Request for Proposals
Comprehensive Timber Inventory

Holt Research Forest
Arrowsic, Maine

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Background

Maine TREE (Timber Research and Environmental Education) Foundation was founded in 1989 by a group of dedicated timberland owners, forest product producers, tree farmers, and others interested in the sustainable stewardship of the Maine woods and forest economy. *Mission: The Maine TREE Foundation educates and advocates for the sustainable use of the forest and the ecological, economic, and social health of Maine's forest community.*

The Holt Research Forest in Arrowsic encompasses nearly 300 forested acres, 30 acres of salt marsh, and significant frontage along Sewell Pond and the Back River. It was established in 1983 and became part of the Maine TREE Foundation in 2014. The Holt Woodlands Research Foundation has funded 40 years of research and forest-based education on the property.

Holt Research Forest is renowned for its long-term, comprehensive datasets. The nearly 100-acre study area is divided into 40 one-hectare blocks, with each hectare block subdivided into four quadrats (Figure 1). Since the study's establishment in 1983, five 100% tree inventories of the study area have been completed. The last 100% timber inventory was completed in 2020, before a timber harvest at Holt Research Forest that same year. A post-harvest 100% timber inventory began in the summer of 2022 ([data are available here](#)). **Maine TREE Foundation seeks proposals to complete the post-harvest 100% timber inventory.**
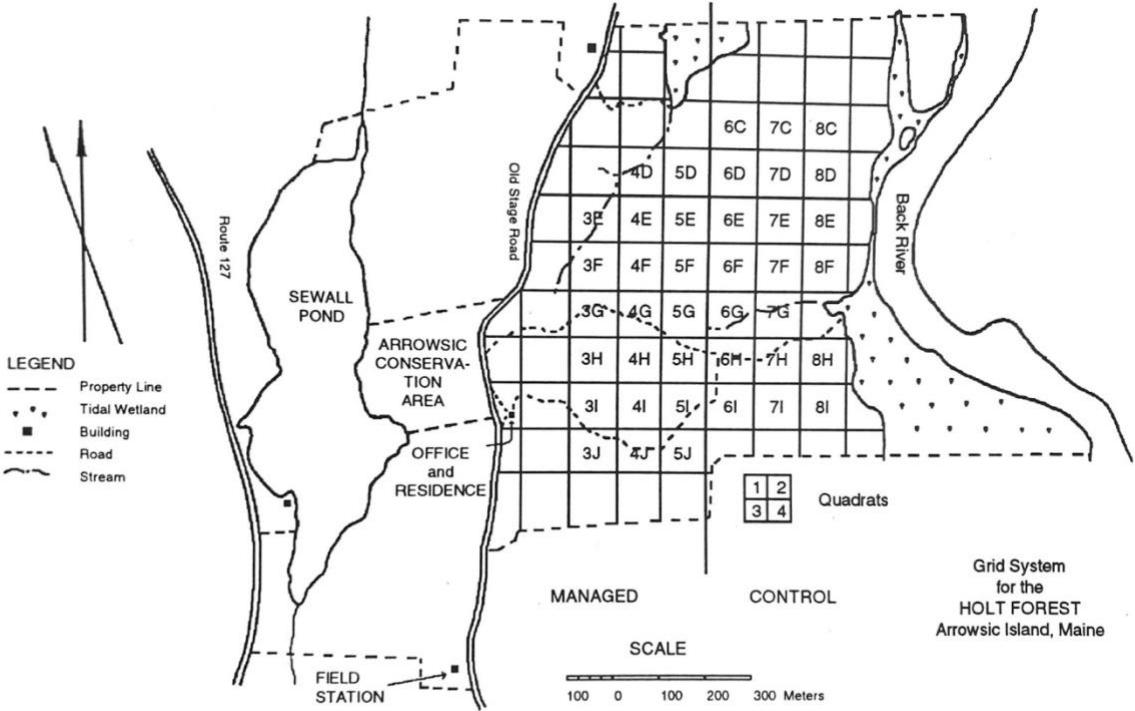

Figure 1. Grid System of the Holt Research Forest.

Scope of Project

Data collected through 100% Timber Inventories at Holt Research Forest includes all living trees (and trees that have died since the previous measurement) with a DBH greater than 9.49 cm. Record block, quadrat, tree number, species, DBH (recorded by one-centimeter classes), condition, and any additional notes of interest (see established methods). This data complements a large repository of ecosystem monitoring data at Holt Research Forest and serves Maine woodland owners who steward coastal oak-pine forests. Oak-pine forests are relatively understudied in the region, and HRF fills a gap in providing landowners with tools and data to inform management of this forest type.

Maine TREE technicians completed ⅓ of a post-harvest 100% tree inventory during the summer of 2022 (Figure 2: inventoried blocks denoted in orange). They completed up to quadrat 3 of block 6E. Maine TREE needs data collected from all other 1-ha blocks. In total, 68.57 acres (approximately 14,000 trees) need to be inventoried.

We are requesting quotes for three types of service: 1) the remaining post-harvest tree inventory (approximately 14,000 trees), 2) a complete post-harvest 100% tree inventory (approximately 21,000 trees) and 3) digitization of previously collected pre-harvest data, which is currently in paper form (sample in Appendix A). Maine TREE is able to provide basic housing for project teams, which may consist of tent sites or shared indoor living space.
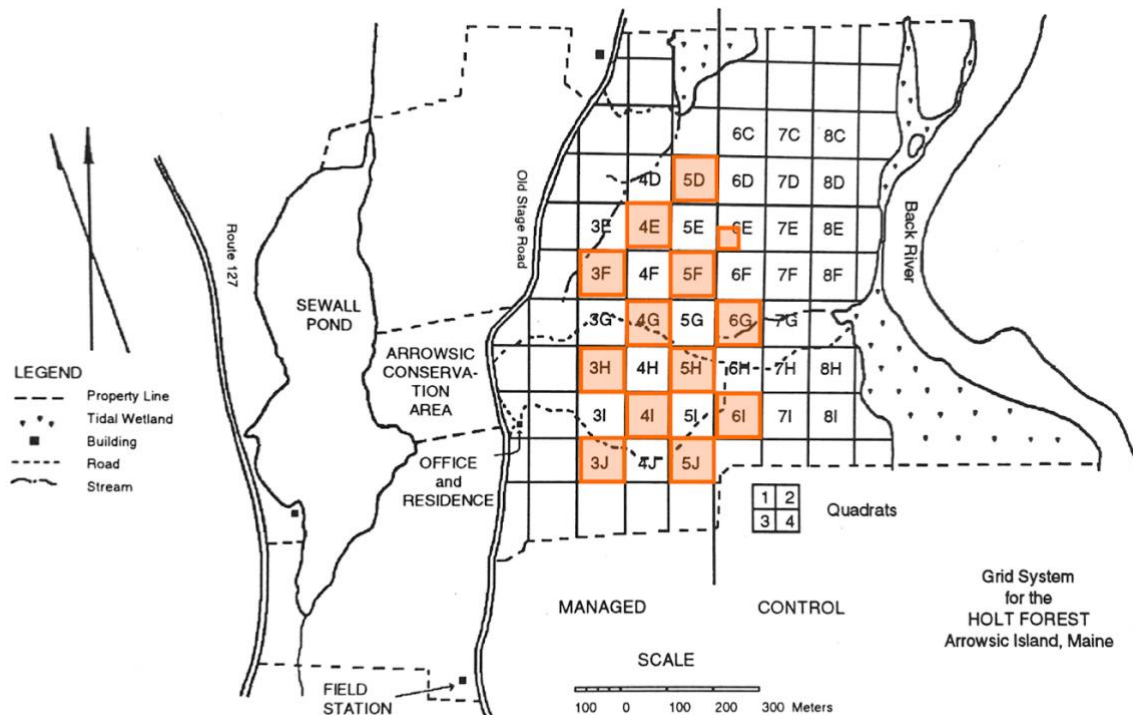
Figure 2. Post-harvest 100% Tree Inventory Completed Blocks (orange denotes completed).
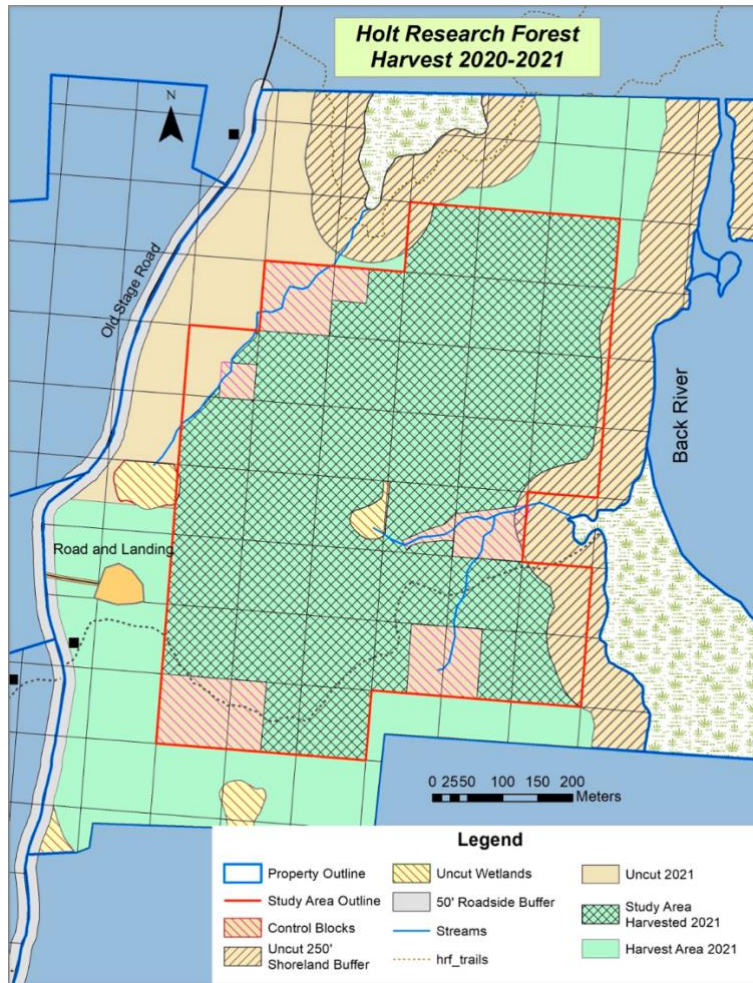
Figure 3. Holt Research Forest 2020-2021 Harvest Map

Project Deliverables

1. Raw data in electronic form
2. Inventory report, including volume, basal area, trees/acre by species, condition class breakdown, and a sample comparison of harvest and control areas.

Proposal Requirements

1. A narrative description of your approach to the project, methods used, and experience with similar projects. Established methods are provided below, though their implementation is not necessary for project completion. Please provide substantive details on methodology if you propose implementing different methods.
2. A proposed schedule for project implementation. Maine TREE Foundation requires a completed 100% tree inventory by October 31, 2023.

3.   Quotes for the following potential projects:
   1. 100% Inventory of the entire 40-ha research area at HRF (including the blocks inventoried by Maine TREE technicians in 2022, denoted in orange in Figure 2)
   2. 100% Inventory of the 28-ha not yet inventoried post-harvest (*excludes* the blocks denoted in orange in Figure 2).
   3. Digitization of raw pre-harvest data (100% tree inventory completed in 2019-2020) currently in paper form (sample in Appendix A)
4.   Contact information for three references.

Timeline

April 21	Request for Proposals.
May 29, 2023	Proposals due to Maine TREE Foundation
June 15, 2023	Consultant selected and contract signed.
October 31, 2023	Project completed.

Project Oversight

Maine TREE Foundation's Executive Director, Logan Johnson, and Forest Programs Manager, Gavriela Mallory, will oversee the project in consultation with the Holt Research Forest Advisory Committee. A quality assurance assessment will proceed payment. Please direct questions regarding the property or project to Gavriela Mallory via email at gavi@mainetree.org.

Proposal Submission Deadline

5 pm Monday, May 29, 2023. Please send proposal materials to gavi@mainetree.org. Please direct all questions to the same.

Established Methods

These methods are provided for proposals to incorporate as is helpful. Maine TREE is not requiring proposals to incorporate these methods.

Set-Up
All blocks in the study area are measured. The block progression should begin with 6C and proceed east on C, west on D, east on E, west on F, east on G, west on H, east on I, west on J. Within a block, each quadrat is tallied separately, moving in the "U" shaped order 1,3,4,2 when doing east and 2,4,3,1 when going west.

Crews consist of three people, one recorder, and two observers. The recorder is responsible for recording data on the polycorder, ensuring observers find and count all numbered and recruited trees, and defining the southern line of the measuring area. The observers measure trees.

Procedure

1. When a crew arrives at a quadrat, the observers lay the 50m ropes along the two quadrat lines to help define the quadrat boundaries. Quadrat lines are marked by two horizontal blue lines painted on bordering trees.
2. The recorder records the date, observers, recorder, weather, and comments on a tally sheet to keep a record of observation dates and any problems encountered.
3. The most efficient means for covering the area of a quadrat is to make three parallel sweeps (east-west) beginning in the NW corner (Figure 3). This can be varied according to stand density. While the observers make the sweeps, the recorder defines the southern edge of the quadrat, keeps the observers in line, and makes sure all trees are measured.
4. The observers call out the tree number, species, diameter, and condition (if it is in a category other than "live"). The recorder repeats the information back to each observer to corroborate it, and then records it on the polycorder with the timber inventory program. Multistem trees have historically been marked as a, b, c, etc., and data has been collected for each stem individually. Such trees are denoted as "tree number . stem number" with stem number "1" corresponding to "a", "2" to "b" etc.
   1. *Diameter measurements.* Measure tree diameter with a diameter tape at breast height as defined by 130cm up from the base of the bole. DBH lines were historically marked and measurements should occur at the top of any identified DBH lines, though not all trees are marked. Marked sticks can be provided by Maine TREE to assist in consistent measurement. All trees with a DBH greater than 9.49 will be recorded by one-centimeter classes. A DBH class (x) is delineated by the following rule: [(x-1)+.5] to [x+.49], e.g., [(10-1)+.5] to [10+.49] = 9.5 to 10.49.
   2. *Tree number, species, and condition.* Tree number is found on an aluminum tag at the base of the tree. Tree species and condition codes are found in Table 1. The conditions are defined as (0) live—a healthy tree; (1) dead—no living cambium layer; (2) cull—a deformed or damaged tree of no commercial value; (3) dead top—a tree with the top 1m or more dead; (4) almost dead—a tree that will probably die within five years; (5) still standing—a tree that was dead during a previous inventory and is still standing; and (6) dead and down—a dead tree that has fallen.
5. Mark the tree on its south side with a chalk stick so the recorder can check the tally. Mark dead trees permanently by tacking them twice on the south side so they are not recorded again in future inventories.
6. In all subsequent timber inventories, crews must look for "recruitment" trees, trees that have grown into the TI class by reaching a DBH 9.5 (measure, don't estimate). Recruitment trees are given a unique number (bring appropriate tags for this purpose). Then measure the tree for timber inventory and record the data.
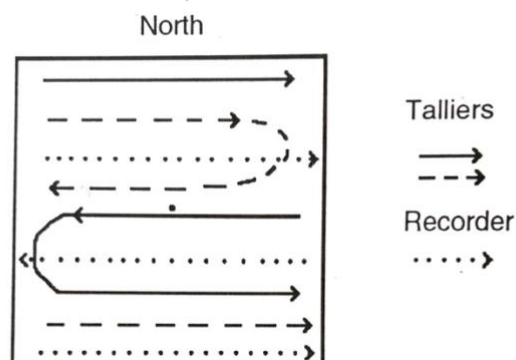
Figure 4. Three-person crew routes to cover one quadrat

Table 3–1. Tree species and condition codes.

	Tree Species Codes	
Species Name	Common Name	Number
Pinus strobus	White Pine	1
Picea rubens	Red Spruce	2
Abies balsamea	Balsam Fir	3
Tsuga canadensis	Hemlock	4
Quercus rubra	Red Oak	5
Quercus alba	White Oak	6
Acer rubrum	Red Maple	7
Betula alleghaniensis	Yellow Birch	8
Betula papyrifera	Paper Birch	9
Betula populifolia	Gray Birch	10
Fagus grandifolia	Beech	11
Fraxinus americana	White Ash	12
Acer pensylvanicum	Striped Maple	13
Populus grandidentata	Bigtooth Aspen	14
Populus tremuloides	Quaking Aspen	15
Prunus serotina	Black Cherry	16
Pyrus malus	Apple	17
Ostrya virginiana	Hop Hornbeam	18
Pinus resinosa	Red Pine	19
Pinus rigida	Pitch Pine	20
Hamamelis virginiana	Witch Hazel	25
Alnus sp.	Alder Sp.	26

Tree Condition Codes	
Tree Condition Class	Code
Live	0
Dead	1
Cull	2
Dead-Top	3
Almost Dead	4
Still Standing	5
Dead and Down	6

Table 1. Tree species and condition codes.

Appendix A.: Sample of raw 2019-2020 pre-harvest data.

Holt Research Forest
Timber Inventory – 2020

Quadrat 3E1   Observers JG ER   Recorder NH   Weather clear, mild
GD TH NH   ER

YEAR	SQ	TREENO	SPEC07	DBH07	COND07	SPEC20	DBH20	COND20	COMMENTS
2007	3E11	1	1	13	5				
2007	3E11	2	1	14	5	1	14	5	
2007	3E11	3	1	21	0	1	21	1	
2007	3E11	5	1	11	5				
2007	3E11	6	1	31	0	1	33	0	
2007	3E11	12	1	21	0	1	22	0	
2007	3E11	13/001841	1	22	0	1	25	0	RT 001841
2007	3E11	15	1	NA	6				
2007	3E11	16	1	22	0	1	25	0	
2007	3E11	17	1	12	5	1	12	5	
2007	3E11	18	1	NA	6				
2007	3E11	19	1	27	0	1	27	0	
2007	3E11	20	1	23	0	1	24	0	
2007	3E11	21	1	NA	6				
2007	3E11	22	1	23	0	1	26	0	
2007	3E11	23	1	19	1				
2007	3E11	24	1	16	1	1	15	5	
2007	3E11	25	1	16	0	1	18	0	
2007	3E11	26	1	NA	6				
2007	3E11	27	1	22	1	1	20	5	
2007	3E11	28	1	21	0				
2007	3E11	30	1	28	1	1	25	5	
2007	3E11	33	1	14	5	1	14	5	
2007	3E11	34	1	22	0	1	23	0	
2007	3E11	35.1	1	NA	6			6	
2007	3E11	35.2	1	20	0	1	20	0	
2007	3E11	36	1	12	1			6	
2007	3E11	37	1	26	0	1	27	0	
2007	3E11	39	1	NA	6				
2007	3E11	40	1	21	0	1	24	0	
2007	3E11	41	1	24	0	1	24	4	
2007	3E11	42	1	11	0	1	11	1	
2007	3E11	43	1	16	5				
2007	3E11	44	1	NA	6				
2007	3E11	45	1	26	1	1	23	5	
2007	3E11	46	1	26	0	1	26	0	
2007	3E11	48	1	NA	6				
2007	3E11	50	1	20	0	1	22	0	
2020	4	001822	12	19	0				
	4	001918	5	12	0				
	4	001823	3	11	0				
	4	320	7	30	0				
	1	14	17	39	0				

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Date 31st July 2019

Holt Research Forest
Timber Inventory – 2019

Quadrat 3J1   Observers DIXIL MMMM   Recorder HA   Weather Cool & Warm

SQ	TREENO	SPEC	DBH96	COND96	SPEC19	DBH19	COND19	COMMENTS
3J11	204	3	14	0	3	15	1	
3J11	205	3	16	0	3	17	0	
3J14	207	1	17	0	1	20	0	
3J11	210	2	10	0	2	13	0	
3J11	211	3	10	0	3	14	0	
3J13	212	3	13	0	3	NA	6	
3J13	213	1	10	0	1	16	0	
3J14	214	1	13	0	1	18	0	
3J12	215	2	11	0	2	11	0	
3J12	217	3	10	0	3	12	0	
3J13	359	1	11	0	1	11	1	
3J12	371	7	13	0	7	19	0	
3J12	373	3	12	0	4	14	0	
3J11	378	2	13	0	2	16	0	
3J11	383	5	17	0	5	22	0	
3J12	393	1	13	0	1	17	0	
3J12	394	1	12	0	1	13	0	
3J12	395	2	17	0	2	22	0	
3J12	396	1	13	0				
3J12	397	5	17	0	5	20	0	
3J11	398	2	13	0	2	16	0	
3J11	399	3	12	0	3	13	0	
3J14	400	3	14	0	3	16	0	
3J11	405	1	22	5				
3J11	406	2	25	0	2	25	6	
3J11	407	2	18	1	2	18	6	
3J11	413	1	37	0				
3J11	414	7	16	3	7	17	0	
3J11	416	1	45	0	1	48	0	
3J11	417	6	22	0	6	26	0	
3J12	420	7	13	0	7	15	0	
3J11	421	7	15	0				
3J12	422	7	16	0	7	19	0	
3J12	423	6	13	0	6	12	1	
3J12	424	2	36	0	2	38	0	
3J12	425	7	21	0	7	24	0	
3J12	426	2	23	0	2	25	0	
3J12	428	5	27	0	5	30	0	
3J12	429	7	12	0				
3J12	430	5	25	0	5	29	0	Re-tag 85
3J12	431	3	15	0	3	15	0	
3J12	432	7	15	0	7	17	0	Re-tag 84

Date __1 AUG__

Quadrat __353__ Observers __HA, MMM__ Recorder __DLW__ Weather __Sunny, warm__

SQ	TREENO	SPEC	DBH96	COND96	SPEC19	DBH19	COND19	COMMENTS
3J33	211	2	23	1				
3J32	218	3	10	0	3	14	0	
3J32	346	3	15	0	3	18	0	RETAG 107
3J34	347	5	13	0	5	16	0	
3J32	354	3	12	0	3	14	1	
3J31	363	2	14	0	2	17	0	
3J33	368	3	20	NA	3	24	0	
3J33	370	3	16	0	3	17	1	
3J33	387	3	14	0	3	N/A	6	
3J33	389	3	15	0				181?
3J31	390	3	15	0	3	18	1	
3J31	391	3	14	0	3	15	1	
3J32	455	1	23	3	1	23	0	
3J32	456	2	18	0	2	19	0	
3J32	457	7	13	0	7	14	0	RETAG 184
3J32	458	7	19	0	7	20	0	RETAG 129
3J32	459	5	35	0	5	39	0	
3J32	460	1	36	0	1	40	0	
3J32	461	5	23	0	5	24	0	
3J32	465	1	14	5	1	N/A	6	
3J32	466	5	19	0	5	20	0	
3J32	467	1	37	0	1	39	0	
3J32	469	1	16	0	1	17	0	
3J32	470	7	21	0	7	24	0	
3J32	473	1	47	0	1	50	0	
3J32	474	2	13	0	2	14	0	
3J32	475	2	17	0	2	18	0	
3J32	476	1	20	5	1	N/A	6	
3J32	478	1	37	0	1	41	0	RETAG 189
3J32	479	2	23	0	2	25	0	RETAG 185
3J32	481	2	22	0	2	23	0	
3J32	482	3	11	1				
3J31	485	7	13	0	7	16	0	RETAG 195
3J31	488	1	25	0	1	26	0	
3J31	489	5	41	0	5	44	0	RETAG 198
3J31	490	5	27	1	5	25	5	
3J31	491	5	30	0	5	38	0	RETAG 147
3J31	493	7	31	0	7	36	0	RETAG 200
3J31	494	1	21	0	1	22	0	
3J31	605	7	19	0	7	19	0	RETAG 176
3J31	606	1	55	0	1	62	0	
3J33	607	7	13	0	7	16	0	RETAG 155