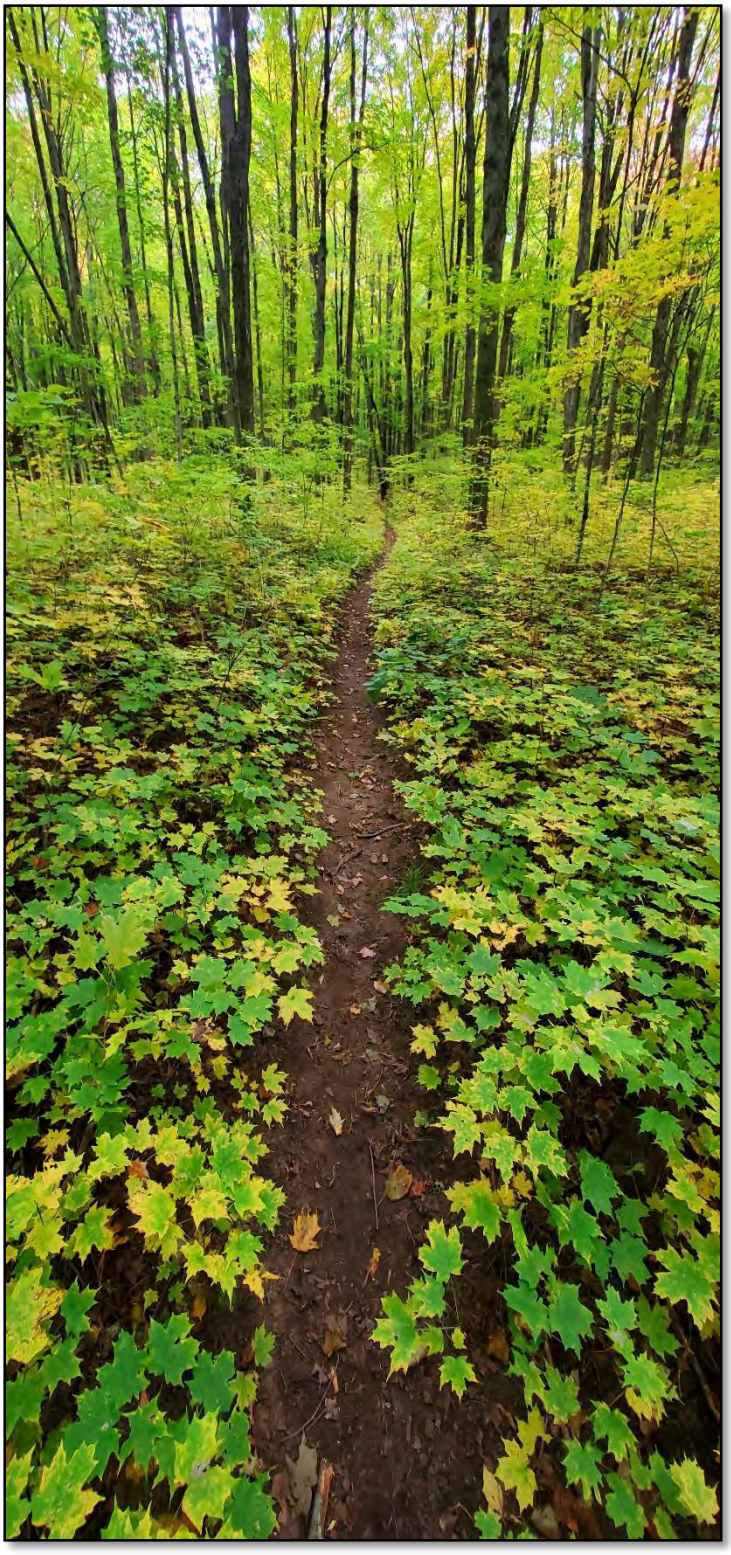

An Ecological Assessment of the Copeland Forest Trails

For

Copeland Forest Friends Association

By

David J. Hawke

November 09, 2022

CONTENTS

Figures and Tables.

Contract Agreement.

As per agreement between the Copeland Forest Friends Association and David J. Hawke an ecological impact assessment of the trails within Copeland Forest was conducted in July, August and September 2022; report compilation and presentations occurred in October.

Questions or clarifications of this report may be directed to David Hawke:

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Project Intent

Since the early 1980s trail building has been conducted by various user groups without holistic planning or approvals. These trails have been attached to the core network of forest access lanes previously built by the Copeland family for forest management purposes.

1. This report will supplement the Copeland Forest Friends Association's initiative to create a "trail plan" that looks both at current uses and the anticipated increase of use as more residential units are constructed nearby.

2. With the ever increasing use by various forest users, there is concern as to the sustainability and capacity limits of the current trail system in regards to ecological impact to the forest. This report may be used as a 'baseline' of ecological impact.

Note: while the original intent was to study just the single-track trails this project included all styles of trails, as the old double-track lanes have, in many places, become overgrown and may now be considered 'single track' in use and function.

Executive Summary

The Copeland Forest is a significant ecological site due to:

- its vastness (4,400 ac) which includes isolated and undisturbed forest interiors,
- its attachment to the Oro Moraine,
- three river systems that begin from the seepages found within this forest,
- being evaluated as a Provincially Significant Wetland (PSW),
- being recognized as being a provincial Area of Natural and Scientific Interest (ANSI),
- being home to several provincial and federal Species at Risk.

There are numerous recreational activities that take place within the property, all of which have some degree of impact on the natural ecology of the forest.

The current trail network within The Copeland Forest consists of 90 kilometres of a combination of single-track and double-track trails. This is an increase from the 75 km previously on record.

Attached to the Copeland Forest are an additional 6.5 km of access trails (e.g. Simcoe County Forest, Horseshoe Valley Resort, and private residential accesses). (See Photograph 14.) Proposed residential constructions adjacent to the Forest will see additional 'unplanned' access points.

The majority of trails have been constructed within the eastern half of the property, primarily on the steep valley slopes of the hardwood forests.

This assessment project found that while the overall health of the forest is good, trail development in the past and various trail uses have resulted in a few concerns:

Most common impacts of the trails are:

- compacted soil on the trail tread;
- increased and unchecked surface runoff of rain and meltwater;
- soil erosion on sloped sections;
- tree root exposure;
- forest fragmentation and the resultant isolation of wildlife species between trail sections;
- disturbance of wildlife by presence of humans, dogs and horses.

- disruption of wet seepage areas either by log corduroy bridges and/or horse hooves.

As a general statement, the author feels that the sloped/hardwood forest areas are already over-utilized; no additional trails should be constructed (including 'short cuts'). If trail remediation can be applied, these steep-sloped trail sections are in the most need.

The 'flat land' trails are wider spaced and overall are in good shape save for distribution of horse manure.

A shout out to the trail maintenance teams and the garlic mustard control teams… your work is well done!

See **Section H: Opinions and Suggestions** (page 26) for further comments regarding impacts of the trail system.

A complete set of the .kmz files (mapping) has been delivered to CFFA for their further use.

Section A. Execution of Project

A1. Methodology

Pre-visit considerations were based on:

- "Virginia's Copeland Forest Trail Map", 2019;
- the TrailForks cell phone app;
- the map of double track trails created by the Copeland Forest Friends Association;
- previous personal experiences of working within and visiting the forest;
- a map of garlic mustard locations provided by Margaret Kennedy (see Figure 7)

Hawke walked each of the trails (90 km of trails) making observations and notes of the impacts of existing trails.

Daily route and waypoints were recorded by hand-held Garmin GPSMAP 64x (3 metre accuracy) and later plotted using Google Earth Pro.

Observations are done on both sides of the trail for approximately 20 meters laterally.

Both single-track and double track trails were included, as some of the older double track (forest access roads) are filling in with shrubs from each side, thus giving appearance of single track.

Topics of observation included:

- Trail surface condition, including soil compaction, exposed tree roots, surface erosion (Photographs 1, 2, 5, 7, 11, 12);
- Hazards such as fallen trees (Photograph 4);
- Trail diversions/widening around wet spots, fallen trees (Photographs 2, 4 and 17);

- Man-made features including stone fences, jumps, log-overs, bridges/platforms and dug berms that were created using found materials (Photographs 6, 8, 9, 10, 13, 17, 18);

- Presence/absence of Species at Risk including wild ginseng, butternut trees, broad beech fern, golden-winged warblers, red-headed woodpeckers, red-shouldered hawk and others known to inhabit the Copeland Forest;

- Presence of Invasive Species including garlic mustard, yellow parsnip, Phragmites, periwinkle, European buckthorn as well as arrival of recent aggressive non-native plant species (Photographs 15, 16; Figure 5);

- Forest composition and any anomalies (e.g. emerald ash borer, beech bark disease, Dutch elm disease);

- Presence of plant species unique to north Simcoe County and the Copeland Forest (e.g. pokeweed, spikenard, maidenhair fern, and spring ephemerals) (Photograph 19)

A2. Trail delineations.

Although "Virginia's Copeland Forest Trail Map" has several of the trails identified by name, (with additional names supplied by Don McKinnon), it was quite difficult to determine where one trail started and stopped or became an extension of another.

Trail segments were recorded with intersections assigned a number via the GPS sequential labelling system. These intersections and trail segments were mapped using Garmin Base Camp and GoogleEarth Pro.

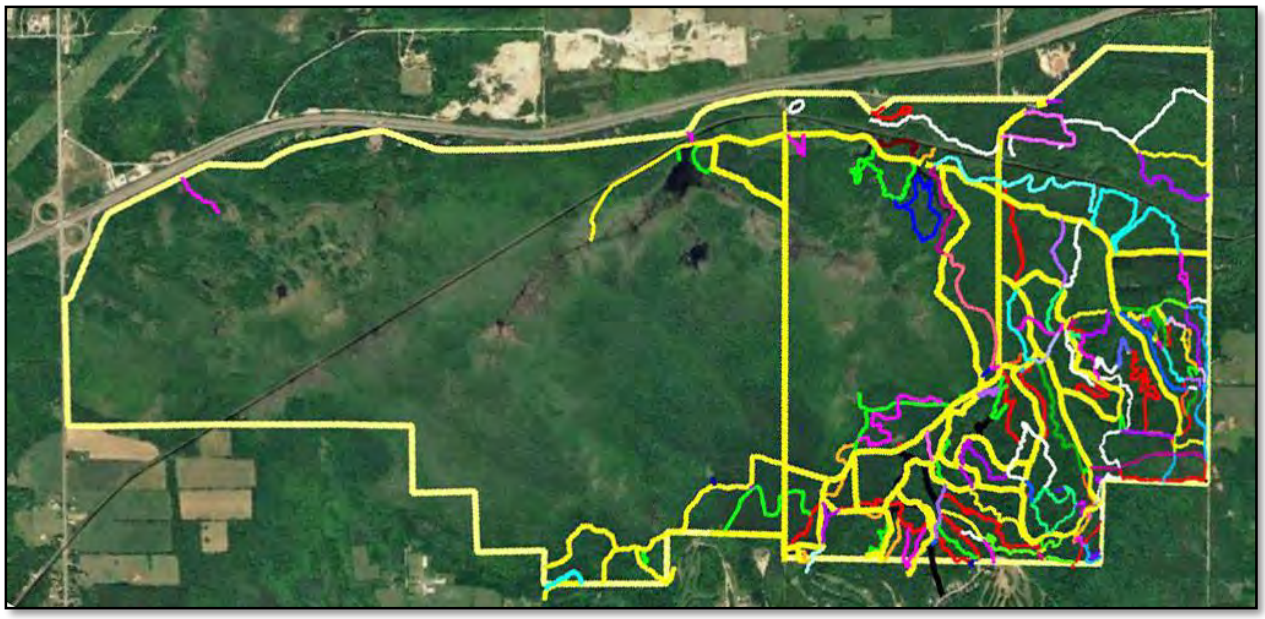

Figure 1. Trails within the boundary of The Copeland Forest showing the clustering of trails within the eastern portions of the property. Colours are simply for visual presentation.

Note that a new ATV trail has been cut into the Forest along the north boundary and south of the two residential lots found on the Ingram Road. *(This has been reported to the Copeland Forest Friends Association and to the Ontario Ministry of Natural Resources and Forestry.)*

A3. Summary of Effort:

Aggregate length of mapped trails: 90 km

Aggregate distance walked: 168 km (includes doubling back and enter/exit routes)

Trail segments mapped: over 290 (a segment is the distance between trail intersections)

Intersection points: over 500 (trails meeting as T, Y or 4-way)

Time in field: 24 visits totaling 76 hours Office time: 95 hours

Section B. Ecological Impacts Associated with Trails.

Any and every "walk in the woods' results in some level of impact to the ecological functioning of a woodlot. The more frequently a trail is used, the greater the negative influence on the land and the nearby wildlife.

B1. Trail Density and Forest Floor Fragmentation.

The trails themselves, regardless of use, create a fragmentation within the forest communities. The application of the term 'fragmentation' is when the forest canopy is separated by an intrusive road; this is not the case with the canopy above these trails yet does apply to the forest floor ecology.

The trail network is dense within the eastern portion of the property and has created many isolated/fragmented islands between the numerous trails. (See Figures 1, 2 and 3)

Within these islands the small mammals (e.g. shrews, voles, moles, chipmunks) and the reptiles and amphibians must find food, shelter, a mate and allow space for any young to spread out. This is an increasingly difficult challenge as when an open trail is encountered the animal will often refuse to cross it, or cross at peril of being detected by a predator.

Trails on the steep-sloped valleys and ravines are laid out close by one to the other; once the flatlands are encountered the trail spacing is much improved.

B2. Zone of Influence

The "Zone of Influence" describes the trail side areas in which wildlife are affected by human activities. This impact may range from simple disturbance to a wild species looking for food, to the abandonment of the area due to the constant anxiety inflicted by nearby trail users.

This "Zone of Influence" varies greatly between species, and may be further compromised depending on seasonal activity (i.e. territory establishment, mate selection, feeding young, migrations). Many University-level studies have been done in North America, with variable results.

The above research indicates that big mammals and some birds need 400 feet of buffer from a trail (each side) to remain acting in a 'normal' manner. Smaller mammals, songbirds, reptiles and amphibians are disrupted if human activity is close by but will remain unconcerned once the trail is greater than 60 feet away.

This "Zone of Influence" must be acknowledged despite the unclear boundaries demanded by each species. Applying the 60' buffer (120' total width) on the current trail network within the eastern portion of the property, there is no area left unimpacted.

B3. Soil Compaction.

With each passing of a footprint, horse hoof or bicycle tire the soil beneath the trail tread becomes compressed. This hardened strip that winds through the forest becomes a barrier for water seepage, burrowing wildlife e.g. (moles, yellow and blue spot salamanders, chipmunks) and root growth.

B3i. Water. Associated with soil compaction is both the interrupted absorption and movement of surface water (rainfall, snow melt). On a normal forest floor, the loose layering of fallen leaves and decaying branches creates a layer called duff. This acts as a sponge to trap moisture and allow its slow percolation into the soil, thus replenishing the moisture regime required by the trees.

A compacted trail surface sheds the water quickly, rapidly moving it to points downhill and restricts forest floor absorption. Thus the moisture regime of the forest is changing and, compounded with the increasing drying effects of climate change, the negative impact on forest growth may be noticeable.

B3ii. Wildlife. Within the duff layer and into the surface soils can be found burrowing wildlife. A group of salamanders are known as 'mole salamanders' (blue spot and yellow spot salamanders) which live the majority of the year within this soft and protected layer; only during the spring mating season (April) do they leave this area of the forest and migrate to vernal pools to mate and lay eggs, afterwards returning to the forest floor.

As these salamanders and other burrowing species encounter compacted soil, they are restricted in movement and must find enough food to survive in a much reduced area.

B3iii. Root growth. Even large trees have an extensive root system close to the surface where nutrients are absorbed thanks to assistance for mycorrhizal fungi. Compacted soil restricts the expansion of the tender root tips, and reduced soil moisture may result in the tree becoming stressed, weakened and susceptible to other negative pressures.

B3iv. Root Exposure. In many sections the roots of the trailside trees have been exposed due to soil compaction (See Photos 2 and 5.) This injury to a tree is usually minimal as the root has the ability to change its cellular construction from one of nutrient absorption to a hard protective coating (bark). While unsightly and making for trip hazards and a rough ride, these roots are still helpful in controlling slope erosion. However, if the tree is completely surrounded by bare and compacted soil (see Photo 1) then the death of even a mature tree is quite possible.

B4. Erosion. When the surface soil is disrupted it becomes vulnerable to transportation via moving water and further blunt force impacts. Erosion locations were on trail sections with light sand or gravel as base material, most notably on the upper slopes of the eastern portions of the property.

The trail tread appears to be susceptible to the locked brakes of mountain bikes sliding downhill, and horse hooves traversing up the slopes.

As these eroded areas continue to lose soil the trail becomes narrow and deeply rutted, with the next step being to move the trail to the side by a metre or so. Over time this trail widening has greater impact on the surrounding forest floor and its inhabitants. (See Photo 12)

Water seepage areas that are on the trail tread become disturbed and siltation may occur as the erosive actions are aggravated. Fortunately, there were very few such sites found on the existing trail sections, thanks to the bridge/platform work that has occurred. However, horse hooves have created further disruptions as the animals avoid the bridges and widen the trail by walking beside the structures.

B5. Seed Dispersal.

Woodland plants have a variety of ways to disperse their seeds, ranging from wind blown to bird droppings to hitching a ride; it is this latter technique that trail use enhances.

While most of the Copeland Forest plant community is comprised of natural or naturalized species, there are a numerous other species which are arriving in great number and disrupting the composition and functions of the natural communities.

Perhaps the most infamous species is garlic mustard, which produces copious small seeds in late summer. These tiny seeds lay on the surface of the soil and become entrapped within the treads of hiking boots and bicycle tires. As they fall off several metres later, they continuously enter the forest and are annually carried forward by trail users.

Other 'hitch hikers' include sweet cicely (sharp black seeds that look like small porcupine quills), burdock (the bane of dog and horse groomers), and the pant-leg covering sticky seeds of enchanter's night shade and pointed-leaved tick trefoil. As these species become prolific along the trail sides and parking lots, the natural plant communities, such as the spring ephemerals, are crowded out.

An activity that is of ecological concern is the distribution of **horse manure** to many areas of the forest, as these dropping include seeds of plants that are not native to these forests. (Photograph 15)

B6. Displaced Forest Floor Materials

When old moss-covered logs are present on a forest floor they create shelter for many species of invertebrates and salamanders. As the Copeland Forest is composed mainly of mid-age growth trees, there are few of these ancient rotting logs available.

Impromptu trail structures, known as log-overs and corduroy platforms, are created by the gathering and placement of dead tree limbs on either side of the fallen tree or over the surface muck of the wet soil. While this practice ensures an easier traversing of the trail it has displaced the few available 'logs' from the forest floor. (See Photographs 8, 9, 10)

Soil is sometimes moved to shore up a log-over or create a banked berm on a corner. Care is required when displacing soil as many plant roots will be impacted by the digging and moving of the duff and soil layers.

An additional concern is **that horses are being taken on single-track trails that have wet seepage areas and footbridges**. As the horses won't/can't walk on the bridges they go around and beside, and subsequently disrupt the seepage muck as well as widen the trail. (Photograph 17)

The following Table indicates how site visitation has ecological impact to the Copeland Forest, as outlined above.

Table 1. Activities and Their Ecological Impacts.

Activity	**Impact**
Mountain bicycle riding	- soil compaction (tree root exposure, surface water redirection) - soil erosion - weed seed dispersal - moved forest debris - wildlife disruptions
Horse riding	- soil compaction (tree root exposure, surface water redirection) - soil erosion - introduction of non-native plants via manure - wet soil disruptions - wildlife disruptions
Dog Walking (off leash)	- weed seed distribution - wildlife disruptions
Winter sports (skiing, snowshoeing)	-some wildlife interference (e.g. deer yards)
Edible Wild Foraging	- off trail compactions (minimal) - interruptions of natural recycling - weed seed dispersal
Hiking / fitness run	- Soil compaction - weed seed dispersal
Nature viewing/Photography	- off trail soil compaction (minimal) - weed seed dispersal - wildlife disruptions

Hunting	- off trail soil compaction (minimal) - weed seed dispersal - wildlife disruptions
Angling	- off trail soil compaction (minimal) - weed seed dispersal - wildlife disruptions

B7. Man-made structures.

A wide range of anthropomorphic structures can be found with the Copeland Forest, some of which are directly related to the trails.

Footbridges/Platforms have been installed in several locations along the trail sections to protect wetland seepage and streams. Most are built with 2x6 type lumber and provide good protection from interference to the surface water movement.

Corduroy crossings are constructed by using found material laid parallel over seepage areas. While this is fast and easy trail repair, the removal of the limbs and branches from the forest floor does impact the natural recycling process of a forest. There is also some interference with the natural flow of the surface waters. Ecological impact could be considered minimal, but a proper bridge/platform would ensure uninterrupted water flow. (Photograph 9)

Corner berms are constructed by placing sand as a banked corner to enable mountain bikes to quickly maneuver the trail. The trail side is raked and hoed to obtain the needed material, a practice that does interfere with forest floor plants and may also redirect surface runoff.

Ramps/log-overs/jumps are built to provide access over fallen trees; these are numerous along the trails. These structures are made from nearby found materials (limbs, branches, rocks). Care should be expressed in collecting this material as the fallen limb wood may be in current use as shelter for salamanders and woodland invertebrates. (Photograph 10)

Stone piles and stone fences are commonly encountered and have been used as riding challenges in a few places. These structures are shelter for snakes, salamanders and small mammals. (Photograph 18)

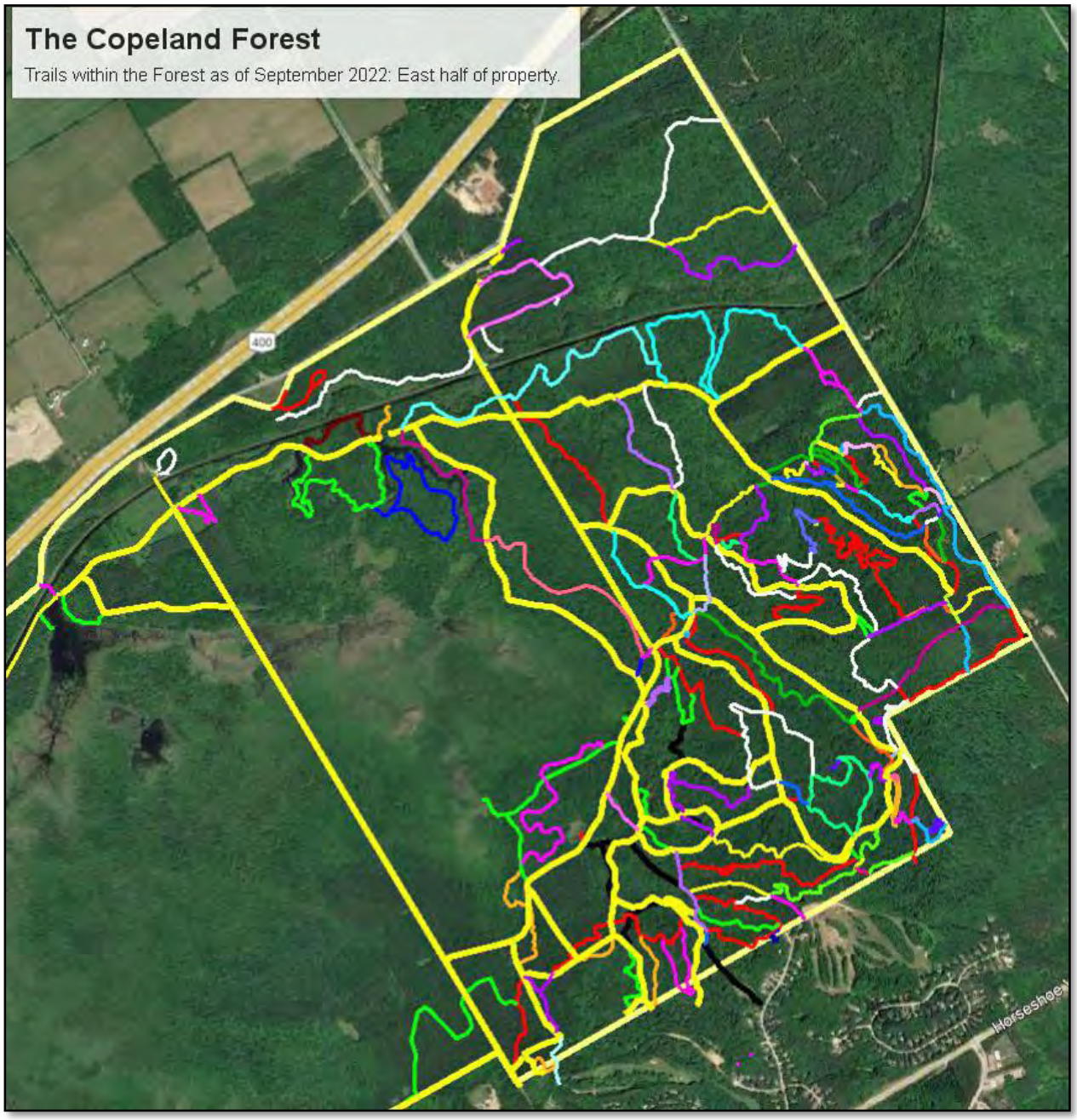

Figure 2. View of trails concentrated within the eastern half of Copeland Forest. Colours are to show trail segments.

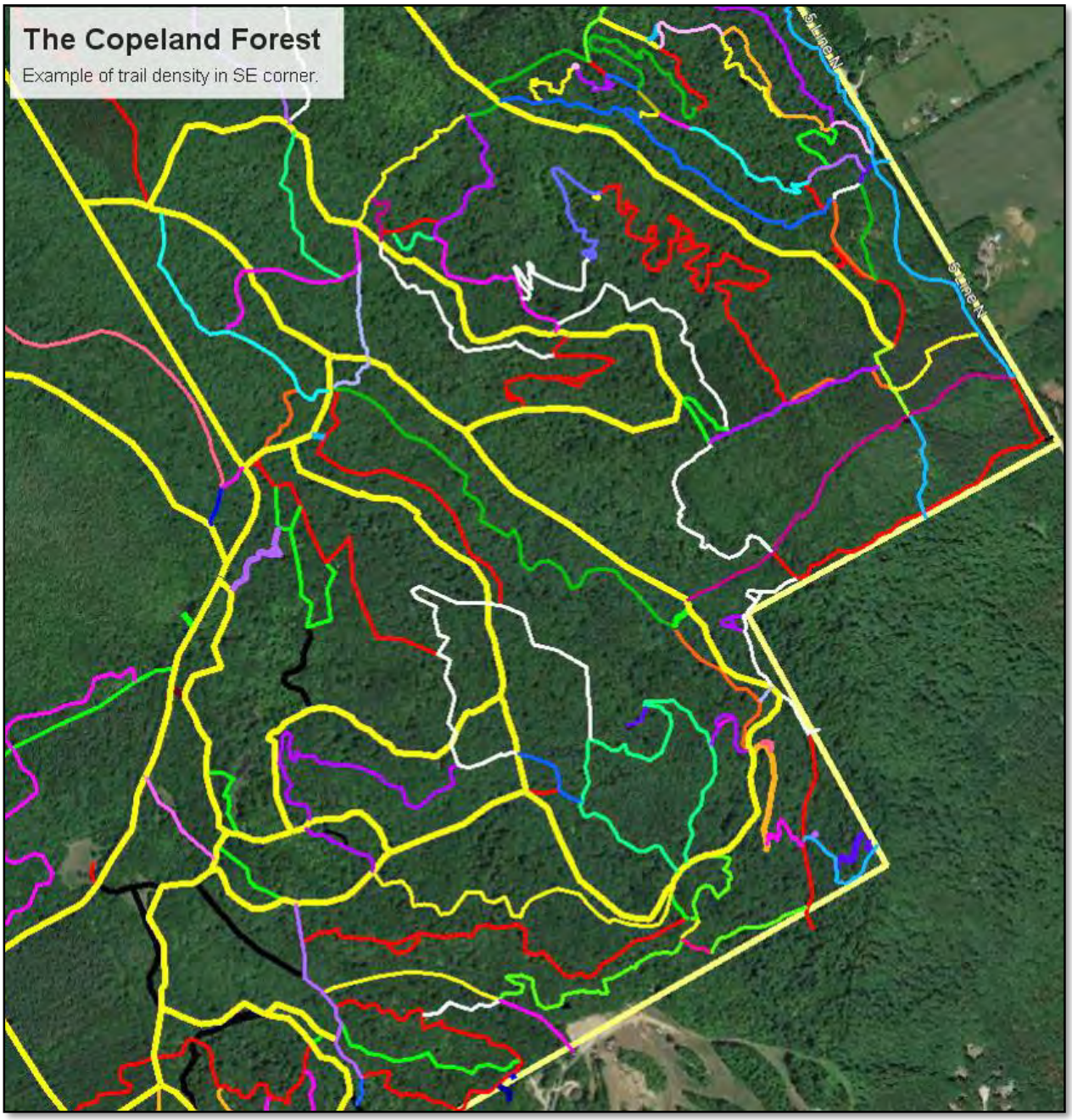

Figure 3. Close up of trail layout showing forest floor fragmentation and the resultant isolated 'islands'. Trail density appears related to the degree of 'challenge' presented by sloped areas versus the wider spaced 'flatland' trails. Colours are to show trail segmentation.

Section C. Wildlife Affected by Trail Use.

Wildlife species require four elements to complete their habitat needs: food, water, shelter and space. Generally speaking, food and water are readily available while **shelter and space components are lacking** within the eastern parts of the Copeland Forest.

Shelter is often found within hollow trees or rotting logs on the forest floor. While there is a scattering of old hollow trees on the ancient fence lines, the majority of the woodlands are still mid-aged in their successional development towards a climax forest. This means that the trees simply are not yet old enough to provide cavities sought by many breeding birds (owls, woodpeckers, chickadees, nuthatches, great crested flycatcher and others).

Other than the recent falling of dead and dying American beech trees (due to beech bark disease) there are few rotting mossy logs available. These soft logs are sought by small mammals and several salamander species. The removal or displacement of these few logs to assist in building trail structures depletes the limited shelter material from the forest floor.

Space is the territory a wildlife species needs to create a home territory for finding adequate shelter (dens, predator escapes), food and mates. This concept has been introduced in Section B2. Zone of Influence. At a 'macro view' the Copeland Forest provides a unique amount of space for wildlife species to settle in; at a 'micro view' the hardwood forest floor in the south-east corner is suffering from the density and sprawl of trail building.

C1. Mammals: Few mammals were encountered during this late summer project. An unusual lack of evidence was noted for **raccoon, white-tailed deer, porcupine, snowshoe hare, and grey squirrel.** This may be due to a lack of available shelter and/or the effects of trail activities (see "Zone of Influence" noted previously).

On the other hand, the discovery of an active **coyote den** right beside a well used trail section was surprising.

Four dead **smoky shrews** were discovered on the open trail tread, all fresh 'road kill' by bicycles that morning. Shrews are "eating machines" that forage

voraciously under the leaf litter; when they suddenly encounter an open area (trail tread) they freeze in anxiety.

A few **red squirrels** were noted, mainly in the pine reforestation areas, both observed and noted by their midens of stored cones (a particularly big miden is near the parking area of P2). **Eastern chipmunks** were found scattered across the study area, mainly in the hardwood stands. Neither of these species appear to be negatively impacted by the trail system.

The scat of a **black bear** was discovered on a quiet trail near the DU pond in the western portion of the property. Also the droppings of a **moose** were found in the wet western areas. These wide ranging mammals are generally known to avoid areas of human activity.

C2. Birds: Avian communities of the Copeland Forest have been well documented for several decades. The various woodlands are used by seasonal migrants, summer breeders and year-round residents.

The list of birds encountered during the timing of this project is small, due to it being a 'quiet time' of the year (breeders are quiet and migrants are not yet in full swing).

The Canadian Wildlife Service via their Forest Bird Monitoring Project (of which at least one station was within Copeland Forest) recommended a buffer of 100 metres need be applied when determining forest interior, ensuring the undisturbed space required by woodland nesting birds. By example, once a wood thrush is at least 100m away from any disturbance from all directions, it will be comfortable to establish a nesting area.

The Copeland Forest does provide for "interior forest" areas, those isolated sections sought by Species at Risk woodland nesters, such as **red-shouldered hawk, wood thrush, ovenbirds and eastern wood pewee.** Records of the presence of these species are found along Line 3 and westwards, away from busy trail uses.

No **ruffed grouse or woodcock** were flushed during this project. These ground nesting birds are at peril from off-leash dogs that range outwards from the trail itself.

C3. Reptiles and Amphibians:

The sightings of reptiles and amphibians were usually near or within wet areas. The large DU pond to the west of the trails area is home to several species of turtles (**painted, snapping and Blanding's**) and frogs (**green, leopard, mink, spring peeper**) as expected. **American toads** were noted on occasion throughout the hardwoods areas.

The smaller ponds and seepage areas within the trails area also yielded species. Most common was the green frog followed by the leopard frog. A **grey tree frog** was heard in the hardwoods area. A single **painted turtle** was observed in the West Nile pond.

Salamanders that have been discovered by The Couchiching Conservancy's citizen science study include **red-backed, spotted, blue-spotted and red-spotted newt**. These species were found using shelter boards laid on the ground around vernal pools and ponds.

One **red eft** (immature red-spotted newt) was encountered in the middle of a gravel section of a trail at the landing point off a rock jump (it was moved off the trail and back to the leaf litter). This aquatic amphibian was found over a kilometer away from any wet area and in the upper third of a valley slope thus indicating the wide range of habitat required to complete their life cycle.

A **DeKay's brown snake** and a small **garter snake** were observed sunning themselves on the double track trail that leads to the DU Pond dam.

Many of these reptiles and amphibians require undisturbed areas for mating and egg laying, therefore trail placement should avoid long continuous stretches along the shore (as is evident on the east shore of the DU pond) or being in close proximity to vernal pools.

C4. Invertebrates, Crustaceans and Others

Woodland invertebrates observed included **giant millipede, polydesmidia, sow bugs, and solitary wasps** (which created their ground burrows on trails), **yellow jacket hornets, and bumblebees**.

A **brown tick** hitched a ride on the author and was discovered that evening; probably from sitting on a log near the DU pond trail.

The overall impact of the trails affecting invertebrates is found in the myriad of open and leafless trails that these creatures have to cross; failure to cross these perceived obstacles may restrain the animal to stay within an 'island' which may exhaust food sources and mate selection.

Section D. Herbaceous Botanicals Affected by Trail Use

The Copeland Forest is rich with botanical communities, notably the spring ephemerals (fawn lily, squirrel corn, hepatica, spring beauty and others) found in the hardwoods areas. Due to development projects across the Oro Moraine these hardwood forest herbaceous communities are steadily disappearing across the Township.

The fern communities are also unique, with maidenhair fern by example being found in unusually large stands. Broad beech fern has been found historically within the forest, a species which is listed as a Species at Risk.

Although the federally endangered wild ginseng was not found during this particular project, the species is known to be within Copeland Forest. The author was surprised at the large amount of pokeweed and spikenard encountered (both of these species are often companions to wild ginseng as they share very similar growing conditions).

Non-native species are becoming prevalent along the trails, their seeds spread by being carried in boot and tire treads (garlic mustard) or sticking to clothing (tick-trefoils, enchanter's nightshade, sweet cicely, burdock).

There is concern about agricultural plant species being introduced throughout the forest via horse manure.

Any consideration for new trail development must include a pre-survey to determine presence/absence of the above Species at Risk or unique density of spring ephemerals and plans then altered to avoid impact.

Section E. Species and Habitats at Risk in regards to Trail Activity:

Due to the Copeland Forest being so large and so diverse in habitat types, it is the **remaining stronghold for several wildlife species** that have lost their native habitat elsewhere. All planning must be aware of the presence of these species and the potential impacts of trail activities.

E1. Species at Risk. There is reluctance to post exact locations of a Species at Risk for public knowledge. In the past this information has led to harassment (by photographers) or removal (by collectors). Interactions with any Species at Risk should be reported to appropriate programs and projects and not spread on social media platforms.

There are official federal, provincial and regional lists that include which species are in trouble, with all of them having been impacted by habitat loss. Note that the Endangered Species Act states it is **illegal to alter the habitat** of a listed Species at Risk, with a protective buffer radius around a nest or growing site.

The following is a listing of the known Species at Risk that have been found within the Copeland Forest.

Little brown bats have been detected along Line 3 via the Couchiching Conservancy citizen science monitoring project. These bats have nursing colonies in hollow trees; great care is needed prior to removing a dead tree for trail safety.

A **Blanding's turtle** has been observed at the beaver pond that floods across Line 3 (reported by Couchiching Conservancy staff). **Snapping turtles** are also in this area. Trails should avoid shoreline gravel areas where turtles come ashore to lay their eggs.

Sightings of **red-shouldered hawk** have come from the Line 3 beaver pond area.

The occurrence of the federally endangered **wild ginseng** has been documented to several sites across the Copeland Forest. While none were found on this project although the hardwoods habitat is well suited for this very rare species.

Monarch butterflies were found in the field areas near P1. Trail clearing should avoid removing milkweed plants.

Wood thrush and other forest interior bird species have been recorded within the quitter areas of Copeland Forest. Trails must remain at least 200m apart to ensure continued presence and breeding of these species.

Broad beech fern has been reported (historically: pre1983) to be growing in the hardwoods along the south side of Ingram Road.

E2. Habitats at Risk.

Wetlands have been compromised across southern Ontario, yet the Copeland Forest contains several types, ranging from mixed woods seepage areas with streams to wooded swamps, to beaver ponds and **vernal pools**. Trails running along the shore areas of beaver ponds should be avoided other than a few strategic lookout points.

Vernal pools, also known as ephemeral ponds, are spring season catchments within a woodlot that are the critical breeding areas for several amphibians (frogs and salamanders) and crustaceans (fairy shrimp). Trails should avoid these sites, especially in April as these species migrate to these pools from the surrounding forest floor area.

Woodland swamps consisting of **black ash are now an imperiled habitat type.** There are small swales of black ash swamps found along the bottom of the slopes. At the moment there are no trails cutting through the larger stands of black ash, yet an awareness of this habitat type can be used for avoidance in future trail planning.

As mentioned in Section C2. Birds, **interior forest** (minimum 200 metre isolated) is a rare commodity in southern Ontario. Should future trail expansions be considered, avoidance of interfering with these pockets of woodland must be avoided.

Section F. Invasive Species:

Garlic mustard is being somewhat contained due to annual extensive control efforts by volunteers picking live plants. Most of the areas indicated on Kennedy's map (see Fig. 7: Map of garlic mustard locations) yielded no or few garlic mustard plants during these visits, indicating the thoroughness of the volunteer plant pickers! However, in places outside the control areas there are intensive patches of garlic mustard to be found. This plant is spread readily via boot and tire treads.

Yellow parsnip has 'exploded' in the central field areas and on the DU dam/berm structure. Some mitigative mowing has been noted along the trail sides. This plant

will need a focussed control plan to eradicate it from the trail sides as it is a noxious plant that causes severe dermatitis to humans.

Other invasive plant species were noted but have little association with trail use:

A few **European buckthorn** shrubs have been noted scattered across the study area. The Ecological committee might want to start a control program for this shrub.

Purple loosestrife continues to be present within the wetlands.

Virginia creeper vine, while not listed as invasive, is aggressively growing into portions of the hardwoods, as is **Wild Grape.**

A couple well-known patches of **periwinkle** were found around the old homestead sites.

The **emerald ash borer** has settled in to the Copeland Forest, with ash trees in parking area P2 being flagged for removal of dangerous dead limbs. Expect more trailside hazards as these trees die off.

Beech bark disease has swept through the forest and caused numerous dead American Beech which have obviously been a challenge for trail maintenance. Surprisingly, a few healthy specimens were found, mainly on the upper slopes of the ridges along the extreme south-east boundary.

Section G. Other studies:

Several other organizations have conducted ecologically related studies within the Copeland Forest, some current and some historical. There is need for cross-organization communication to ensure sensitive areas are delineated and avoided as trail use areas.

The Couchiching Conservancy land trust is conducting several citizen science projects within Copeland Forest, including **salamander monitoring** (shelter boards and DNA testing); **bat monitoring** (resulting in 5 species of bats detected; **frog call monitoring**; and **water quality testing.**

The third **Ontario Breeding Bird Atlas** project is underway and local birdwatchers (i.e. Dave Lord) will have better lists than this report provides.

The Severn Sound Environmental Association and the Nottawasaga Valley Conservation Association conduct **water quality sampling** within the Copeland Forest.

The Ministry of the Environment have a series of **water testing wells** situated along the 'downstream' side of the sewage treatment lagoons.

The Canadian Wildlife Service conducted a **Forest Bird Breeding Project** in the 1980s and 90s; research plot set up near Line 5 and P3.

A MNR forestry **Growth and Yield** plot was found on the north side of the RR tracks and to the west of P2. It unknown if this project has continued since its inception in 1990s.

Section H. Author's Opinions and Suggestions:

H1. Opinions about Copeland Forest.

The Copeland Forest is an impressive collection of habitats, from hardwood stands to conifer plantations to valleylands to wetlands. It remains truly unique within the southern Ontario landscape, both in intact size and ecological diversity.

This assessment project found that while the overall health of the forest is good, trail development in the past and various trail uses have resulted in a few concerns:

The density of the trail network, notably within the hardwood slopes and ravines, is severe and has created great fragmentation of the forest floor ecology.

While soil compaction and tree root exposures were expected, there are some sites where these concerns, coupled with erosions, are rendering trail sections quite unusable due to displaced soil from the trail tread.

Encounters with trail users included dog walkers (50% off leash), hikers, mountain bike riders, horse riders and mushroom foragers. Conversations, when held, were always pleasant and the users are very appreciative of the trail system (many were using the AllTrails or the TrailForks app to find their way around).

There was an almost complete absence of litter along the trails. Most occurrences of debris were near the parking lots of P1 and P2.

Under a healthy forest management plan, the conifer plantations (e.g. white spruce, red pine, tamarack) would be due for a forestry thinning. At present they are quite 'park like' in appearance yet within a decade will be deteriorating due to crowding and weather damage due to weak stems. Be forewarned that this weakening will result in many dead trees falling across trails, similar to the current challenges with dying beech and ash.

H2. Suggestions as related to ecological impacts.

1. In support of the current CFFA trail building moratorium, prohibit any further trail constructions until an approved trail plan can be adopted.

2. Review suitability of horse riding on certain single track trails sections that have steep slopes or wetland crossings; address the problem of the spread of undesirable non-native plant species via horse manure on single track trails.

3. Upgrade wet crossings to lumber bridges/platforms (thus avoiding use of found limbs for corduroy tread).

4. Consider trail surface remediation to areas with severe erosion (e.g. water deflection ditches) or exposure of tree roots (cover or fill with aggregate).

5. Close some of the superfluous short cuts and crossovers, thus enlarging the 'islands' contained between the trail sections.

6. Consult with the other organizations that are conducting ecological studies to further delineate areas of concern (e.g. The Couchiching Conservancy Citizen Science projects; Severn Sound Environmental Association water testing; Ontario Breeding Bird Atlas).

7. Enhance educational messaging regarding uniqueness and fragility of forest ecosystems, thus reducing rogue trail and structure building

8. Install trail markers at intersection points to aid in locating positions of interest. Install trail name signs.

9. Conduct a spring/summer survey for unique botanical communities.

10. Review practice of leaf-blowing in autumn: trail tread safety concerns versus allowing leaves to retain moisture for percolation into the soil.

11. Consider closing/redirecting trail segments near vernal ponds during salamander migration (March-April).

Appendices:

Appendix 1. Additional Maps

Note: a complete set of the .kmz mapping files has been delivered to the Copeland Forest Friends Association for their further use.

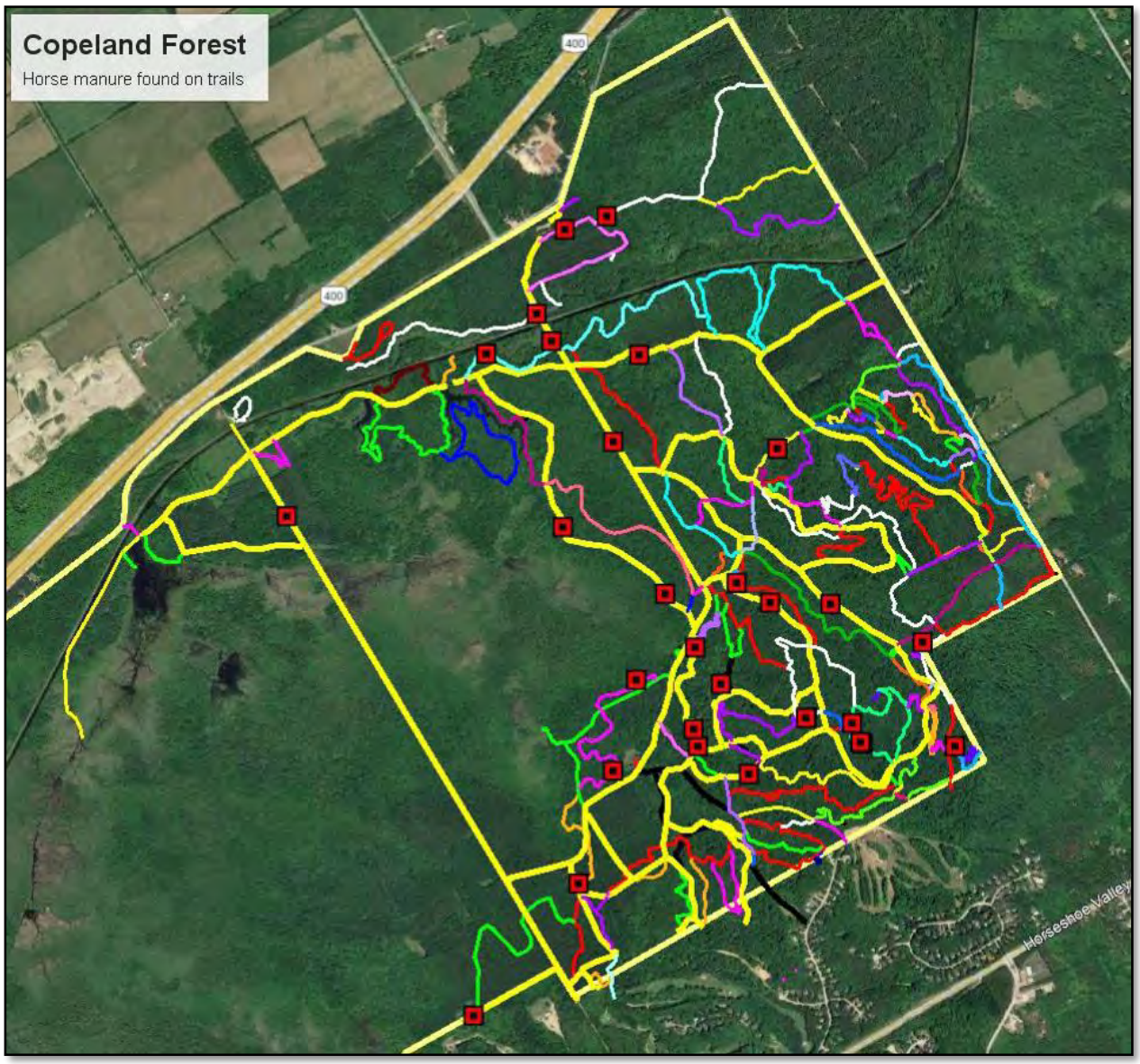

Figure 4. Locations where horse manure was encountered.

This shows the widespread area that manure can vector in alien plants to the forest interior. Several of the encounters were on single-track trails.

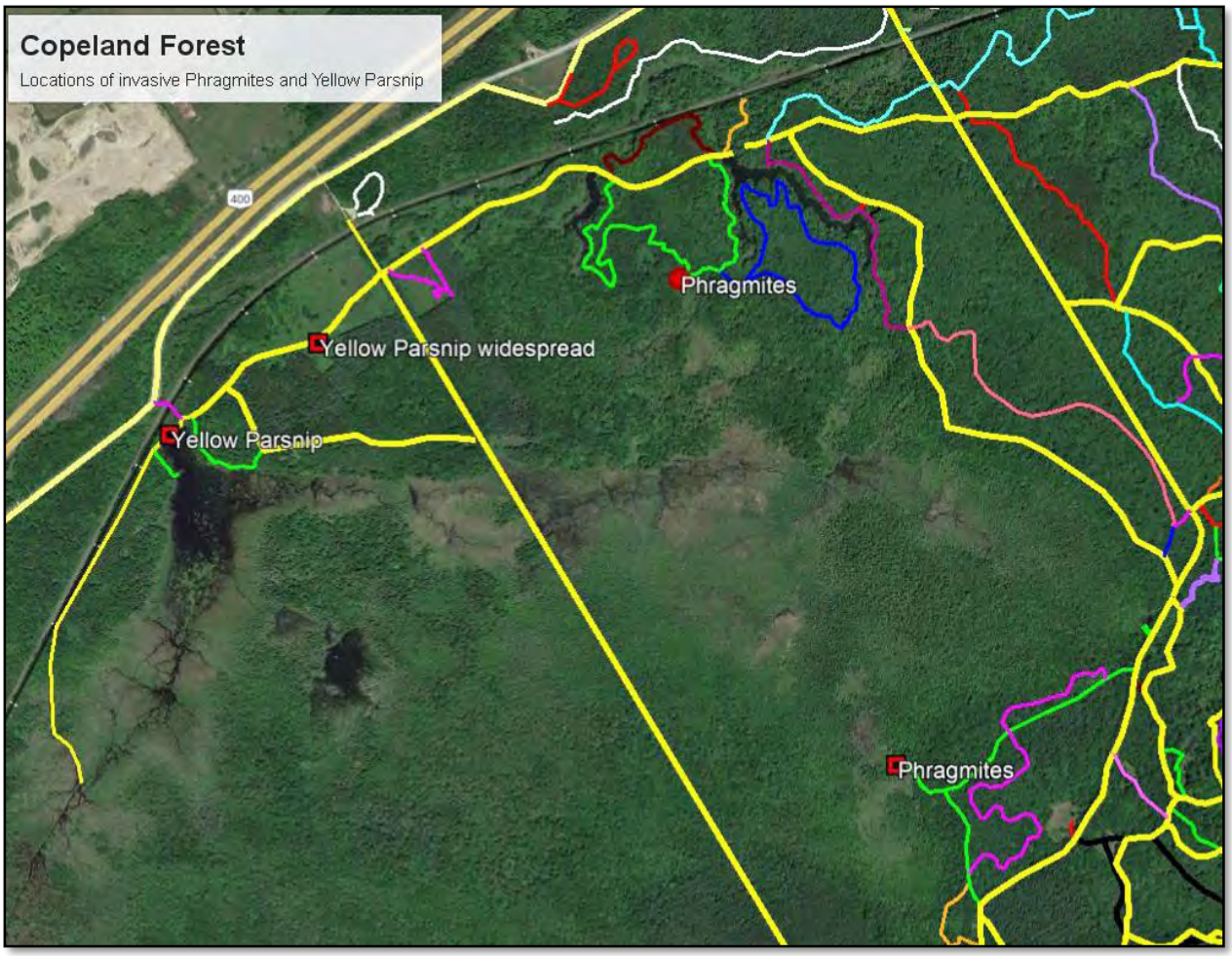

Figure 5. Invasive species: Trail side locations of Phragmites reed and yellow parsnip.

There are additional sites of Phragmites within the large wetland area upstream of the DU Pond.

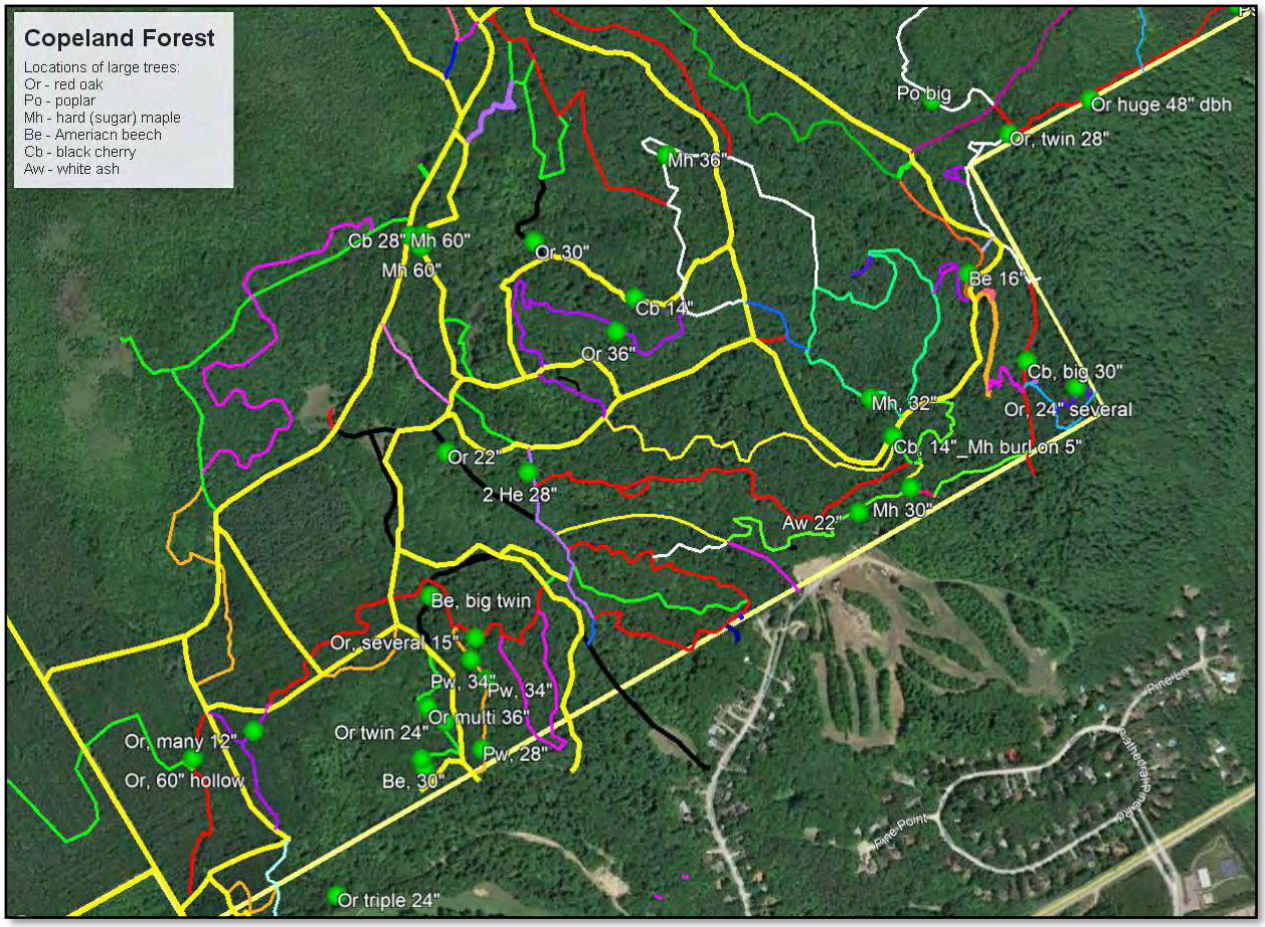

Figure 6. Sample map of large trees encountered.

Despite the majority of the Forest being young to mid-aged successional forest, several large diameter individual trees are found growing along the trail sides, often within settlement fence rows. Included were white pine, red oak, white ash, American beech and black cherry. These trees are an inherent attraction to visit Copeland Forest, as well as important shelter for wildlife.

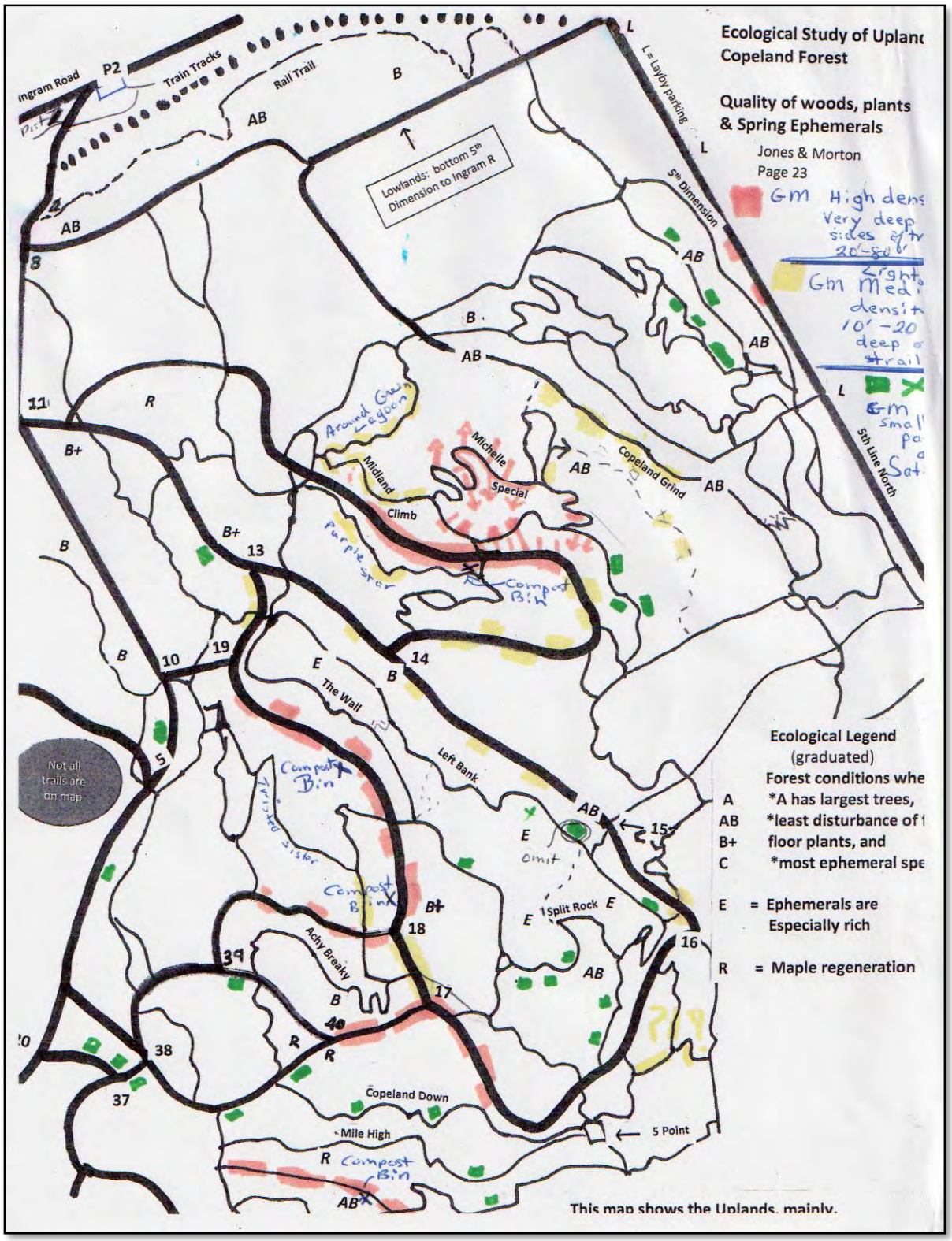

Figure 7. Garlic mustard control areas; Kennedy map.

Appendix 2. Photographs

Photo 1. Severe soil compaction and root exposure; usually at multi-trail intersections.

Photo 2. Trail widening due to avoidance of exposed roots.

Picture 3. Trail close to slumping bank at the pond washout area; set back may be required.

Photo 4. Trail widening to avoid hazard tree, showing need for trail maintenance.

Photo 5. Root exposure due to soil compaction.

Photo 6. One of several bike jumps enhanced with found materials.

Photo 7. Unnecessary short-cut trail over a stream.

Photo 8. Log-over enhanced with found materials over fallen tree.

Photo 9. Corduroy crossing that needs to be replaced with a bridge.

Photo 10. Soil and roots displaced from forest floor to enhance log-over structure.

Photo 11. New short-cut trail on steep side slope.

Photo 12. Severe erosion of new trail section built over sand.

Photo 13. Memorial garden with introduced horticultural plants and a butternut tree sapling.

Photo 14. An example of a private entrance into Copeland Forest.

Photo 15. Horse manure with seedling growth coming from within.

Photo 16. Cyclist riding through yellow parsnip.

Photo 17. Horses mucking in seepage beside footbridge on single-track trail.

Photo 18. Example of colonial stone fence, used by small mammals and salamanders.

Photo 19. One of many scenic trailside views of maidenhair fern and boulders. Many spring ephemerals found within forest floor.

Photo 20. David Hawke conducting study with the Copeland Forest.

Appendix 3. Author's Resume.

David J. Hawke has been retained for this project based upon his skills and experiences as follows:

Education and Certification:

- Fish and Wildlife Technician, Sir Sanford Fleming College
- Wetland Evaluator, Ontario Ministry of Natural Resources
- Ecological Land Classification, Ontario Ministry of Natural Resources
- Butternut Assessor, Ontario Ministry of Natural Resources
- Exterminator (Forestry, Aquatic), Ontario Ministry of Agriculture, Food and Rural Affairs (dog-strangling vine, garlic mustard, Phragmites)

Trail design and construction:

- Bayview-Wildwood Resort (Beaver Lake Trail; Old Joe's trail)
- Taboo Resort and Conference Centre (design, construction and maintenance of 8 km multi use with 14 bridges)
- Couchiching Conservancy Land Trust (trail maintenance and visitor safety for 25 properties)
- Valk Valley Farm (trail design, construction and maintenance, six bridges)

Property Reports:

- Property Management Plans (5 yr renewals) for nature reserves owned by the Couchiching Conservancy Land Trust
- Baseline Documentation Reports for properties considered for Conservation Lands Easement by Environment Canada
- Preparation of Managed Forest Tax Incentive Program properties

Community Profile:

- Executive positions held with Orillia Naturalists' Club
- Regional Coordinator for Ontario Breeding Bird Atlas (1st edition)
- Weekly nature columnist for local media (33 years)
- Public speaker/presenter at numerous annual club meetings

Awards and Recognitions:

- Ontario Nature: Richards Education Award
- Outdoor Writers of Canada: Best Book

- Outdoor Writers of Canada: Best Magazine Article
- Nottawasaga Valley Foundation: Nature Photographer of the Year
- Huronia Woodland Owners White Pine Award for stewardship.

Copeland Forest Affiliations:

- Explored property since 1978 (birdwatching, photography)
- Set up bird atlas for Orillia Naturalists' Club in 1981
- Assisted MNR staff with research projects (deer radio collars; deer habitat management)
- Worked with Simcoe County Board of Education to provide outdoor education opportunities within Copeland Forest
- Provided guidance to Copeland Forest Friends garlic mustard control initiative
- Lives nearby on family farm with similar soils and vegetation cover; enrolled in Ontario 50 Million Trees program