Old-growth Forest
Field Sampling Protocols for Citizen Science

Level 2 – Intermediate Survey Protocol v2.1

Peterborough Old-growth Forest Project

Ancient Forest Exploration & Research

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Introduction

It is generally accepted that all types of old-growth temperate forests in Ontario are endangered ecosystems, and the vast majority of them remain unprotected and available to logging. These unique landscapes provide numerous benefits to people locally, regionally and globally including carbon storage and sequestration, biodiversity protection, education, scientific study, recreation, and spirituality. In this document, we present a sampling protocol that has been developed to support field surveys of potential undocumented old-growth forests in Peterborough County, Ontario to be carried out by citizen scientists during the 2019 field season. However, it is also applicable to other temperate forest landscapes in Ontario.

This rapid assessment technique is generally not faster than the Level 1 protocol but is more rapid than Levels 3 and 4. It is designed to cover large areas of old-growth forest in a relatively short period of time with minimal technical expertise. For all protocol levels, we recommend using *Trees of Ontario* (Kershaw 2001) or *Forest Plants of Central Ontario* (Chambers et al. 1996) to identify tree species, however, there are many other good tree identification field guides that apply to Ontario.

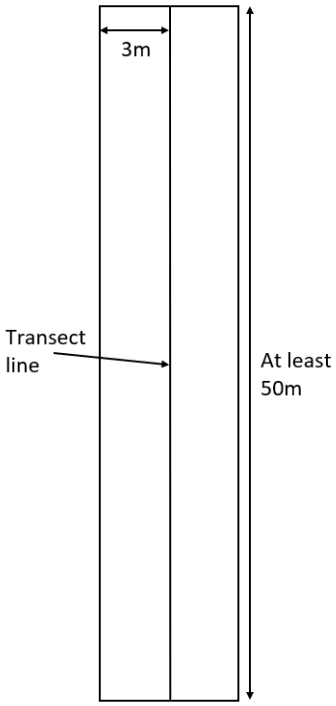
Whenever possible, Ancient Forest Exploration & Research (AFER) will create maps of potential undocumented old-growth forests to support citizen-science surveys and will recommend high priority areas for sampling. However, since these protocols include a minimum tree diameter at breast (4.5 ft) height (DBH) and circumference at breast height (CBH) (Table 1), AFER maps are not required for the use of the Basic Survey Protocol (Level 1). AFER mapping should be used, however, for Protocol Levels 2 through 4. Metric units are used for these protocols. For those using tapes with English units, 1 inch is equal to 2.54 cm – be sure to convert when applying the values presented here.

The conservation status of Ontario's temperate forests at risk (all forest ages) is provided in Tables 2 and 3, which can be used to help determine which forest types and/or forest community types for citizen scientists to focus their surveys on. Some may prefer to survey in old-growth forests that are most at risk thus increasing the likelihood that they may be protected.

AFER will collect, analyze and present field data and related results obtained by citizen scientists on one or more of AFER's websites. These protocols will inevitably be revised as the number of old-growth forest surveys carried out by citizen scientists grows and feedback is received. In particular, we are interested in the relationships among tree age, tree size and habitat conditions in order to refine our predictions of tree age from tree diameter under a variety of growth influences.

Level 2 – Intermediate Survey Protocol

Overview: The *Intermediate Survey Protocol* builds on the *Basic Survey Protocol* by (1) adding an area component to the sampling, which enables density and volume calculations, (2) sampling of the gradient of habitat conditions in the forest stand, and (3) the presence of an approved AFER field leader. The field leader should have the following attributes: able to identify tree species in the sampling area, an understanding of basic forest ecology, and experience bushwacking and leading groups in remote locations. AFER will assist those interested in becoming an approved Level 2 field leader.



Variables (features) to Assess: This protocol involves collecting tree data within a transect 6 m wide. The transect geolocation should be determined prior to going to the field using FRI and topographic maps. Transects can be re-oriented in the field in order to avoid landscape features such as ponds, rivers, cliffs, wetlands, and active or historical logging areas. Within each transect, the following features should be assessed and recorded:

- DBH, species, and geolocations of trees that meet the old-growth size criterion for the species (see Table 1);
- stumps (≥ 10 cm DBH)– species identification (if possible), diameter, geolocation, and decay class (1- 5) (see Appendix B); and
- geolocations of any healthy American beech and ash trees.

Photos of large trees should also be obtained but are not required for every large tree. The Site Observations Form should be completed every 100 m.

Spatial Distribution of Samples (measured trees): Whenever possible, a complete hill system (valley to hilltop) should be sampled starting with a north-south transect and ending with an east-west transect. Slope position, slope aspect and slope steepness types can be recorded using the Site Observations form. A transect can be as long as necessary to cover the area selected, but should be at least 50 m long. Transects should be at least 20 m away from major roads or paths and separated parallel transects by at least 50 m.

Recommended Equipment and Materials: (1) tree identification field guide, (2) local topographic maps, (3) compass, (4) GPS unit or phone with a GPS app, (5) camera, (6) pens, pencils, and field notebook, (7) DBH tape or standard measuring tape for CBH, (8) a 50 or 100 m tape should be used to establish the transect centreline, (9) binoculars to view branches, leaves/needles, (10) flagging tape, and (11) standard bushwack-hiking items such as a first-aid kit, bug jacket, mosquito repellent, rainwear, waterproof boots, etc.

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Woldendorp, G. et al. 2002***. An Analysis of Sampling Methods for Coarse Woody Debris in Australian Forest Ecosystems***, A Report For the National Greenhouse Strategy, Module 6.6 - Criteria and Indicators of Sustainable Forest Management, Bureau of Rural Sciences, The Landscape Management Sciences Program, Canberra, Australia. (http://data.daff.gov.au/brs/brsShop/data/12882_analysis_cwd.pdf)

TABLE 1. Estimated Minimum Diameters for Old-growth Forest Trees in Temperate Forests of Ontario

Species	Minimum Old-Growth Age (yrs)	Minimum Diameter (cm/in)	Minimum Circumference (cm/in)
American Basswood	110	60	188
American Beech	140	30	94
Balsam Fir	70	30	94
Black Ash (from Green Ash)	120	50	157
Black Cherry	120	50	157
Black Spruce Swamps	100	15	47
Black Spruce Uplands	100	30	94
Bur Oak (from White Oak)	120	40	126
Eastern Hemlock	140	40	126
Eastern White Pine	120	50	157
Jack Pine	120	25	79
Poplar	90	40	126
Red Maple	90	35	110
Red Oak	120	50	157
Red Pine	120	40	126
Silver Maple	120	60	188
Sugar Maple	140	35	110
Tamarack	90	25	79
White Ash (from Green Ash)	120	50	157
White Birch	100	35	110
White Cedar	110	30	94
White Oak	120	40	126
White Spruce	100	30	94
Yellow Birch	140	45	141

TABLE 2. Conservation Status of Temperate Forest Types in Central Ontario (on the Canadian Shield)
(>60% dominance in the overstory; all ages; based on FRI data)

Forest Type	2001		2006		2011		10-yr Change	Conservation Status
	Ha	%	Ha	%	Ha	%		
American Basswood	263	0.02	177	0.02	177	0.01	declined (33%)	**Critically Endangered**
American Beech	2,261	0.2	388	0.2	404	0.03	declined (82%)	
Yellow Birch	4,913	0.3	5,670	0.4	5,366	0.4	increased (9%)	
Eastern Hemlock	20,236	1.4	18,140	1.5	18,618	1.5	declined (8%)	**Endangered**
Red Maple	165,213	11.6	21,043	12.5	20,930	1.6	declined (87%)	
Ash (Black & White)	24,575	1.7	29,792	1.9	27,580	2.2	increased (12%)	
Oak (all; primarily Red)	52,671	3.7	37,271	4.0	38,902	3.0	declined (26%)	**Threatened**

Red Pine	59,193	4.2	67,195	4.5	73,025	5.7	increased (36%)	**Special Concern**
Balsam Fir	102,838	7.2	127,316	7.8	100,940	7.9		
White Spruce	99,007	7.0	115,953	7.5	108,785	8.5		
Eastern White Pine	110,607	7.8	121,607	8.4	130,916	10.2		**Common**
Northern White Cedar	237,805	16.8	253,444	18.0	237,691	18.6		
Sugar Maple	539,900	38.0	521,883	40.9	515,099	40.3		
Total	1,419,482		1,319,879		1,278,433			

TABLE 3. Ontario's Endangered Forested Ecosystems
(Ontario NHIC 2019; https://www.ontario.ca/page/natural-heritage-information-centre)

Critically Imperiled Forested Ecosystems (S1)
Upland Types
Cedar Forests
Red Cedar Basic Treed Rock Barren
Red Cedar Treed Granite Barren
Red Cedar Treed Limestone Barren
Hickory Forests
Shagbark Hickory-Prickly Ash - Philadelphia Panic Grass Treed Alvar Grassland
Oak Forests
Black Oak Tallgrass Dry Savannah
Black Oak-Pine Tallgrass Dry Savannah
Black Oak-White Oak Tallgrass Dry Woodland
Black Oak-White Oak Tallgrass Moist-Fresh Woodland
Bur Oak Northern Tallgrass Moist-Fresh Savannah
Black Oak Tallgrass Moist-Fresh Savannah
Bur Oak Treed Alvar
Bur Oak-Shagbark Hickory Tallgrass Dry Woodland
Chinquapin Oak - Nodding Onion Treed Alvar Grassland
Chinquapin Oak Carbonate Treed Dry-Fresh Talus
Oak Treed Limestone Barren
Oak-Pitch Pine Mixed Dry Forest
Pin Oak-Bur Oak Tallgrass Moist-Fresh Savannah
Pin Oak Tallgrass Fresh-Moist Woodland
Pine Forests
Pitch Pine Treed Granite Barren
Imperiled (S2)
Upland Types
Basswood Forest
Basswood-White Ash-Butternut Moist Treed Limestone Talus
Black Walnut Forest
Black Walnut Moist-Fresh Deciduous Forest
Hemlock Forest

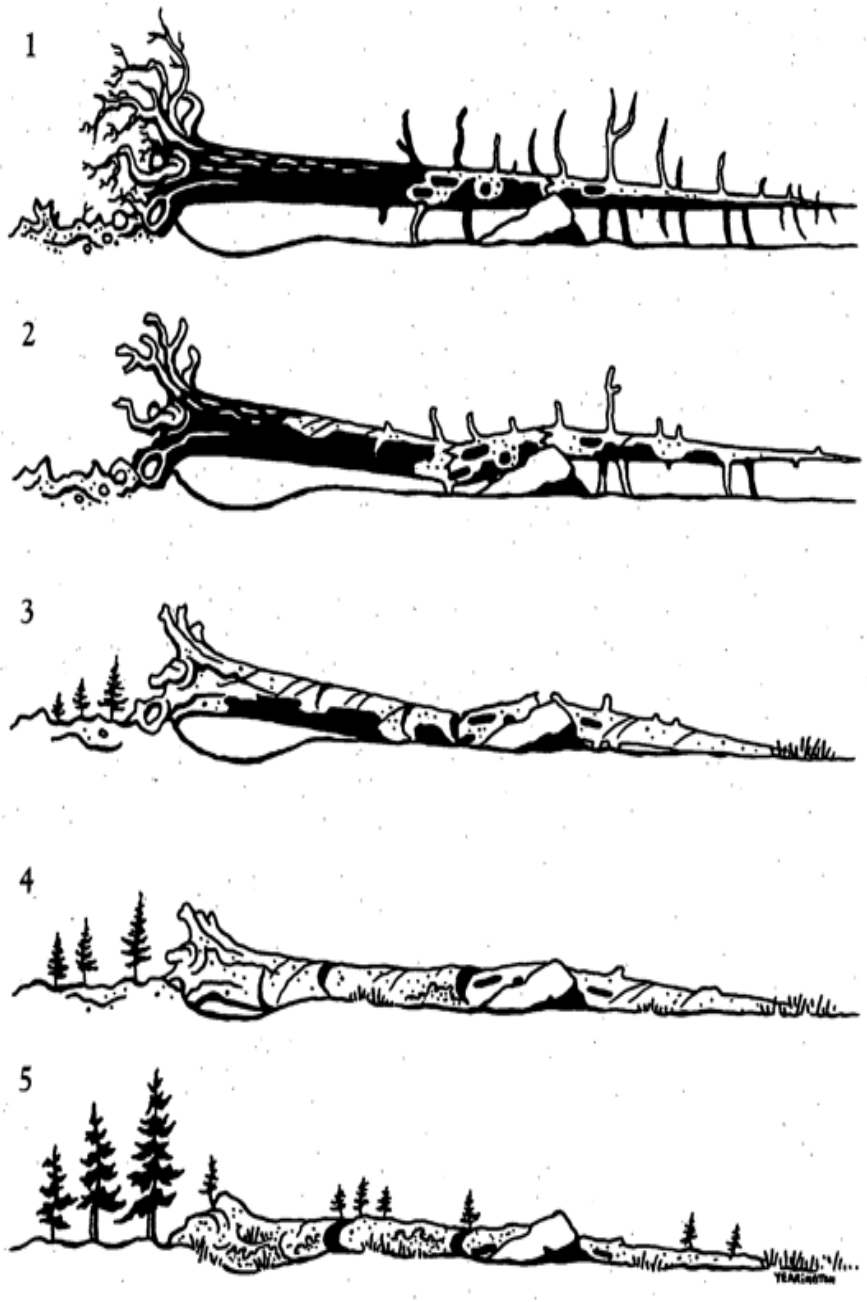
Hemlock-Sugar Maple Moist Limestone Talus
Oak Forest
Bur Oak Basic Treed Rock Barren
Bur Oak-Green Ash-Trembling Aspen Moist-Fresh Deciduous Forest
Bur Oak Saskatoon Berry Dry Deciduous Woodland
Chinquapin Oak-Pine Dry Mixed Forest
Wetland Types
Maple Forest
Red Maple-White Pine Mineral Mixed Swamp
Oak Forest
Pin Oak Mineral Deciduous Swamp
Shumard's Oak Mineral Deciduous Swamp
Swamp White Oak Mineral Deciduous Swamp
Pine Forest
White Pine-Coniferous Mineral Swamp
Vulnerable (S3)
Upland Types
Birch Forests
White Birch-Aspen Treed Limestone Cliff
White Birch Dry Treed Limestone Talus
Cedar Forest
White Cedar-White Spruce Philadelphia Panic Grass Treed Alvar Grassland
White Cedar Dry Treed Limestone Talus
White Cedar Treed Limestone Cliff
Hickory Forest
Bitternut Hickory Fresh-Moist Deciduous Forest
Hickory Dry-Fresh Deciduous Forest
Shagbark Hickory Fresh-Moist Deciduous Forest
Maple Forest
Sugar Maple-Black Maple Moist-Fresh Deciduous Forest
Black Maple Lowland Fresh-Moist Deciduous Forest
Sugar Maple-Ironwood-White Ash Treed Limestone Cliff
Sugar Maple Moist Treed Limestone Talus
Oak Forest
Mixed Oak Dry-Fresh Deciduous Forest
Black Oak Dry Deciduous Forest
Oak-Hickory Dry Deciduous Forest
Bur Oak Fresh-Moist Deciduous Forest
Hill's Oak-White Pine-Poplar Acidic Treed Rock Barren
Sassafras Forest
Sassafras Fresh-Moist Deciduous Forest
Wetland Types
Cedar Forest
White Cedar-Hemlock Coniferous Mineral Swamp
White Cedar-Hemlock Coniferous Organic Swamp

Maple Forest
Red Maple-Hemlock Mixed Mineral Swamp
Red Maple-Hemlock Mixed Organic Swamp
Oak Forest
Bur Oak Mineral Deciduous Swamp
Pine Forest
White Pine-White Birch Mineral Mixed Swamp
Tamarack Forest
Tamarack-Leatherleaf Treed Kettle Peatland
Apparently Secure (S4)
Cedar Forest
Red Cedar Dry Coniferous Forest
Maple Forest
Maple-Yellow Birch-Hardwood and Mixedwood
Sugar Maple-Basswood-Leatherwood Forest
Sugar Maple-Hickory Dry-Fresh Deciduous Forest
Oak Forest
Oak-Maple Fresh-Moist Deciduous Forest
Oak-Red Maple-Pine Basic Treed Rock Barren
Oak-Sugar Maple Fresh-Moist Deciduous Forest
White Oak Dry-Fresh Deciduous Forest
Pine Forest
Jack Pine Basic Treed Rock Barren
Red Pine-White Pine Dry Coniferous Forest

APPENDIX A – SITE OBSERVATIONS FORM (June 2019)

SITE CHARACTERISTIC	DESCRIPTION
TOPOGRAPHIC HABITAT DETERMINANTS (circle appropriate choice)	**1) slope position:** hilltop; upper slope; mid-slope; lower slope; valley; riparian **2) slope aspect:** N; NE; E; SE; S; SW; W; NW **3) slope steepness:** none/flat; low; medium; high
BEDROCK/SURFICIAL GEOLOGY (large slabs, boulders, jagged rocks, etc. - covered by moss/lichen?) – add notes	
EVIDENCE OF FIRE (e.g., fire scars on trees, burned foliage, burned logs, burned snags, charcoal in soils, other) – add notes	
ANIMALS (scat, bird/frog calls, tracks, sightings, insects, antlers, bones, etc.) – add notes	
GAPS IN OR NEAR PLOT (describe location (N, E, S, W), size, composition) – add notes	
WETLANDS (in or near plot - how close to plot? Type of wetland? Open water? Extent of wetland?)	
SNAGS AND LOGS ASSESSMENT FOR SURVEY LEVEL 1 (describe size, amount, decay level, and distribution relative to big tree)	
OTHER (impressions, rare or uncommon plant species, etc.)	

Appendix B –Decay Class Cheat Sheet



Looking beneath logs is a good way to start studying the ecology of downed woody debris. But be careful. If you roll a log over to look beneath it, remember to roll it back. If the log is left rolled over, the moist micro-habitat will dry out and will take quite a while to recover.

Decay Class	Form and Shape of Log	Branches	Bark	Wood Moisture/ Texture	Plant and Animal Habitat
Decay Class 1	•Tree recently fallen, form still distinct •Log round and rigid	•May be elevated by branch stubs or ground	•Bark intact	•Solid, rigid tree with dry, hard wood	•Little or no new plant growth on log
Decay Class 2	•Form still distinct •Log round •Log supports weight of person	•Branches and branch stubs mostly gone	•Bark loose but patches may still remain	•Moist wood, beginning to soften •Log somewhat rigid but sags	•Some new moss, lichen, fungal and algal growth on parts of the log •Grouse drumming and woodpecker foraging site
Decay Class 3	•Log round but sags to conform with ground contours	•No branches	•Trace of bark	•Wood breaks into large hard pieces •Log does not fully support weight of person	•Tree seedlings and flowering plants begin to grow on log •Bear foraging site (ants)
Decay Class 4	•Log rotten and covered with leaves •Log oval or flattened •All of log on ground or beneath surface of ground or leaf litter	•No branches	•No bark	•Soft and powdery wood •May not appear as log at first glance	•Nurse log for tree seedlings •Perched trees or seedlings may be only evidence of log
Decay Class 5	•Log rotten and covered with leaves •Log oval or flattened •All of log on ground or beneath surface of ground or leaf litter	•No branches	•No bark	•Soft and powdery wood •May not appear as log at first glance	•Nurse log for tree seedlings •Perched trees or seedlings may be only evidence of log •Breeding site for snakes and salamanders