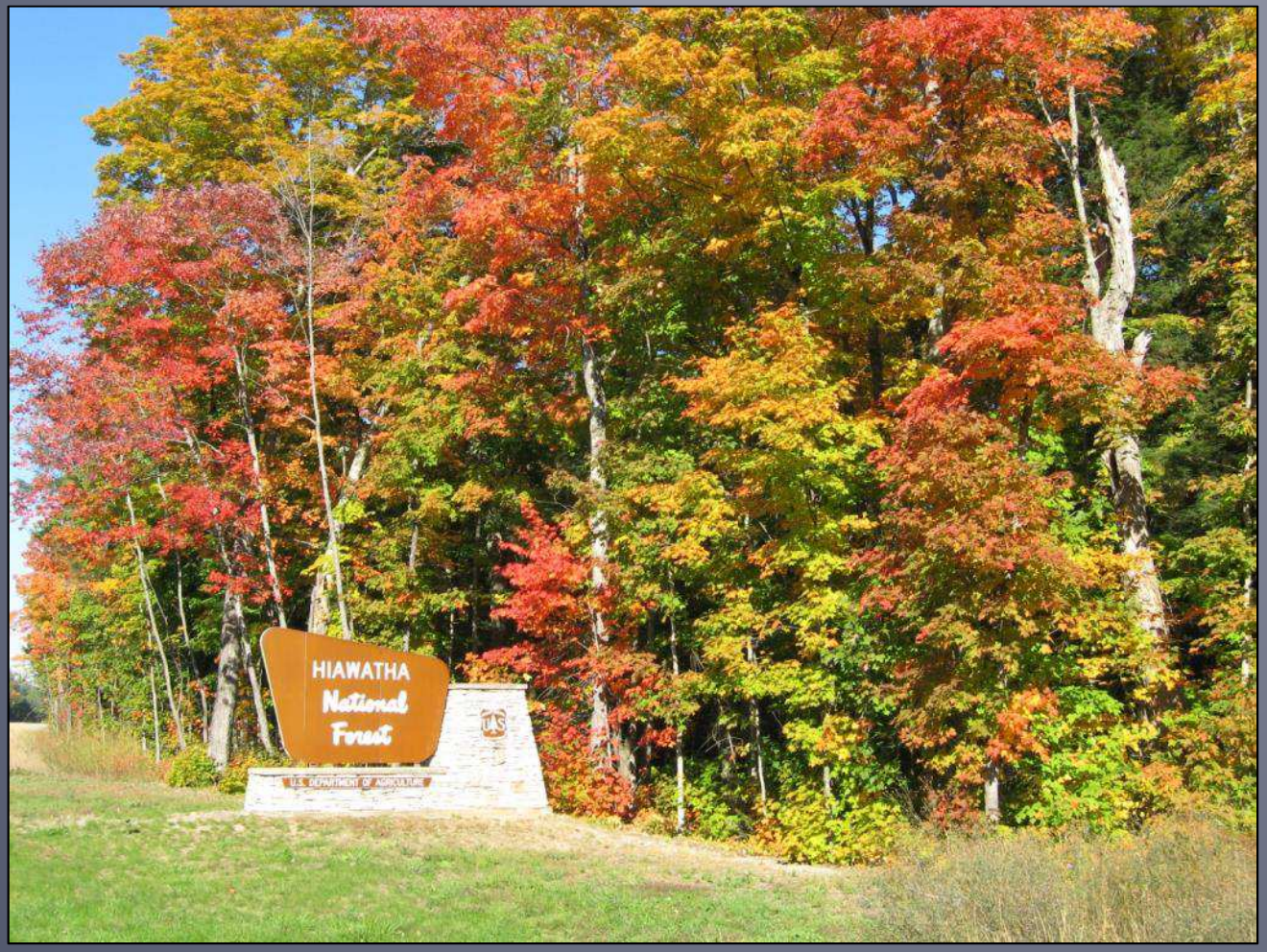
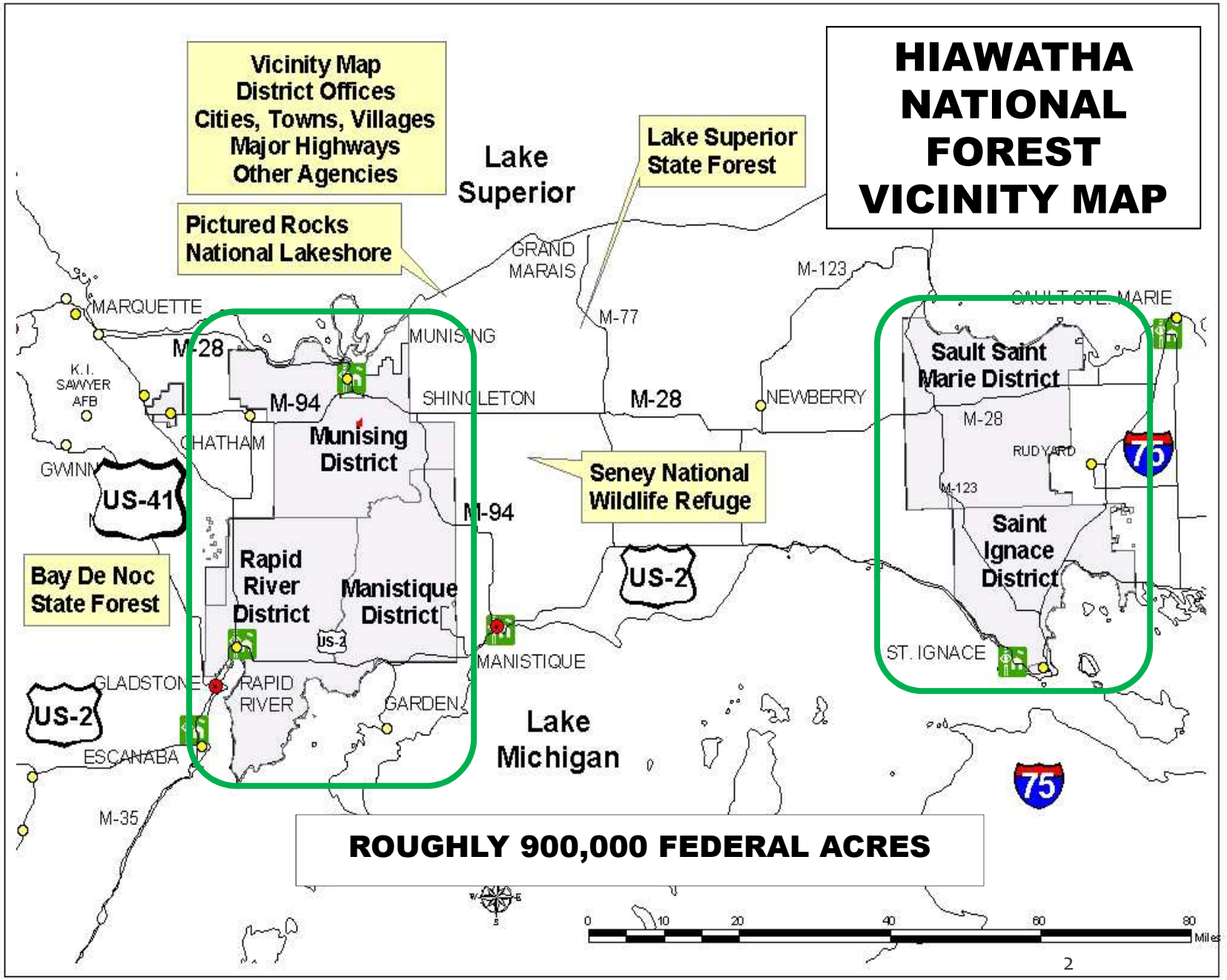
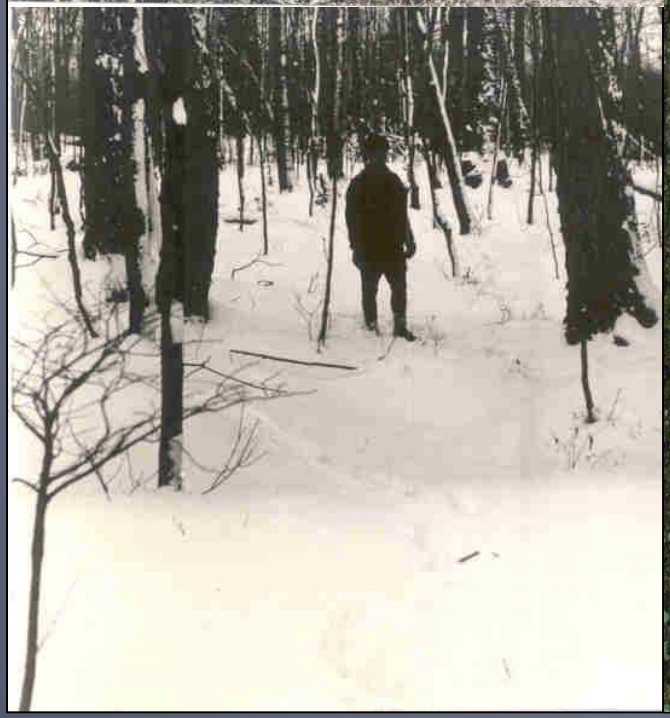
FOREST SERVICE EXPERIENCE WITH NORTHERN HARDWOOD REGENERATION



Tim Baker
Forest Silviculturist

USDA Forest Service,
Hiawatha National Forest

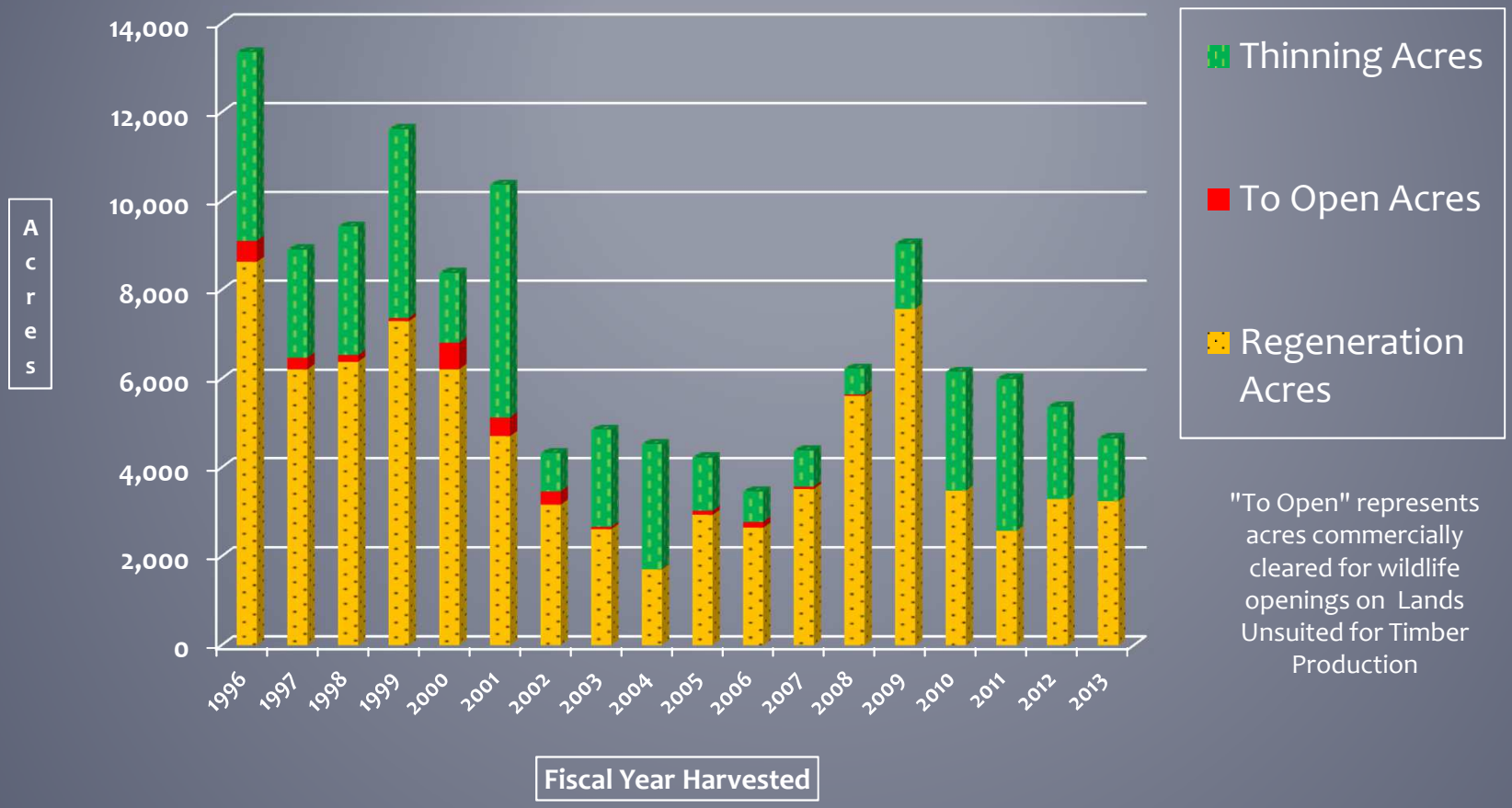

HIAWATHA NATIONAL FOREST VICINITY MAP
Vicinity Map
District Offices
Cities, Towns, Villages
Major Highways
Other Agencies
Lake Superior
Lake Superior State Forest
Pictured Rocks National Lakeshore
GRAND MARAIS
M-123
M-77
MARQUETTE
M-28
MUNISING
K.I. SAWYER AFB
M-94
SHINGLETON
M-28
NEWBERRY
CHATHAM
Munising District
GWINN
US-41
M-94
Seney National Wildlife Refuge
Sault Saint Marie District
M-28
RUDYARD
75
M-123
Saint Ignace District
Bay De Noc State Forest
Rapid River District
Manistique District
US-2
US-2
MANISTIQUE
ST. IGNACE
GLADSTONE
RAPID RIVER
GARDEN
US-2
Lake Michigan
ESCANABA
75
M-35
ROUGHLY 900,000 FEDERAL ACRES
0
10
20
40
60
80
Miles



OLD GROWTH IN 1926 PRIOR TO CUTTING EXPERIMENTS, DUKES EXPERIMENTAL FOREST

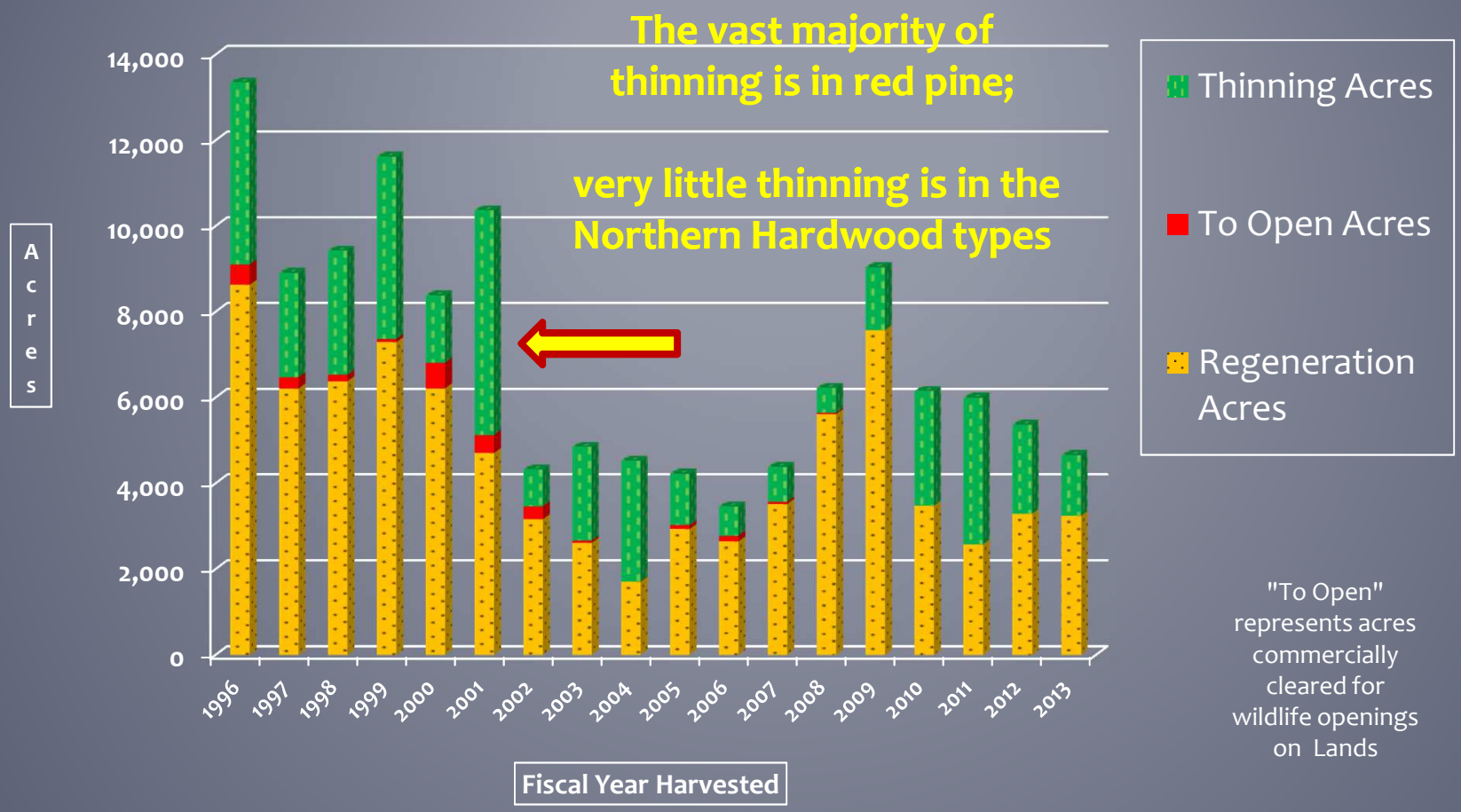
POST HARVEST 1933

HIAWATHA N.F. – ALL HARVEST ACRES BY FISCAL YEAR AND HARVEST REGIME



"To Open" represents acres commercially cleared for wildlife openings on Lands Unsuited for Timber Production

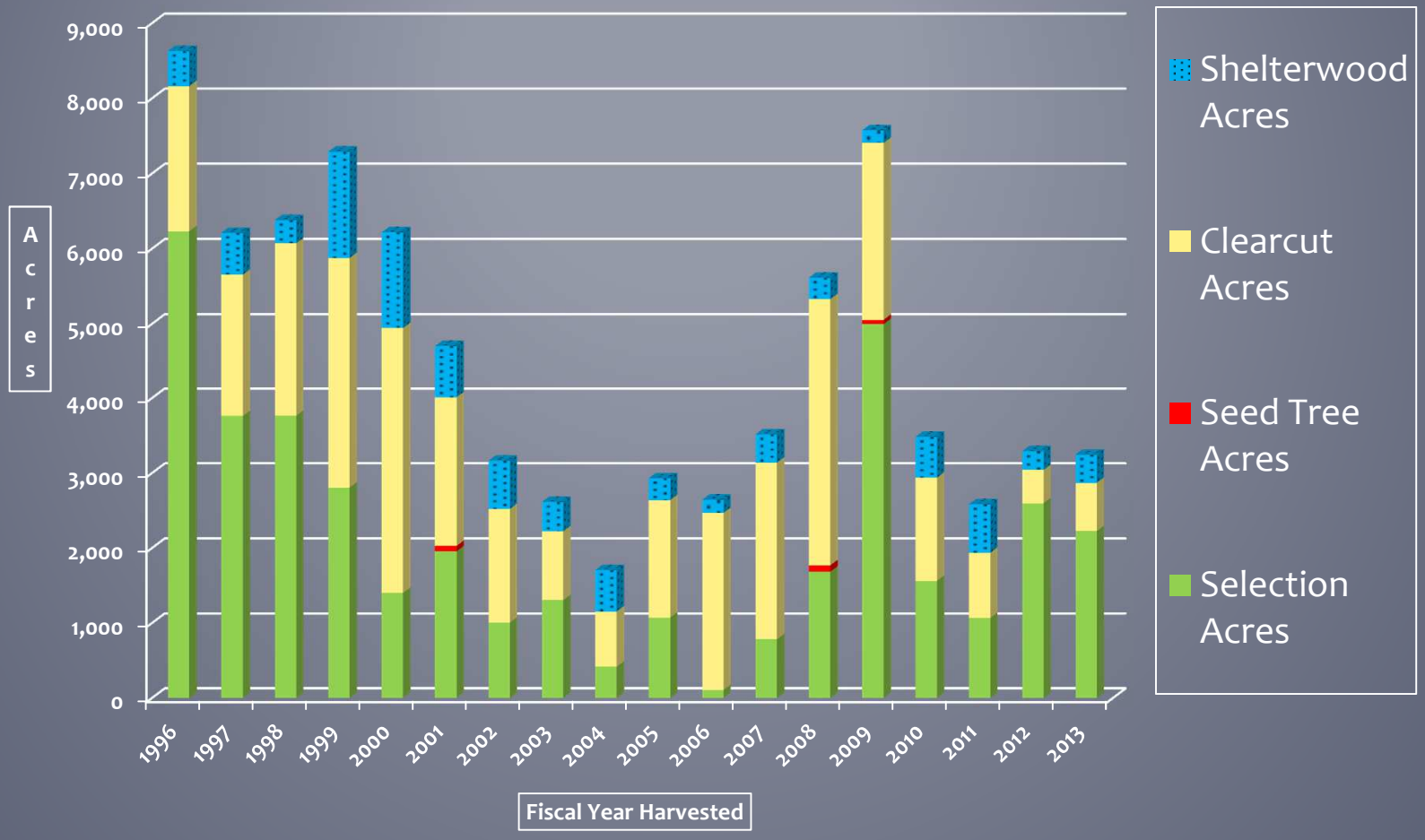
HIAWATHA N.F. – ALL HARVEST ACRES BY FISCAL YEAR AND HARVEST REGIME



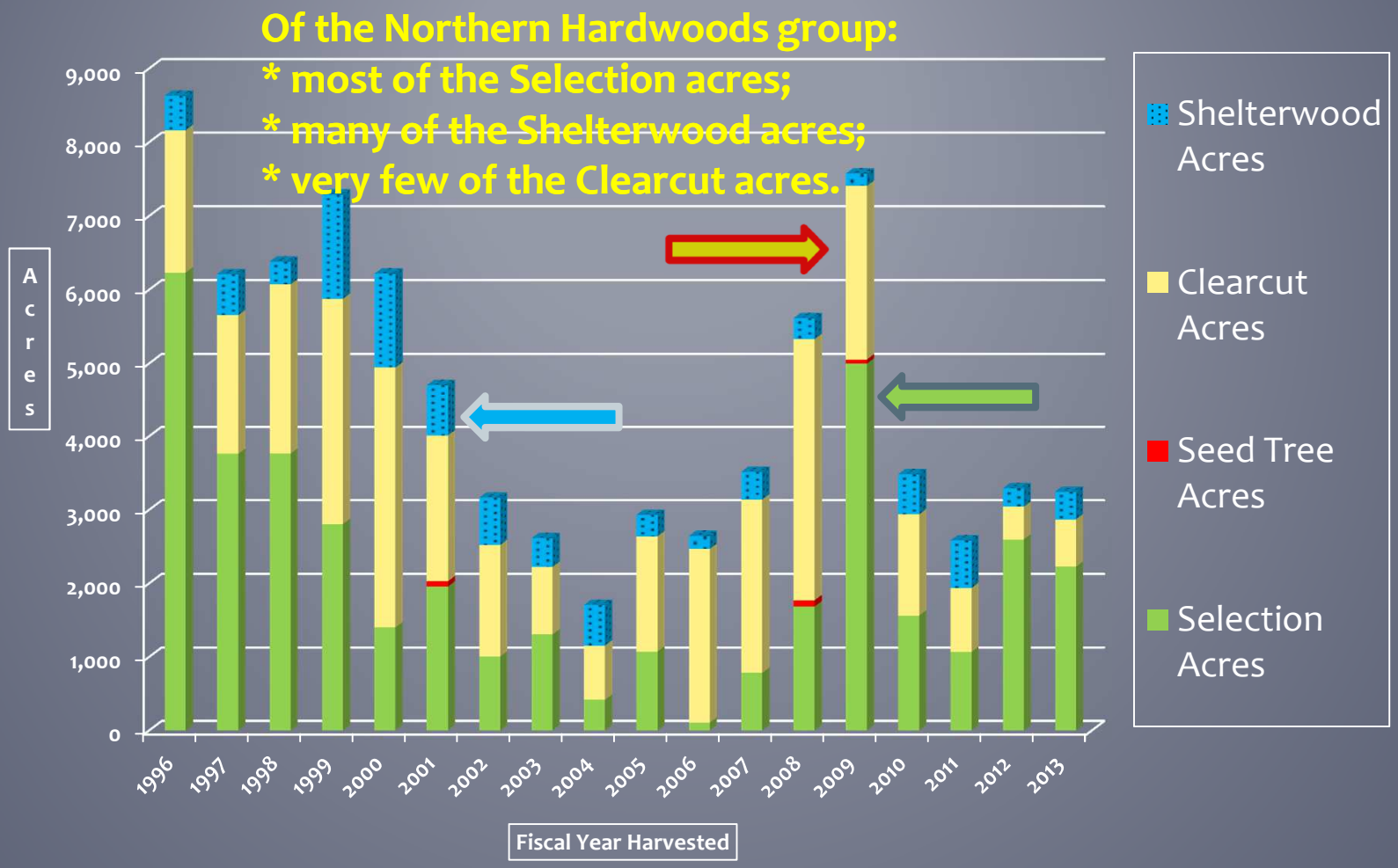
"To Open" represents acres commercially cleared for wildlife openings on Lands


POST HARVEST AFTER RECENT
BEECH BARK SALVAGE

HIAWATHA N.F. – ALL REGENERATION HARVEST ACRES BY FISCAL YEAR AND HARVEST METHOD



HIAWATHA N.F. – ALL REGENERATION HARVEST ACRES BY FISCAL YEAR AND HARVEST METHOD



What is a Forester, a Park Ranger, a Wildlife Manager, a Large Corporate Land-owner, or a Small Land-owner to do?

It really depends on what your objectives are…


HARDWOOD CONVERSION TO ASPEN
(CLEARCUT WITH RESERVES)
BEECH BARK DISEASE SALVAGE UNIT


LOW SITE INDEX HARDWOOD
CONVERSION TO WHITE PINE
SHELTERWOOD PREP CUT/SEED CUT


GROUP SELECTION
Cutting groups of trees.
Also called patch cutting. Trees were cut in patches up to 1/3 acre. First cut in 1929, the openings were recut and enlarged in 1944. Although yellow birch regeneration was abundant in the patches following harvest, the patches are now dominated by sugar maple. In fact, it is now difficult to identify the patches.


GROUP SELECTION
RECENTLY SCARIFIED
REGENERATING TO YB, BC, WA, SM

UNEVEN-AGED HARDWOOD MANAGEMENT

Stand Prescription	Date: 10/2002	Hiawatha National Forest	Munising Ranger District

T-R-Section(s)	Compartment	Stand	LTA	LSC	Stand Acres	Cut Acres
T46N R20W S.17	10	44	MM	500	141	141

1. PRESENT STAND CONDITIONS:

Type, Size, Density 819 Stand Condition 6 Age 79
Average DBH 10 B.A. 120

Species Compositions: Black cherry, sugar maple, beech, and red maple.

Biotic Factors (Wildlife, insect, disease, fisheries):
Physical Site Factors: Site Index 56 Soil Type Kalkaska

Other Resource Considerations: MA 2.2. VQO: Retention.

2. OBJECTIVES:

Management Direction for this stand: All age stand of northern hardwoods.

Silvicultural Objective:
Type, Size, Density 819 B.A. 80 Avg. DBH 10
Species Composition:

Are you planning a type conversion? no If so, has the soil scientist made an on-site evaluation?_____ What is the reason for this conversion?

3. TREATMENT:

Method of Cut: 151 If cutting method is 111 112, 113, or 114 is clearcutting the optimum method to meet management objectives?

Estimate of cut volume: 705 cords volume per acre: 5 cords / acre
Other activities needed to achieve silvicultural objective: 493

Timing or Techniques: No logging activities May 15 through Labor Day (camping season) and December 1 though March 30 (snowmobile season). No hauling December 1 through March 30 on FR 2276. Remove slash 25 feet from FR2596. Reduce slash 48" or less within 1 year 25 to 50 feet from FR2596. Leave 4 trees 8" dbh/ac, 2 trees 12" dbh/ac. and 2 trees 20" dbh/ac for snag and cavity trees according to the Forest Plan.

Coordination: Recreation use of campground and snowmobile trail. See mitigation above.

4. DETAILED MARKING INSTRUCTIONS:

Mark first and foremost to improve stand quality and to promote future quality sawlogs. Mark for stand quality improvement regardless of tree size until low quality is removed from stand. Use a Q-factor of 1.3, a residual target of 80 basal area, and a maximum diameter of 24 inches. Larger trees may be left for wildlife. A stand-specific Q-factor stocking chart is attached. Mark for high-quality future sawlogs, and use gap management principles and guidelines. There should be about 3 to 4 gaps per acre average, about 40-60 feet in diameter.

The chart shows that the stand is currently **overstocked** in the 6" through 12" diameter classes, and **understocked** in the 22" and 24" diameter classes. Mark to move the "current" curve closer to the

"desired" curve. The spreadsheet shows both the +/-% and the ratio of current to desired stocking to help guide cut and residual tree decisions.

Cut and leave tree selection instructions: Use the *Manager's Handbook for Northern Hardwoods in the North Central States* (Tubbs - 1977, pp 24-25) as a general reference to guide cut and leave tree selection. High-risk sawlog trees should always be marked first and with general disregard for basal area, unless being left for specifically for wildlife (in which case it should be counted as a wildlife tree). Mark sawlog trees likely to die before the next entry. Mark V-forked trees whenever reasonably possible; the lower the fork, the greater the need for removal. V-forks high in the tree crown are ***not*** high-risk trees. Generally, do ***not*** mark for cutting any 10" class pulpwood trees with good form but with high-risk forks. These should be left to grow into sawlogs in for the next entry; if they do die, they will contribute to the wildlife hard-snag component for the next 15 years, serving a higher-value purpose than pulpwood fiber.

If basal area allows (after high-risk tree removal) use the following priorities in tree removal (in order of general importance): 2. cull; 3. form/crown/branching; 4. species; 5. crown position; and 6. size.

Mark using the above guidelines, but override as needed to provide skidding access. If the removal of a cull tree and an adjacent group of poorly formed trees cause the BA to drop below 80, they can be removed if the spot can be used to create a new gap or enlarge an existing gap. Given similar form, tend to mark red maple before sugar maple, unless epicormic branching is a problem. Cherry and birch trees may be marked or may be left, depending on the tree; if a given cherry or birch tree is a good wildlife tree, it may be left despite poor form, but should then be counted as a wildlife tree.

The prescription shows a "maximum diameter". This does not mean that trees over that diameter must be marked. It means that all trees at or above that diameter will be counted in the highest Q-factor grouping shown in the chart. Feel free to leave larger diameter trees which are in good condition or if good for wildlife, even if exceeding the recommended rate. Compensate for basal area in those spots by marking more lower-quality trees in the lower diameter classes.

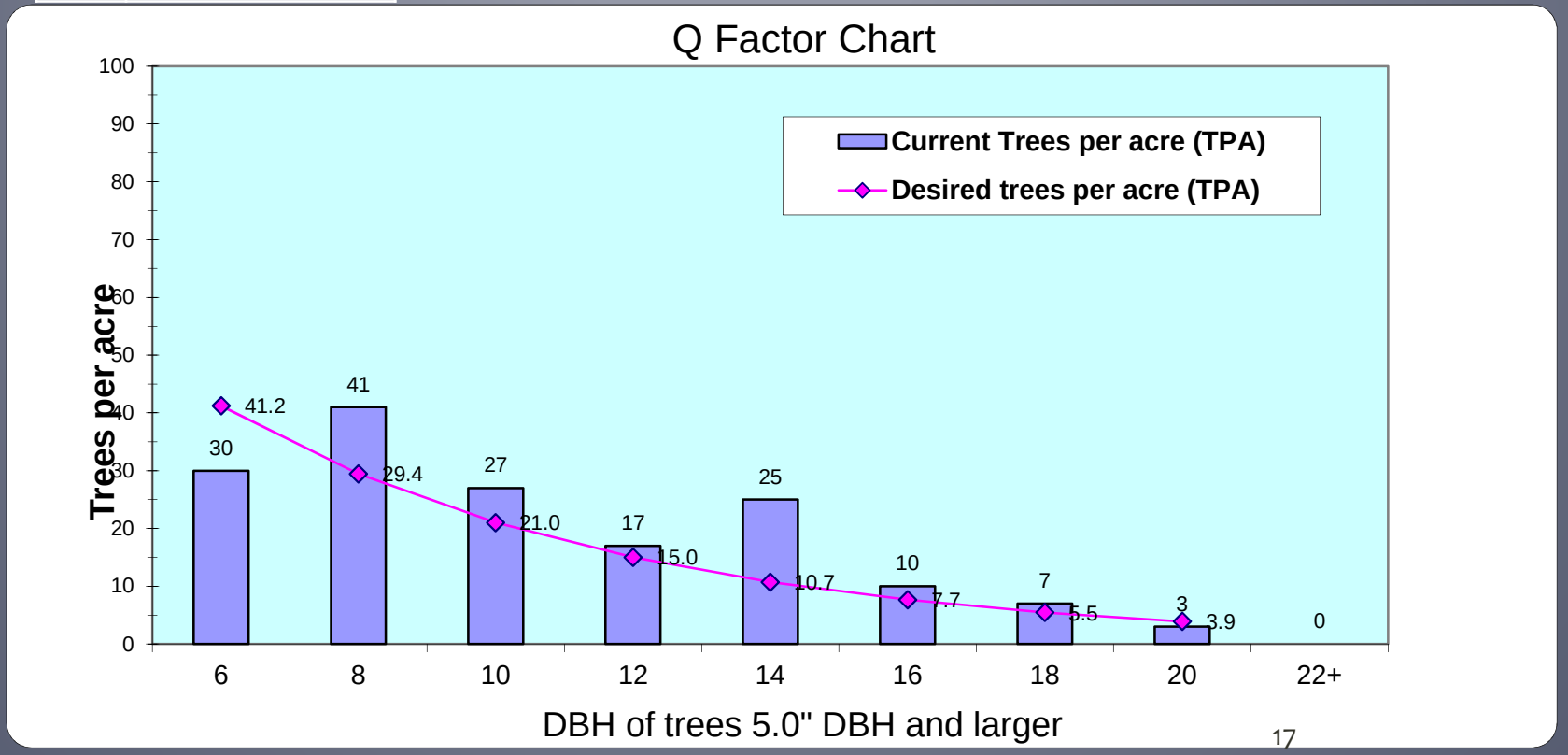
Mark and count poorly formed understory hardwood trees in new or enlarging gaps as needed (with an "X") to allow gaps to properly develop. Some gaps may need no "X" trees, but others may need several. Edges of the stand may be poor quality. Mark edges to improve quality and/or understory development if possible; at a minimum mark to allow skidding access through any poor quality patches of timber and mark sub commercial trees needed for skidding paths with a vertical stripe and a stump mark.

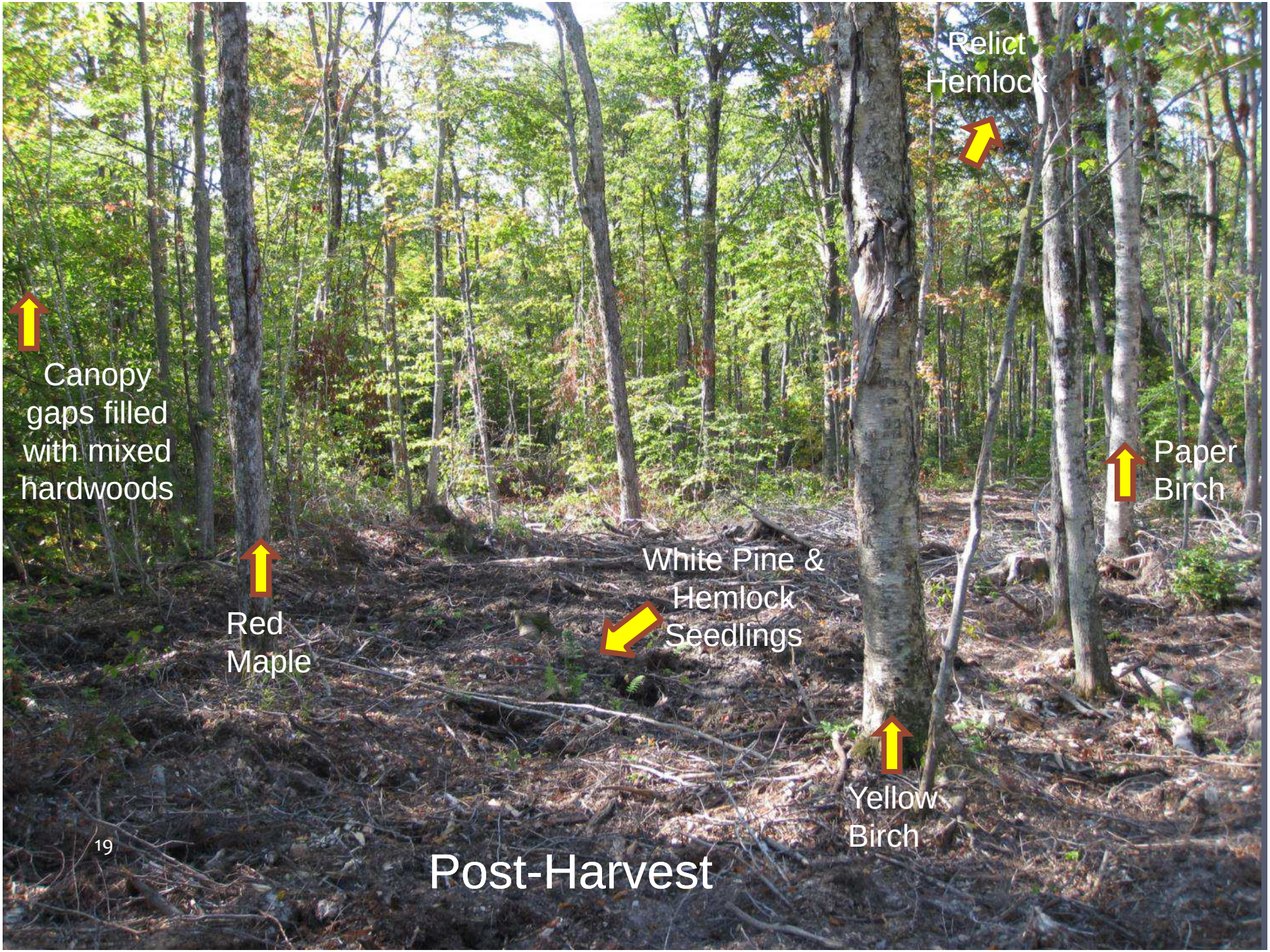
Prepared By: Paul Sweeney	Title: Forester	Date: 10/2002
Field Checked By:	Title:	Date:

UNEVEN-AGED NORTHERN HARDWOOD MANAGEMENT

	160
DBH	Current # TPA
22+	0
20	3
18	7
16	10
14	25
12	17
10	27
8	41
6	30

3	<-- Enter District				
10	<-- Enter Compartment		Q FACTOR SPREADSHEET		
44	<-- Enter Stand		20-INCH MAXIMUM DBH		
82	<-- Enter Desired Residual BA				
1.4	<-- Enter Desired Q Factor				
2002	<-- Enter Year of Stand Exam		Note: TPA = Trees per acre		




Relict Hemlock
Canopy gaps filled with mixed hardwoods
Paper Birch
Red Maple
White Pine & Hemlock Seedlings
Yellow Birch
Post-Harvest

Report 26: Live Tree Stocking Report

AUG-12-2011

Setting Id	091003000100044	**Region**	09	**Forest**	10	**District**	03	**Location**	00010	**Stand**	0044	**Acres**	141
GIS Link	09100300010044	**EV Code**	81	~~2008~~		**Year of Origin**		**No. of Plots**	59	**Meas Date.**	AUG-03-2011		

Remarks: CERTIFY. 3RD YR SURVEY. 2008 YR OF ORIGIN. OVERSTORY IS WELL STOCKED WITH SAW SIZED TIMBER. UINDERSTORY IS 85PCT STOCKED. GAPS LOOK GOOD BUT MAY NEED RELEASE FROM RASPBERRIES. LOTS OF RASPBERRIES GROWING IN THE GAPS.

Live Trees Per Acre/Basal Area Per Acre

Seedlings | SAPLINGS | POLES | Diameter Classes | SAW LOGS

Species		Null	< 1"	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32+	Total	QMD >0	QMD >=5
ACRU	TPA	1525						3		3	1									1533	13.4	13.4
	BA/A							2		3	1	1	1							7		
ACSA2	TPA					4	2													7	8.1	8.1
	BA/A					1	1						1							3		
ACSA3	TPA	2254		38	19		19	8	7	6	5	2	1	1						2361	8.4	11.9
	BA/A			1	2		7	4	6	7	7	4	3	2						41		
BEAL2	TPA					4	2		1	1	1									10	9.8	9.8
	BA/A					1	1		1	1	1	1								5		
FAGR	TPA	1203	51		10	4	2		3	2	1									1276	4.6	10.5
	BA/A				1	1	1		3	2	2									8		
PRSE2	TPA	1881					5	6	4	11	2	2								1911	12.7	12.7
	BA/A						2	3	3	12	3	3	1							27		
TSCA	TPA									1										1	14.0	14.0
	BA/A									1										1		
Total	TPA	6864	51	38	29	13	31	17	16	23	9	5	2	1						7099	8.5	11.8
	BA/A			1	3	3	11	9	12	25	12	9	5	2						92		

plots = 1/1,000th

SM = 34/59 = 57.6%

BC = 34/59 = 57.6%

done

TSI? Possibly release Black Cherry

4341 ✓ 3×4

4382 ✓

4310 ✓ (+1)

Typo Error

SC=17

RC

LSC=500

YOR=NULL

S%=85%

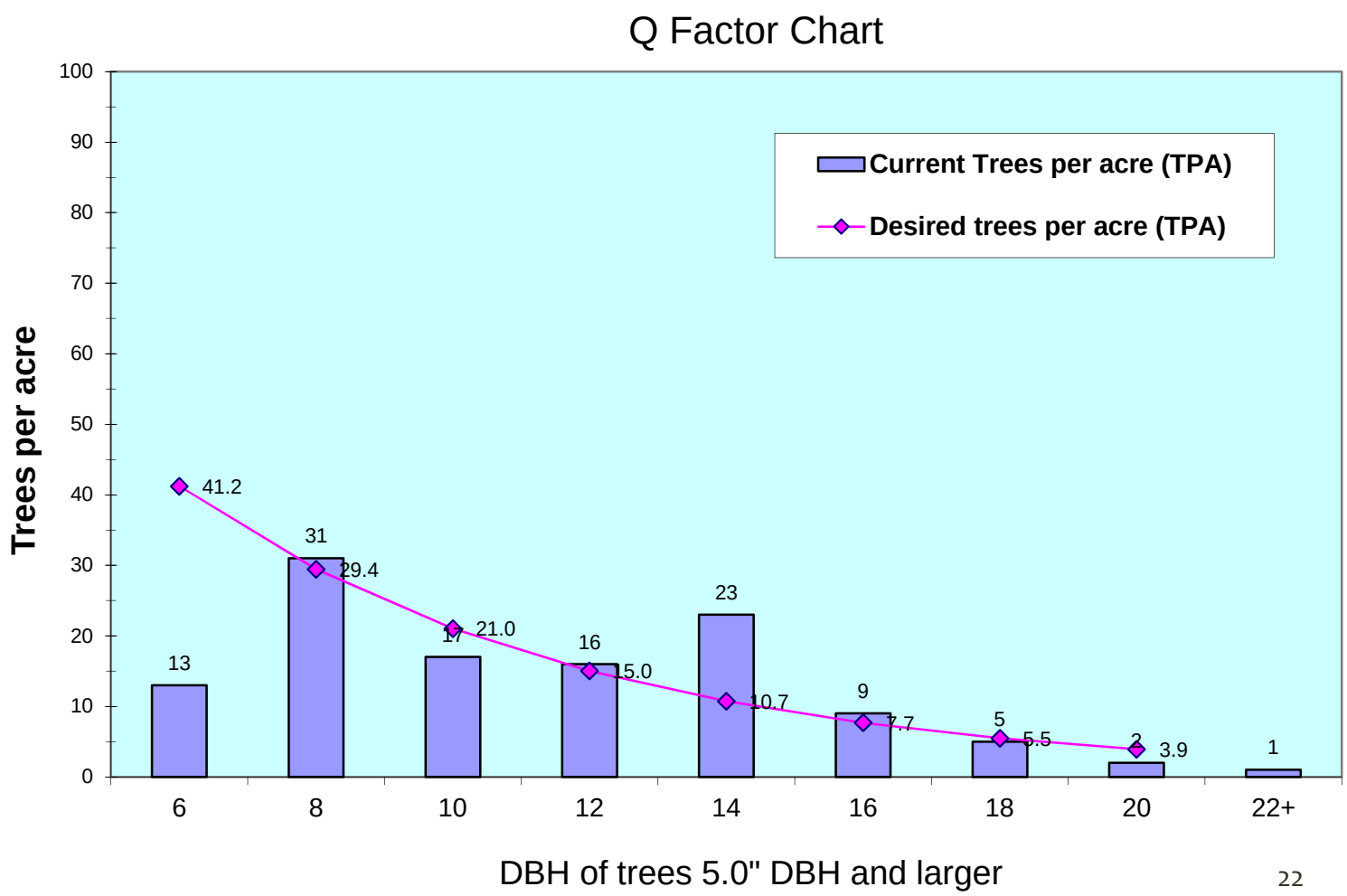
SF=Y

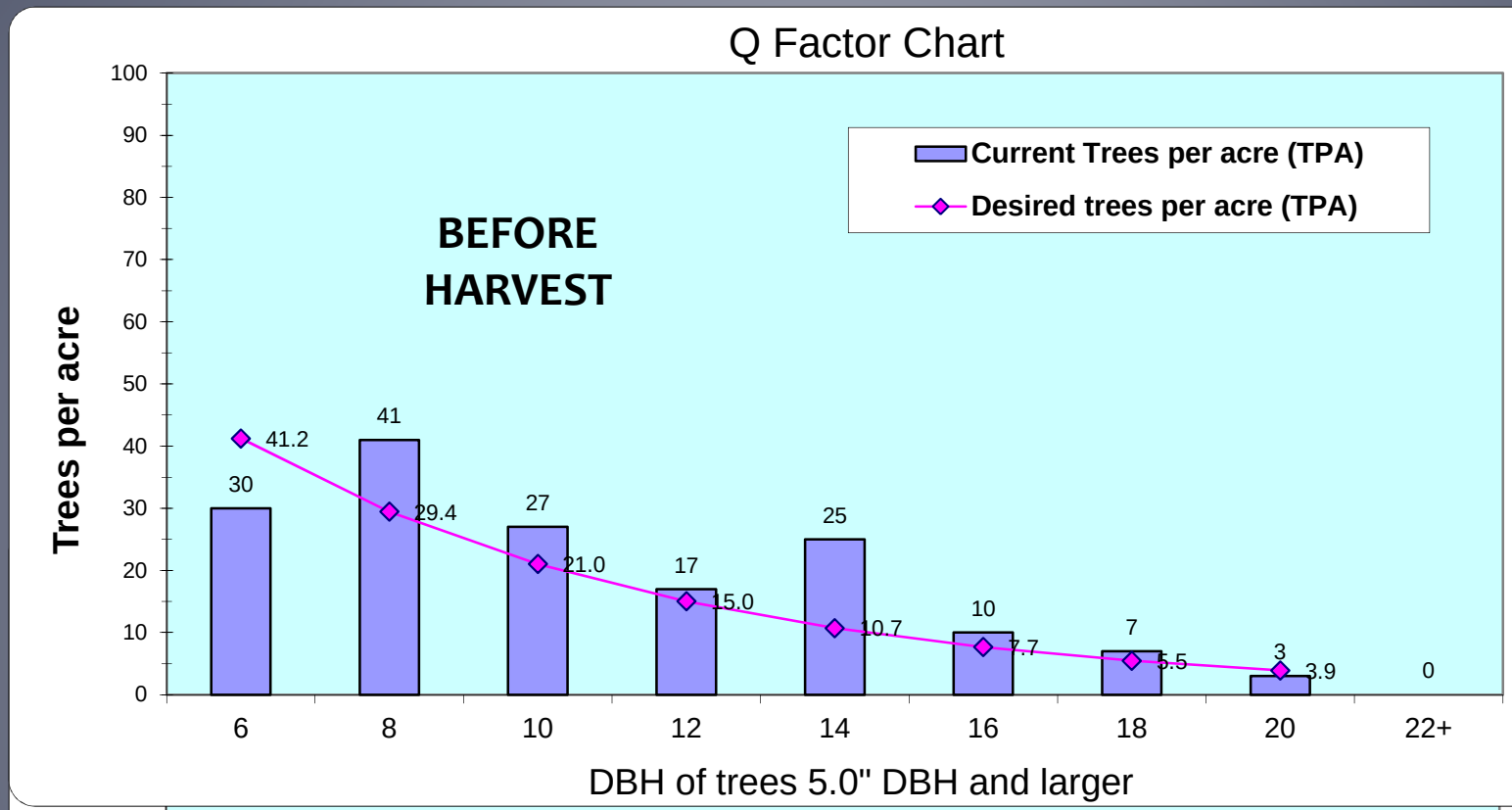
MT=81

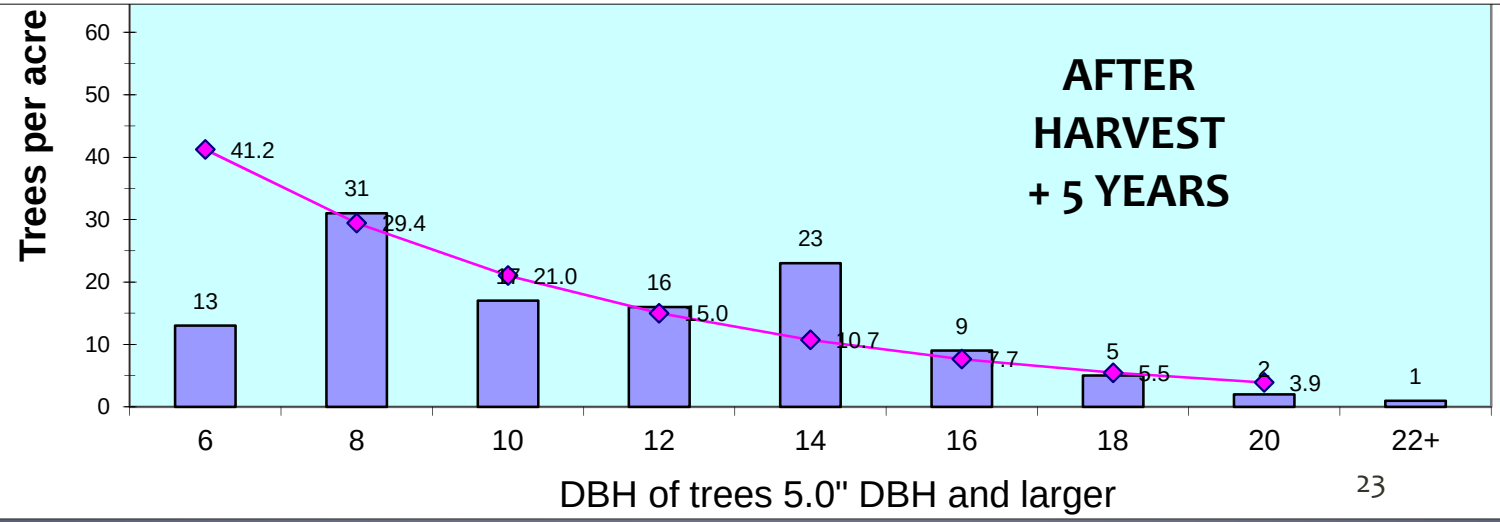
UNEVEN-AGED POST-HARVEST DBH STRUCTURE (Q-FACTOR)

	3	<-- Enter District								
	10	<-- Enter Compartment			Q FACTOR SPREADSHEET					
	44	<-- Enter Stand			20-INCH MAXIMUM DBH					
	88	<-- Enter Desired Residual BA			(Data Sheet)					
	1.4	<-- Enter Desired Q Factor						Version 3.1		
	2011	<-- Enter Year of Stand Exam			Note: TPA = Trees per acre					
	116				20.97	134	82	86		
DBH	Current # TPA	DBH	Q to the `n the`	Basal Area	{k}	Desired # TPA	Desired BA/Acre	Current BA/Acre	Percent +/-	Ratio 1:x.x
22+	1	22	1.00	2.64	2.64			3		
20	2	20	1.00	2.18	2.18	3.9	9	4	-49%	-1.0
18	5	18	1.40	1.77	2.47	5.5	10	9	-9%	-10.6
16	9	16	1.96	1.40	2.74	7.7	11	13	17%	6.7
14	23	14	2.74	1.07	2.93	10.7	11	25	114%	1.9
12	16	12	3.84	0.79	3.02	15.0	12	13	7%	16.3
10	17	10	5.38	0.55	2.93	21.0	11	9	-19%	-4.2
8	31	8	7.53	0.35	2.63	29.4	10	11	5%	19.8
6	13	6	10.54	0.20	2.07	41.2	8	3	-68%	-0.5
Note: Enter ONLY the items in red. Everything else is auto-calculated.										

UNEVEN-AGED POST-HARVEST DBH STRUCTURE 20” MAXIMUM, 82 BA IN 5.0+” TREES, Q-FACTOR = 1.4




Q Factor Chart
Current Trees per acre (TPA)
Desired trees per acre (TPA)
BEFORE HARVEST
Trees per acre
100
90
80
70
60
50
40
30
20
10
0
41.2
30
41
29.4
27
21.0
17
15.0
25
10.7
10
7.7
7
5.5
3
3.9
0
6
8
10
12
14
16
18
20
22+
DBH of trees 5.0" DBH and larger


AFTER HARVEST + 5 YEARS
Trees per acre
60
50
40
30
20
10
0
41.2
13
31
29.4
21.0
16
15.0
23
10.7
9
7.7
5
5.5
2
3.9
1
6
8
10
12
14
16
18
20
22+
DBH of trees 5.0" DBH and larger


Post-Harvest
Uneven-aged
management
with a Hemlock
emphasis

PROBLEMS WITH HARDWOOD REGENERATION

* Post-harvest **control of species composition (regeneration)**
* Beech Bark Disease – **seeding, sprouting & thickets**
* **Raspberries**
* **Sedges** and grasses
* **Deer herbivory**
* **Invasive plants**, especially garlic mustard
* Maple & cherry **sprouting**
* Species-specific **insects & diseases**
* Invasive **earthworms**

BEECH SCALE DISTRIBUTION

- *We modelled the spread rate of beech scale*
- *Evaluated variability in beech scale colonization rates within stands*

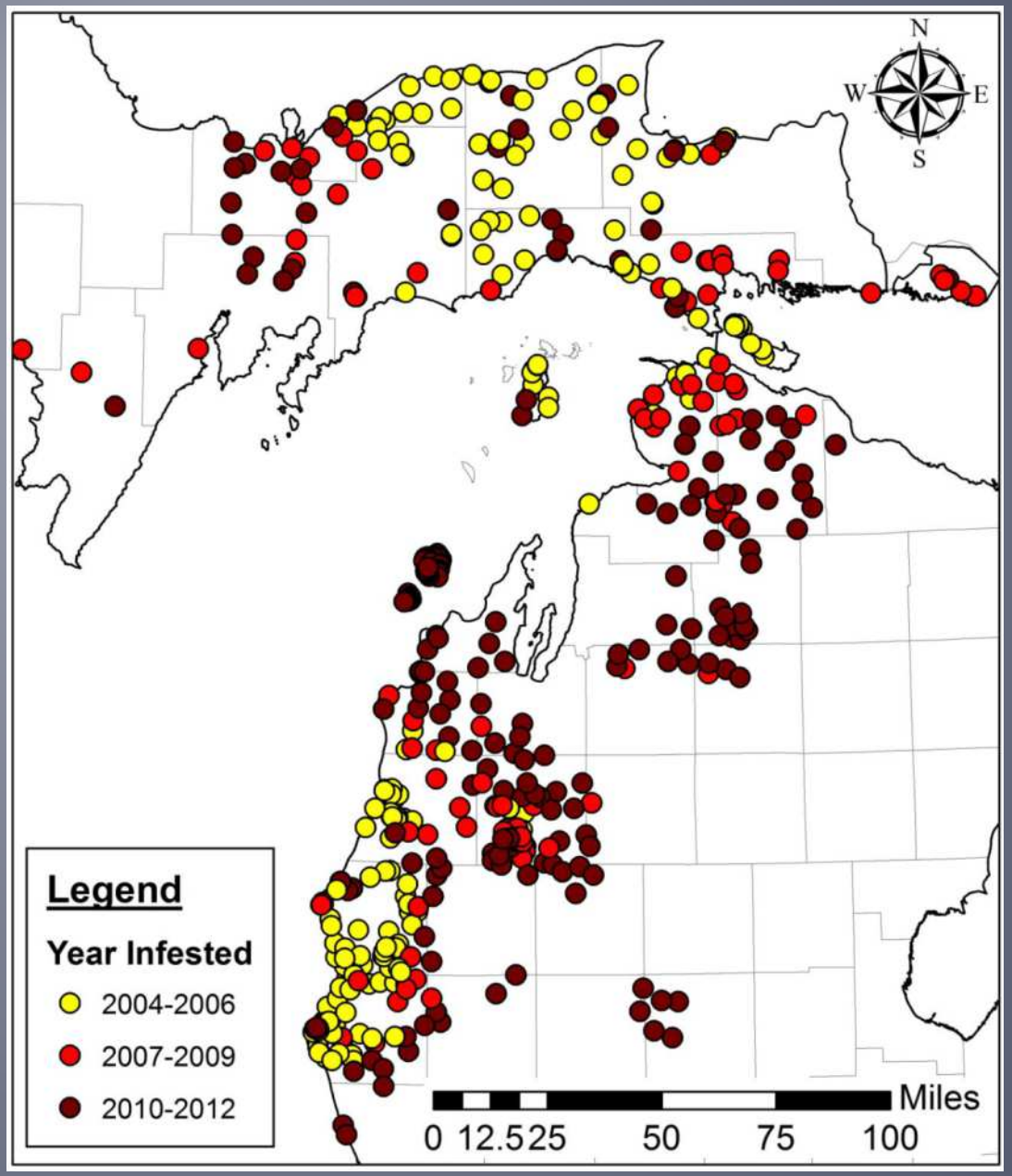


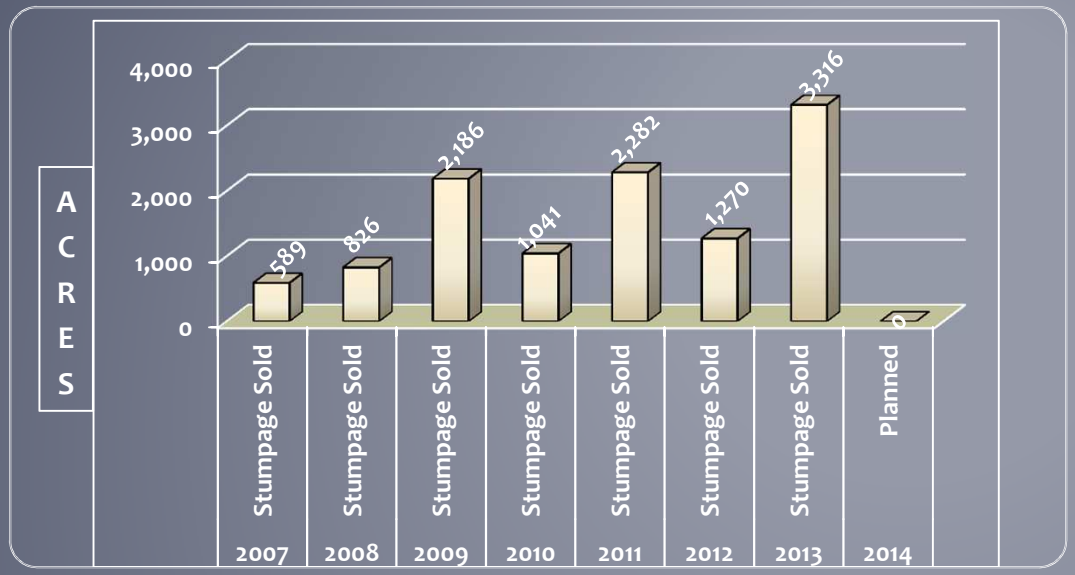
Image from MSU/James B. Wieferich, 2013

BBD SILVICULTURAL OBJECTIVES

- *Reduce expected losses from BBD and leave a residual stand more resilient to future impacts of BBD, including leaving as many potentially resistant trees as possible*
- *Increase species diversity in the stand while reducing the amount of beech*
- *Grow quality sawlogs and manage northern hardwoods for a variety of wildlife habitats*
- *A beech "operational season" to reduce sprouting (non-wet ground conditions)*

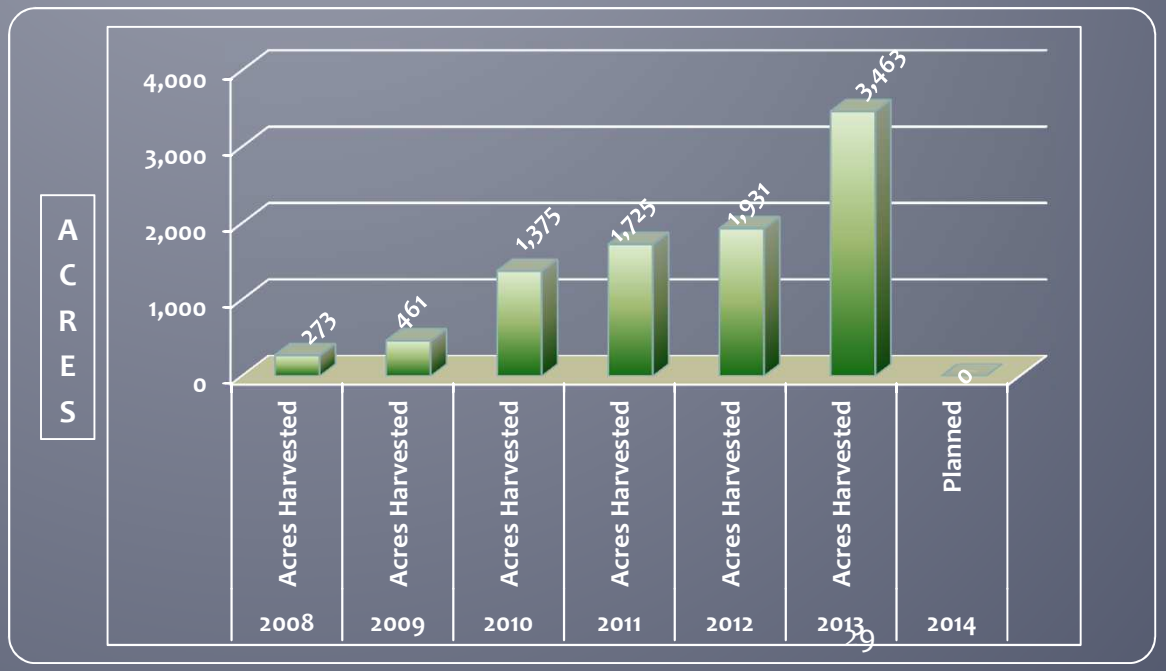
Effects of Nectria on Beech

BEECH BARK DISEASE 2007-2013



ACRES OFFERED FOR SALE

ACRES HARVESTED




Possibly Resistant
Beech Tree


RASPBERRIES AFTER BEECH BARK DISEASE SALVAGE

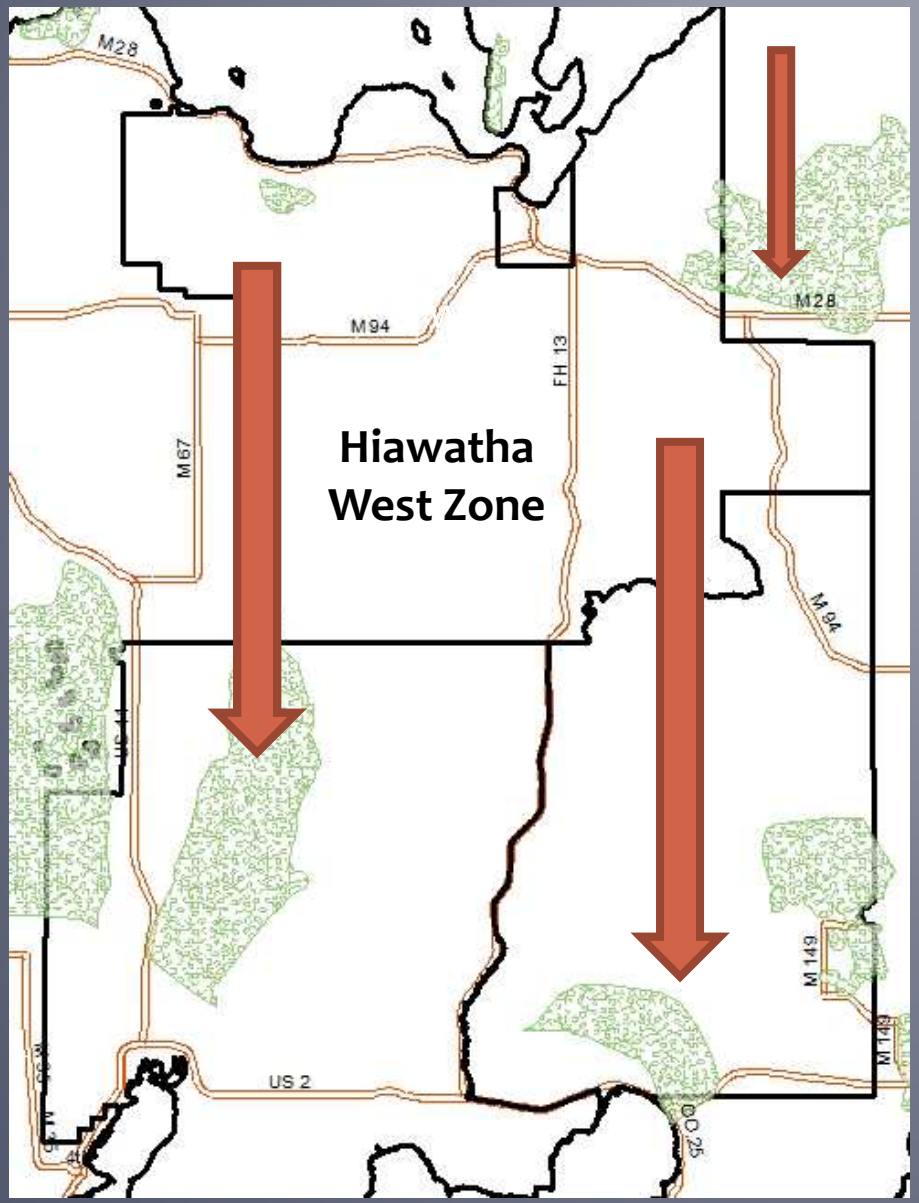

RASPBERRIES AFTER GROUP SELECTION

SPROUTING

CONTROLLING POST-HARVEST SPECIES COMPOSITION

STRIPED MAPLE CAN CREATE AN IMPENETRABLE LAYER INHIBITING OTHER SPECIES

DEER BROWSE & MIGRATION



DEER BROWSE

GARLIC MUSTARD

GARLIC MUSTARD

SEDGES & GRASSES

EARTHWORM DAMAGE IMAGES FROM TARA BAL


OTHER NATIVE OR NON-NATIVE INVASIVE PLANTS, SUCH AS THISTLE & BURDOCK

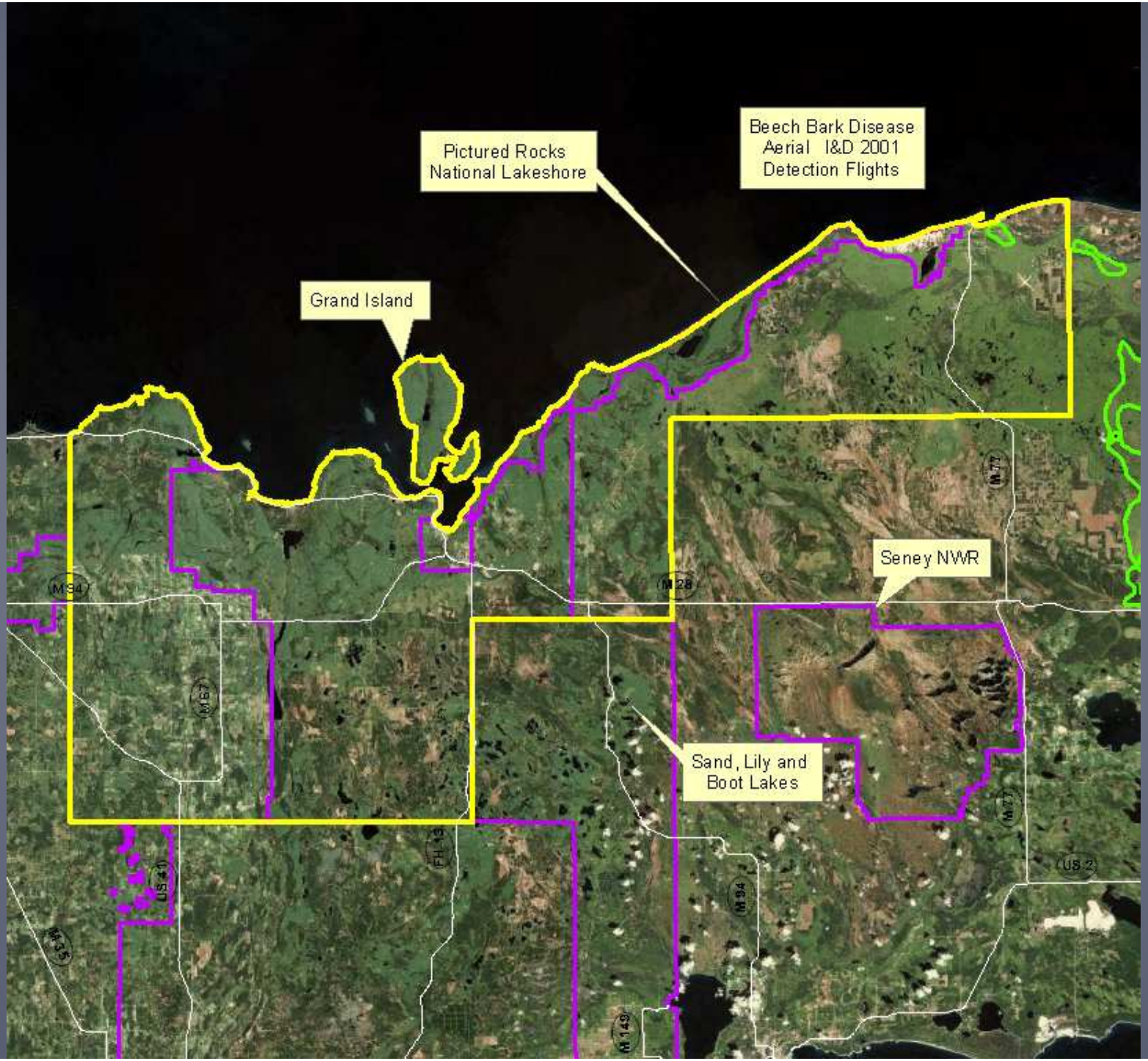
BLACK KNOT OF BLACK CHERRY

AND OTHER NATIVE INSECTS, DISEASES, FUNGI, VIRUSES AND BACTERIA

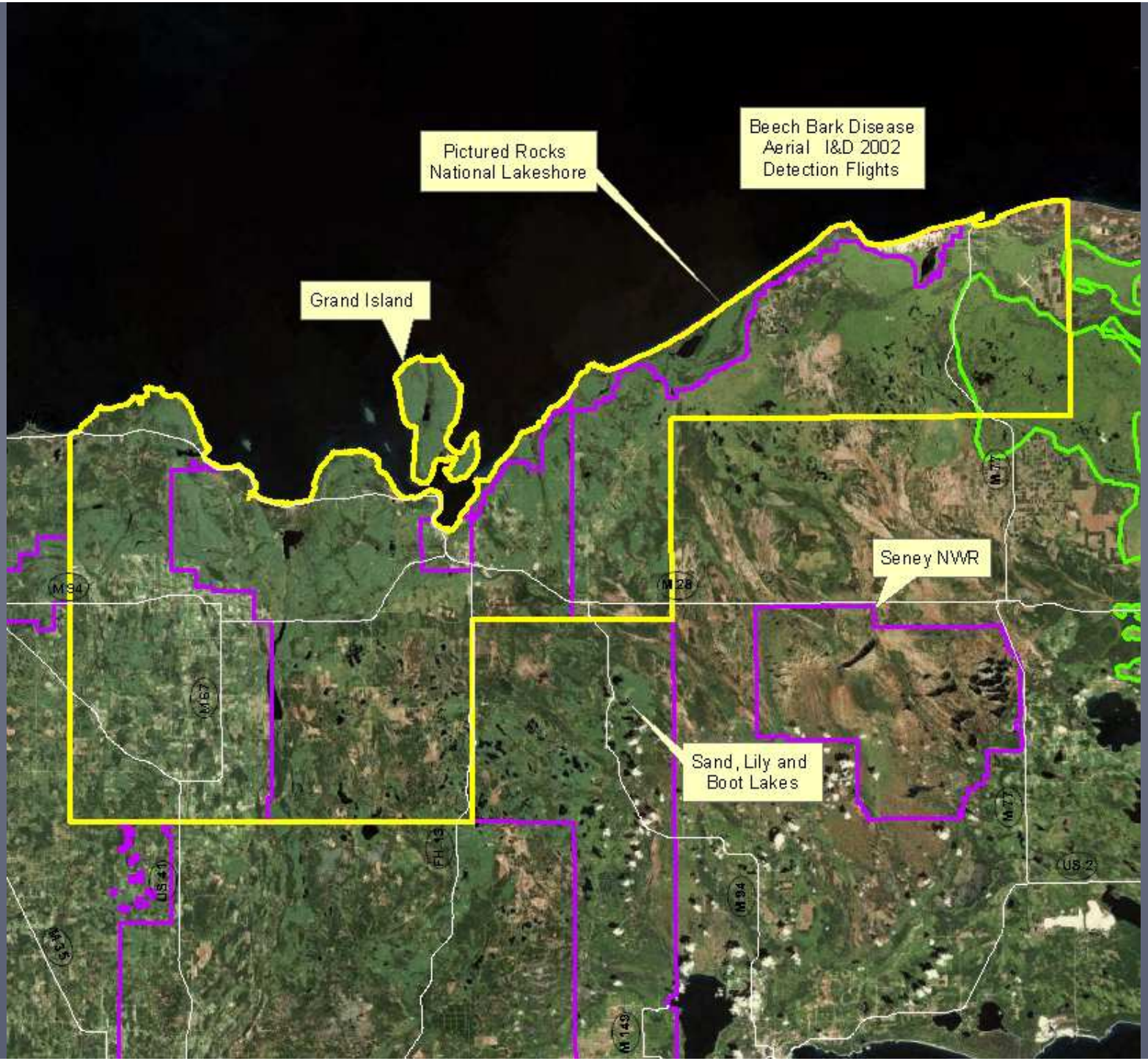
CLIMATE CHANGE MONITORING, MITIGATION AND ADAPTATION

THANK YOU

2001


Pictured Rocks
National Lakeshore
Beech Bark Disease
Aerial I&D 2001
Detection Flights
Grand Island
Seney NWR
Sand, Lily and
Boot Lakes
M-28
M-77
M-94
M-67
M-123
M-149
M-35
US-41
US-2
FH-13

2002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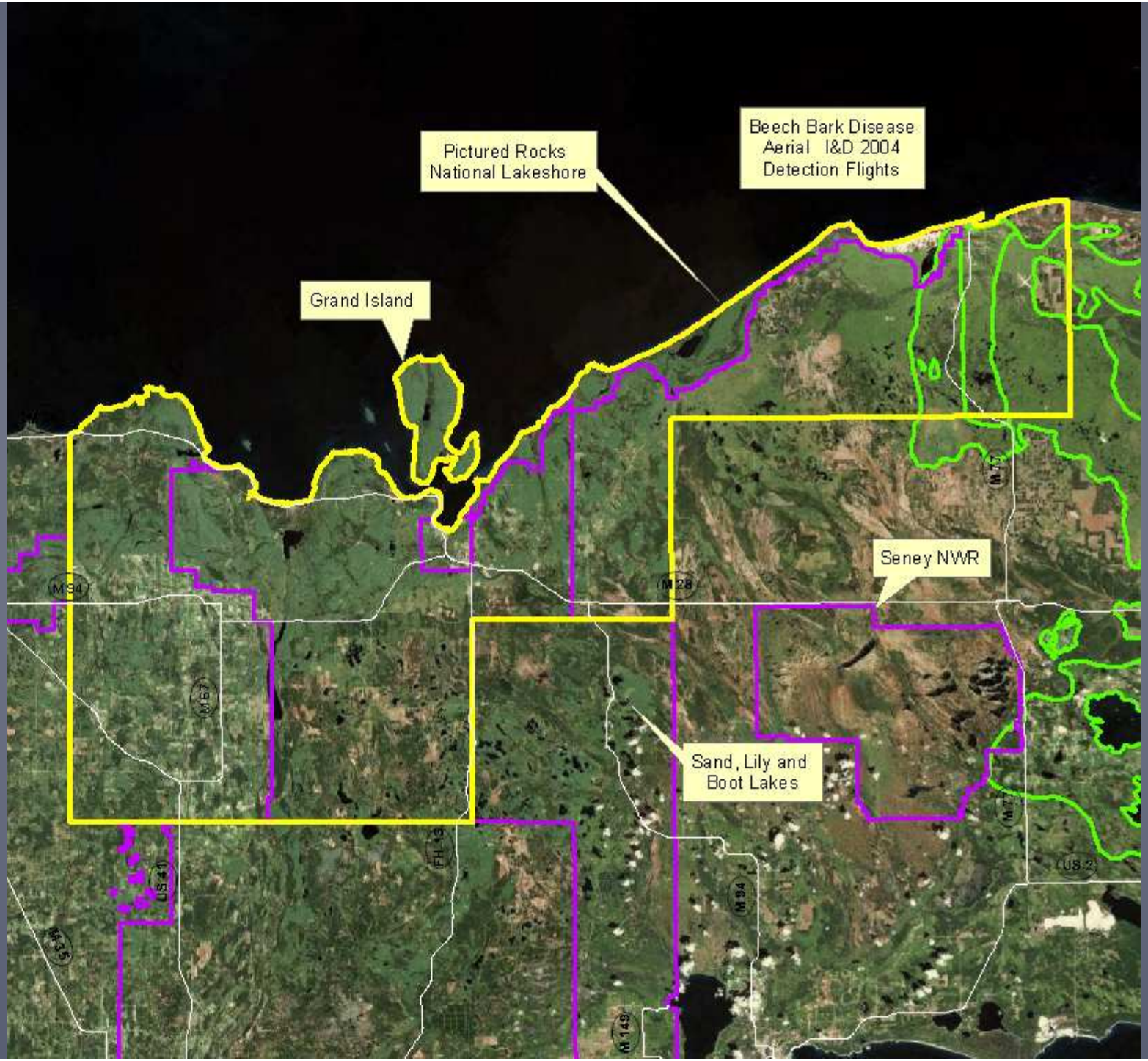
US-2
FH-13

2004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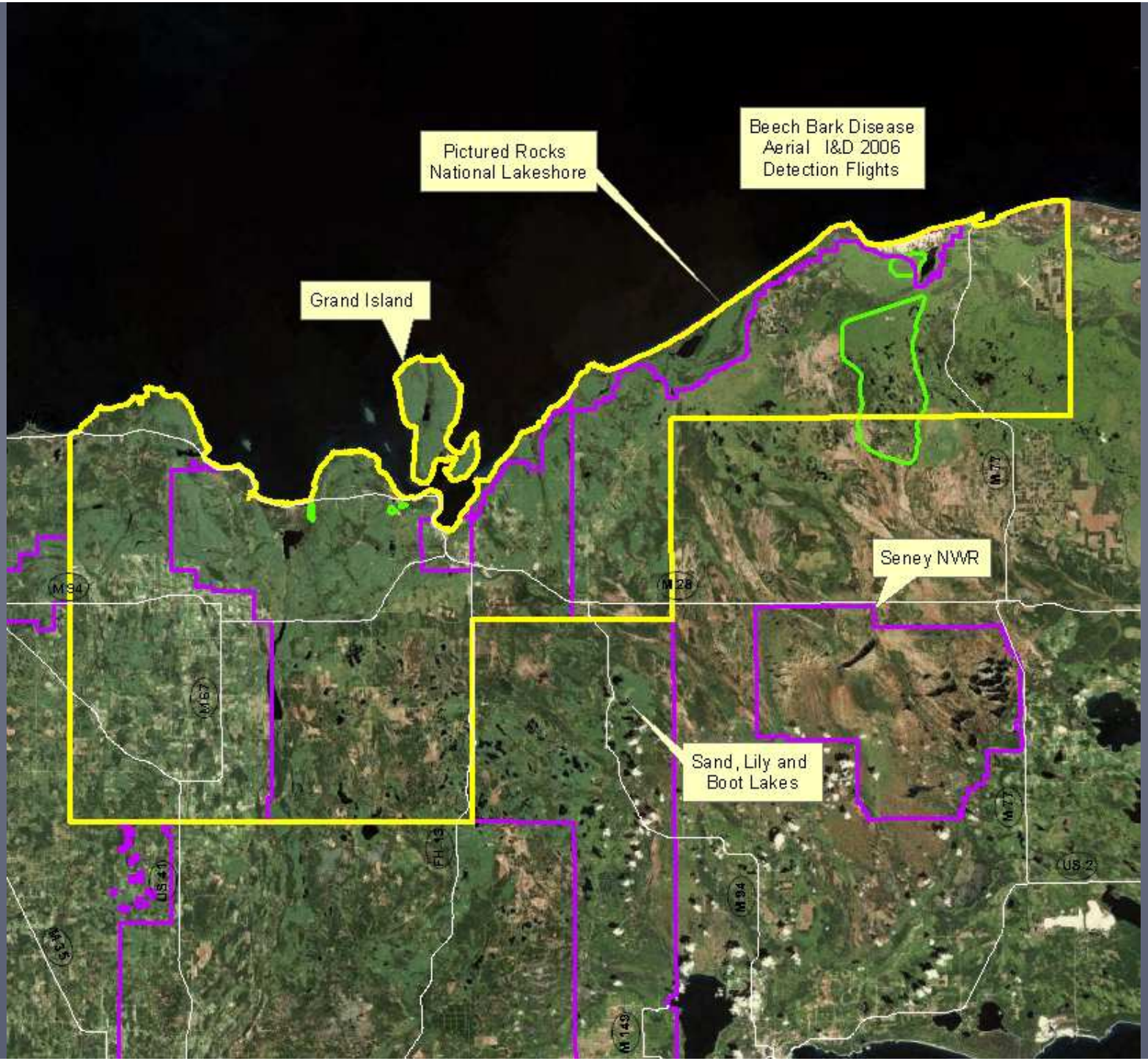
FH-13

2006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Aerial I&D 2006
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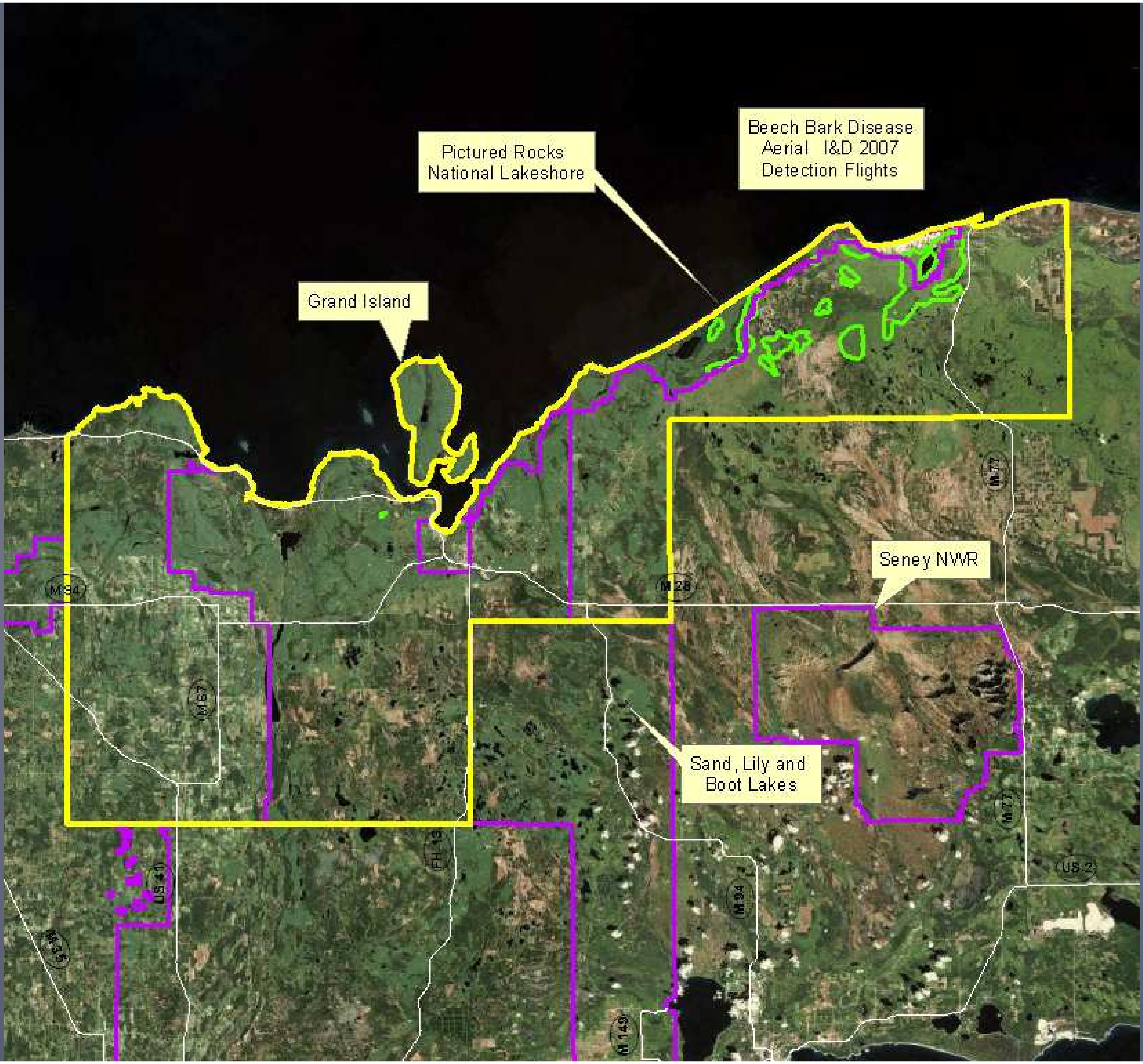
M-67
M-84
M-35
US-41
US-2
FH-13

2007


Beech Bark Disease
Aerial I&D 2007
Detection Flights
Pictured Rocks
National Lakeshore
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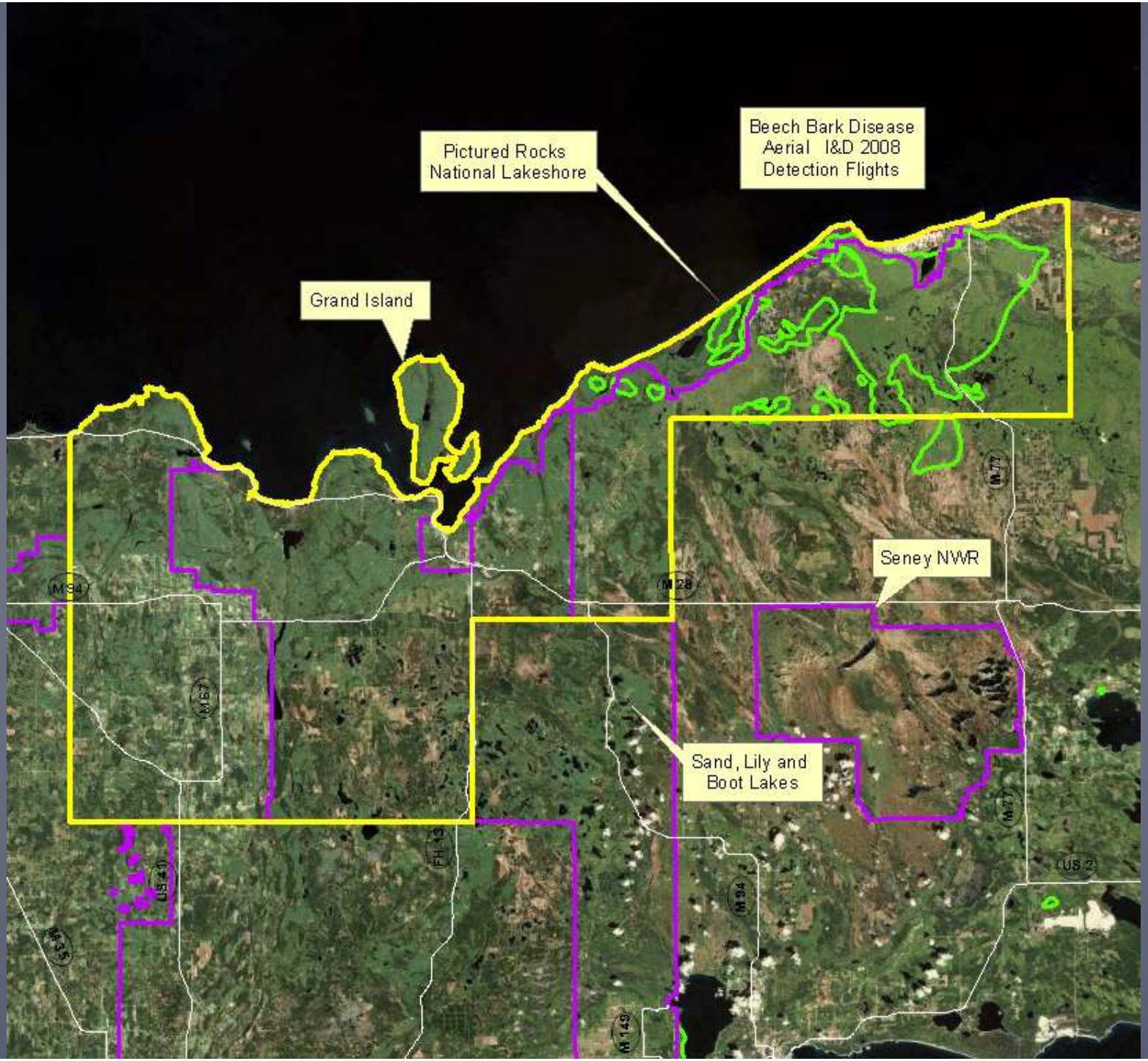
Seney NWR
Sand, Lily and
Boot Lakes

2008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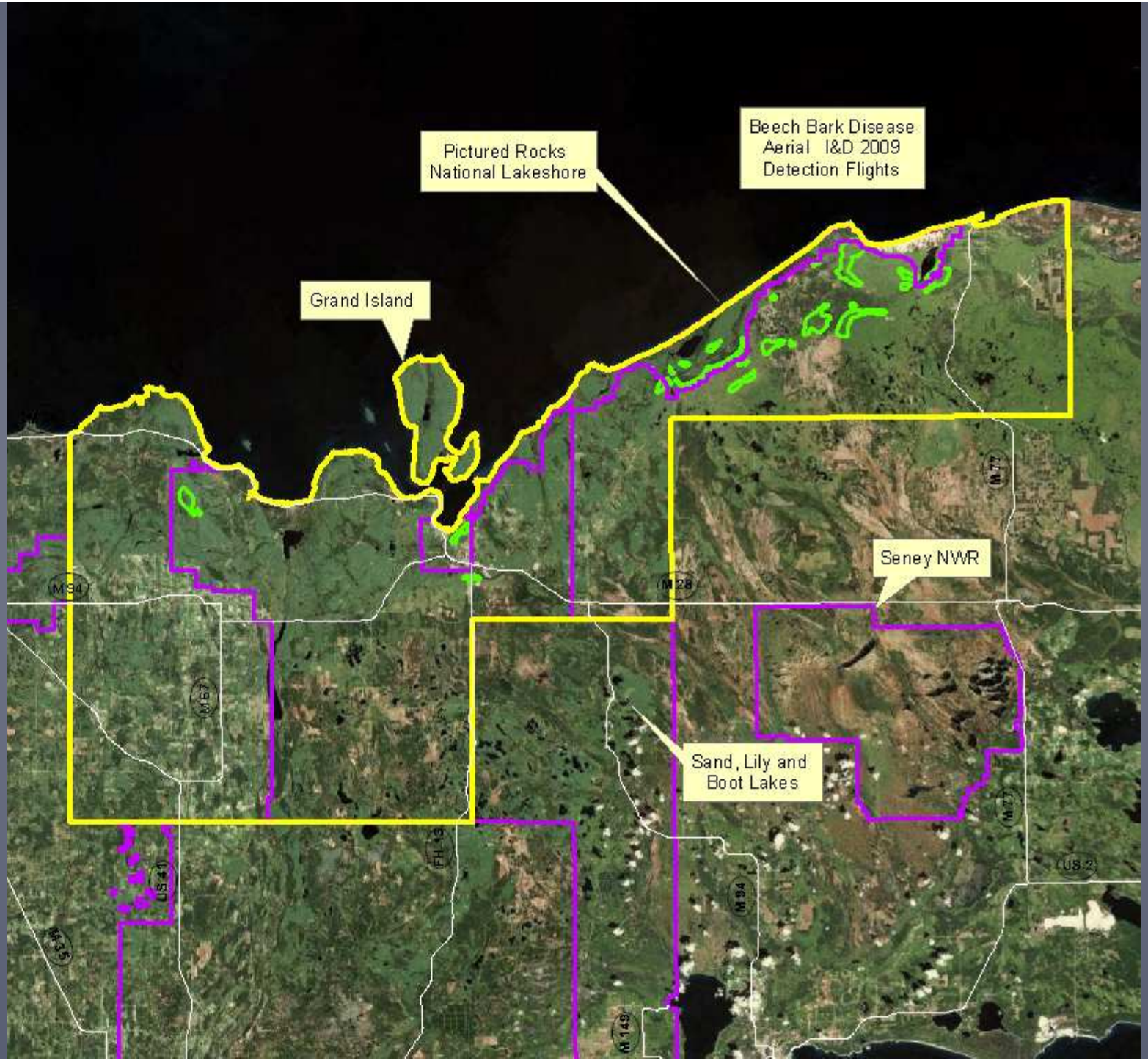
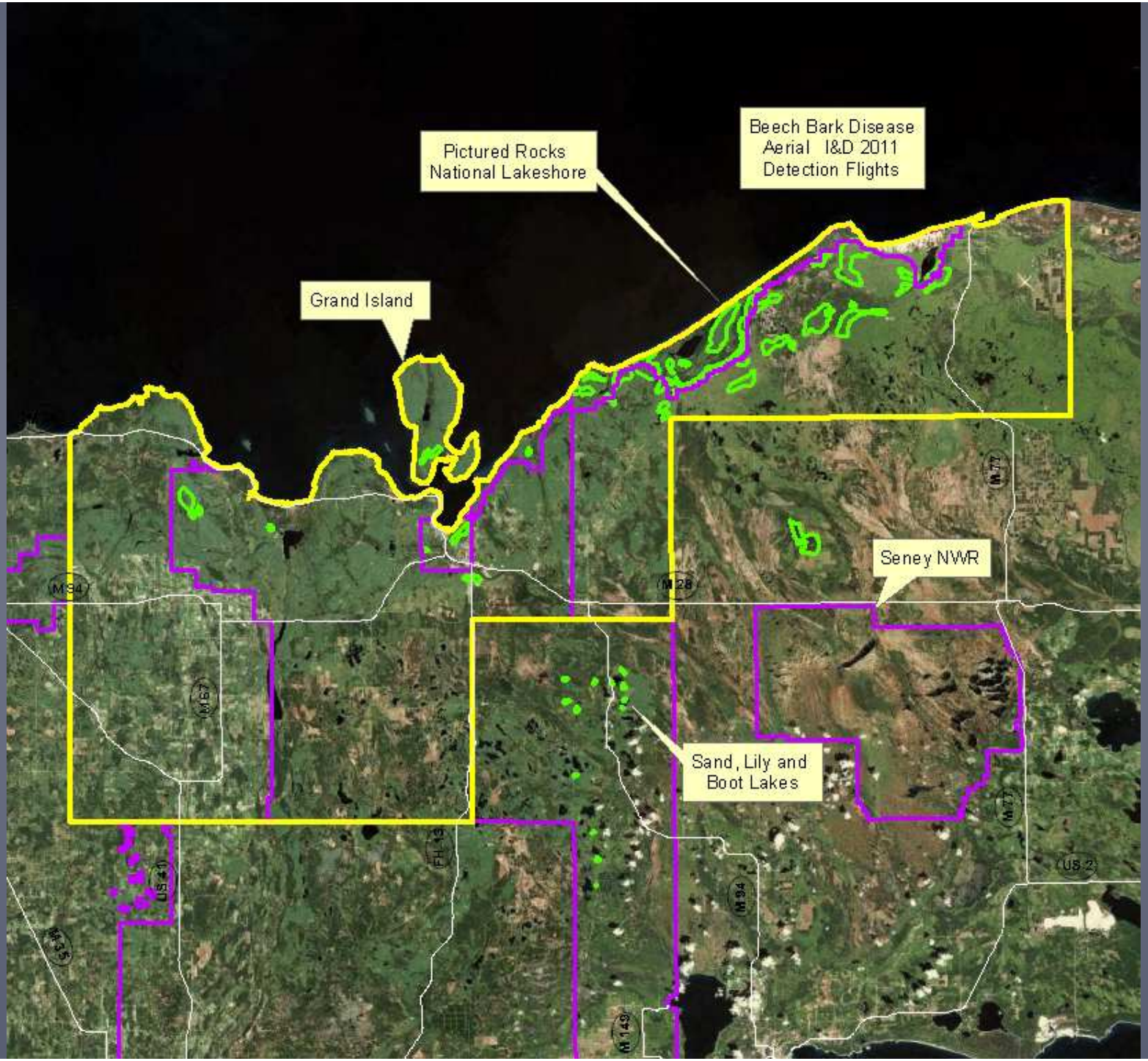
US-41
M-35
FH-13

2009


Pictured Rocks
National Lakeshore
Beech Bark Disease
Aerial I&D 2009
Detection Flights
Grand Island
Seney NWR
Sand, Lily and
Boot Lakes
M-28
M-77
M-94
M-67
M-84
M-149
US-41
US-2
FH-13

2011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DEER BROWSE