

DUNN NATURE TRAIL

A self-guided natural-history tour through
a northern hardwood forest

[3rd edition]



PLEASE
TAKE ONLY PHOTOGRAPHS
LEAVE ONLY FOOTPRINTS
STAY ON THE TRAIL
REMOVE NOTHING

WINDMILL HILL PINNACLE ASSOCIATION
PO Box 584, Saxtons River, VT 05143
2014

SOME IDENTIFICATION MANUALS

A Field Guide to the Birds of Eastern and Central North America by R.T. Peterson & V.M. Peterson (Houghton Mifflin, 2002). *A Field Guide to Ferns & their Related Families of Northeastern and Central North America* by B. Cobb et al. (Houghton Mifflin, 2005). *A Field Guide to the Mammals: North America North of Mexico* by W.H. Burt & R.P. Grossenheider (Houghton Mifflin, 1976). *A Field Guide to Reptiles & Amphibians of Eastern and Central North America* by R. Conant & J.T. Collins (Houghton Mifflin, 1998). *National Audubon Society Field Guide to North American Trees: Eastern Region* by E.L. Little (Alfred A. Knopf, 1980). *Spring Wildflowers of New England* by M.J. Dwelley (Down East Enterprise, 2000). *Wildflowers of Vermont* by K. Carter (Cotton Brook Publications, 2005). *Caterpillars of Eastern North America: a Guide to Identification and Natural History* by D.L. Wagner (Princeton University Press, 2005). *Tracking & the Art of Seeing: How to Read Animal Tracks & Sign* by P. Rezendes (HarperPerennial, 1999). *Mammal Tracks and Scat: Life-size Tracking Guide* by L. Levine & M. Mitchell (Heartwood Press, 2008), a 2014 pocket edition of which is also available. *Forest Forensics: A Field Guide to Reading the Forested Landscape* by T. Wessels (Countryman Press, 2010).

BACKGROUND READING

Hands on the Land: a History of the Vermont Landscape by J. Albers (MIT Press, 2000). *The Nature of Vermont: Introduction and Guide to a New England Landscape* by C.W. Johnson (University Press of New England, 1998). *The Story of Vermont: a Natural and Cultural History* by C.M. Klyza & S.C. Trombulak (University Press of New England, 2000). *Wetland, Woodland, Wildland: a Guide to the Natural Communities of Vermont* by E.H. Thompson & E.R. Sorenson (University of New England Press, 2000). *Sermons in Stone: the Stone Walls of New England and New York* by S. Allport (W.W. Norton, 1990).

FEEDBACK

The WINDMILL HILL PINNACLE ASSOCIATION trusts that you found this brochure useful. Any suggestions for its improvement or other feedback would be most welcome. Contact: whpa@sover.net –or– 802/869-2071.

—AHW/140921

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THE MEMORIAL SANCTUARY

This magnificent 113-acre woodland (44 acres in Rockingham, 69 acres in Westminster) was a gift from Sarah Ann Martin (1922–2000) of New York and Vermont for its continued use as a forest preserve and wildlife refuge. She gave the land in memory of her brother **Stephen Martin** (1924–1945), who is buried in Saxtons River. Stephen was a Marine in World War II killed in action during the Battle of Iwo Jima, a cataclysmic event that claimed the lives of almost 7 thousand other Marines and over 20 thousand Japanese soldiers.

These woods, which have been little disturbed in well over half a century, rest in large part on a bedrock of limy (calcareous) schist. The resulting locally rich soils now support majestic specimens of Oak (*Quercus*), Hickory (*Carya*), Hophornbeam (*Ostrya*), Maple (*Acer*), Ash (*Fraxinus*), and other trees and shrubs as well as a diverse herbaceous understory that includes many spring flowers and a variety of ferns, including the Maidenhair fern (*Adiantum pedatum*). The habitats range from dry rocky ridges to vernal pools and other wetland areas.

The **WINDMILL HILL PINNACLE ASSOCIATION** is honored to be able to maintain this memorial sanctuary in accordance with the intent of the donor, which limits its use to low-impact daytime foot traffic, excludes dogs and other domestic animals, does not allow bicycles, prohibits fires, and forbids hunting or trapping. A Grant of Development Rights, Conservation Restrictions, and Public Access Easement is held in perpetuity by the Vermont Land Trust.

THE DUNN NATURE TRAIL

The Dunn Nature Trail has been made possible through the generosity of relatives and friends of **Richard Byam Dunn Sr** (1913-2002) and **Margaret Myers Dunn** (1916-2003) of Massachusetts, valued members of the **WINDMILL HILL PINNACLE ASSOCIATION**. The Duns were lovers of nature and supporters of environmental conservation. It is thus most fitting that a nature trail be established in their honor and memory, to help instill similar values to present and future generations of visitors to the **ASSOCIATION's** Stephen Martin Memorial Wildlife Sanctuary.

SANCTUARY REGULATIONS

- * **This conserved area is to be held in perpetuity as a wildlife refuge, natural area, and site for contemplation and inspiration.**
- * **Human pedestrian daytime traffic only.**
- * **Please stay on the trails so as to minimize disturbance of the plants and animals.**
- * **No bicycles or mechanized vehicles of any kind, including all-terrain vehicles (ATVs) and snowmobiles.**
- * **No dogs (except for leashed seeing-eye dogs), horses, pack animals, other livestock, or any pets.**
- * **No hunting, fishing, or trapping.**
- * **No removal of any game, wildlife, or plant, dead or alive.**
- * **No use of metal detectors or removal of artifacts.**
- * **No fires.**
- * **No camping.**
- * **Please observe a strict low impact, carry-in carry-out, leave-no-trace policy to help us keep the Sanctuary pristine.**

* * * * *

Please note: These special Wildlife Sanctuary regulations are of necessity considerably more stringent than those applicable to the remainder of the Windmill Ridge Nature Reserve & Trail.

Questions? Contact: **WINDMILL HILL PINNACLE ASSOCIATION**
PO Box 584, Saxtons River, VT 05154
whpa@sover.net 802/869-2071

LICHENS
A SANCTUARY CHECK LIST

- Reindeer-moss (*Cladina rangiferina*) — [Fruticose]
- British soldiers (*Cladonia cristatella*) — [Fruticose]
- Old man's beard (*Usnea cavernosa*) — [Fruticose]
- Plated rock tripe (*Umbilicaria muehlenbergii*) — [Foliose]
- _____
- _____
- _____

HOW TO USE THIS GUIDE

The **Dunn Nature Trail** offers a 1.33-mile round-trip walk through this majestic northern hardwood forest that has been left relatively undisturbed for more than half a century and is now protected in perpetuity. The **Trail**, which is marked with **blue disks**, begins at the Martin Sanctuary Trailhead (and vehicular pull-off) at 1522 Bemis Hill Road in Westminster. For its initial 0.25 mile, the Dunn Nature Trail goes in a generally northeast direction. It then turns to the right (southeast) to go in a rough circle for a further 0.65 mile. There it turns to the left (south then southwest) for the final 0.43 mile back to its trailhead at the vehicular pull-off. A **Trail map** can be found on Pages 16-17.

Numbered stations (14 signposts) are placed at points of natural or cultural interest, these being described in the following pages. The signpost descriptions are followed by check lists of the biota that might be observed in the Sanctuary: trees, shrubs, & lianas; ferns & clubmosses; amphibians & reptiles; birds; mammals; mosses; flowers; and lichens. Some further readings are suggested on Page 32.

Regulations governing the Sanctuary can be found on Page 31, but in the last analysis of greatest importance is for you to really try to leave no trace of having visited. This brochure is meant to offer an opportunity for self-guided enrichment for all; it should also prove ideal for teacher-led groups especially of middle-school or older pupils.

A simpler (two-page) guide with map is also available, more suitable for the younger users of the Dunn Nature Trail. And both of these two publications are available at <www.windmillhillpinnacle.org>.

Station #1: NORTHERN HARDWOOD FOREST

Typical of the northern hardwood forest type growing in southeastern Vermont is a mixture primarily of Sugar maple (*Acer saccharum*), Northern red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), Black birch (*Betula lenta*), White ash (*Fraxinus americana*), and Eastern hemlock (*Tsuga canadensis*). Other species found here as well, although in lesser amounts, are Yellow birch (*Betula alleghaniensis*), Basswood (*Tilia americana*), Bitternut hickory (*Carya cordiformis*), Black cherry (*Prunus serotina*), Red maple (*Acer rubrum*), Hophornbeam (Ironwood) (*Ostrya virginiana*), Eastern white pine (*Pinus strobus*), and Red spruce (*Picea rubens*). The White ash and Basswood are indicators of the rich limy soils found locally in the Sanctuary; and the Red maples do best in the wetter areas. You may still find an occasional Butternut (*Juglans cinerea*), one that to date has survived the introduced bark-canker fungus that attacks it (see Station #8). Look for name tags on trees along the Trail.

Among the trees found here, Sugar maple has long been prized not only for its dense, fine-grained wood for cabinetry, flooring, and bowling pins, but also for its magnificent display of fall leaf coloration and, perhaps most of all, for the maple syrup that is boiled down from its over-wintering xylem sap, a commodity that has made Vermont known throughout much of the world. The wood of Black cherry is among the most valuable furniture woods we have; and the best baseball bats were once made from White ash heartwood. Red oak wood makes excellent construction timbers, flooring, and railroad ties; formerly it was also in demand for nail kegs and other slack cooperage; and its acorns are a boon to some wildlife.

Finally, although the Sanctuary is protected from logging and other human disturbances, it is nonetheless bound to change in the decades to come. Wind storms and old age take their toll, but the **fallen trees** you see slowly decompose largely through fungal action, thereby returning their components to the soil as a key step in the cycling of nutrients within the ecosystem (see Station #11). However, many of the Butternut and Beech trees will succumb to fatal diseases before their time, and the Hemlocks can be expected to do likewise as a warming climate permits their major insect nemesis to move north (see Station #8). And browsing by the over-abundant White-tailed deer (*Odocoileus virginianus*) on seedlings of Red oak and Sugar maple may largely prevent those trees from being replaced as they die of old age.

* * * * *

For a **check list** of woody plants — **trees, shrubs, and lianas** — you may encounter, see Page 23.

FLOWERS A SANCTUARY CHECK LIST

- Aster, Purple-stemmed (*Aster puniceus*) — [Flowers August–October]
- Beech-drops (*Epifagus virginiana*) — [Flowers August–October]
- Bloodroot (*Sanguinaria canadensis*) — [Flowers April–May]
- Cohosh, Blue (*Caulophyllum thalictroides*) — [Flowers April–June]
- Coltsfoot (*Tussilago farfara*) — [Flowers March–June]
- Crinkleroot (Two-leaved toothwort) (*Dentaria diphylla*) — [Flowers April–June]
- Cucumber-root, Indian (*Medeola virginiana*) — [Flowers May–June]
- Dutchman's breeches (*Dicentra cucularia*) — [Flowers April–May]
- Hepatica, Round-lobed (*Hepatica americana*) — [Flowers April–May]
- Herb Robert (*Geranium robertianum*) — [Flowers May–September]
- Jack-in-the-pulpit (*Arisaema triphyllum*) — [Flowers April–June]
- Lily, Trout (Dogtooth-violet) (*Erythronium americanum*) — [Flowers March–May]
- Mayflower, Canada (*Maianthemum canadense*) — [Flowers May–July]
- Shinleaf (*Pyrola elliptica*) — [Flowers June–August]
- Solomon's seal, Smooth (True) (*Polygonatum biflorum*) — [Flowers May–July]
- Spring beauty (*Claytonia virginica*) — [Flowers March–May]
- Squirrel-corn (*Dicentra canadensis*) — [Flowers April–May]
- Trillium, Purple (Wake robin or Stinking Benjamin) (*Trillium erectum*) — [Flowers May–June]
- Twisted stalk (*Streptopus amplexifolius*) — [Flowers May–June]
- Violet, Smooth yellow (*Viola pensylvanica*) — [Flowers April–May]
- Wild-oats (*Uvularia sessilifolia*) — [Flowers May–June]
- _____
- _____
- _____

MOSSES
A SANCTUARY CHECK LIST

- Moss, Hair-cap (*Politrichum*)
- Moss, Pin-cushion (*Leucobryum glaucum*)
- Moss, Sphagnum (Peat moss) (*Sphagnum* spp)
- _____
- _____
- _____

Station #2: STONE WALLS & ROCK PILES

Vermont's woodlands are crisscrossed by thousands of miles of stone walls, built by our early settlers especially for one or more of the following reasons: to make livestock enclosures or exclosures; to clear a field for tilling; and/or to mark property boundaries. Typically, a farmer would build such a wall with the help of his family or neighbors, and they might have been able to lay 10 to 20 feet of wall a day. However, some were built by itinerant stone masons.

It is amazing how straight and true to compass bearing the walls would run often for many, many hundreds of feet. A good wall was a source of pride for its owner. After 1880 or so, the stone walls were often augmented (or extended) by **barbed wire**. The many stone walls — now essentially permanent features of Vermont's rural landscape — remain immensely useful in determining property boundaries on the ground. They also provide a habitat and thoroughfare for many small creatures; they inhibit soil erosion when they follow the contours of the land in hilly terrain; and they help us to interpret past land-use patterns (note, for example, the marked difference in the woods on either side of the stone wall you see to the right of you here, owing to the far more recent past logging and use as a pasture on its far side). We can certainly look upon our stone walls as historic structures of both natural and cultural significance.

As you walk along, keep your eye out for occasional **rock piles** on both sides of the Trail (you already passed one near the start of the Trail on the left, and two others are further along to the right), which the early settlers made to clear their fields for tilling in places where those rocks were not needed for nearby stone-wall construction.

Station #3: FERNS

Ferns are the highest of the lower plants: they do not produce flowers and fruits, but they do have a plumbing (vascular) system that brings the water with its dissolved minerals up from the soil, and distributes throughout the plant the food (dissolved sugars) produced in the green cells. Ferns reproduce either asexually (vegetatively) by sending up new stalks from their generally horizontal underground stems (rhizomes), or else sexually by producing spores which in turn drop and develop into tiny new plants (gametophytes) that then produce the equivalent of sperm and egg cells (male and female gametes) which subsequently fuse and then divide to form the fern plants (sporophytes) we see.

Here in the Sanctuary all of the ferns are non-woody (herbaceous) perennials. However, some woody tree ferns do exist in the tropics and semi-tropics (and were quite common on earth about 300 million years ago [during the Carboniferous Period], with many of them turning into the coal or oil we use so profligately today).

A fern's leaves are known as "**fronds**"; young developing fronds are known as "**fiddleheads**". A fern frond that is divided into frondlets (leaflets) is referred to as being pinnate or **once cut**; if each frondlet is also divided, the frond is called bipinnate or **twice cut**; and if each part of a divided frondlet is once again divided, the frond is called tripinnate or **thrice cut**.

Here are some of the ferns found in the Sanctuary:

Christmas fern (*Polystichum acrostichoides*): Fronds once cut, up to 24" long. Often found in deciduous semi-shaded woods. Named "Christmas" because the fronds stay green through Christmas (and beyond).

Sensitive fern (*Onoclea sensibilis*): Fronds once cut, up to 18" long (separate dark brown fertile fronds shorter). Often found in damp open or shady sites. Named "sensitive" because the fronds are sensitive to frost.

New York fern (*Thelypteris noveboracensis*): Fronds twice cut, up to 16" long, tapering at both ends. Often found in dry open woods. Named "New York", it is said, because New Yorkers burn the candle at both ends.

< Continued on facing page >

MAMMALS A SANCTUARY CHECK LIST

- Bat, Big brown (*Eptesicus fuscus*)
- Bear, Black (*Ursus americanus*)
- Chipmunk, Eastern (*Tamias striatus*)
- Coyote (*Canis latrans*)
- Deer, White-tailed (*Odocoileus virginianus*)
- Fisher (*Martes pennanti*)
- Fox, Gray (*Urocyon cinereoargenteus*)
- Fox, Red (*Vulpes fulva*)
- Hare, Snowshoe (*Lepus americanus*)
- Moose (*Alces alces*)
- Mouse, Deer (*Peromyscus maniculatus*)
- Mouse, White-footed (*Peromyscus leucopus*)
- Porcupine (*Erethizon dorsatum*)
- Skunk, Striped (*Mephitis mephitis*)
- Squirrel, Eastern gray (*Sciurus carolinensis*)
- Squirrel, Red (*Tamiasciurus hudsonicus*)
- _____
- _____
- _____

BIRDS
A SANCTUARY CHECK LIST

- Chickadee, Black-capped (*Poecile atricapilla*) — [Year-round]
- Creeper, Brown (*Certhia americana*) — [Year-round]
- Grouse, Ruffed (*Bonasa umbellus*) — [Year-round]
- Hawk, Red-shouldered (*Buteo lineatus*) — [Summer]
- Hawk, Red-tailed (*Buteo jamaicensis*) — [Year-round]
- Jay, Blue (*Cyanocitta cristata*) — [Year-round]
- Nuthatch, Red-breasted (*Sitta canadensis*) — [Year-round]
- Nuthatch, White-breasted (*Sitta carolinensis*) — [Year-round]
- Ovenbird (*Seiurus aurocapillus*) — [Summer]
- Owl, Barred (*Strix varia*) — [Year-round]
- Sapsucker, Yellow-bellied (*Sphyrapicus varius*) — [Summer]
- Sparrow, Tree (*Spizella arborea*) — [Winter]
- Tanager, Scarlet (*Piranga olivacea*) — [Summer]
- Thrush, Hermit (*Catharus guttatus*) — [Summer] — [Our State Bird]
- Thrush, Wood (*Hylocichla mustelina*) — [Summer]
- Titmouse, Tufted (*Baeolophus bicolor*) — [Year-round]
- Turkey (*Meleagris gallopavo*) — [Year-round]
- Veery (*Catharus fuscescens*) — [Summer]
- Vireo, Red-eyed (*Vireo olivaceus*) — [Summer]
- Vulture, Turkey (*Cathartes aura*) — [Summer]
- Warbler, Black-and-white (*Mniotilta varia*) — [Summer]
- Woodpecker, Downy (*Picoides pubescens*) — [Year-round]
- Woodpecker, Hairy (*Picoides villosus*) — [Year-round]
- Woodpecker, Pileated (*Dryocopus pileatus*) — [Year-round]
- Wood-pewee, Eastern (*Contopus virens*) — [Summer]
- _____
- _____
- _____

< Station #3: FERNS — Concluded >

Interrupted fern (*Osmunda claytoniana*): Fronds twice cut, up to 38" long. Often found in dry sunny sites. Named "interrupted" because the leaflets on fertile fronds are interrupted by a section of short dark brown spore-bearing leaflets.

Royal fern (*Osmunda regalis*): Fronds twice cut, up to 36" long on dry sites and up to 72" on wet sites. Often found on wet sites. Named "royal" because the fiddleheads are somewhat royal purple in color.

Ostrich fern (*Matteuccia struthiopteris*): Fronds twice cut, up to 72" long. One of our largest ferns, limited to the wetter sites. The fiddleheads are edible.

Maidenhair fern (*Adiantum pedatum*): Fronds of an unusual shape for a fern, up to 24" long. A good indicator of the rich soils we can find here.

* * * * *

For a **check list** of **ferns** you may encounter, *see* Page 24.

* * * * *

Finally, please note that **Sweet-fern** (*Comptonia peregrina*) — found here on some dry sites — is not a fern, but rather a higher plant (a woody deciduous shrub), so named because it looks a bit like a fern (and because of the odor when a leaf is crushed) — for woody plants (trees, shrubs, and lianas), *see* Station #1.

Station #4: A LIME KILN

Here to the left of the Trail you see the remains of a farmstead lime kiln that is over 150 years old. Lime was an important though scarce commodity in Vermont during the 18th and 19th centuries. Limy (calcareous) schist forms much of the bedrock in this local area (see Station #5). That rock is in essence an impure metamorphosed limestone, the limestone having originally been a sedimentary rock consisting of the consolidated skeletons of marine invertebrates long ago deposited on the ocean floor. The limestone-containing schist was quarried, broken into small pieces, and then loaded into the kiln together with locally harvested wood fuel below it.

The limestone, which is calcium carbonate (CaCO_3), was then roasted for some hours at a high temperature (over 600°C or 1100°F), which converted it to **lime** (also called **quicklime**), which is calcium oxide (CaO), an unstable white powder. This lime would then be collected and mixed with water, a tricky chemical reaction known as slaking, to produce **slaked lime**, which is calcium hydroxide ($\text{Ca}[\text{OH}]_2$), a relatively stable, strongly basic (high pH), and highly useful crystalline product.

Much of the slaked lime produced here and elsewhere in the region would be used to "sweeten" the generally acidic agricultural soils here in Vermont. When the essentially insoluble slaked lime was mixed with water — to produce a suspension or slurry called **milk of lime** — it was then variously used as a mortar, a plaster, or a whitewash. The milk of lime was also used in preparing hides for tanning (it would make the hair fall out), in the making of soap, as a medicinal, and in several other ways.

AMPHIBIANS & REPTILES A SANCTUARY CHECK LIST

Amphibians:

- Frog, Wood (*Rana sylvatica*)
- Frog, Tree (*Hyla versicolor*)
- Newt, Red-spotted (Red eft) (*Notophthalmus viridescens*)
- Salamander, Blue-spotted (*Ambystoma laterale*)
- Salamander, Jefferson (*Ambystoma jeffersonianum*)
- Salamander, Red-backed (*Plethodon cinereus*)
- Salamander, Spotted (*Ambystoma maculatum*)
- Toad, American (*Bufo americanus*)
- _____
- _____
- _____

* * * * *

Reptiles:

- Snake, Eastern garter (*Thamnophis sirtalis*)
- Snake, Red-bellied (*Storeria occipitomaculata*)
- _____
- _____
- _____

**FERNS & CLUBMOSES
A SANCTUARY CHECK LIST**

Ferns:

- Fern, Christmas (*Polystichum acrostichoides*)
- Fern, Interrupted (*Osmunda claytoniana*)
- Fern, Maidenhair (*Adiantum pedatum*)
- Fern, New York (*Thelypteris noveboracensis*)
- Fern, Ostrich (*Matteuccia struthiopteris*)
- Fern, Royal (*Osmunda regalis*)
- Fern, Sensitive (*Onoclea sensibilis*)
- _____
- _____
- _____

* * * * *

Clubmosses:

- Clubmoss, Common (Running clubmoss or Staghorn clubmoss)
(*Lycopodium clavatum*)
- Clubmoss, Flat-branched (Princess-pine) (*Dendrolycopodium*
[Lycopodium] obscurum)
- Ground-cedar, Northern (*Diphasiastrum [Lycopodium] complanatum*)
- _____
- _____
- _____

Station #5: BENEATH IT ALL

Beneath the mantle of soil, and poking through here and there, is the bedrock upon which all else rests here. Thus, our northern hardwood forest ecosystem — the **biosphere** — is sandwiched between the air above and around it — the **atmosphere** — and the platform of rocks beneath it — the **lithosphere**. This underlying lithosphere was formed many millions of years ago, and the undulating topography is the result of its subsequent upthrusting, folding, twisting, and fracturing — those tectonic actions in turn accentuated by the ever ongoing water erosion that reshapes the hills and ridges plus the valleys between them. The bedrock in the Sanctuary consists primarily of relatively friable **limy (calcareous) schist** — as you can see here ahead of you to the right (and also in several places further along), weathered to a dark rusty color. Later you will also see a bit of milky quartz outcropping. The limy schist had probably originally been deposited as a mixture of sand and seashells at the bottom of the nearby Atlantic Ocean some 400 million years ago, was subsequently pushed down and subjected to great pressures, thereby converting (metamorphosing) it to its present form, and was then thrust westward to where we find it here today.

The bulldozer action of the various immensely (perhaps a mile or so) thick and heavy glaciers which subsequently shoved their way south across this area scraped the forest and soil away and further modified the topography, also leading to most of the occasional exposures of bedrock you see here today. The most recent glacier to cover this area began to melt away roughly 14 or 15 thousand years ago. All it left behind was some deposits of sand and gravel, known as **glacial till**, on the then largely scoured surface, and also a scattering of boulders, referred to as **glacial erratics**. At present, the Sanctuary is thought to be rising by as much as 2 millimeters per year, owing to a combination of tectonic action and glacial rebound.

It will be of interest to point out here that after the disappearance of the most recent glacier, and the subsequent draining away of any pent-up waters, it took many centuries for a soil cover to re-develop, one that at first supported a tundra ecosystem. Trees began to re-inhabit the Sanctuary about 11 or 12 thousand years ago, and the mix of those we see today roughly 4 to 5 thousand years ago.

Station #6: A VERNAL POOL

Woodland vernal pools are relatively small and isolated bodies of water that collect annually in woodland depressions having no inlet or outlet, the hydro-period lasting at least through the spring season before drying up. Also referred to as ephemeral or temporary pools, they are most often considerably less than ½ acre in size and less than 2 feet deep at their maximum. Small (1-inch long) Fairy shrimp (*Eubranchipus* spp) are found exclusively in vernal pools, but the vernal-pool characteristic of greatest ecological importance is that no fish live in it, thereby — for those pools that persist for at least 4 months or so — permitting certain amphibians (both salamanders and frogs) to breed there and then have their young develop in relative safety.

The four amphibians around here that depend upon our vernal pools are three mole salamanders (so-called owing to their largely underground habit as adults) — the quite common Spotted salamander (*Ambystoma maculatum*), which can get to be almost 8 inches long, the Blue-spotted salamander (*Ambystoma laterale*), and the rather more rare Jefferson salamander (*Ambystoma jeffersonianum*) — and the Wood frog (*Rana sylvatica*). Of course, some other amphibians may use these pools as well. Those four species requiring a vernal pool live their adult lives within a woodland area of perhaps 25 acres surrounding the vernal pool (that is, out to a distance of perhaps 600 feet), and generally return to the pool of their birth for breeding purposes. The ecological significance of vernal pools has in the past been greatly under-appreciated. We now know that for their long-term conservation in general, the surrounding 1 acre or so (that is, out to about 120 feet) should ideally be left undisturbed, and at least 6 acres (that is, out to about 300 feet) should be kept in woodland.

Finally, note the major outcropping of bedrock, consisting of limy schist, here on the left side of the Dunn Nature Trail.

* * * * *

For a **check list** of **amphibians** you may encounter, see Page 25.

TREES, SHRUBS, & LIANAS A SANCTUARY CHECK LIST

Trees:

- Ash, White (*Fraxinus americana*)
 - Aspen, Bigtooth (*Populus grandidentata*)
 - Aspen, Quaking (*Populus tremuloides*)
 - Basswood (*Tilia americana*)
 - Beech, American (*Fagus grandifolia*)
 - Birch, Black (*Betula lenta*)
 - Birch, Gray (*Betula populifolia*)
 - Birch, Paper (White birch) (*Betula papyrifera*)
 - Birch, Yellow (*Betula alleghaniensis*)
 - Butternut (*Juglans cinerea*)
 - Cherry, Black (*Prunus serotina*)
 - Hemlock, Eastern (*Tsuga canadensis*) — [Conifer]
 - Hickory, Bitternut (*Carya cordiformis*)
 - Hophornbeam (Ironwood) (*Ostrya virginiana*)
 - Maple, Red (*Acer rubrum*)
 - Maple, Striped (Moose maple) (*Acer pensylvanicum*)
 - Maple, Sugar (*Acer saccharum*) — [Our State Tree]
 - Oak, Northern red (*Quercus rubra*)
 - Pine, Eastern white (*Pinus strobus*) — [Conifer]
 - Spruce, Red (*Picea rubens*) — [Conifer]
 - _____
 - _____
 - _____
 - _____
- * * * * *

Shrubs:

- Alder, Speckled (*Alnus rugosa*)
 - Hazelnut, American (*Corylus americana*)
 - Sweet-fern (*Comptonia peregrina*)
 - _____
 - _____
 - _____
- * * * * *

Lianas (woody vines):

- Bittersweet, Oriental (*Celastrus orbiculatus*) — [Invasive]
- Grape, Fox (*Vitis labrusca*)
- _____
- _____
- _____

Station #14: INVASIVE EXOTIC PLANTS

Approximately 20% of our wild northeastern plants have come to us from Europe, Asia, or Africa since colonial times, whether intentionally or otherwise. And a much higher proportion of all our agricultural, horticultural, and floricultural species are similar immigrants. Of those numerous naturalized aliens, a small number have become unwelcome members of our natural communities. Here in the Sanctuary we must contend with one such invader, **Oriental bittersweet** (you will see some examples just ahead, at the end of the Trail near the vehicular pull-off not far from the road); and we must be on the lookout for two others present in the neighborhood, **Common buckthorn and Glossy buckthorn**.

Oriental Bittersweet (*Celastrus orbiculatus*): This is a liana (a woody vine) that was introduced from eastern Asia in the mid 19th century as an ornamental, sporting attractive fruit clusters along the stem. The species has become a highly invasive local pest, being spread by birds into our woodlands. To make matters worse, the roots often send up new stems (root suckers). As a Bittersweet stem grows it perforce spreads along the ground until it twines around and up the stem of an encountered tree. The liana then harms such host by some combination of strangling its stem, shading out its leaves, and adding to its weight and thus to its potential for windthrow. We intend to make every effort to destroy these noxious weeds, so harmful to the native woodland we are conserving.

Common Buckthorn (*Rhamnus cathartica*) –&– Glossy Buckthorn (*Frangula alnus* = *Rhamnus frangula*): These two only somewhat related, but quite similar looking shrubs were introduced from Eurasia in the late 19th century as hedgerow species. The abundant fruits are readily spread by birds into woodland openings created by wind, fire, or logging. Common buckthorn prefers the more alkaline soils, whether dry or wet, whereas Glossy buckthorn prefers the wetter, more acid soils. Both of these pioneer species establish dense thickets in the openings they invade, thereby shading and crowding out the native plant reproduction that would normally occur there. With both buckthorns having become established in the neighborhood, we must remain on the lookout for a possible invasion into the Sanctuary, especially into any of the more open areas.

Station #7: BIRDS & BEASTS

As you walk quietly along the Dunn Nature Trail, while it wends its way through the mature northern hardwood forest of this Sanctuary, you will occasionally see some of the wildlife that make their home here, or at least notice evidence of their presence. You are likely to see Black-capped chickadees (*Poecile atricapilla*), perhaps our State bird, the Hermit thrush (*Catharus guttatus*) or an Ovenbird (*Seiurus aurocapillus*), and — if you are lucky — a Pileated woodpecker (*Dryocopus pileatus*) or Yellow-bellied sapsucker (*Sphyrapicus varius*). You might look for the characteristic holes chiseled out of tree trunks by these and other local woodpeckers. Nocturnally active Barred owls (*Strix varia*) also live here. And soaring overhead you may see some Turkey vultures (*Cathartes aura*), useful carrion feeders which have been able to move this far north as the climate continues to warm.

Red squirrels (*Tamiasciurus hudsonicus*) find plenty to eat here. The large hollow American beech (*Fagus grandifolia*) just to the left of the Trail has been home to a Porcupine (*Erethizon dorsatum*); and nearer to the Trail the porcupine has scraped off and eaten some bark on a smaller beech tree. White-tailed deer (*Odocoileus virginianus*) and the occasional moose (*Alces alces*) make use of the Sanctuary, at least during the winter. You might come across the secretive (and harmless) Red-bellied snake (*Storeria occipitomaculata*); or see a Red-spotted newt (Red eft) (*Notophthalmus viridescens*) or perhaps a Spotted salamander (*Ambystoma maculatum*), the latter dependent on our vernal pools for completing its life cycle (see Station #6). The snow in winter will let you find the tracks of White-tailed deer (*Odocoileus virginianus*) as well as of the re-introduced Fisher (*Martes pennanti*), of mice (*Peromyscus* spp), and of other medium-sized to small mammals — and perhaps also of the re-introduced wild Turkey (*Meleagris gallopavo*).

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For a **check list of amphibians and reptiles**, see Page 25; of **birds** you may encounter, see Page 26; and of **mammals**, see Page 27.

Station #8: TREE MORTALITY

Fortunately, most of the tree species that today comprise this northern hardwood forest are thriving here. Many of them will eventually die of old age. However, some will not be so fortunate and will die before their time. As you can see around you, some of the latter will be blown over in wind storms and yet others will succumb to pests and diseases. Four examples of the latter are singled out below, all the result of exotic invasives, and two exacerbated by our now warming climate.

American Beech (*Fagus grandifolia*): A healthy Beech tree under the excellent site conditions found here can live and grow for more than 300 years, attaining a diameter at breast height (DBH) of perhaps 36 inches and a height of well over 80 feet, maintaining its smooth grayish bark throughout its lifetime. The crop of beechnuts (called "mast") the tree produces every several years is an important source of food for wildlife. However, as you can see (for example, near Station #9), many of our Beech trees are now succumbing to a beech bark disease, recognized in its later stages by the tree's rough, heavily pitted, and cankered bark. The trouble begins with puncture wounds made by the **Woolly beech scale** insect (*Cryptococcus fagisuga*) (inadvertently introduced from Europe around 1900), those punctures in turn providing a means of entry for a fungus, generally *Nectria coccinea faginata*, often fatal within a decade or even sooner. We can expect ever heavier infestations as the climate continues to warm, as this permits ever greater numbers of the scale insects to survive the winter.

American Chestnut (*Castanea dentata*): You will see no chestnut tree here today, although they were an occasional component of these woods up to roughly 75 years ago. Mature trees attained a size at least as large as the mature beech trees described above. Their durable wood was prized for construction purposes and furniture making, their bark was a source of tannin, and the chestnut crop they produced every several years was equally sought after by our forebears and the wildlife. Calamity struck in the form of another fatal fungal bark disease, known as **Chestnut blight**, caused by the alien fungus, *Cryphonectria parasitica*, inadvertently introduced from eastern Asia, also around 1900.

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< Station #13: LICHENS — Concluded >

Old man's beard (*Usnea cavernosa*): A fruticose lichen, gray in color. Found hanging from tree trunks and branches. It is one of the lichens especially sensitive to sulfur-dioxide pollution. (This lichen looks a bit like Spanish-moss [*Tillandsia*], a southern plant that is neither a lichen nor a moss, but rather a higher plant distantly related to the pineapple [*Ananas comosus*].)

Plated rock tripe (*Umbilicaria muehlenbergii*): A foliose lichen, brown in color. Found attached loosely to rocks. Named "tripe" since it is edible, either raw or boiled. It is one of the lichens especially sensitive to sulfur-dioxide pollution.

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For a **check list** of lichens you may encounter, see Page 30.

Station #13: LICHENS

Lichens are organisms composed of a fungus (which forms the visible structure) and a green alga or similar organism (which lives inside the fungal cells) — an inseparable union known as a symbiotic relationship. The fungus contributes a protective structure (the thallus) for the two organisms while the green alga produces the food (sugar) used by both of them. Lichen symbiosis is an amazingly ancient phenomenon, found in the fossil record as far back as 600 million years ago (during the precambrian Ediacaran Period), and thus about as far back as any living organism ever found in the fossil record. Lichens generally attach themselves to rocks or trees (on the trunks and branches), grow very slowly, and live for many decades and centuries (some are estimated to have even lived a mind-boggling 5 thousand or more years). The lichens are incredibly tolerant of extreme environmental conditions (as to temperature, wind, and moisture). On the other hand, most are quite sensitive to air pollution (especially so to sulfur-dioxide, a product of coal burning), their relative abundance in the Sanctuary thus telling us that the air here is reasonably clean.

Lichens can be divided into three main growth forms (although some confusing intermediates do exist): (1) **Fruticose** (those with a branching shrublike form, either with upright stalks, or else with hanging threadlike stalks); (2) **Foliose** (those with a more or less loosely attached leaflike form); and (3) **Crustose** (those forming a crust on rocks or trees, looking almost as if they were painted on; although some crusts form small warts). The rock outcrop to the left of the Trail has both crustose and foliose lichens growing on it. The following are some of the lichens that can be found here and there in the Sanctuary:

Reindeer-moss (*Cladina rangiferina*): A fruticose lichen, ashy gray in color. Often found on the ground in dry rocky sites. Mis-named "moss" because it looks a bit like a moss; and "reindeer" because it is a favored food of Reindeer (*Rangifer tarandus*) (it grows worldwide in the far north) and similar local animals such as Moose (*Alces alces*).

British soldiers (*Cladonia cristatella*): A fruticose lichen, greenish in color. Found in sunny spots, often on decaying logs. Named "British soldiers" because its upright spore stalks have a bright red tip.

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< Station #8: TREE MORTALITY — Concluded >

Butternut (*Juglans cinerea*): Given rich, deep, moist soils, a Butternut can during its life span of only 75 or so years attain a diameter at breast height (DBH) of over 24 inches and a height of 80 feet or even a bit more. Its mast crop of sweet, oily nuts is a favored food of squirrels. And its wood, used in furniture making, is similar to that of Black walnut (*Juglans nigra*), only a bit softer and lighter in color (hence the alternate name of White walnut). The very survival of the Butternut is now threatened throughout its range by a fungal disease known as **Butternut canker** (*Sirococcus clavigignenti-juglandacearum*) that was inadvertently introduced from Asia into North America during the 1960s. The fungus produces sunken elliptical cankers on branches and stems (and dark brown stains beneath the bark). As the cankers increase in number and size they coalesce, resulting in dieback and ultimate death (sometimes hastened by a secondary root-rot fungus, *Armillaria mellea*). The fungal spores infect nearby healthy trees with the help of rain splash, wind, insects, birds, and rodents. You will be hard-pressed to still find a healthy individual.

Eastern Hemlock (*Tsuga canadensis*): Trees growing under cool, moist, and shady conditions (at least to start with) can attain a diameter at breast height (DBH) of up to 30 inches or so and a height of over 80 feet — and they are known to sometimes live for more than 600 years. Tannin for leather making was extracted from their bark in Colonial times, and the wood can be used for rough lumber and low-grade pulp. White-tailed deer (*Odocoileus virginianus*) often winter in Hemlock stands. A tiny insect, the **Hemlock woolly adelgid** (*Adelges tsugae*) was introduced from Asia to the eastern United States in the 1920s. Those insects, which can be found quite readily owing to the small white cottony sacs they produce around themselves, feed on the sap of twigs, thereby slowly killing the associated leaves — and in this way the entire tree, often within several years. The adelgids are dispersed by wind, birds, and mammals. They have now expanded as far north as northern Massachusetts, where their advance seems for now to have been arrested by our lower ambient temperatures. So the Hemlocks you see here in the Sanctuary remain unaffected. But their days may be numbered if the regional climate continues to get warmer and warmer (or else if advancing Adelgid populations evolve into more cold-hardy forms). Their loss would alter the character of much of our forested lands.

Station #9: CLUBMOSES

Clubmosses are lower plants closely related to the ferns (and not at all to the mosses), producing spores and having a vascular system (thus in both ways similar to the ferns noted at Station #3). The clubmosses (also called **Ground-pines** or **Ground-cedars**) are small evergreen perennials found here and there on the shaded forest floor of the Sanctuary. They can spread widely by "running", their horizontally growing underground stems (rhizomes) sending up new plants at frequent (about 6") intervals.

Here are the clubmosses most likely to be found in the Sanctuary, the first two of which are growing here to the left of the Trail (and the other can be found further along):

Flat-branched tree clubmoss (*Dendrolycopodium [Lycopodium] obscurum*): In dry shady woods, 6" to 12" high, upright stem much branched and re-branched, covered with tiny leaves; looking a bit like a pine tree seedling. Also called "**Princess-pine**".

Common clubmoss (*Lycopodium clavatum*): In shady woods, especially under conifers, 5" to 10" high, upright stem once or twice branched, covered with small bristly (toothed) leaves. Also called "**Staghorn clubmoss**", or sometimes "Running clubmoss".

Northern ground-cedar (*Diphasiastrum [Lycopodium] complanatum*): In dry partly shaded woods, 4" to 15" tall, upright much-branched stem, covered with tiny flattened leaves.

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For a **check list** of **Clubmosses** you may encounter, see Page 24.

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To the left of the Trail, beyond the Clubmosses, you will see a vernal pool (see Station #6).

Station #12: FLOWERS

The rich alkaline soils found along some stretches of the Dunn Nature Trail derive from the limy schist bedrock underlying them (see Stations #5 & #11). Such soils lead not only to the grand overstory of northern hardwood trees you see all about you (see Station #1), but also to a splendid herbaceous understory of ferns (see Station #3) and flowering plants (see this Station).

Among the flowering plants you will encounter are such early flowering individuals as the Spring beauty (*Claytonia virginica*); the Blue cohosh (*Caulophyllum thalictroides*); the Round-lobed hepatica (*Hepatica americana*); the Jack-in-the-pulpit (*Arisaema triphyllum*), which in many of those you see should more properly be called Jill-in-the-pulpit; and, more rarely, the Bloodroot (*Sanguinaria canadensis*), the stems and roots of which contain a red sap. These so-called **spring flowers** develop very early in the growing season, which permits them to benefit from the sunlight not as yet obscured by the emerging leaves of the overstory trees. The spring flowers are often found on eastern and southeastern slopes, such slopes serving to soften the early-season cool temperatures.

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For a **check list** of **flowers** you may encounter, see Page 29.

Station #11: THE LIVING SOIL

The soil underfoot is an inseparable and dynamic component of this woodland ecosystem. The soil permits the trees and other plants to send down their roots, both to anchor them in place and to take up their needed water with its dissolved essential minerals. The soil contains untold kinds and numbers of microorganisms (fungi and bacteria). Some of the fungi present form a necessary partnership (a symbiotic relationship) with the plant roots, from which they obtain their food, at the same time helping the roots absorb a sufficiency of water. Some of the soil bacteria convert ("fix") the insoluble nitrogen (N₂) of the air to the soluble nitrate form (–NO₃), making this essential nutrient available to the plants.

Numerous fungi and bacteria make it their job to decompose the leaves, twigs, and other plant and animal droppings and debris that fall to the ground, thereby making the nutrients they contain once again available to the plants from which they had come. In fact, the top layer of the soil — known as the **litter layer** — consists largely of the leaves and other organic debris that fall and collect each year, in this fashion carrying out its share of the endless nutrient cycling within this ecosystem. The litter layer forms a natural mulch, thus serving the function of protecting the soil from erosion as well as from drying out. The soil is also home to many tiny (and not so tiny) burrowing animals (mice, ants, wasps, spiders, earthworms, millipedes, sowbugs, beetles, snakes, slugs, salamanders, nematodes, etc.). Their tunnels and galleries help to aerate the soil and also permit water to be more readily distributed, stored, and taken up by the plant roots.

Thus the soil consists of a most complex assemblage of living or once living ("organic") and non-living ("inorganic") constituents. The so-called inorganic matter — the clay, silt, sand, and rock fragments — is in part derived from breakdown (so-called weathering) of the underlying bedrock of limy schist and other rock types (see Station #5), in part from having been moved here by stream action, and in further part by wind and rain (fallout and washout). But the bulk of the inorganic or mineral matter of the soil in the Sanctuary was actually produced elsewhere and shoved here by the glaciers that last moved south across this area perhaps 12 thousand years ago (that material being known as glacial till).

To the left of the Trail please note the Maidenhair fern (*Adiantum pedatum*), a good indicator of the rich soils found here. To the right of the Trail see the outcrop of milky quartz.

Station #10: MOSSES

Mosses are known as lower plants because they do not produce flowers and fruits. The mosses do not have a true plumbing (vascular) system to move water with its dissolved minerals — or the food (dissolved sugars) made in their green cells — throughout the plant. In these plants, such transport occurs via capillary action (like water moving up a blotter). Mosses are thus somewhat less advanced in evolution than the ferns. The moss plants we see (gametophytes) produce tiny plants (sporophytes) which remain attached to the gametophytes, those tiny sporophytes producing the equivalent of sperm and egg cells which subsequently fuse and then divide to form the new moss plants (gametophytes) that we again see. Mosses are small (being low-growing owing to their lack of a true vascular system), non-woody (herbaceous) perennials. They usually have upright stalks, and they generally prefer moist sites. (Many, many species of mosses are found in the wet tropics.) The rock to the right sports a fine display of mosses. Here are some that can be found in the Sanctuary:

Hair-cap moss (*Polytrichum*): Forms mats with each stalk ending with its leaflets star-shaped, often growing on soil in shady or open woods. Spores are carried on erect stalks about 3" long.

Pin-cushion moss (*Leucobryum glaucum*): Forms small mounds (up to 12" or so across) that resemble pin cushions, often growing on rocks in shady woods.

Sphagnum moss or **Peat moss** (*Sphagnum girgensohnii*): Forms extensive green (sometimes reddish) mats in wet areas, often around bogs. The moss can absorb much water, whether alive or dead.

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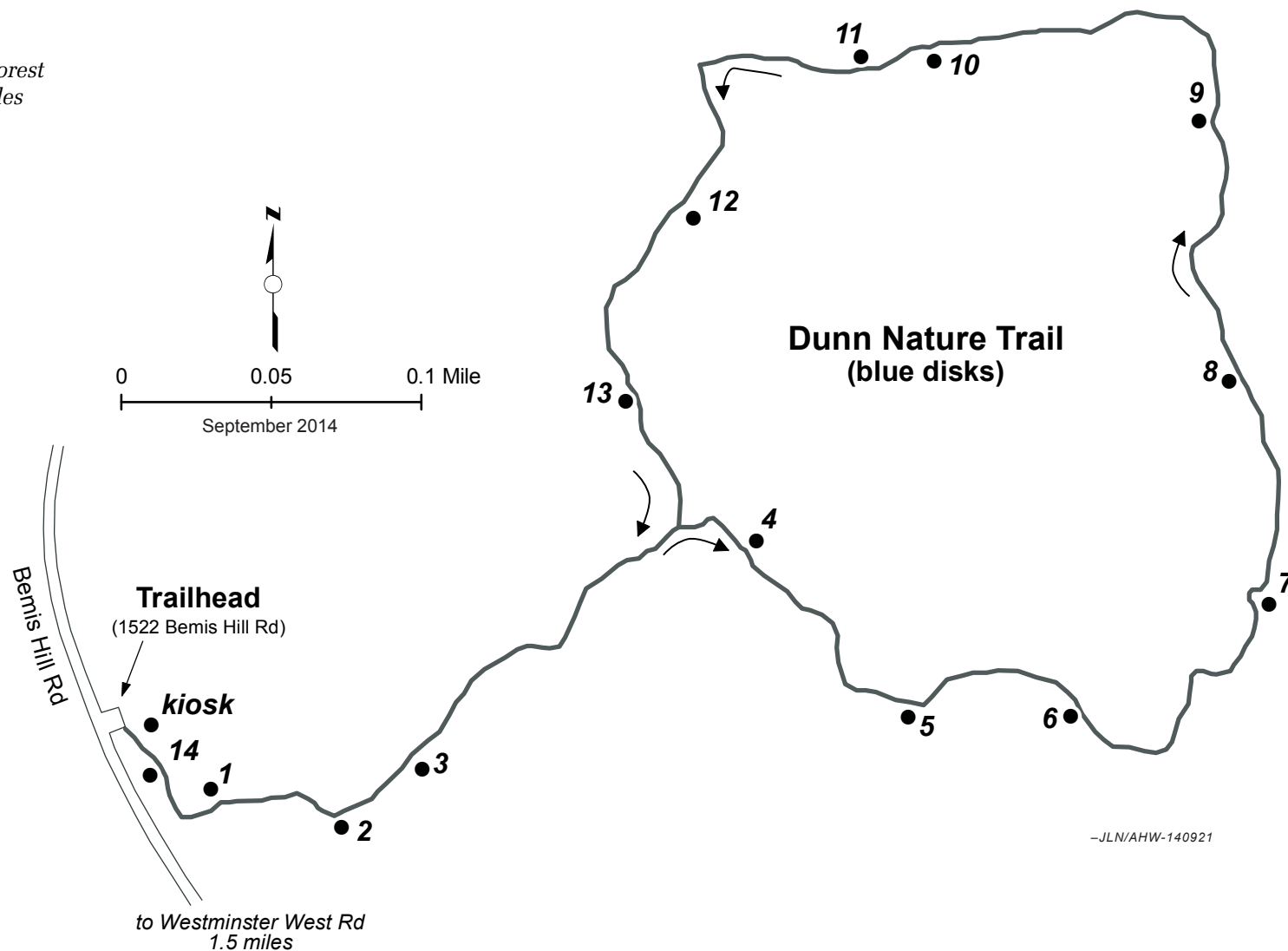
For a **check list** of **Mosses** you may encounter, see Page 28.

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Finally, please note that **Reindeer-moss** (*Cladonia rangiferina*) — found here in dry rocky sites — is not a moss, but rather a lichen (a symbiotic fungus plus green alga or similar organism), so named because it looks a bit like a moss (and because it is a favored food of Reindeer (*Rangifer tarandus*), and of Moose [*Alces alces*]) — for lichens, see Station #13. Neither are the **Clubmosses** (*Lycopodium* etc.) we find here mosses, but rather plants quite closely related to the ferns (see Station #3) — for Clubmosses, see Station #9.

**WINDMILL HILL PINNACLE ASSOCIATION
STEPHEN MARTIN MEMORIAL WILDLIFE SANCTUARY
< Southern (Westminster) Portion >**

- Station # 1 Northern Hardwood Forest
- Station # 2 Stone Walls & Rock Piles
- Station # 3 Ferns
- Station # 4 A Lime Kiln
- Station # 5 Beneath It All
- Station # 6 A Vernal Pool
- Station # 7 Birds & Beasts
- Station # 8 Tree Mortality
- Station # 9 Clubmosses
- Station # 10 Mosses
- Station # 11 The Living Soil
- Station # 12 Flowers
- Station # 13 Lichens
- Station # 14 Invasive Exotic Plants



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