco		Threatened	No
<i>Cygnus buccinators</i>	Trumpeter swan		Threatened	No
<i>Cypripedium arietinum</i>	Ram's head lady's slipper		Threatened	No
<i>Elliptio complanata</i>	Eastern elliptio		Special Concern	No
<i>Emydoidea blandingii</i>	Blanding's turtle		Special Concern	Yes, possibly the pond in the Bowl Tract
<i>Gavia immer</i>	Common loon		Threatened	No
<i>Glyptemys insculpta</i>	Wood turtle		Special Concern	No
<i>Haliaeetus leucocephalus</i>	Bald eagle		Special Concern	No
<i>Ixobrychus exilis</i>	Least bittern		Threatened	No
<i>Lanius ludovicianus migrans</i>	Migrant loggerhead shrike		Endangered	Yes, fields with shrubs
<i>Lasmigona compressa</i>	Creek heelsplitter		Special Concern	Unknown as nothing is known about its habitat requirements in Michigan
<i>Lasmigona costata</i>	Flutedshell		Special Concern	No
<i>Ligumia nasuta</i>	Eastern pondmussel		Endangered	No
<i>Ligumia recta</i>	Black sandshell		Endangered	No
<i>Microtus pinetorum</i>	Woodland vole		Special Concern	Yes, forests
<i>Mimulus michiganensis</i>	MI monkey flower	Listed Endangered	Endangered	No
<i>Opheodrys vernalis</i>	Smooth green snake		Special Concern	Yes, fields and forest
<i>Orobancha fasciculata</i>	Broomrape		Threatened	No
<i>Panax quinquefolius</i>	Ginseng		Threatened	Yes, forests
<i>Pandion haliaetus</i>	Osprey		Special Concern	No
<i>Physella magnalacustris</i>	Great Lakes physa		Special Concern	No
<i>Physella parkeri</i>	Broadshoulder physa		Threatened	No
<i>Pyganodon lacustris</i>	Lake floater		Special Concern	No
<i>Setophaga discolor</i>	Prairie warbler		Endangered	No
<i>Sistrurus catenatus</i>	Eastern massasauga	Listed Threatened	Special Concern	No
<i>Stenelmis douglasensis</i>	Douglas stenelmis riffle beetle		Special Concern	No
<i>Terrapene carolina carolina</i>	Eastern box turtle		Special Concern	Yes, fields and forest
<i>Toxolasma parvum</i>	Lilliput		Endangered	No
<i>Trimerotropis huroniana</i>	Lake Huron locust		Threatened	No

Wildlife Habitat

The habitats found within the Highland and Bowl Tracts are inherently diverse in both vegetative species composition and structure. This vegetative diversity correlates with high wildlife habitat diversity. In addition, the stands contain a variety of structural habitat features which contribute to the overall quality of the habitat for wildlife. These include; significant dead down woody debris, snags, living cavity trees, a large tree component, canopy gap openings, and mast producing species (examples; service berry, oak, and black cherry). The Bowl Tract also has multiple water features. Water adjacent to undeveloped forest is beneficial to wildlife.

Of the 399 vertebrate wildlife species found in Michigan, 297 are found in Benzie County. Of this, Northern Hardwoods (Sapling, Pole, Small Saw, and Large Saw size classes) provide habitat for 112 species (MIWILD analysis, Appendix 3a). Herbaceous and brushy habitats provide habitat for 141 species (MIWILD analysis, Appendix 3b). Structural features within stands that are important to wildlife

include: living cavity trees (20 wildlife species), dead cavity trees (15 wildlife species), snags (20 wildlife species), dead down woody debris (32 wildlife species), canopy openings (15 wildlife species), and vernal pools (7 wildlife species) (MIWILD analysis, Appendix 3c).

Wildlife recorded within the Tracts on two brief visits include: red-shouldered hawk, scarlet tanager, winter wren, eastern wood pewee, hermit thrush, red-eyed vireo, American redstart, black squirrels, raccoons, black bear, and multiple white-tailed deer.

Unique Natural Sites

The state element ranking for the Mesic Northern Hardwoods forest type is S3. The S3 ranking is defined as “Vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation”

(<https://mnfi.anr.msu.edu/reports/MNFI-Report-2007-21.pdf>). The Mesic Northern Hardwood type has been negatively impacted by logging and overabundant deer populations. Past and current logging practices and high deer densities have direct and indirect effects on stand structure and vegetative species composition including the presence of invasive species. These combined factors have resulted in a loss of vertical structure (i.e. layers within the stand) and a reduction in plant species diversity, including the loss of conifers. For example, an old growth Northern Hardwood stand at low deer densities has a variety of plant species including herbaceous plants, as well as trees of all size classes (seedlings, saplings, poles, sawlogs) and shade tolerance/intolerance (Figure 22). For a complete discussion see the Michigan Natural Features Mesic Northern Hardwoods Abstract and the deer herbivory papers in Appendix 4.



Figure 22. Old growth Northern Hardwoods in the McCormick Wilderness, Michigan. Note ample vertical structure and the variety on plant species including eastern hemlock.

Landscape Considerations

Prior to European settlement, Benzie County was predominantly forested and the most extensive forest type was Northern Hardwoods (see GLO survey Appendix 5). Logging began around 1875 and the majority of the communities that exist today had their beginnings as logging towns. For a complete and insightful discussion of Benzie County logging history and early forest conditions see the paper by William and Edith Overlease (Appendix 5).

The remaining forested habitats in Benzie County are reduced and fragmented (Figure 23). However, the Highland and Bowl Tracts reside within a neighborhood that is still relatively forested and well connected with other forested stands in the area, including Sleeping Bear Dunes National Lakeshore. Larger expanses of contiguous forested habitat is beneficial to forest dwelling species and local biodiversity.

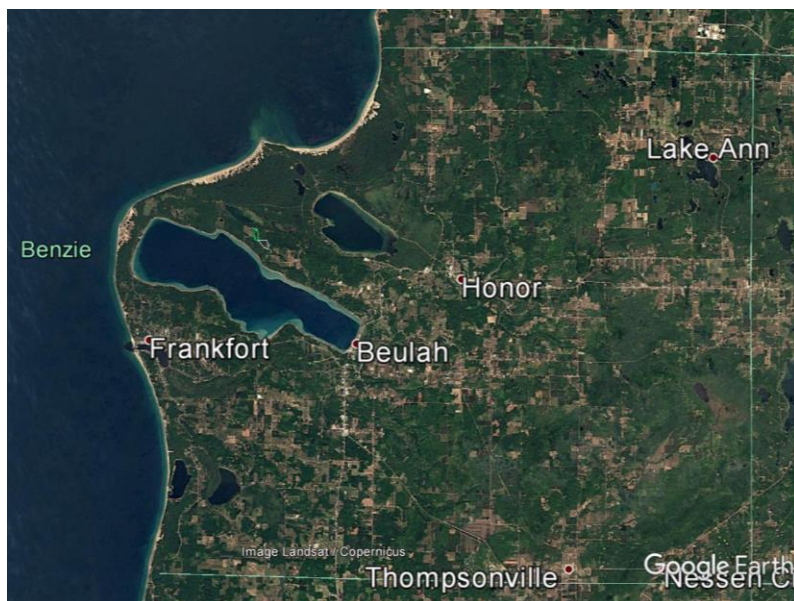


Figure 23. Benzie County Land Cover. Much of the remaining forests in (dark green) tend to be fragmented.

Pre-settlement hardwood forests had a greater proportion of conifer than we observe today. The conifer component is limited in part due to past logging practices and high deer densities (Figure 24). Eastern white pine and hemlock were selectively removed in logging operations, thereby removing any potential seed source. White pine and hemlock are also highly palatable to deer and without protection, are quickly and heavily browsed. This reduction of conifer in the landscape results in a loss of biodiversity. The forests of the Highland and Bowl Tracts play an important role in sustaining the biodiversity of the neighborhood.



Figure 24. Leaf-on and Leaf-off images of the neighborhood incorporating the Highland and Bowl Tracts. Conifer appears as dark green in the Leaf-off image.

The neighborhood incorporating the two tracts continues to change. The property adjoining the Highlands Tract to the north and the Bowl Tract to the east is being actively managed to promote white tailed deer. Even though it will remain predominantly forested (excluding food plots and woods roads), the increase in logging activities has opened up the canopy. This is done in hopes of stimulating regeneration for forage as well as a variety of size classes and tree species. Unless the owners strive to practice Quality Deer Management and reduce the overall herd size, any increase in the herd will further exasperate regeneration efforts in both the Highland and Bowl Tracts.

Invasive Species

Populations of non-native invasive species were found in both the Highland and Bowl Tracts. They include; honeysuckle, autumn olive, Scotch pine, garlic mustard, bull thistle, barberry, and spotted knapweed (Figure 25). The Highland Tract had the lowest density of invasive species. There are scattered patches of honeysuckle and autumn olive on the forest field edge and spotted knapweed and St. Johnswort in the disturbed sites within the Old Orchard-Field. Garlic mustard was found at multiple locations in the Highland Tract mostly along the trail by the Douglas fir plantation as well as scattered patches in the Northern Hardwoods along the northern edge of the tract. The Bowl Tract is exceedingly impacted by honeysuckle. A formal stand inventory could not be conducted due to the impenetrable thickets of honeysuckle and autumn olive. Scotch pine was also present in the Bowl Tract as scattered individuals around the base of the field and forest edge. Barberry was also found along Trail D just down from Highland Drive. The Invasive Species Specialist from the Benzie Conservation District could be consulted regarding methods of eradication. Population control of these invasive species should be conducted as soon as possible to prevent the spread and encroachment on native species.



Figure 25. Invasive species found include; garlic mustard, bull thistle, spotted knapweed, barberry, autumn olive, Scotch pine, St. Johnswort and honeysuckle.

Hazard Trees

Wind events are the primary natural disturbance regime in the Northern Hardwood forest. Small micro-bursts create canopy gaps fairly frequently while large, stand replacing events happen every 1,200-1,500 years (https://mnfi.anr.msu.edu/abstracts/ecology/Mesic_Northern_Forest.pdf, Appendix 4). The potential impact of a wind event on a stand is dependent in part on soil type and topographic position. The majority of the soil types comprising the two tracts are rated as having a “Slight” wind-throw potential (<https://websoilsurvey.sc.egov.usda.gov/>). Only the Milnichol Fine Sand was rated as “Moderate” by the Web Soil Survey. The Milnichol soil type is found in the low lying areas of the Bowl Tract (Figure 7). This type’s moderate rating is due in part to its fine structure and shallow depth to the water table. Despite the majority of the area having only a “Slight” rating, the evidence for wind-throw is great. This is due in part to the topographic position of the stands. Much of the Northern Hardwood stand in the Highland Tract is at the top of the ridge and exposed to wind events from many directions (Figures 5 and 6). The Bowl Tract is suitably named as it lies at a low topographic position and is less exposed to the wind (Figure 4). Past wind events are evident in the tree species composition of the Highland Tract. Throughout the stand there are patches of shade-intolerant trees such as big tooth aspen and northern red oak. Both require a fairly large opening in the canopy for establishment. Today, canopy gap formation is made by wind events coupled with ash mortality due to Emerald Ash Borer. The combined effect has created numerous gaps of various sizes through-out the stand. The numerous standing dead trees and those that are hung-up are regarded as Hazard Trees (Figure 26). The high mortality rates of the Douglas fir in the plantation is also a source of Hazard Trees.



Figure 26. White ash mortality from Emerald Ash Borer has left numerous dead and down and standing dead trees.

Aesthetic Quality

People respond positively to trees and other vegetation. Research indicates a direct link between visual quality and human health. People respond positively to natural versus urban landscapes. Within forested landscapes, they tend to prefer more open forest conditions with scattered large trees. Negative features include; many small trees, large amounts of dead and down woody debris, and a thick shrub understory. At times, human perceptions of visual quality may be at odds with the ecological

value of the stand. For instance, dead down woody debris is of significant value to wildlife and important in carbon retention and nutrient cycling.

The Highland and Bowl tracts are as diverse in visual quality elements as they are in stand structure and habitat types. This diversity is represented in a variety of forms, colors, and textures across a relatively short distance, which lends to high visual quality. Within stand features which contribute to high visual quality include: tree species diversity, canopy breaks, some open stand conditions, and a large tree component. The considerable dead and down woody debris has low visual value but high ecological value. The high invasive shrub component in the Bowl tract has a low value.

Management Recommendations

Goal 1) Maintain or enhance open meadow space.

Sustaining an open condition will require active management as the natural progression on these sites is to move to a forested condition (Figure 13). In the Highlands Tract, the Association should define just how much they want to open up the old orchard/field, understanding that the degree of openness is directly related to initial effort, expense, and maintenance. To clear, mow, and maintain the entire field may be cost and labor prohibitive as well as eliminating some plant species that are limited elsewhere on the ownership and have significant wildlife value (e.g. serviceberry). An alternative is to create viewing opportunities by clearing multiple aesthetically pleasing viewsheds (Figure 27). Creation and maintenance costs would be reduced as management would be confined to the viewshed. As with any management action that disturbs the soil, care should be taken to reduce the risk of invasive species. Disturbed sites could be seeded with an appropriate mix of native grasses and forbs available from the Benzie Conservation District. The field in the Bowl Tract is in good condition. Mowing appears to be suppressing the invading shrubs and should be continued.

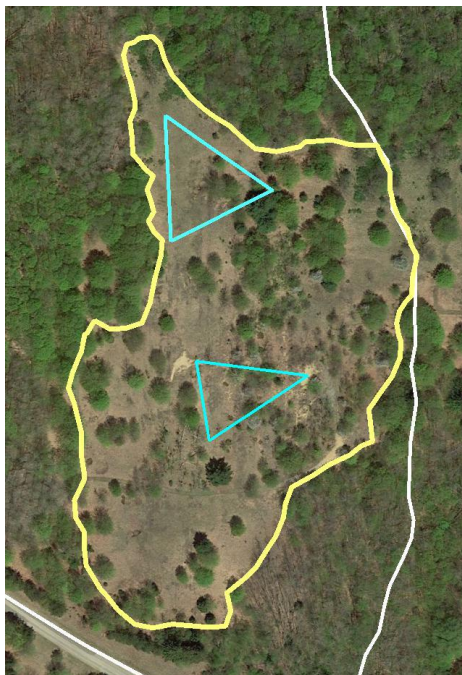


Figure 27. Example viewsheds that could be created in the Old Orchard/Field of the Highlands Tract.

Goal 2) Manage/eliminate problem invasive plant species, especially in the meadows.

Invasive species destroy native communities, disrupt ecosystem processes and are harmful to the environment. By far the most challenging invasive species issue is the honeysuckle infestation in the Bowl Tract. It is pervasive throughout the tract but is at its greatest impact and density adjoining the field (Figure 28). This site is significant as it drains to the east and has the potential to spread to the adjoining property. The Board consulted with Mr. Scott Hughey, Natural Resource Conservation Service regarding treatment. Mr. Hughey visited the site and suggested that the Association complete a Conservation Program Application to seek financial support for treating the site. Per the discussion, management would follow the mechanical removal method as outlined in the NRCS document on honeysuckle control (Appendix 6). The Board should consult further with the Mr. Hughey to discuss necessary planning documents, the application process, specific methods as they relate to site factors, costs, deliverables, and NRCS and landowner expectations. As this property is under Conservation Easement, the Grand Traverse Regional Land Conservancy should also be involved.

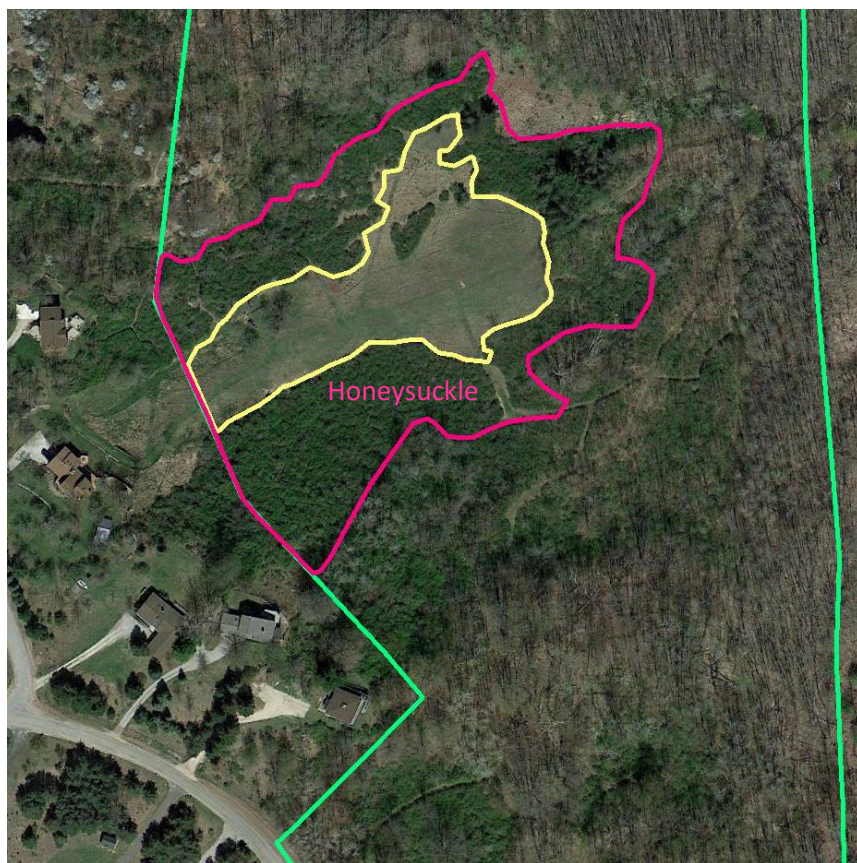


Figure 28. Extensive infestation of invasive honeysuckle in the Bowl Tract.

Smaller infestations of invasive species in the Bowl Tract include barberry on Trail D. Infestations in the Highland Tract are not as severe but include scattered populations of honeysuckle, autumn olive, and garlic mustard. Every attempt should be made to eradicate or control these populations before they expand. Protocol for eradicating these invasive species can be found in Appendix 6. The proper identification of invasive species is necessary prior to any attempt at removal.

Goal 3) Ensure safe and passable trails

Standing dead trees are valuable to wildlife but pose a hazard along trails. With the topographic position of the Highlands Tract, wind events will always be an issue, however, with the recent loss of white ash to the Emerald Ash Borer the number of dead trees has grown significantly. Removal of the dead trees through logging is not recommended. The dead trees have no merchantable value and removal of high value large diameter oak, cherry, and maple would be necessary to compensate logging costs. Additionally, much of the Highlands Tract is steeply sloped increasing the potential for site degradation (Figure 29). Options are limited but include hiring a tree removal service to come in and drop those individual trees that pose the greatest threat. Standing dead trees are extremely dangerous to cut and should only be felled by an experienced and insured professional. The last option is to simply wait and they will eventually fall on their own.



Figure 29. The steep slopes in the Highlands Tract limit logging operations.

Goal 4) Enhance wildlife while discouraging deer overpopulation and bear presence and Goal 6) Sustain and enhance biodiversity

These two goals will be address simultaneously as the methods for achieving them are the same. The Highland and Bowl Tracts are important from an ecological perspective because they are predominantly forested and reside within a fairly contiguous forested neighborhood which includes Sleeping Bear Dunes National Lakeshore. The forested stand within the Highland Tract consists of a mature mix of both shade tolerant and intolerant species. Mature stands of larger diameter trees are becoming increasingly rare in this landscape.

Aside from controlling invasive species, enhancing vegetative diversity into the tracts will benefit both wildlife and overall biodiversity. Two areas to focus on is the establishment of conifer within the deciduous stands and shade intolerant species in all stands, especially the Douglas fir plantation. What is noticeably lacking in the hardwood stand in the Highland Tract is a conifer component of eastern hemlock and white pine. There are a few individual hemlocks in the drainage by Trail Marker C but not much elsewhere within the stand. By increasing the conifer component in Northern Hardwoods,

researchers have found an increase in the diversity of forest songbirds. It does not take much conifer before those wildlife species typically associated with conifer habitats will use a deciduous stand. As conifer was once an integral component of these sites, reestablishment efforts should be made. This could be accomplished by planting and protecting white pine within the larger gaps created by the dead white ash. The planting of eastern hemlock is not encouraged at this time due to the Hemlock Woolly Adelgid, however, protecting existing hemlocks and hemlock seedlings is recommended. All planted seedlings must to be protected from browsing deer. Fairly inexpensive and DIY methods of protection include fencing individual trees (Figure 30), using the ample dead down woody debris to build barricades around seedlings, or for larger areas, fence the area by simply stringing fish-line at 1 foot spacing around T-posts (Figure 31).



Figure 30. Fenced white pine seedlings.



Figure 31. A fish-line fence protecting oak and aspen.

The larger canopy gaps within the stand as well as the Douglas fir plantation have the potential to regenerate shade intolerant species such as the northern red oak, black cherry, and big-tooth aspen. From both a wildlife and biodiversity aspect, efforts should be made to encourage these seedlings in all forested and non-forested stands. According to Tallamy's book "Bringing Nature Home; How You Can Sustain Wildlife with Native Plants" (2007) oaks support 534 Lepidoptera species, Cherry 456, and Poplars 368. Oak is a highly palatable species for deer and its mast is important to a variety of wildlife. Existing seedlings throughout the ownership that are browsed by deer should be protected (Figure 32).



Figure 32. Heavily browsed oak seedling in the Old Orchard/Field of the Highland Tract.

Not only do the Highland and Bowl tracts contribute to the stand level diversity of the neighborhood there is also considerable within stand diversity in the form of water features (Figure 33), mast producing plants (Figure 34), living and dead cavity trees, snags, and dead down woody debris. These are all unique features that contribute to wildlife and within stand diversity. The standing dead and dead down woody debris in the Northern Hardwoods may not be aesthetically pleasing but it does provide habitat for numerous wildlife species (Figure 35). In the absence of cavities, like in the open areas of both tracts, something as simple as a blue bird box would add an additional species as well as a visual attraction (Figure 36).



Figure 33. Turtle pond. Figure 34. Serviceberry. Figure 35. Red eft. Figure 36. Eastern blue bird.

Next to invasive species, an overabundance of white-tailed deer pose the greatest challenge. Deer impact plant diversity and structure and threaten any attempts at restoration. All management options have to consider deer. Efforts should be made to reduce the local herd by hunting and elimination of supplemental feeding. Feeding stations concentrate the herd. It is not healthy for the deer or the environment. Consider working with the Michigan Department of Natural Resources to see if it would be possible to increase the take in the area in hopes of creating better habitat for all wildlife. Black bears have exceedingly large home ranges and pose little threat to hikers. Like the deer, the best thing Association members can do to thwart bears is pull their bird feeders at night. Supplemental feeding draws bears into the area. Eliminate feeding and the problem goes away.

Goal 5) Reduce potential for forest fires

Contrary to what one might expect, the ample dead and down wood from the dead ash in the Northern Hardwood stand of the Highland Tract poses little threat to wildfire. Fire rotations within this type are more than 1,000 years and tend to occur only after broad-scale catastrophic windthrow. In their publication "Fire Return Intervals and Fire Cycles for Historic Fire Regimes in the Great Lakes Region", Dickman and Cleland refer to rich, mesic, late-successional hardwood stands as "asbestos" forests. The potential threat of wildfire is more closely linked to invasive species. More highly flammable plants include those that tend to produce dry leaves and twigs, dry leathery leaves, abundant dense foliage, and lots of dead leaves under the plant. Notable highly flammable species include Douglas fir and Japanese honeysuckle. Japanese honeysuckle does occur in Michigan, however the particular species of honeysuckle in the Bowl Tract has not been determined. The characteristics of more highly flammable plants listed above is characteristic of the existing honeysuckle and autumn olive found in

both tracts. To reduce the potential for forest fires, efforts should be made to eradicate these potential threats (see methods in Appendix 6). This is especially true near structures.

Additional Resources

Best Management Practices

Poor land management practices can degrade surface and ground water quality by increasing sedimentation, nutrient and chemical input, heat, and debris. Forest landowners and their agents and contractors are responsible for any damage to streams, lakes, and wetlands. Any land management activity in either tract should follow “Sustainable Soil and Water Quality Practices on Forest Land” (Best Management Practices –

https://www.michigan.gov/documents/dnr/IC4011_SustainableSoilAndWaterQualityPracticesOnForestLand_268417_7.pdf). The purpose of the manual is to provide specific guidance to the forest landowner on how to protect water quality, critical habitat, and aquatic resources when conducting forest management activities. Following these practices results in healthy forests and watersheds by preventing erosion, sedimentation, and soil compaction.

Invasive Species

Contact Emily Cook, Invasive Species Network Outreach Specialist (ecook@gtcrd.org, 231-941-0960 x20) or Katie Grzesiak, Invasive Species Network Coordinator (kgrzesiak@gtcd.org, 231-941-0960 x29) to discuss funding sources as well as a formal inventory and evaluation of invasive species within the tracts. Invasive species inventories should be conducted on an annual basis at the floristically appropriate time of the year.

Forest Health

Forest health is an issue of concern with Emerald Ash Borer and Beech Bark Disease already present within the stands. The stands should be monitored annually (during different seasons) for changes that may indicate additional insect or disease problems. The “Forest Health Highlights” publication on forest insects and diseases is updated annually and available at www.Michigan.gov/ForestHealth. An additional source of information is www.Michigan.gov/ExoticPests.

Deer Management

Contact Ashley Autenrieth, Deer Program Biologist, MDNR Wildlife Division, Gaylord Customer Service Center 989-732-3541 x5044

Steve Griffith, Wildlife Biologist, MDNR Wildlife Division, Traverse City Customer Service Center 231-922-6052

Summary Chart of Activities

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Monitoring

The successful implementation of this Land Stewardship Plan is dependent upon frequent monitoring by the Board. The Board members (or their agent) should walk the tracts at least annually to inspect the forests for changes and to evaluate the success of earlier management activities. All Land Stewardship Plans should be adaptable and flexible enough to accommodate changes in landowner goals or forest resources over a 10 year planning period. Please use the following table to record notes and make modifications to this plan as needed.

Updates and Modifications

Appendix 1. Conservation Easement between the Crystal Highlands Association and the Grand Traverse Regional Land Conservancy for the Bowl Tract.

See accompanying PDF

Appendix 2. Soil Map and Soil Map Unit descriptions for soils found in the Highlands and Bowl Tracts of the Crystal Highlands Association, Benzie County.

See accompanying PDFs

Appendix 3. Wildlife habitat associations from MIWILD for the habitat types found in the Highland and Bowl Tracts.

See accompanying PDFs

Appendix 4. Michigan Natural Features Inventory Abstract for Mesic Northern Hardwoods and Deer Herbivory Research Papers.

See accompanying PDFs

Appendix 5. Pre-settlement vegetation and forest history of Benzie County, MI papers.

See accompanying PDFs

Appendix 6. Control measures for invasive species, USDA Natural Resources Conservation Service Bulletins.

See accompanying PDFs

