ARGONNE EXPERIMENTAL FOREST

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IMAGINE MORE … FOR FOREST SUSTAINABILITY

- A PLACE TO DEMONSTRATE YOUR APPROACH
- A PLACE TO TEST YOUR IDEAS
- A PLACE TO DISCUSS ISSUES THAT ARE IMMEDIATE & PRACTICAL
- A PLACE TO DISCUSS ISSUES THAT ARE LONG-TERM & REQUIRE DATA
- A PLACE THAT ISN'T YOURS YET IS EVERYBODY'S
- A PLACE THAT CAN MOVE ALL THE FORESTRY SECTOR

Outline – Argonne Experimental Forest

- A story of a place that advance forest sustainability
- Who, What, Where, Why, & How
- Now what?
- Your opportunity

THE STORY OF THE NORTHERN HARDWOOD MANAGEMENT GUIDES

ARGONNE EXPERIMENTAL FOREST

SILVICULTURE, IN THE BEGINNING

http://www.loc.gov/pictures/item/fsa1998022617/PP/

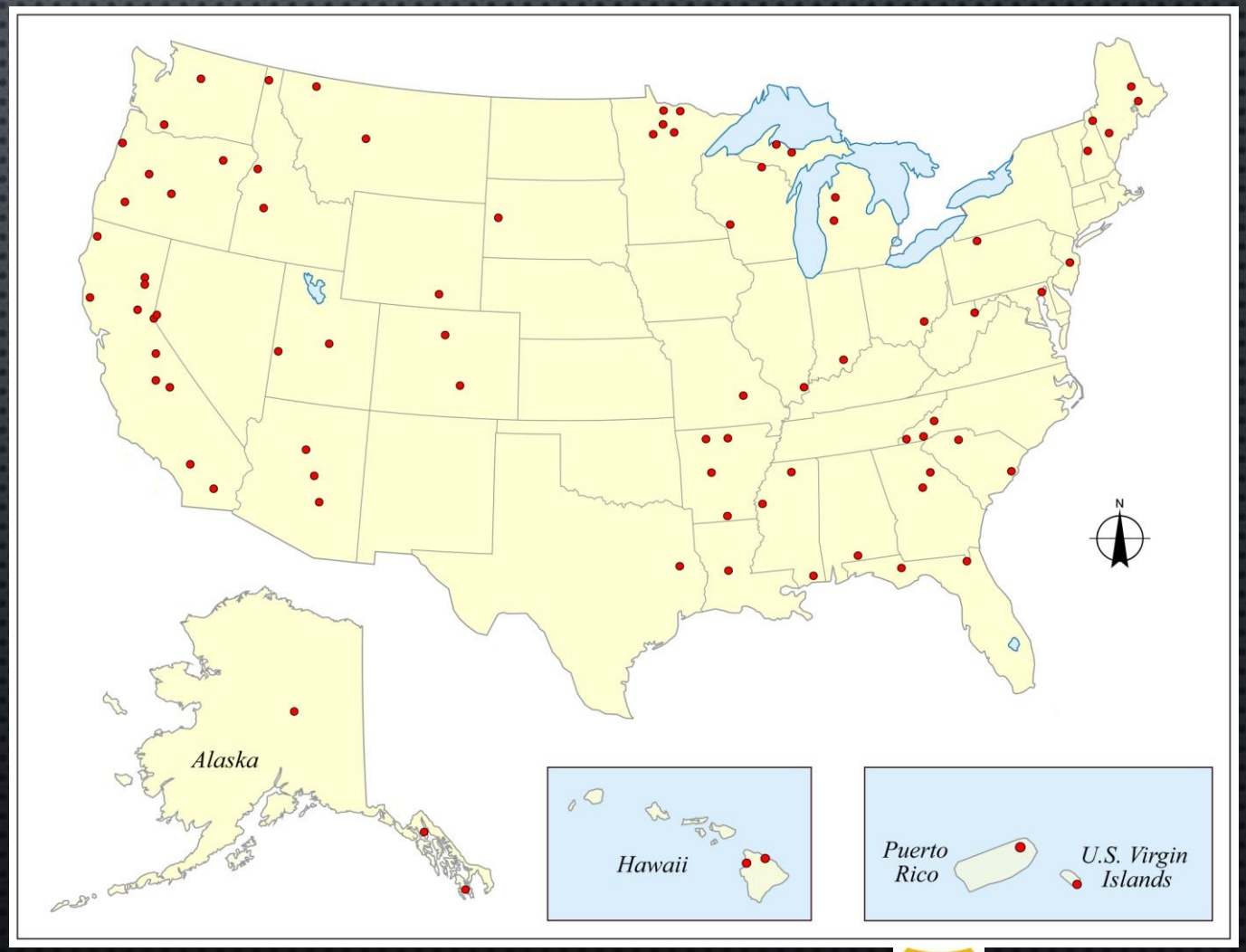
Silviculture, in the beginning

- Selective Cutting Era (1925-1960) *(Seymour 2004)*
  - Public opposition to exploitive cutting
  - Sustained yield concept

http://www.loc.gov/pictures/item/fsa1998022617/PP/

Silviculture, in the beginning

- Experimental Forests (EF)
  - 80 EFRs and 4 Cooperating EFRs
  - Outdoor laboratories and classrooms
  - Trees to watershed scales
  - Basic and applied



EFs of the Forest Service R&D

NORTHERN HARDWOODS

- Forecasted timber shortage
- Economic fallout

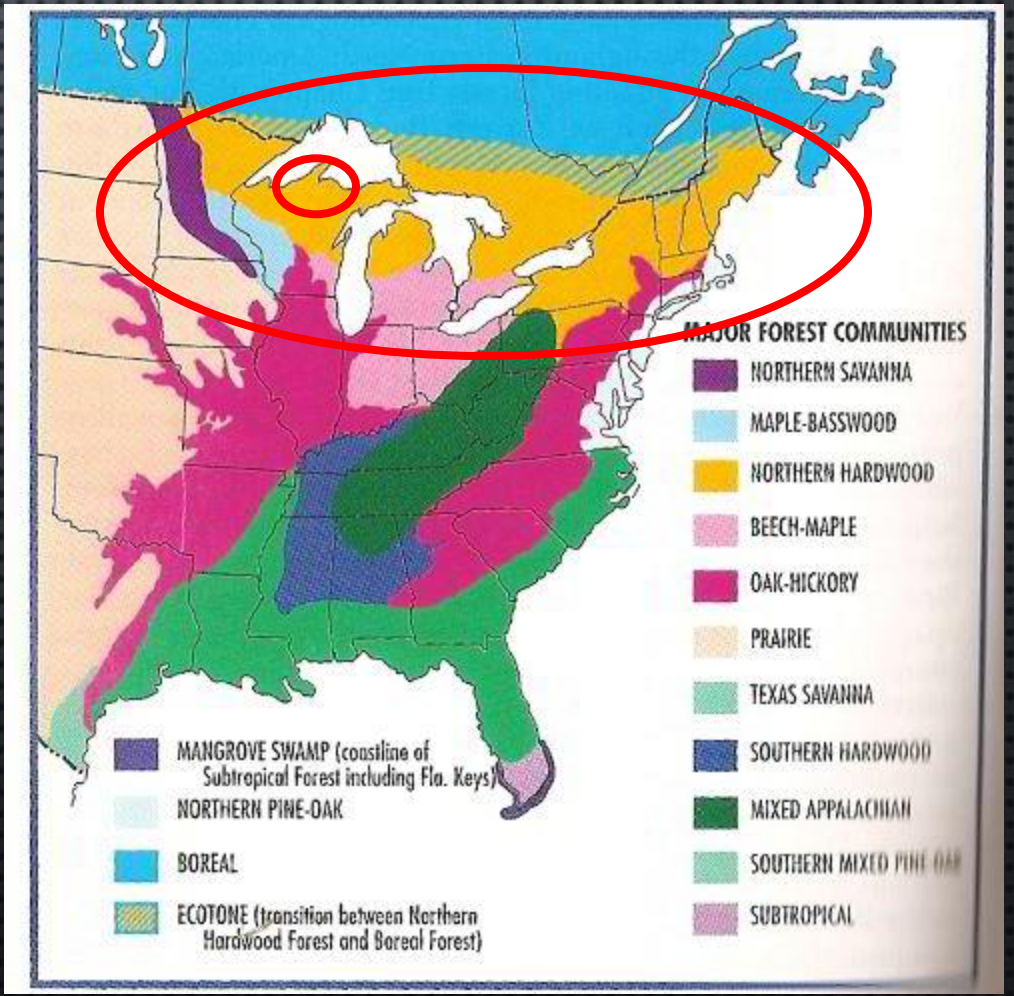


Image from: http://www.nativetreesociety.org/forestecology/regional_boundaries.htm; *Peterson's Guide "Eastern Forests"*

NORTHERN HARDWOODS

- MULTI-COHORT STRUCTURE
- SHADE TOLERANT SPECIES
- WIND DISTURBANCE

Photo by Terry Strong

Northern Hardwoods

- Old growth condition
- Economically valuable
  - Yellow birch
  - Veneer
- Ecologically complex
  - Management options

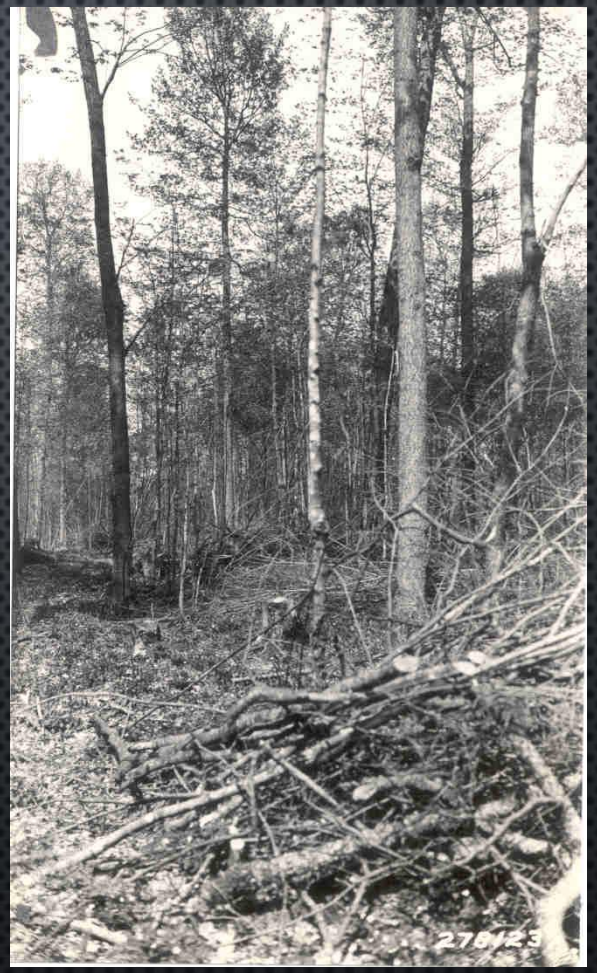
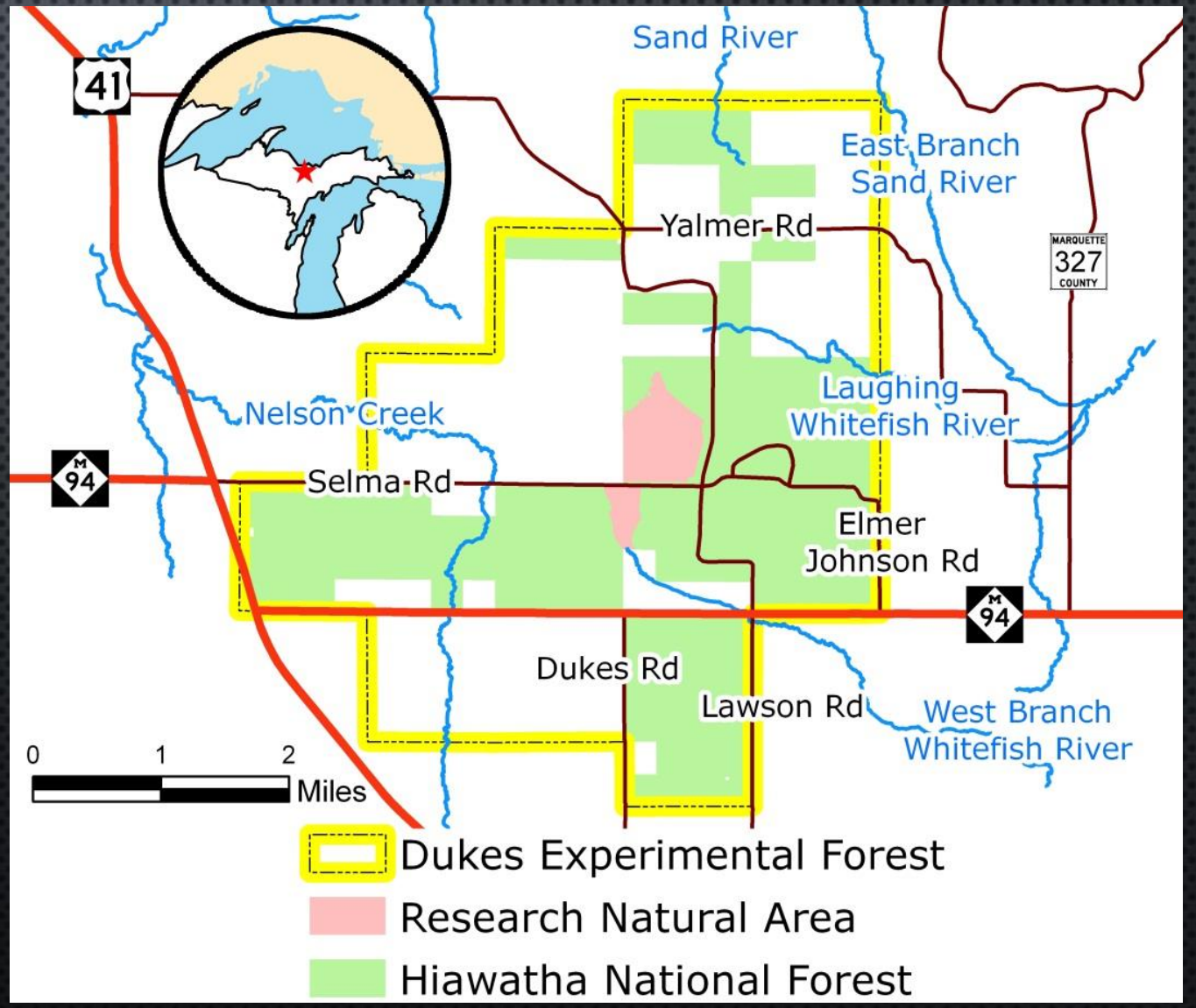


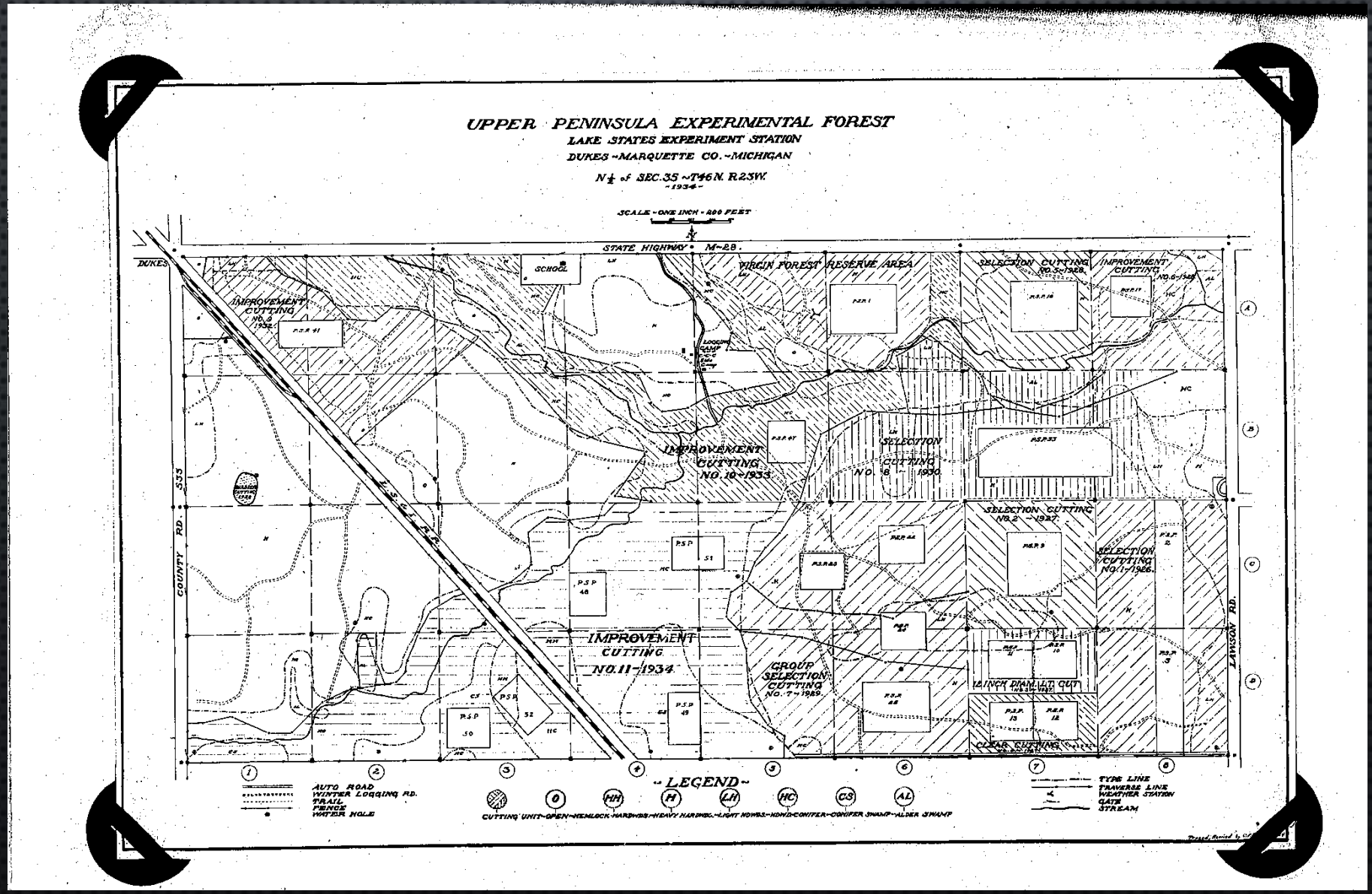
Photo archive. Selection 1932.

DUKES EXPERIMENTAL FOREST

- HIAWATHA NF, MICHIGAN
- NORTHERN HARDWOODS
- OLD GROWTH
- 5,500 ACRES

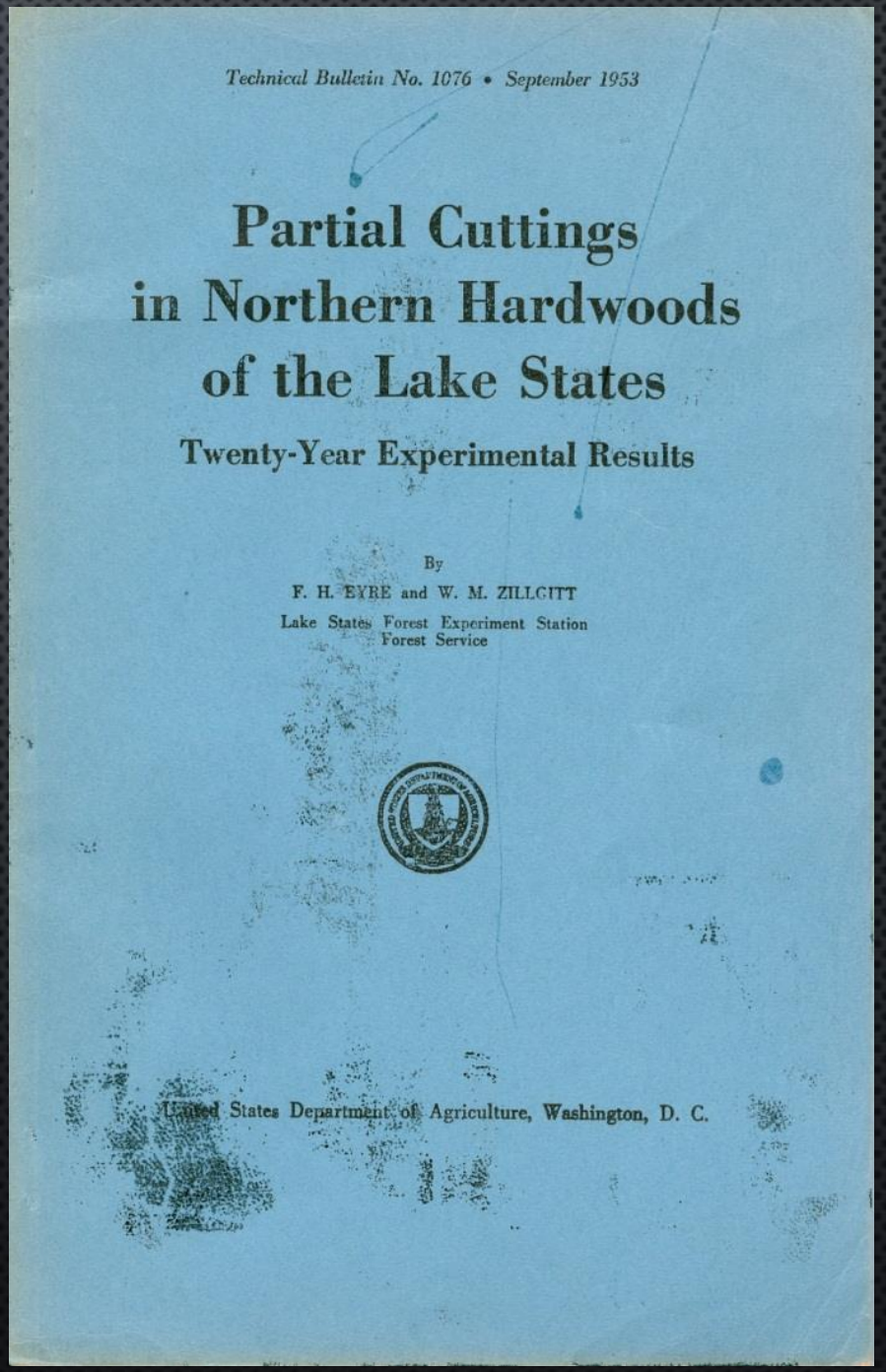


PARTIAL CUTTINGS STUDY, DUKES EF



PARTIAL CUTTINGS STUDY, DUKES EF

- <u>THE FIRST 20 YEARS</u>
  - REPEATED MEASUREMENTS
  - MAJOR PUBLICATIONS
    - MONOGRAPH BY EYRE AND ZILLGITT 1953



Technical Bulletin No. 1076 • September 1953

Partial Cuttings in Northern Hardwoods of the Lake States

Twenty-Year Experimental Results

By

F. H. EYRE and W. M. ZILLGITT

Lake States Forest Experiment Station
Forest Service

United States Department of Agriculture, Washington, D. C.

Partial Cuttings Study, Dukes EF

- <u>The first 20 years</u>
  - Marking guide by Arbogast 1957
    - Based on Eyre & Zillgitt 1953
    - AKA "Arbogast Guide"
    - Focused on selection

PARTIAL CUTTINGS STUDY, DUKES EF

- THE FIRST 20 YEARS (EYRE & ZILLGITT 1953; ARBOGAST 1957)
- SINGLE-TREE SELECTION
  - SUSTAIN SAWTIMBER
    - MAINTAIN COMPOSITION
    - RANGE OF AGE CLASSES

RECOMMENDED SILVICULTURAL SYSTEM

The selection method of cutting with certain modifications is recommended for the management of northern hardwoods. Under this all-aged system of sustained yield forest management, a stand of high-quality trees is developed and maintained by removing the poor trees over the entire range of size classes, and the mature and overmature trees through a continuing series of partial cuts made at relatively short

Table 2.--Summary of desirable stocking recommendations

Crown class	Tree size	Normal d.b.h. range	Recommended stocking
		Inches	Square feet
Dominant	Sawtimber	10+	65-75
Intermediate	Poles	5-9	10-20
Suppressed	Saplings	2-4	5-10

Partial Cuttings Study, Dukes EF

- The first 20 years (Eyre & Zillgitt 1953; Arbogast 1957)
  - Keep best trees
    - 68 ft^2/ac BA sawlogs
      - 16 ft^2/ac BA poles
    - Reverse-J structure
  - Remove defective/high risk
    - Max DBH = 24”
    - ~15 year cutting cycle

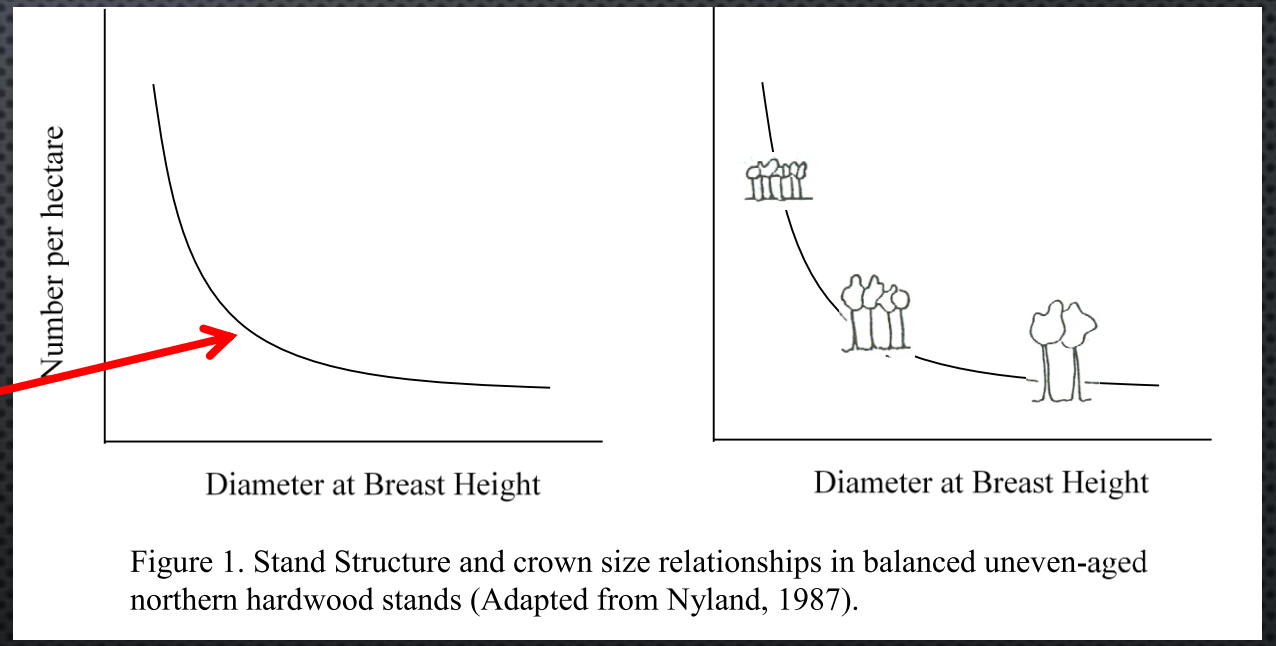
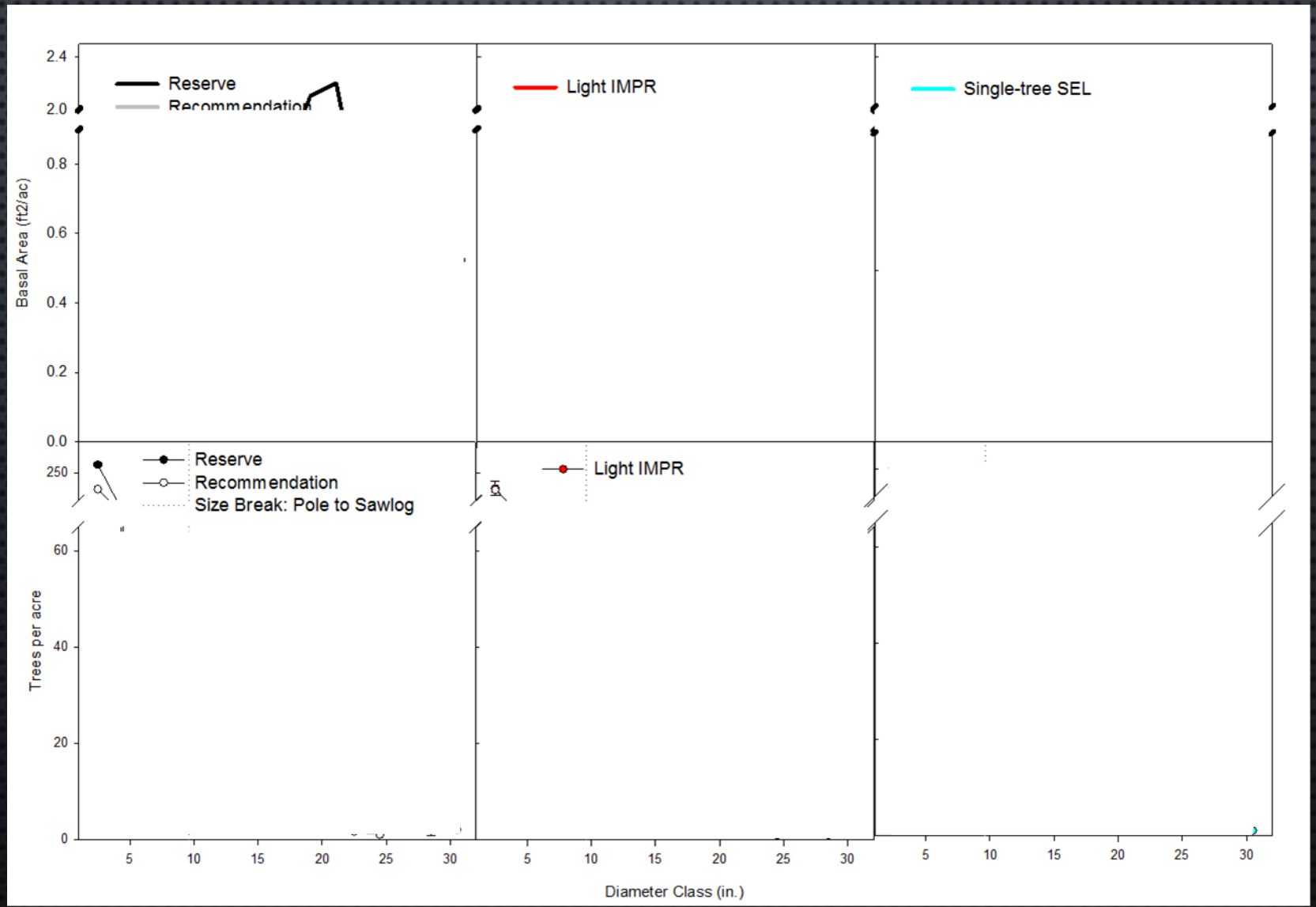
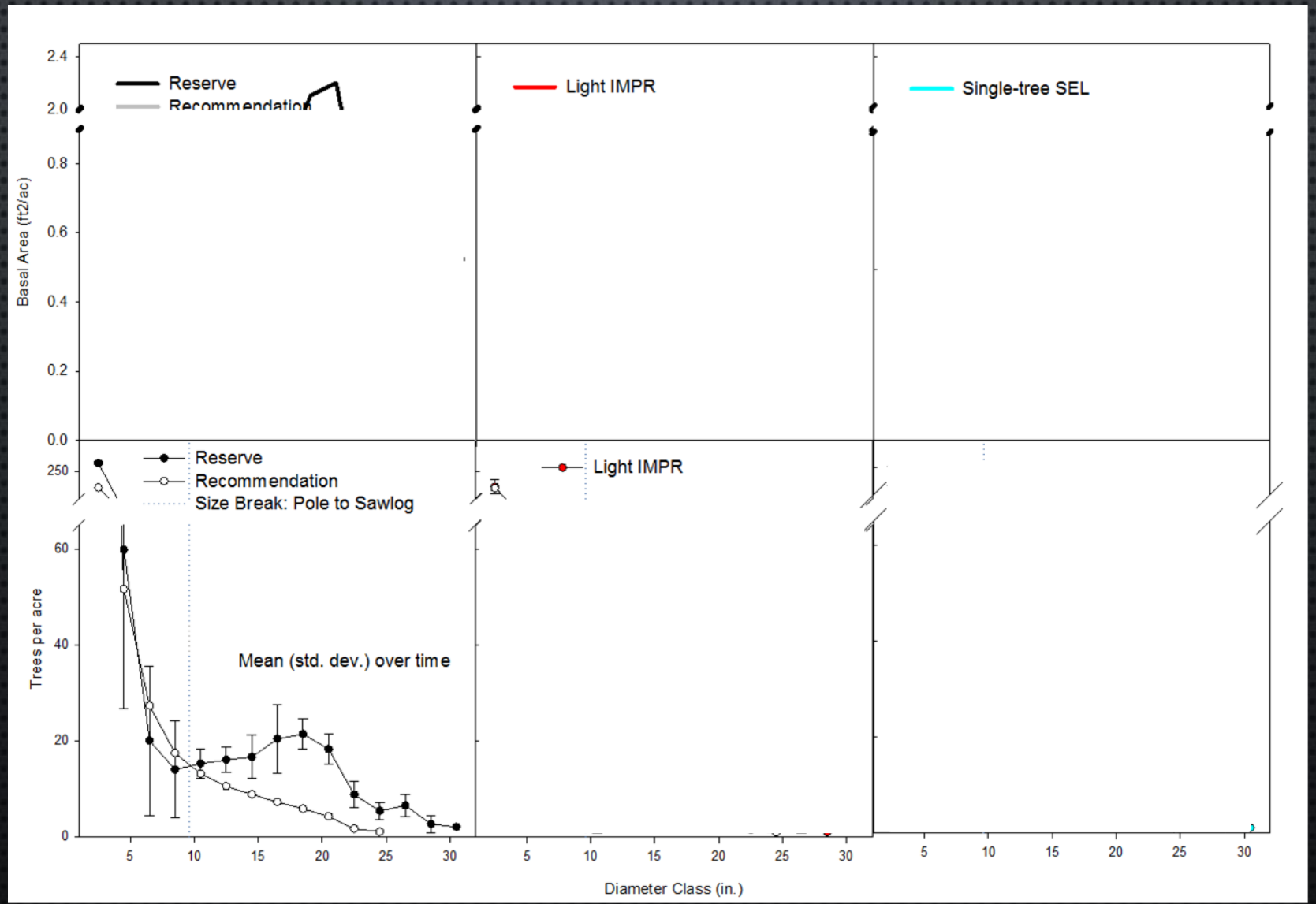


Figure 1. Stand Structure and crown size relationships in balanced uneven-aged northern hardwood stands (Adapted from Nyland, 1987).

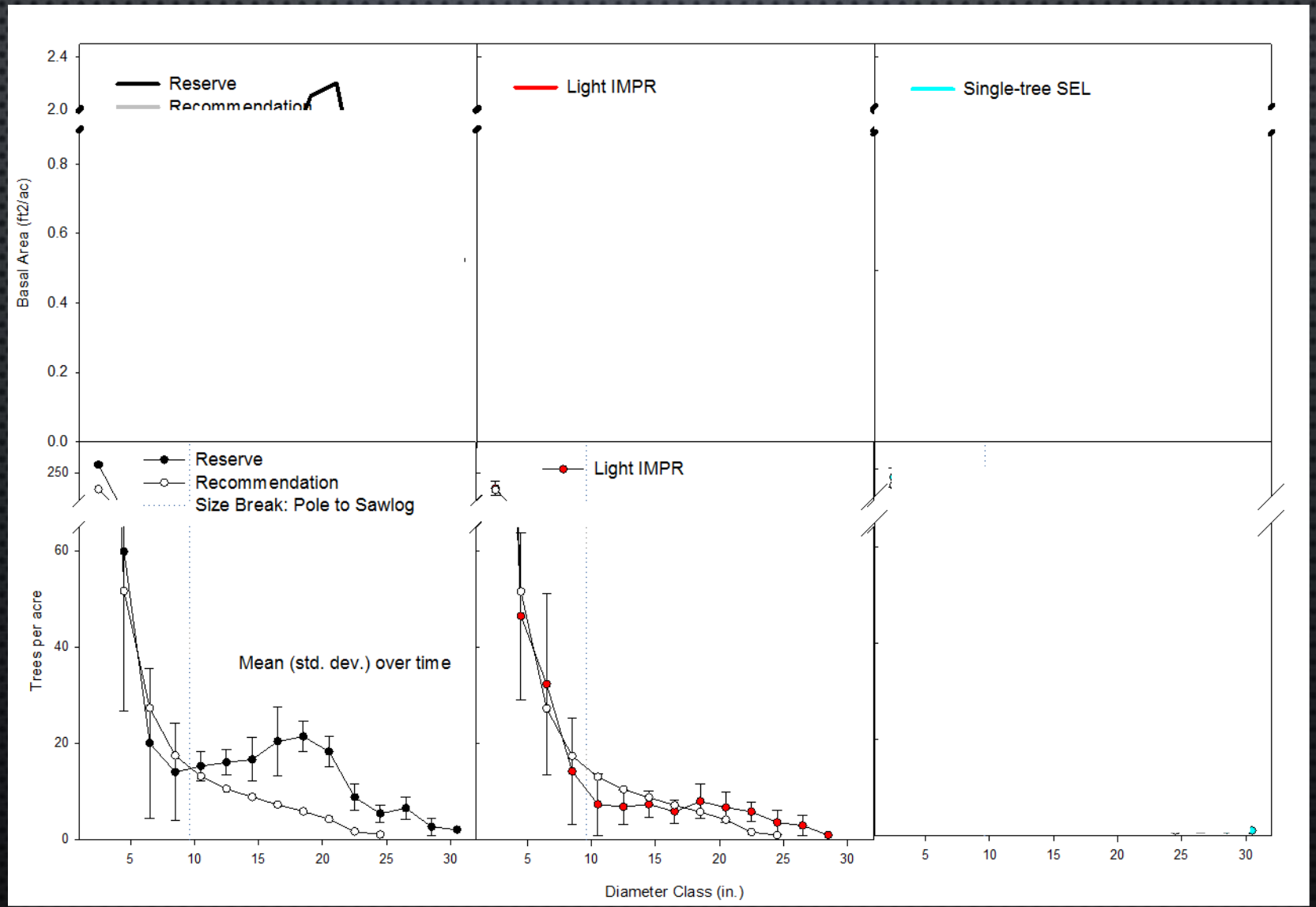
PARTIAL CUTTINGS STUDY, DUKES EF



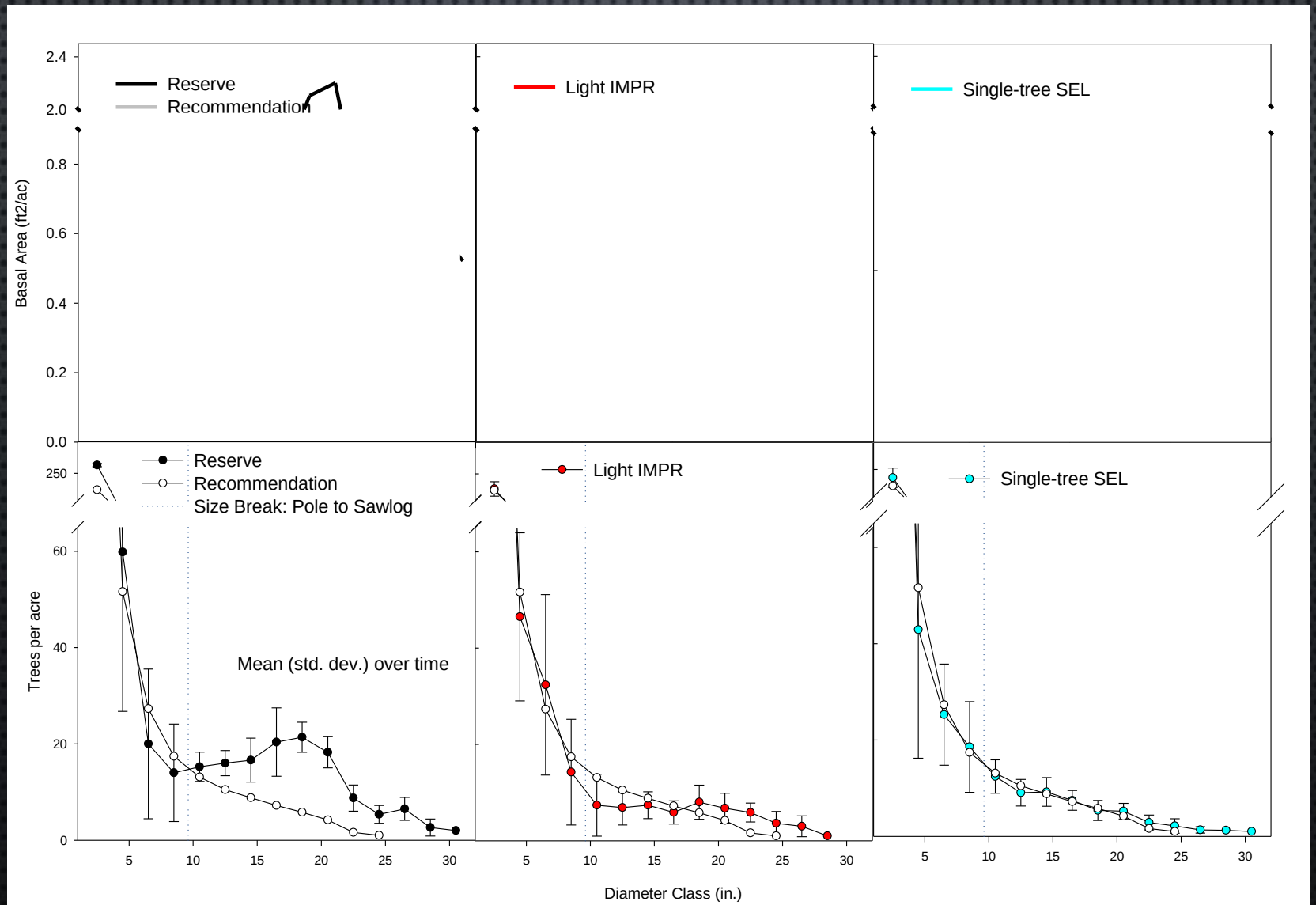
PARTIAL CUTTINGS STUDY, DUKES EF



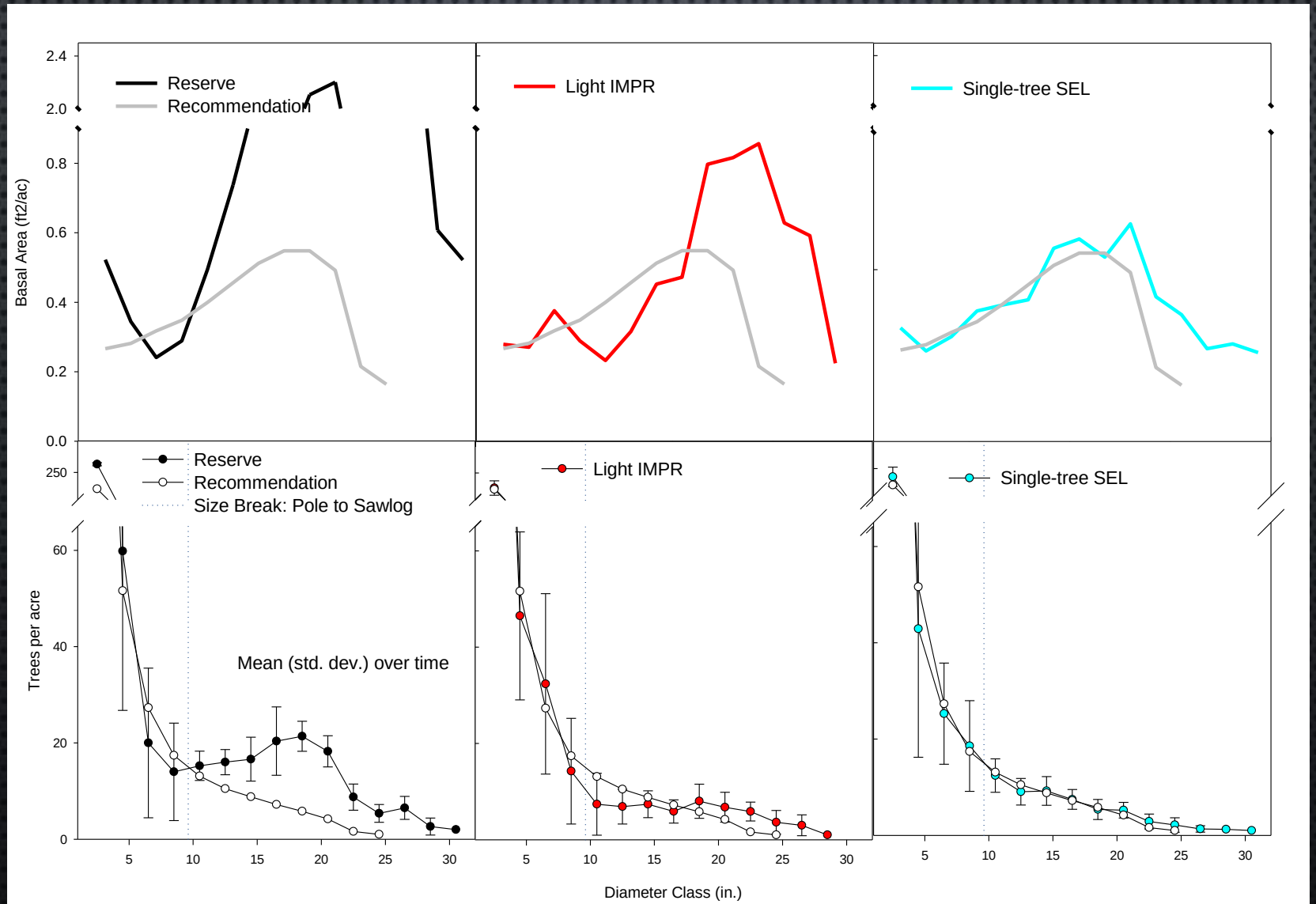
PARTIAL CUTTINGS STUDY, DUKES EF



PARTIAL CUTTINGS STUDY, DUKES EF



PARTIAL CUTTINGS STUDY, DUKES EF



PARTIAL CUTTINGS STUDY, DUKES EF

- Single-tree Selection Paradigm
  - Wide spread application
    - Across ownerships
      - Industry
      - Government
      - Tribal
      - Private landowners
    - Across regions
      - Northeastern U.S.
      - Canada

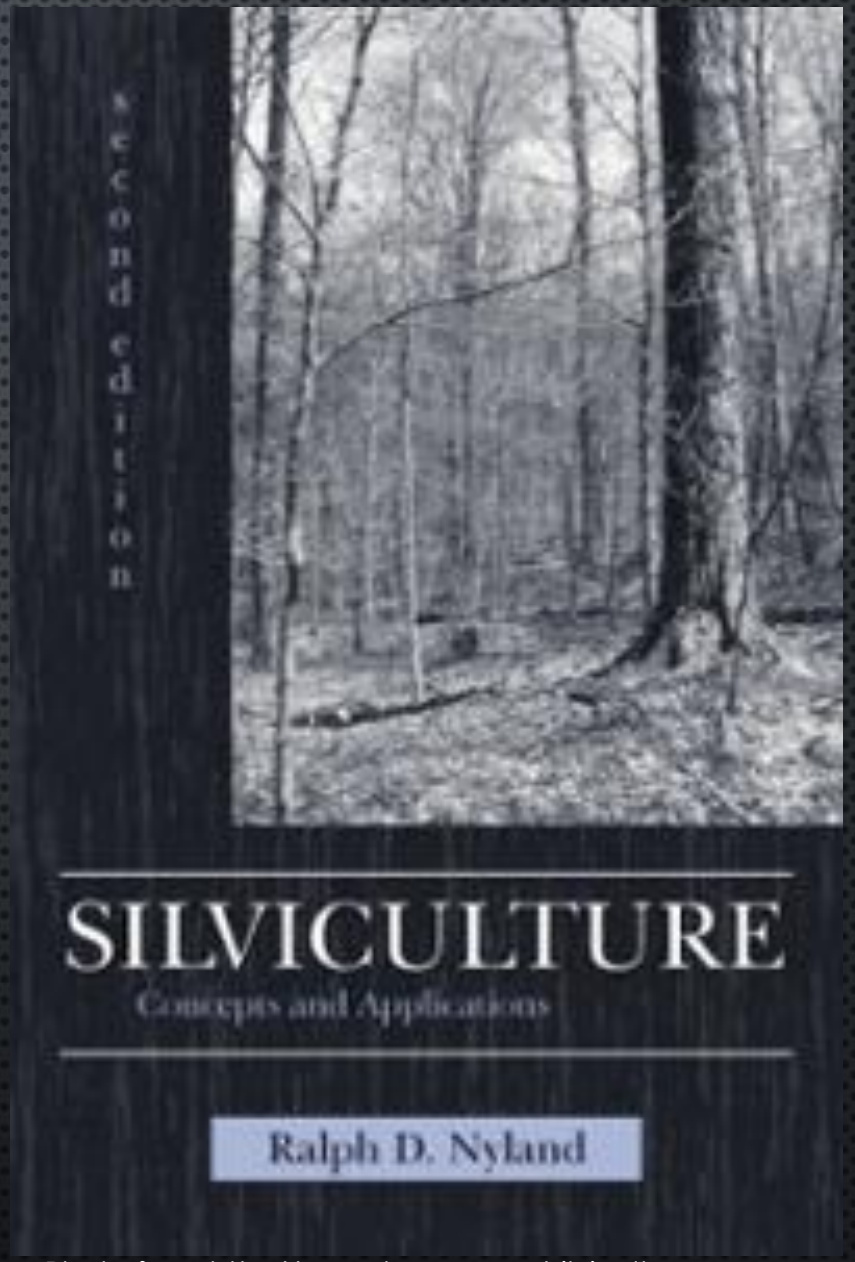


Photo from http://www.tower.com/silviculture-concepts-applications-ralph-d-nyland-paperback/wapi/107259230

PARTIAL CUTTINGS STUDY, DUKES EF

- Single-tree Selection Paradigm
  - Basis
    - 20 years of data
    - Unreplicated design

Permanent Plot, Partial Cutting Study, Dukes EF, 1930s

PARTIAL CUTTINGS STUDY, DUKES EF

- Single-tree Selection Paradigm
  - Other Research
    - New Studies (replicated)
      - Dukes Exp. Forest
      - **Argonne Exp. Forest**
    - Universities
    - Other regions
      - Bartlett EF, NH
      - Quebec

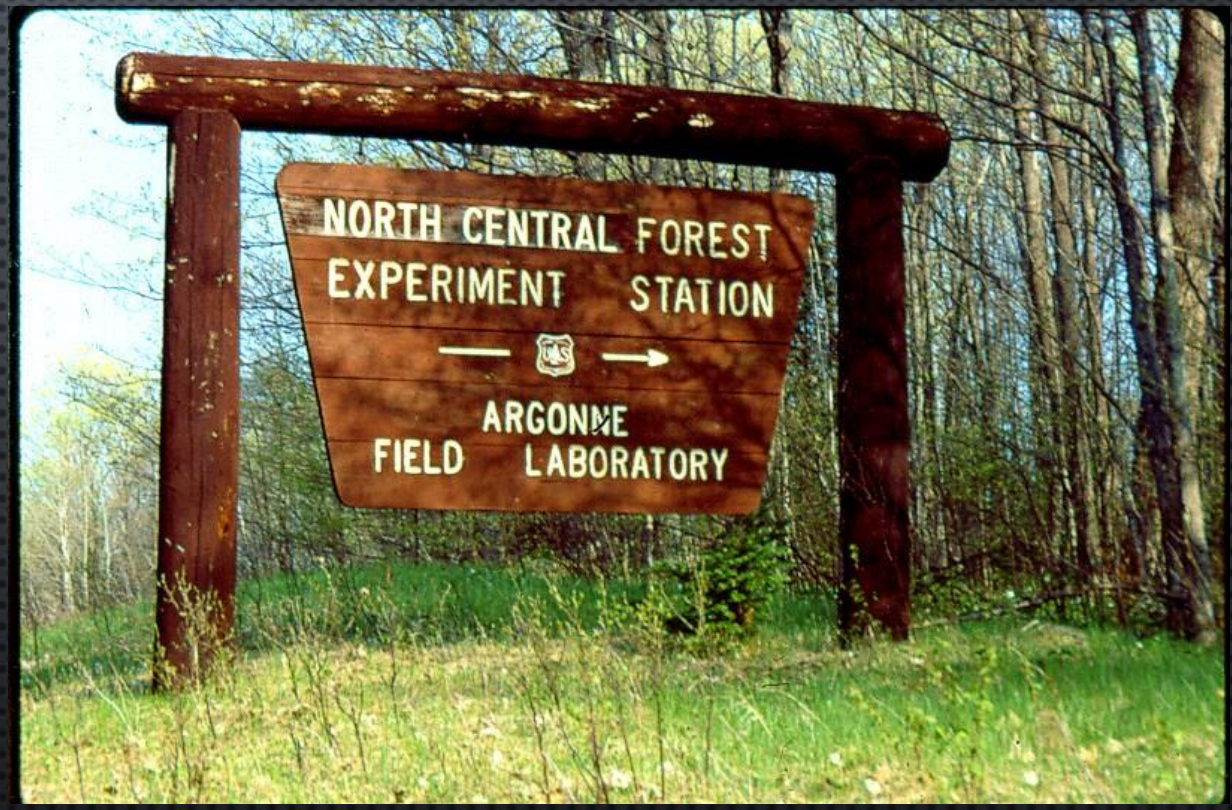
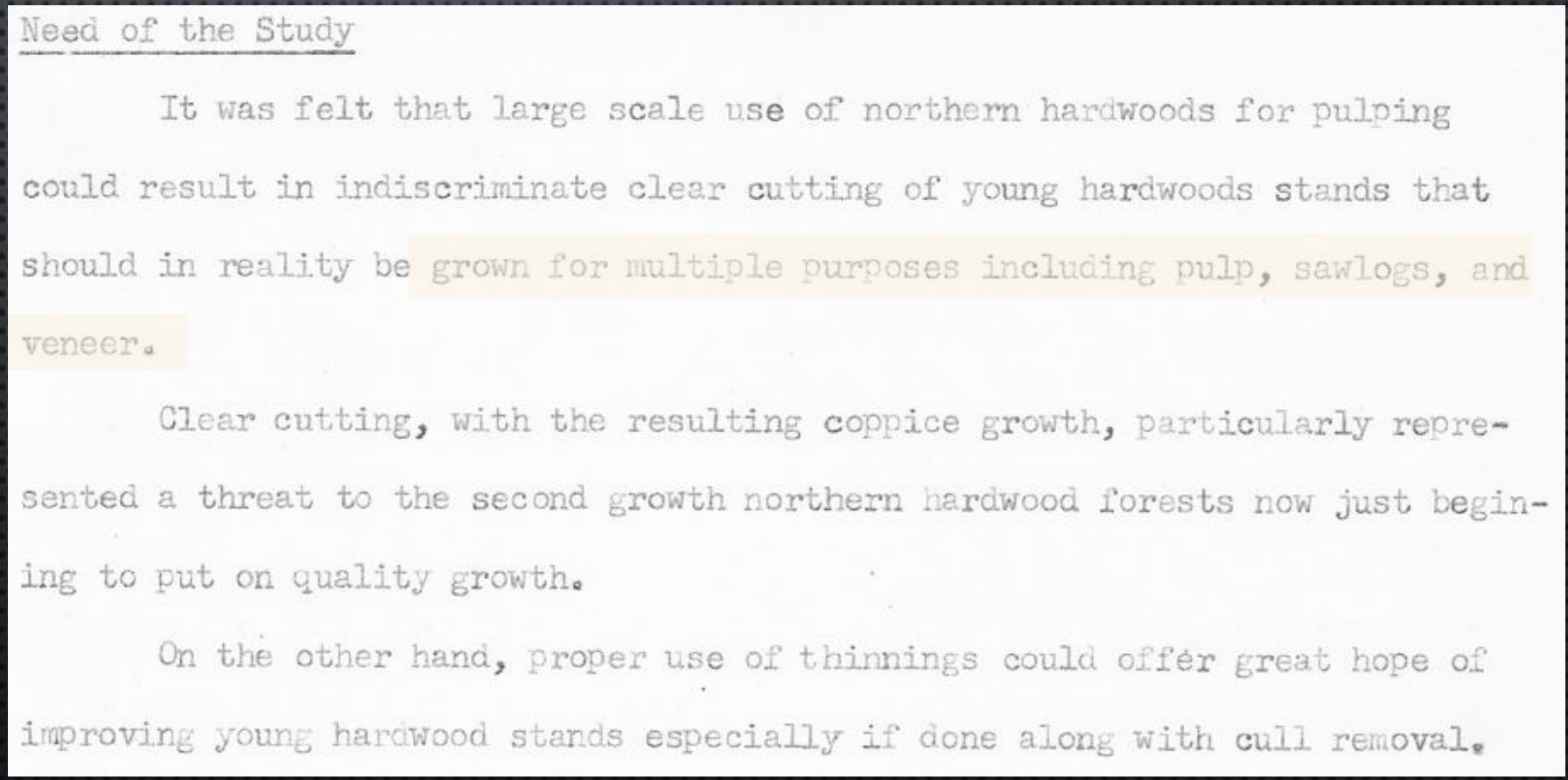


Photo by Terry Strong

CUTTING METHODS STUDY IN SECOND-GROWTH, ARGONNE EF



Need of the Study

It was felt that large scale use of northern hardwoods for pulping could result in indiscriminate clear cutting of young hardwoods stands that should in reality be grown for multiple purposes including pulp, sawlogs, and veneer.

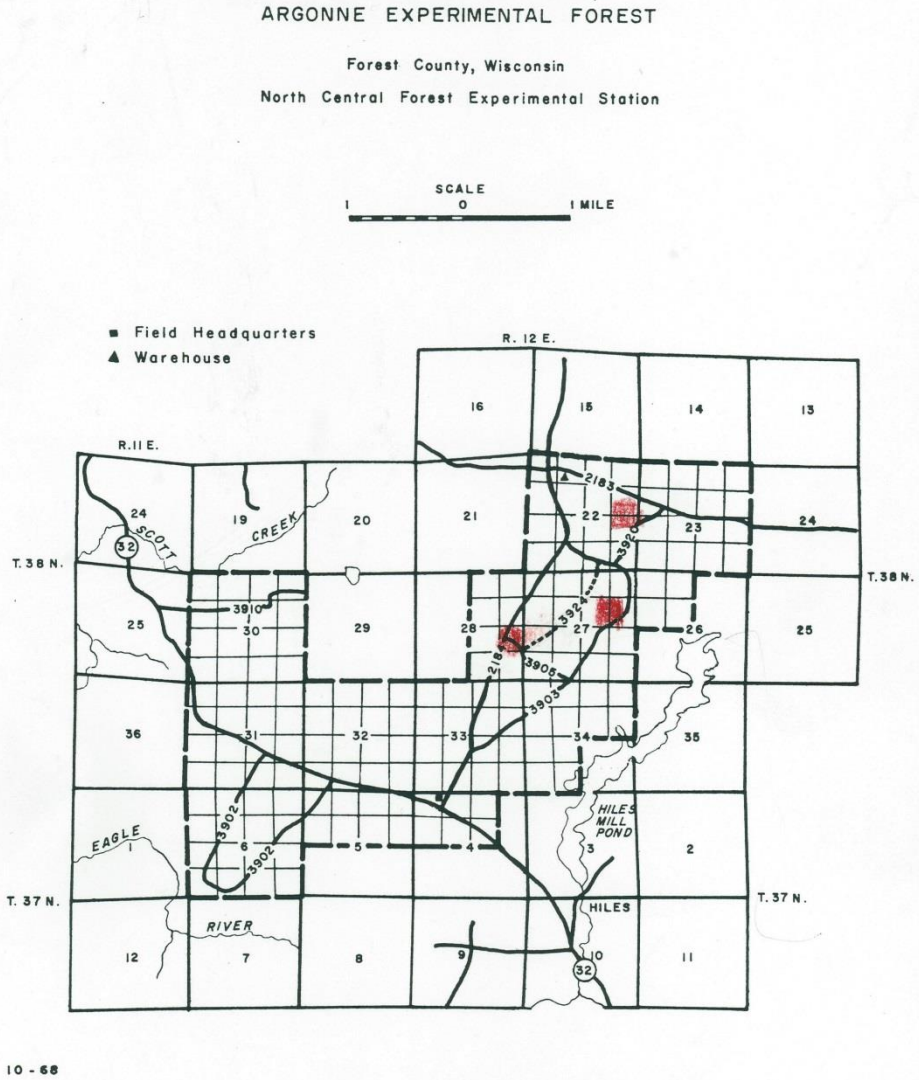
Clear cutting, with the resulting coppice growth, particularly represented a threat to the second growth northern hardwood forests now just beginning to put on quality growth.

On the other hand, proper use of thinnings could offer great hope of improving young hardwood stands especially if done along with cull removal.

Establishment Report, J. Stoeckeler, 1951

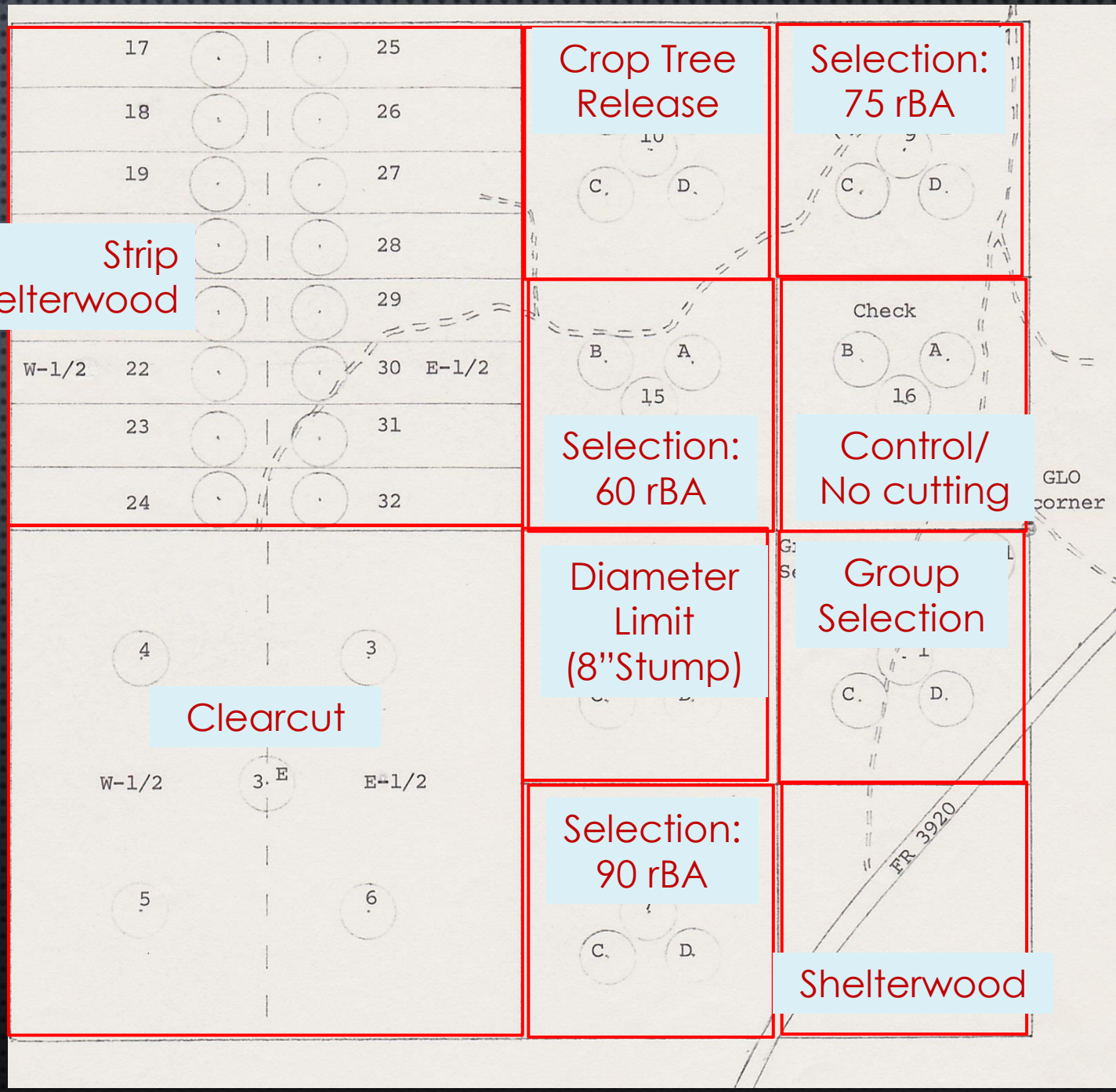
CUTTING METHODS STUDY IN SECOND-GROWTH, ARGONNE EF

- ESTAB. 1951
- 3 REPS (40-AC BLOCKS)



CUTTING METHODS STUDY, ARGONNE EF

- EVEN-AGED VS UNEVEN-AGED SYSTEMS

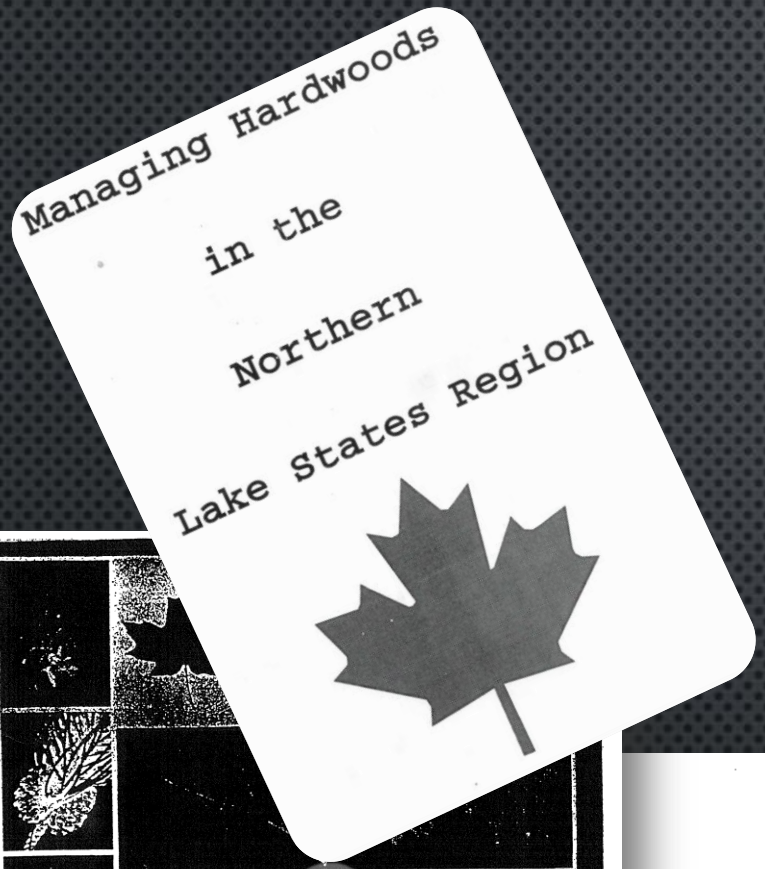


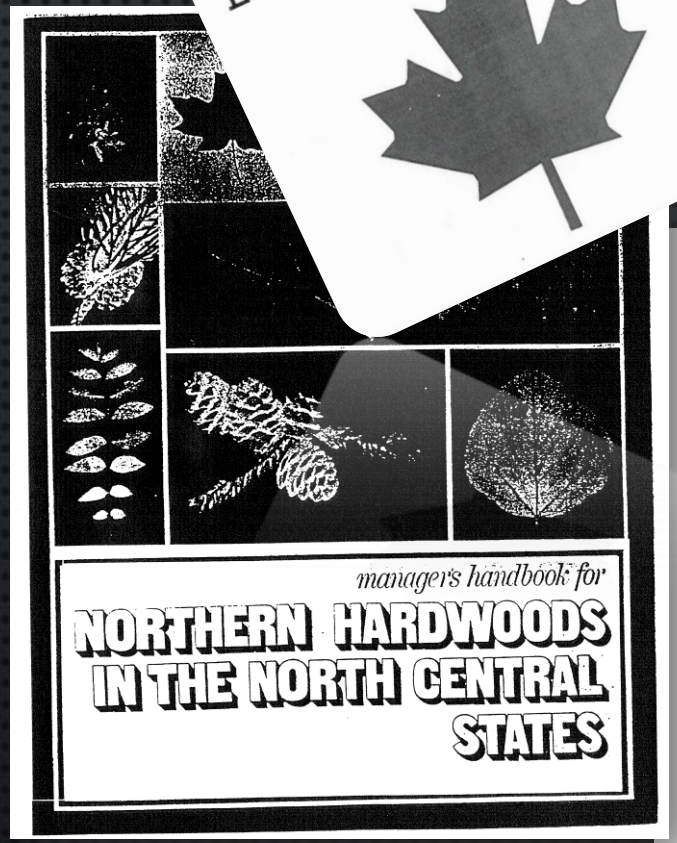
CUTTING METHODS STUDY, ARGONNE EF

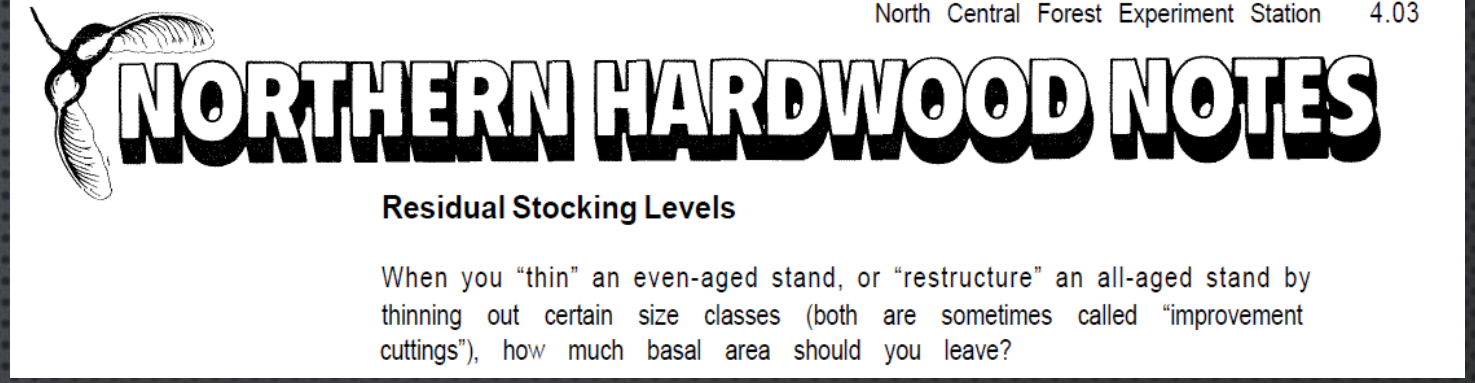
- 7 SELECTION HARVESTS
- 2 DIAMETER LIMIT CUTS
- EA THINNINGS DUE

CUTTING METHODS STUDY, ARGONNE EF

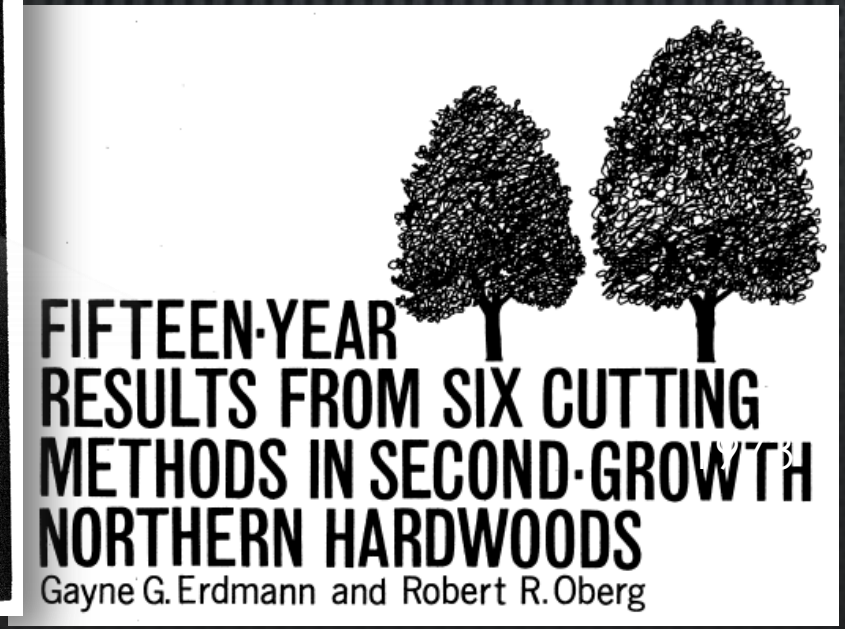
- 65+ YEARS DATA
  - SPECIES
  - DBH
  - TREE QUALITY
- REGEN
- VEG







Selected Publications



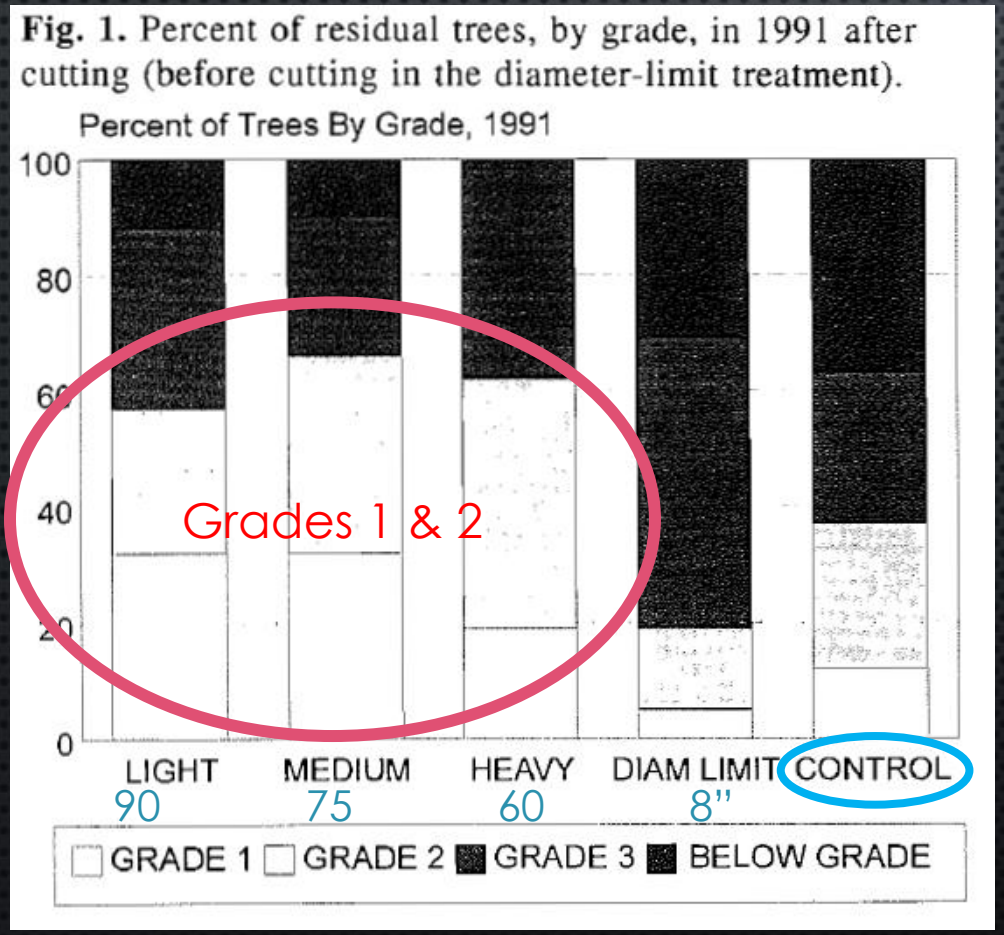
Forty years of alternative management practices in second-growth, pole-size northern hardwoods. I. Tree quality development

Terry F. Strong, Gayne G. Erdmann, and Jeffrey N. Niese

Forty years of alternative management practices in second-growth, pole-size northern hardwoods. II. Economic evaluation

Jeffrey N. Niese, Terry F. Strong, and Gayne G. Erdmann

CUTTING METHODS STUDY, ARGONNE EF



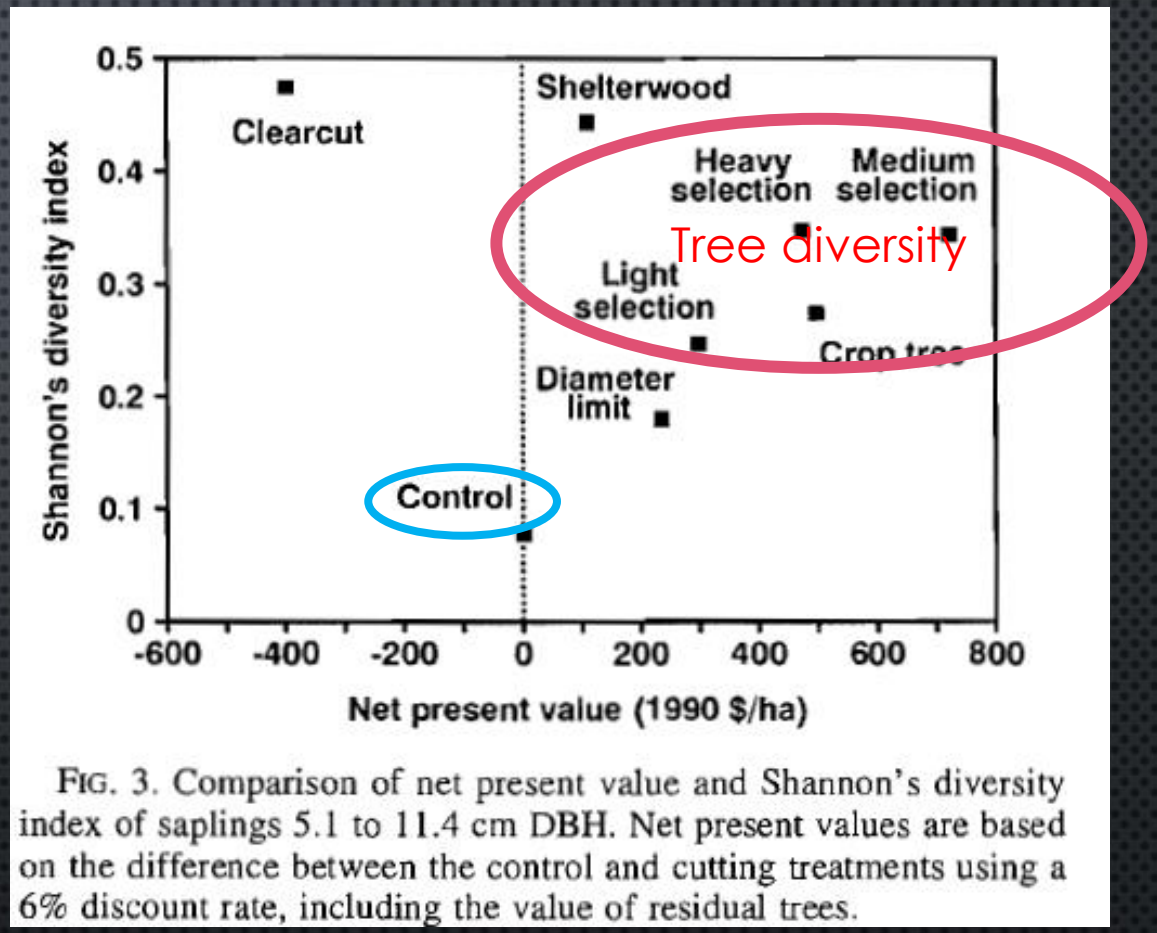


FIG. 3. Comparison of net present value and Shannon's diversity index of saplings 5.1 to 11.4 cm DBH. Net present values are based on the difference between the control and cutting treatments using a 6% discount rate, including the value of residual trees.

NIESE, J.N. AND STRONG, T.F. 1992. CAN. J. FOR. RES., 22, 1807-1813.

NIESE, J.N., STRONG, T.F. AND ERDMANN, G.G. 1995. CAN. J. FOR. RES. 25, 1180-1188.

CUTTING METHODS STUDY, ARGONNE EF

WI DNR Silviculture Handbook

Table 40.12. Even-age stocking levels for northern hardwoods by mean stand diameter, basal area, and number of trees per acre for specified crown covers after thinning. (USDA Forest Service 2005)

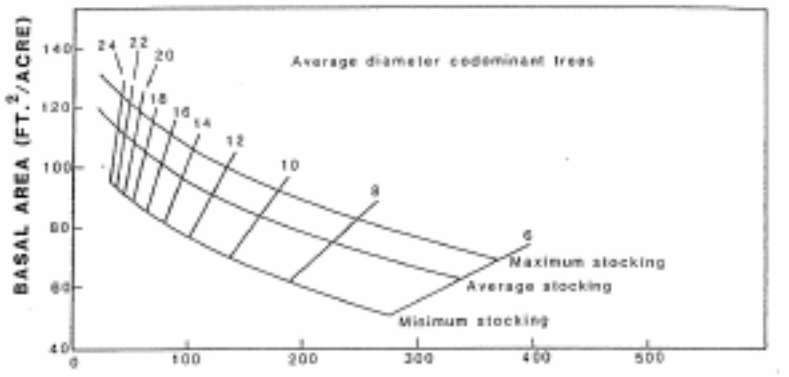
Mean Stand Diameter (in)	Crown area/tree (ft²)	Basal area/tree (ft²)	Crown cover (percent of 43,560 ft²/ac) 80 percent Trees/ac (No.)	80 percent BA/ac (ft²)	90 percent Trees/ac (No.)	90 percent BA/ac (ft²)
4	78	0.0873	447	39	503	44
5	104	0.1364	335	46	377	51
6	133	0.1963	262	51	295	58
7	164	0.2673	212	57	239	64
8	199	0.3491	175	61	197	69
9	238	0.4418	146	65	165	73
10	279	0.5454			141	77
11	325	0.6600			121	80
12	373	0.7854			105	83
13	422	0.9218			93	86
14	480	1.0690			82	87
15	536	1.2272			73	90
16	598	1.3963			66	92
17	662	1.5762			59	93
18	728	1.7671			54	95
19	803	1.9689			49	96
20	881	2.1817			44	97
21	952	2.4053			41	99
22	1035	2.6398			38	100
23	1120	2.8852			35	101
24	1207	3.1416			32	102

Chequamegon-Nicolet NF Forest Plan

Appendix FF

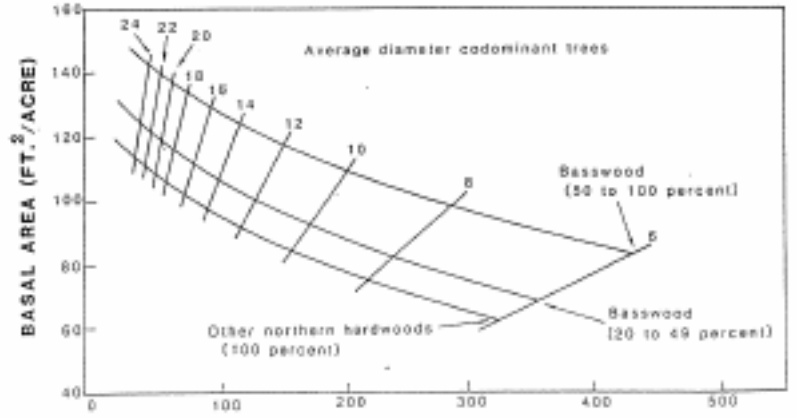
Stocking Level Charts

Figure FF-1. Stocking levels for northern hardwoods.



Stocking levels for northern hardwood stands containing less than 20% conifers or basswood by basal area, and number of trees per acre for specified diameter classes. Reference, General Technical Report NC-39, North Central Forest Experiment Station.

Figure FF-2. Stocking levels for even-aged northern hardwood-basswood stands.



Stocking levels for even-age northern hardwood basswood stands in the Lake States by basal area and number of trees per acre for specified diameter classes and certain percentages of basswood and other northern hardwoods. Reference, General Technical Report NC-39, North Central Forest Experiment Station.

IMAGINE … MORE FOR FOREST SUSTAINABILITY

- ARGONNE EXPERIMENTAL FOREST IS THE PLACE

Outline – Argonne Experimental Forest

- A story of a place that advance forest sustainability
- Who, What, Where, Why, & How
- Now what?
- Your opportunity

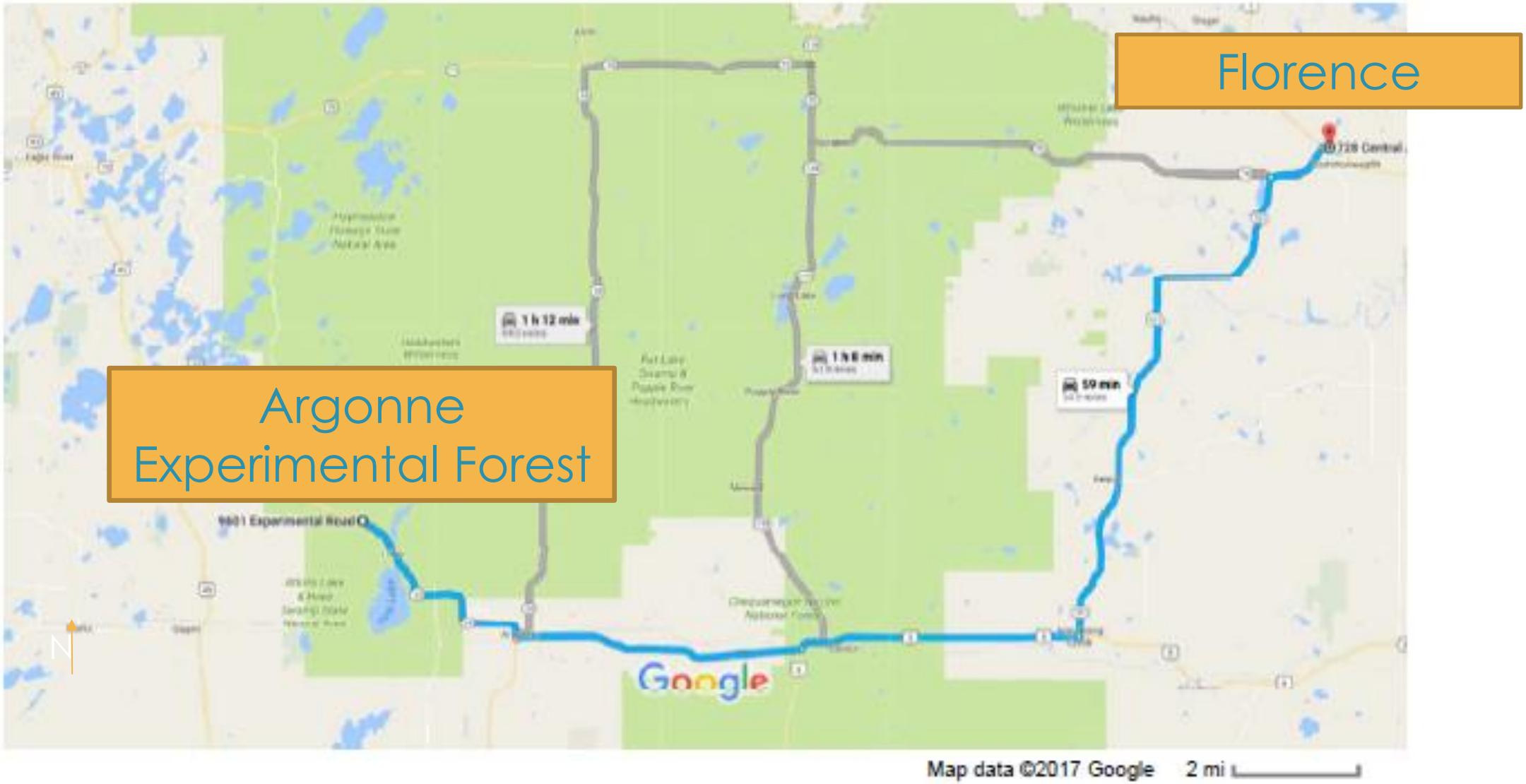
WHERE

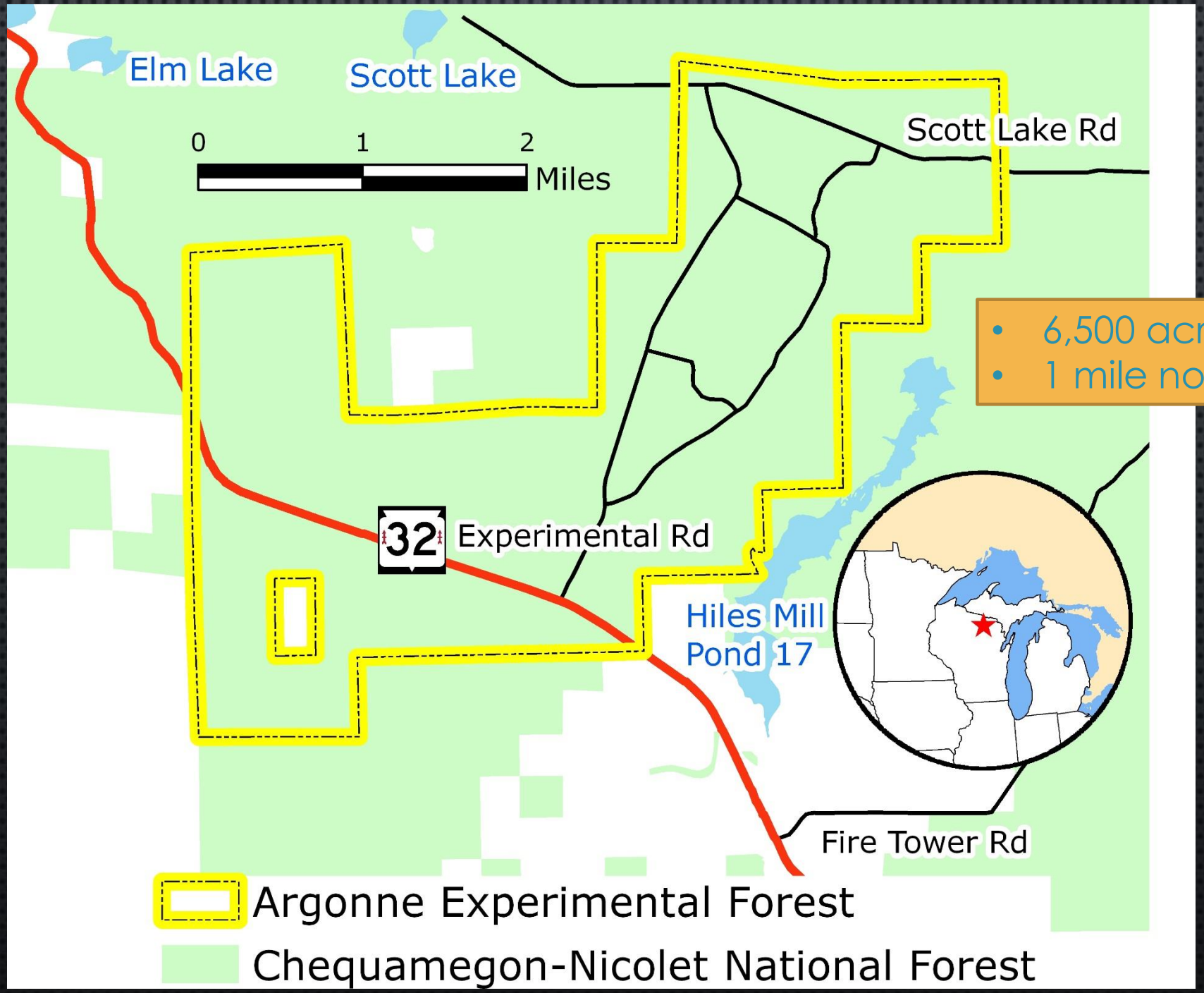
Argonne Experimental Forest

Google Maps

9601 Experimental Rd, Argonne, WI 54511 to 728 Central Ave, Florence, WI 54121

Drive 54.0 miles, 59 min





- 6,500 acres
- 1 mile north of Hiles

WHAT

Argonne Experimental Forest

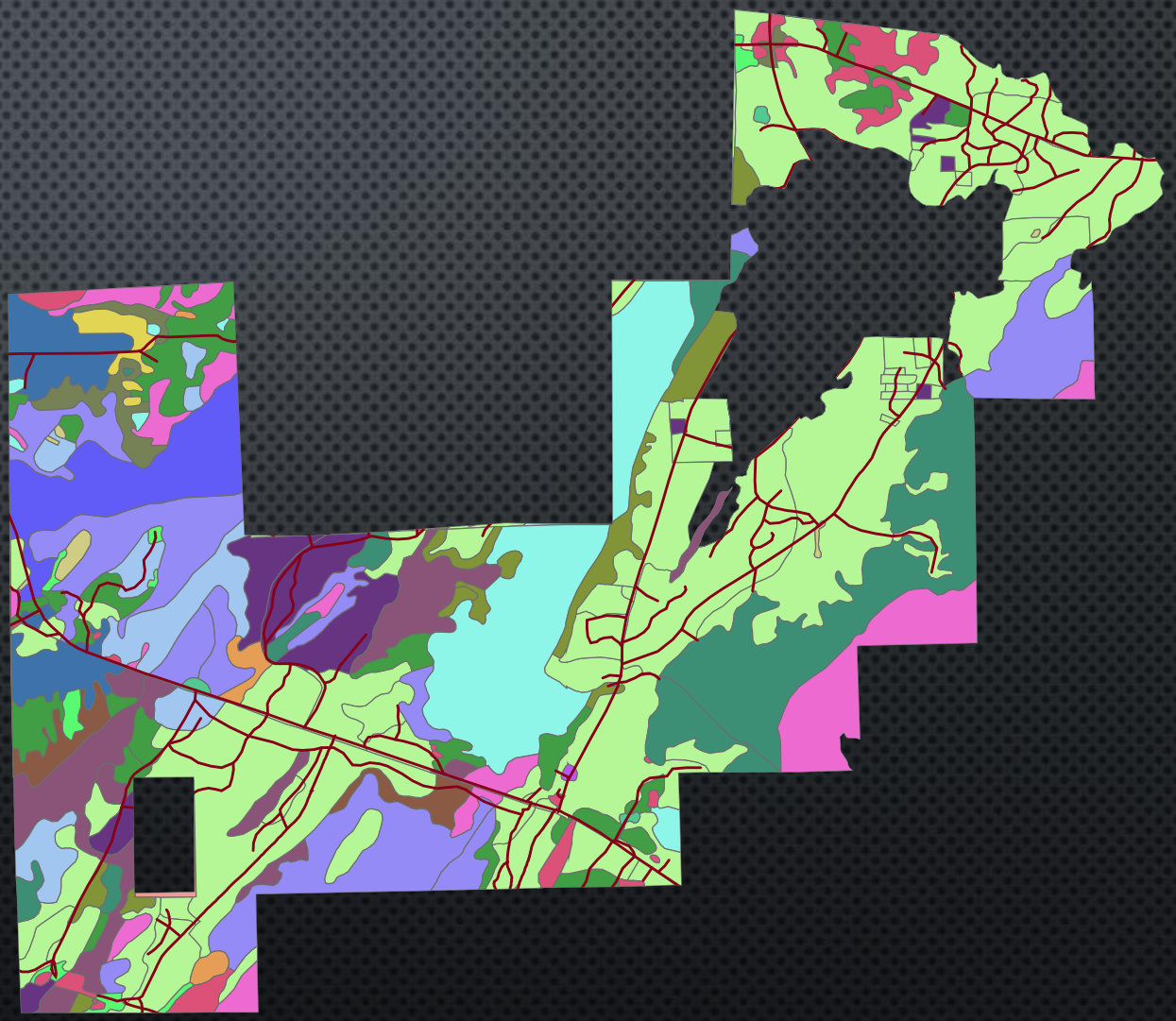
ARGONNE EF

SOILS

- Iron River loam
- Carbondale peat
- Tawas sand

FOREST TYPES

- Northern mesic hardwoods
- Lowland conifers
- Northern dry forest



ARGONNE EF

History

- 1905 Cutover
- 1933 Nicolet National Forest
- 1930s Scott Lake CCC Camp
- 1947 Argonne Experimental Forest
  - Named after forest of WWI battle

T-1377 1-21-47

A few buildings are available on the site of the former Scott Lake CCC Camp including a garage, tool room and blacksmith shop. In NW of NW of Sec. 22, T36N, R12E.
Nicolet National Forest, Wisconsin.

Establishment Record 1947

WHY

Argonne Experimental Forest

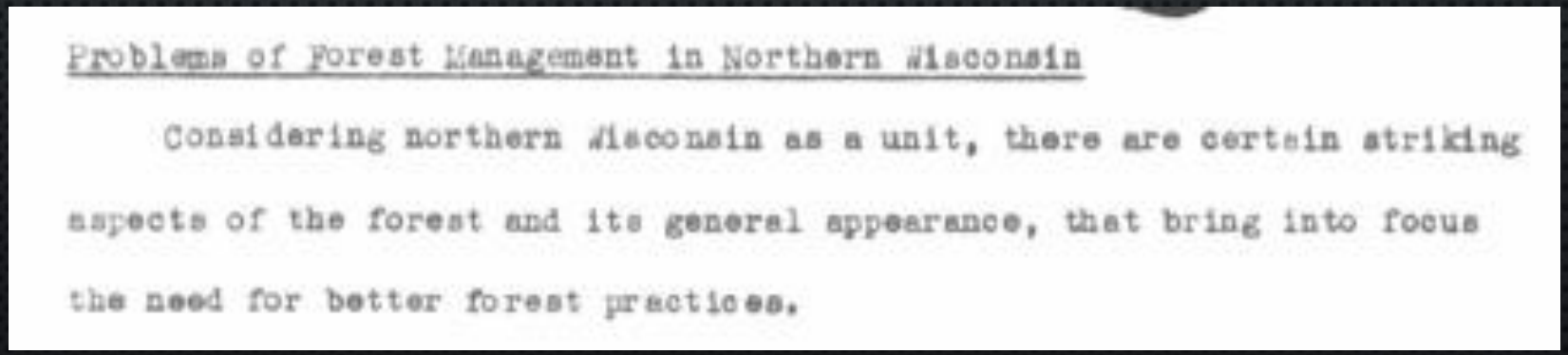
ARGONNE EF ESTABLISHMENT REPORT 1947

Purpose

- Address forestry problems, including:
  - Deforested lands
  - Second-growth hardwoods

Need

- Long range forest experiments
- Forest research center



Problems of Forest Management in Northern Wisconsin

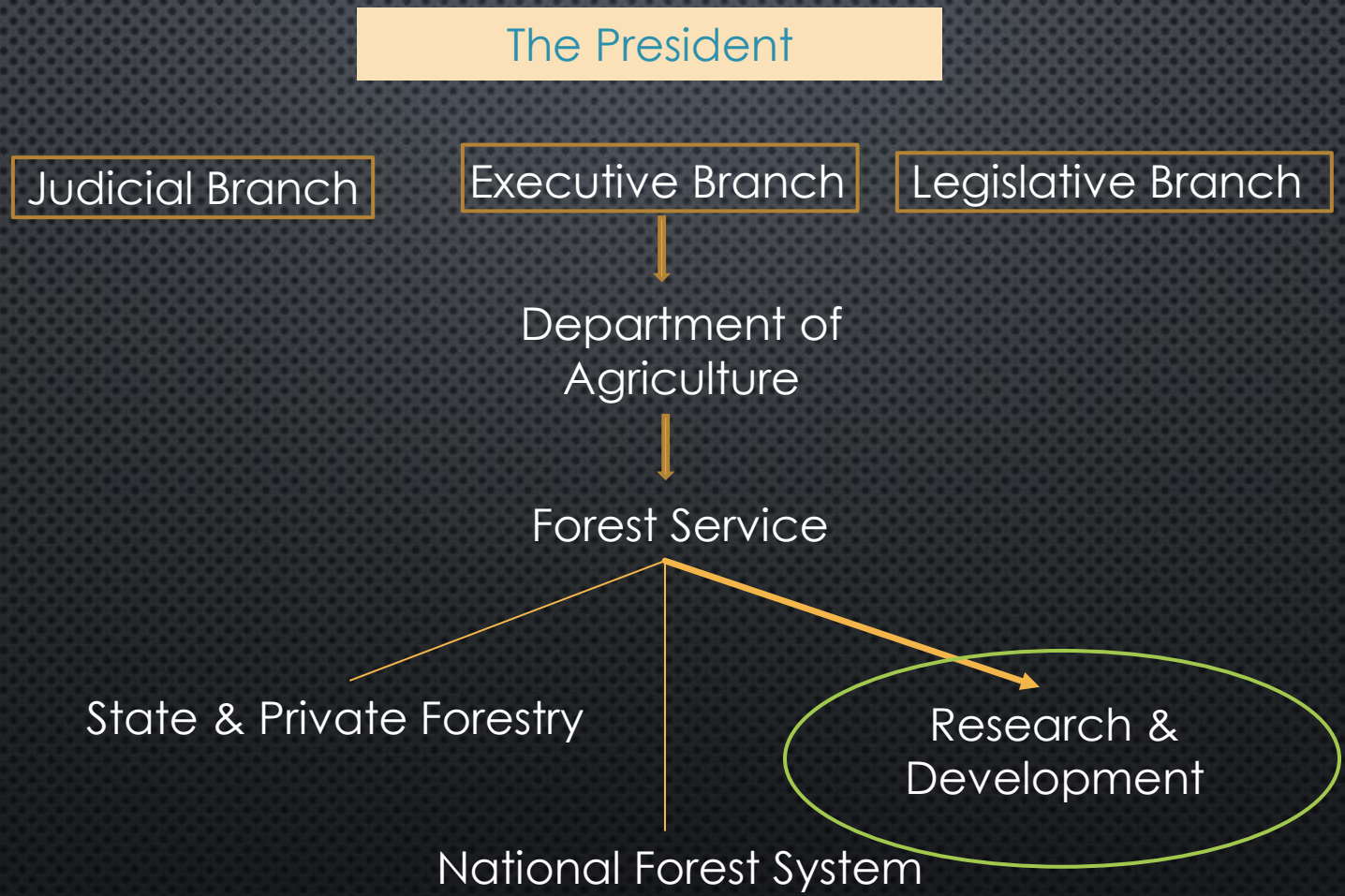
Considering northern Wisconsin as a unit, there are certain striking aspects of the forest and its general appearance, that bring into focus the need for better forest practices.

Establishment Record 1947

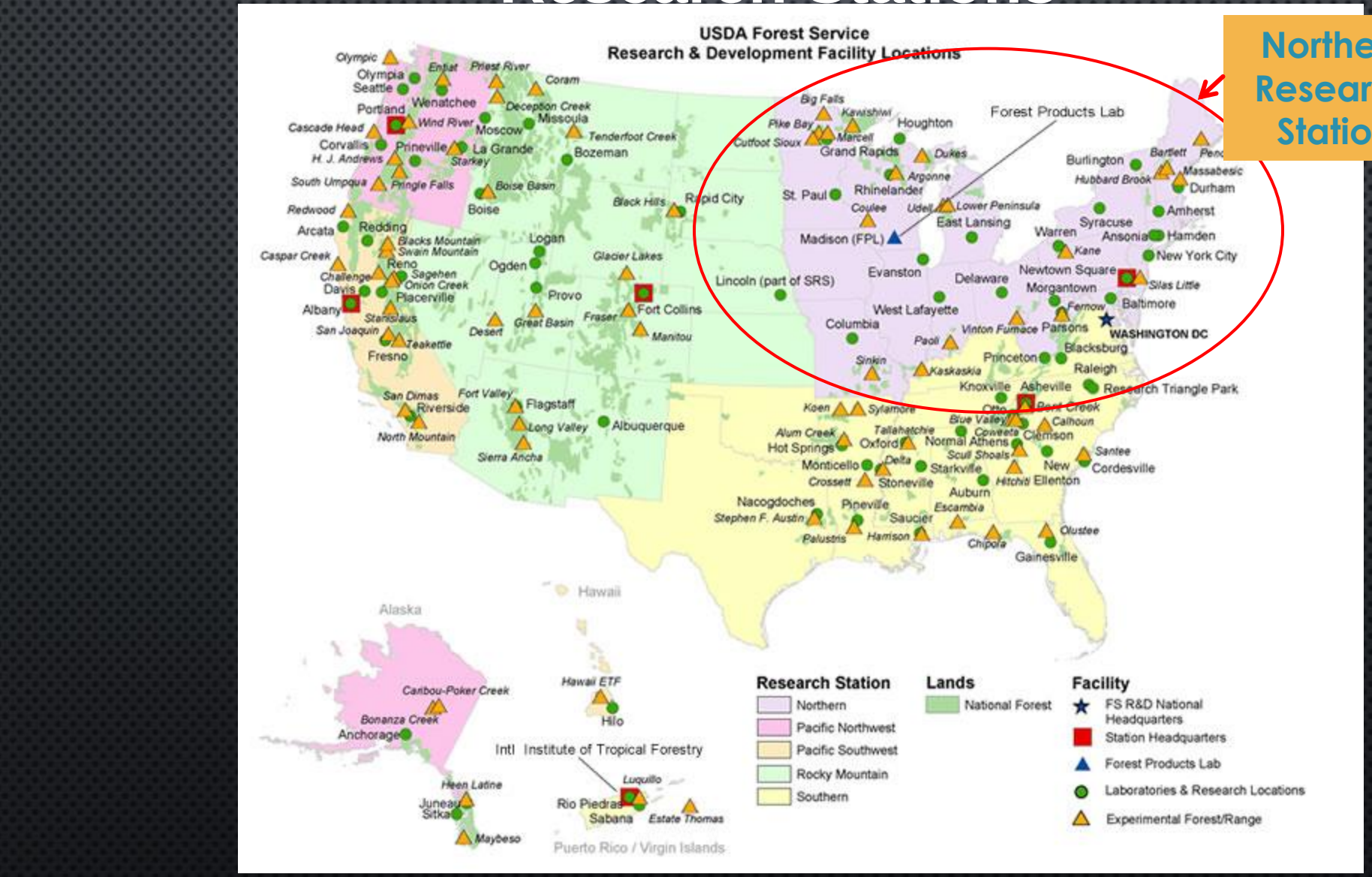
WHO

Argonne Experimental Forest

FOREST SERVICE



Research Stations

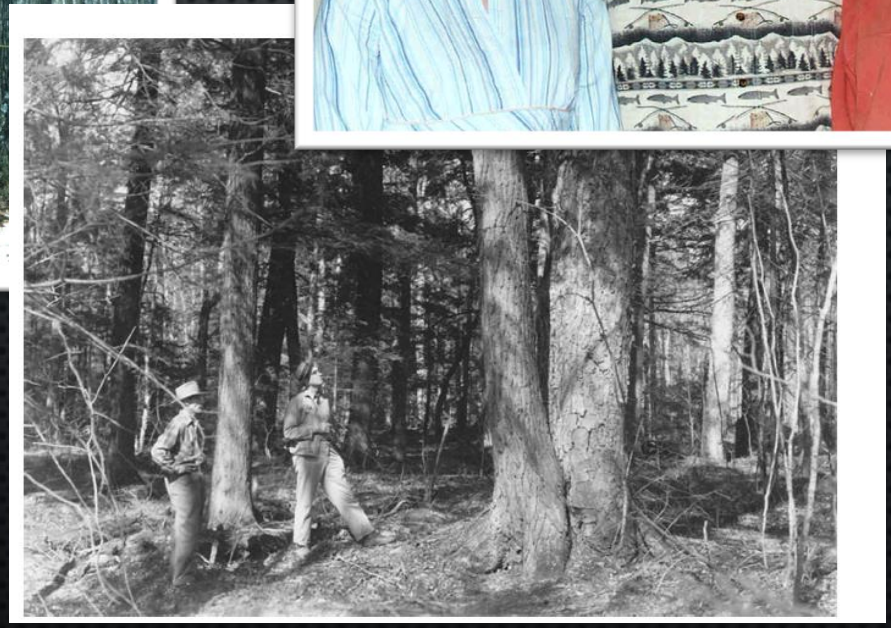


IN THE NORTHERN RESEARCH STATION:

- 22 EFRs and
- 2 Cooperating EFRs—Howland and Baltimore
- Oldest: Dukes (1926)
- Newest: Rhinelander

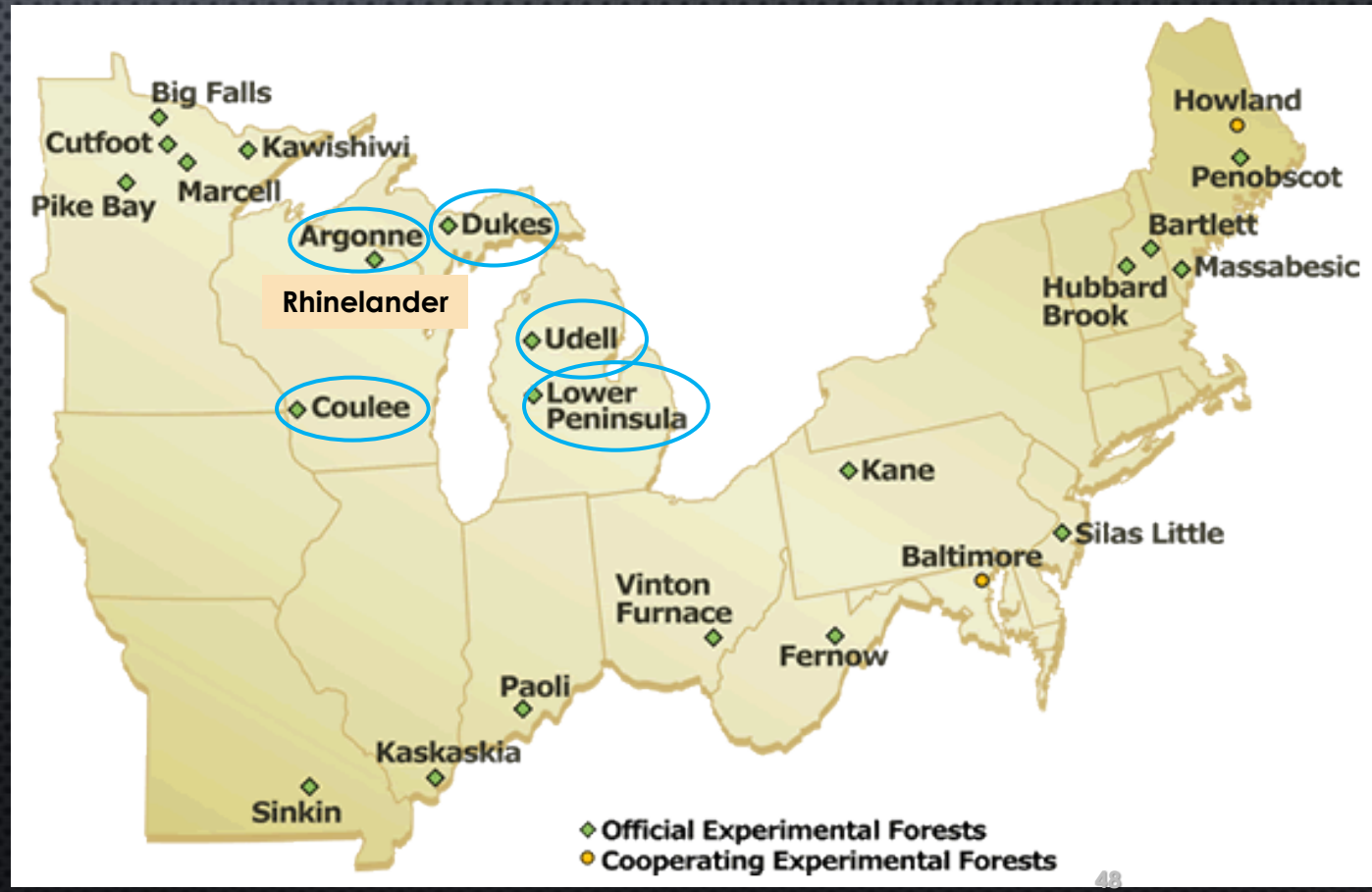
PRIOR ARGONNE EF LEAD SCIENTISTS

- Terry Strong, 1989-2005
- Gus Erdmann, 1966-89
- Dick Godman, 1964-82
- Rod Jacobs, 1958-62
- Harold Scholz, 1950-64
- Joe Stoeckler, 1947-1955
- Carl Arbogast, 1947-52



Christel Kern, Argonne EF Lead Scientist

- EF Responsibilities
  - Argonne (CNNF)
  - Dukes (HNF)
  - Lower Peninsula (HMNF)
  - Udell (HMNF)
  - Coulee (Wisc. DNR)



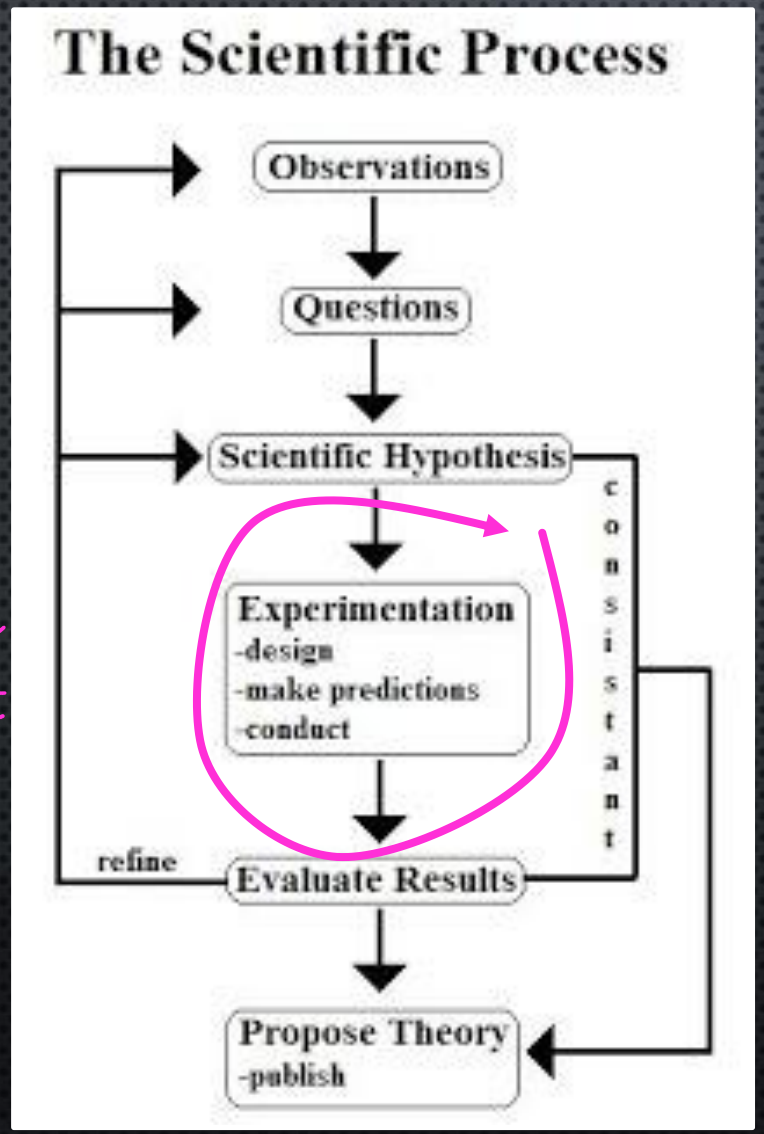
HOW

Argonne Experimental Forest

LONG-TERM SILVICULTURE STUDIES

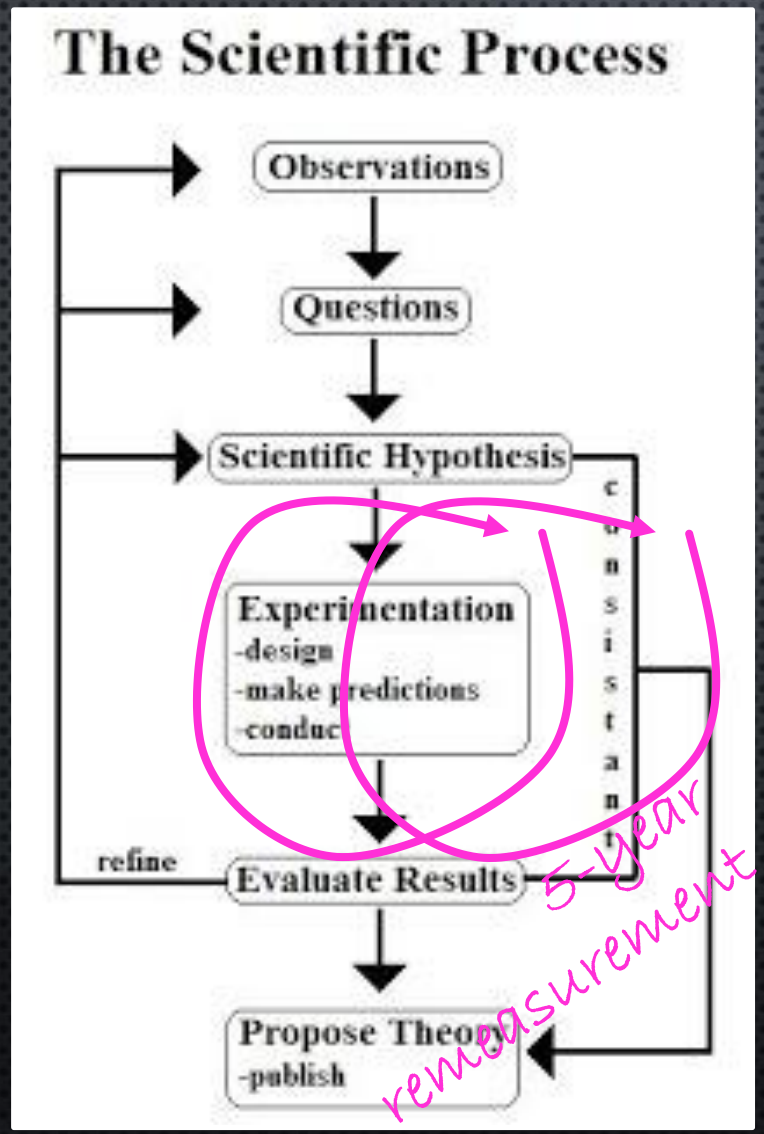
INITIAL DATA, RESULTS, PUBLICATION, OUTREACH, APPLICATION

Initial measurement



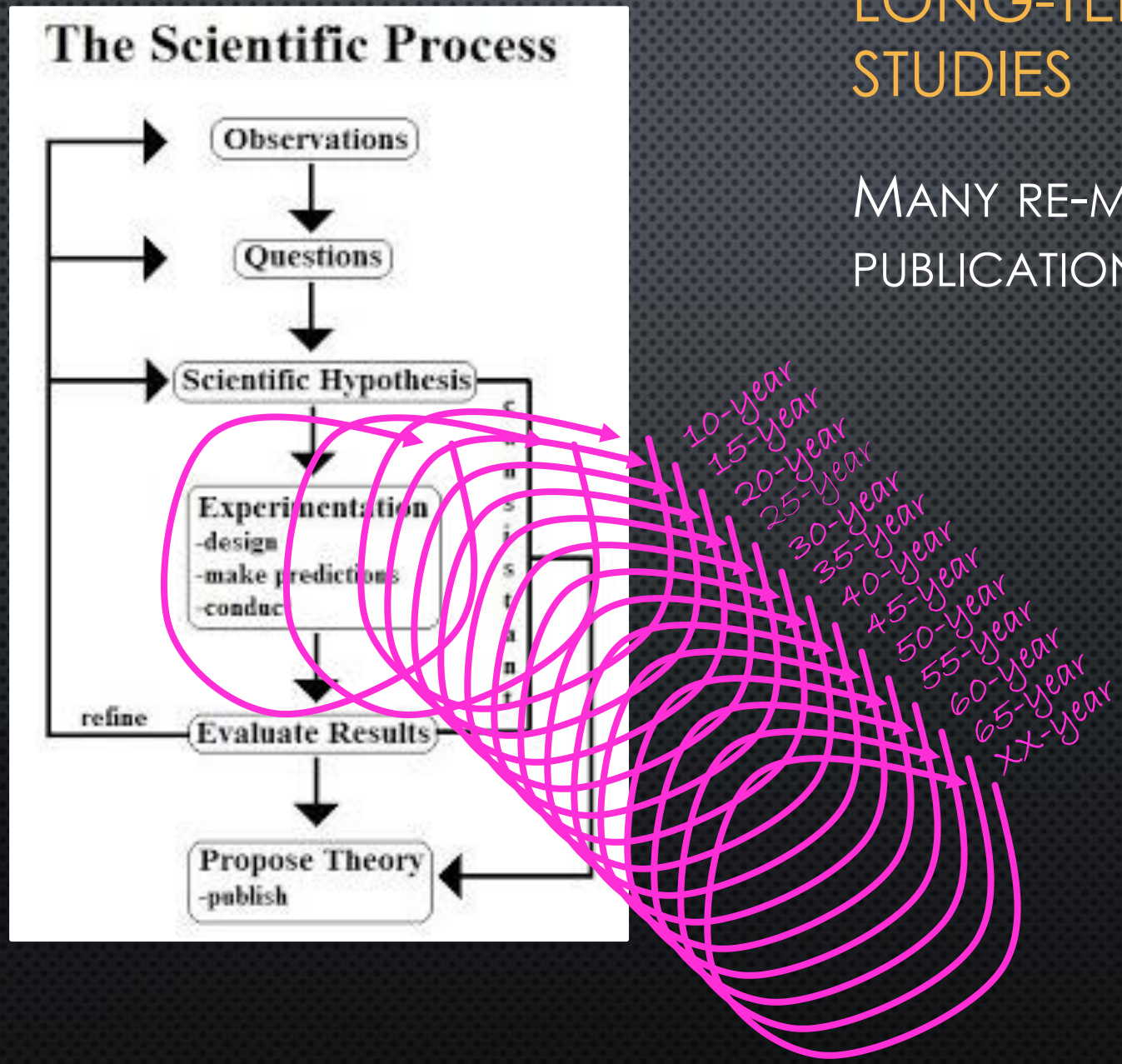
LONG-TERM SILVICULTURE STUDIES

5-YEAR RE-MEASUREMENT, RESULTS, PUBLICATION, OUTREACH, APPLICATION



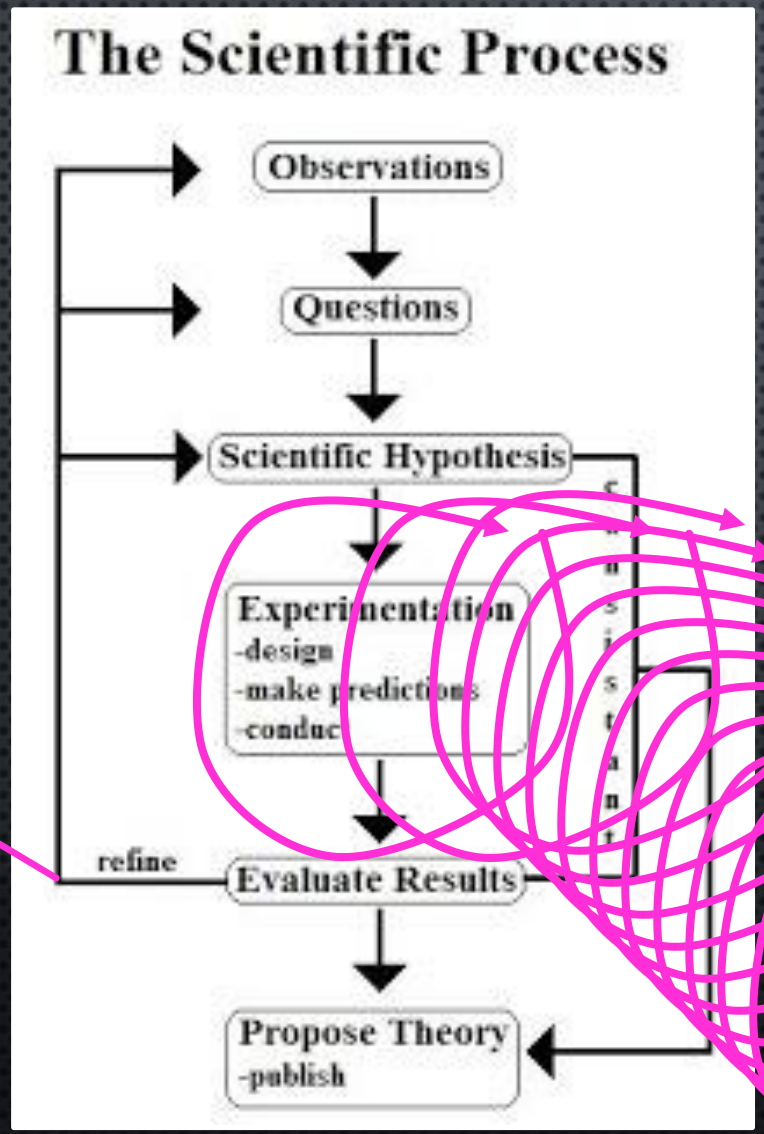
LONG-TERM SILVICULTURE STUDIES

MANY RE-MEASUREMENTS, RESULTS, PUBLICATION, OUTREACH, APPLICATION



LONG-TERM SILVICULTURE STUDIES

- NEW STUDIES
- NEW PARTNERSHIPS



New studies

Partnerships

LONG-TERM SILVICULTURE STUDIES

OUTREACH

TRAININGS

THE UPPER PENINSULA OF MICHIGAN

THE CLEVELAND-CLIFFS IRON

LAKE SUPERIOR & ISHPEMING RAILROAD COMPANY

HARDWOOD TIMBER FOR SALE
CITY LOTS FOR SALE
FARM LANDS FOR SALE ON EASY TERMS
THE SOIL WONDERFULLY PRODUCTIVE
AN UNSURPASSED HOME MARKET

LAND DEPT.

JOHN M. BUSH, LAND AGENT

FOREST SERVICE
LAKE STATES EXPERIMENT STA
ST. PAUL, MINN.
MAY 13 1930
RECEIVED
Answered.....

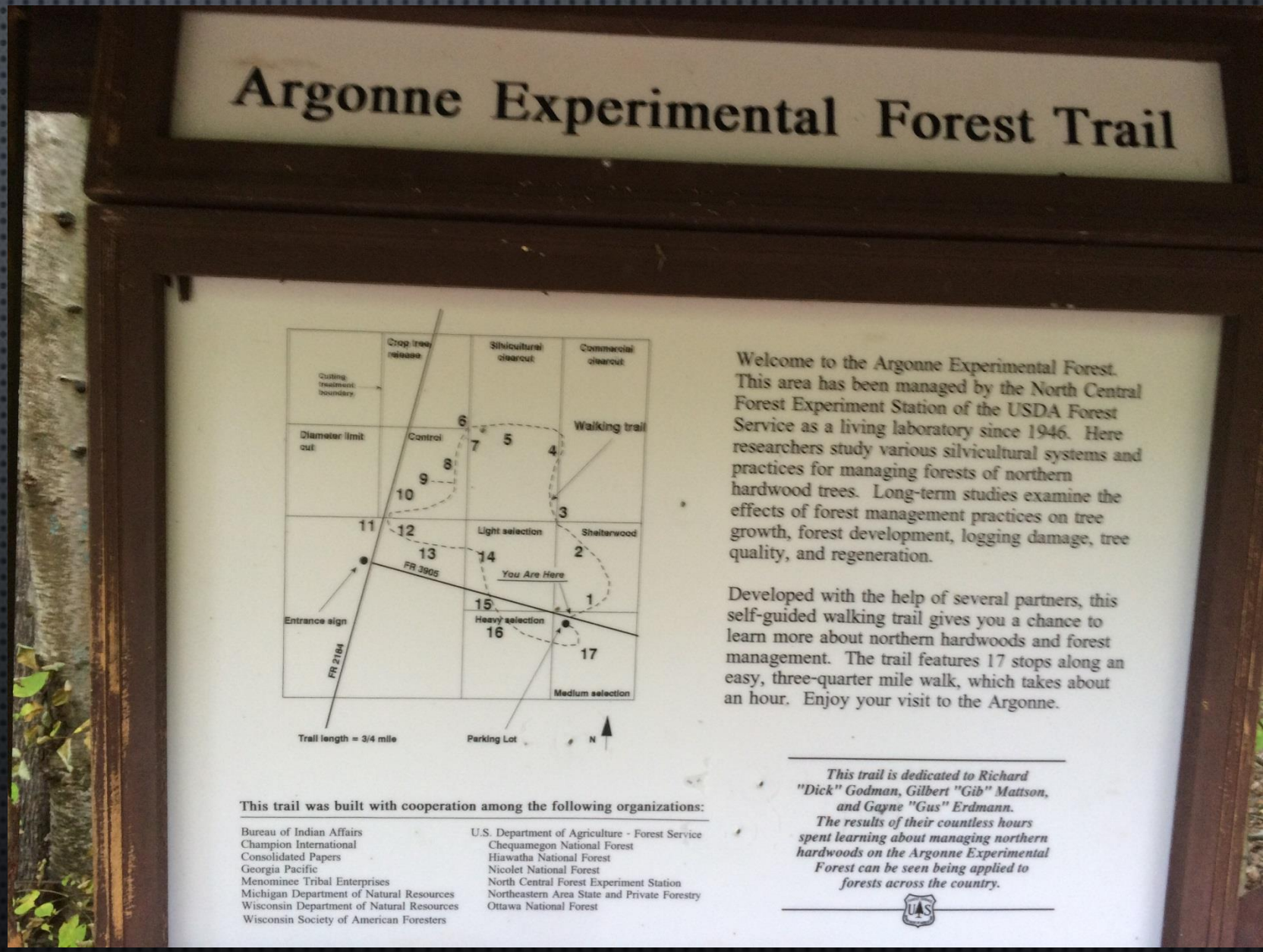
Negaunee, Mich.,
May 12, 1930.

Mr. Raphael Zon, Director,
Lake States Forest Experiment Station,
University Farm,
St. Paul, Minnesota.

Dear Sir:

OUTREACH

- TOURS
- TRAININGS
- SELF-GUIDED TRAIL



ARCHIVES

- WHAT'S HAPPENED & WHERE?
- DIGITAL ACCESS NEEDS

NEWER RESEARCH

- Plant diversity
- Compaction
- Canopy gaps
- Structure management (e.g., wildlife)

Photo by K. Fassinacht

Photo by K. Fassinacht

NEWER RESEARCH

- PLANT DIVERSITY
  - NO DIFFERENCE AFTER 4 CUTS, OVER 40 Y
  - WINTER LOGGING

Kern, C.C., Palik, B.J. and Strong, T.F. 2006. For. Ecol. Manage., 230, 162.

NEWER RESEARCH

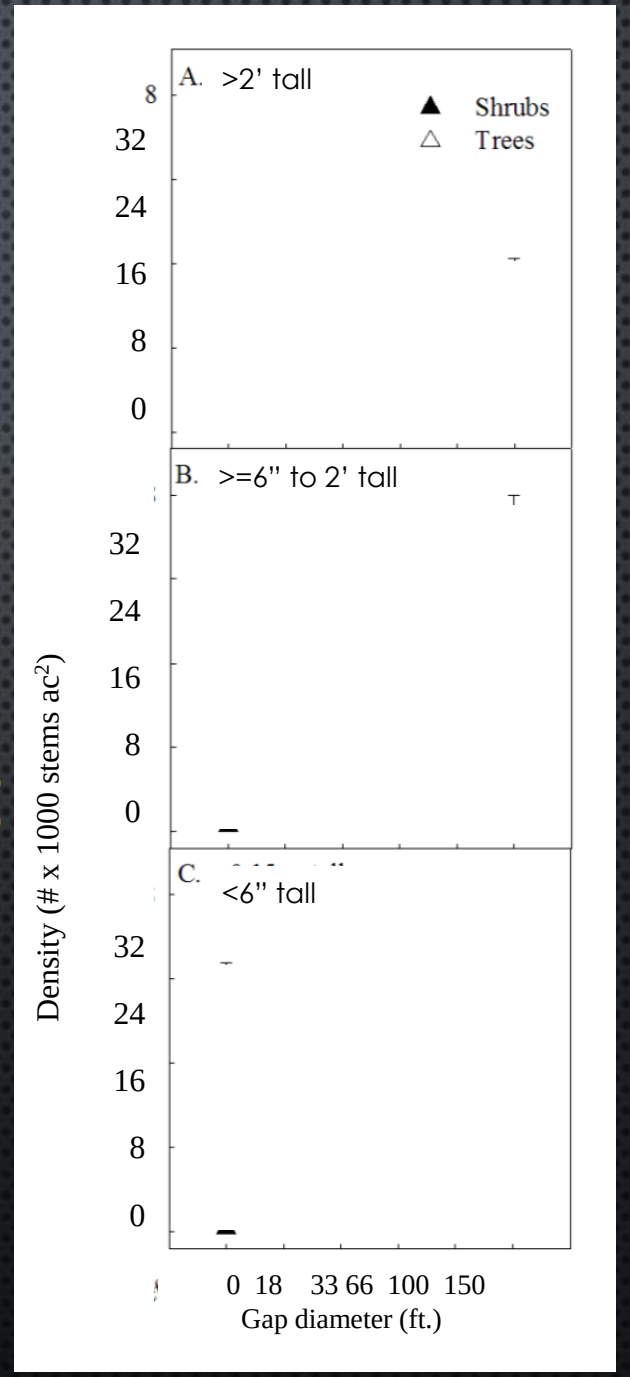
- Compaction
  - No Different over 6 cuts, 50 years
  - Rocky, loam soil

Tarpey, R.A., Jurgensen, M.F., Palik, B.J. and Kolka, R.K. 2008. Canadian Journal of Soil Science, 88, 849-857.

NEWER RESEARCH

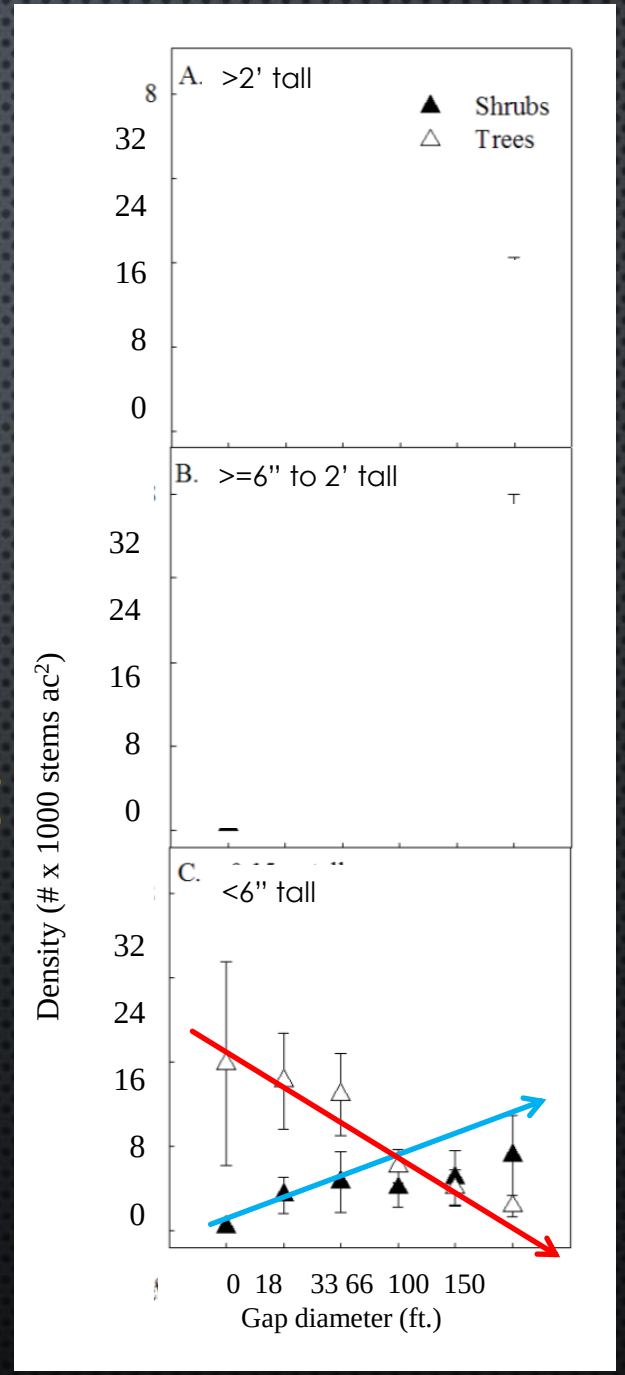
- CANOPY GAPS
  - 18’, 33’, 66’, 100’, 150’ DIA.

CANOPY GAPS



*KERN, C.C., D'AMATO, A.W. AND STRONG, T.F. 2013 FOR. ECOL. MANAGE., **304**, 110-120.*

CANOPY GAPS



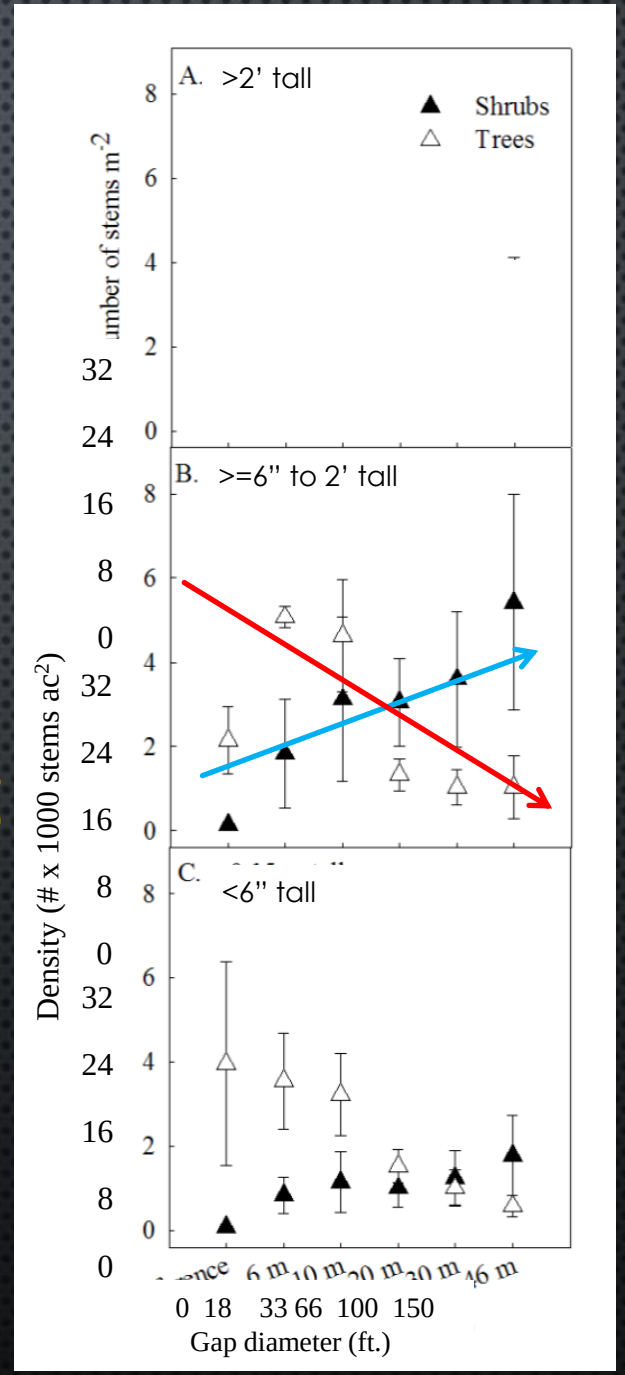
Year 12

Shrubs

Trees

Kern, C.C., D'Amato, A.W. and Strong, T.F. 2013 For. Ecol. Manage., ***304****, 110-120.*

CANOPY GAPS



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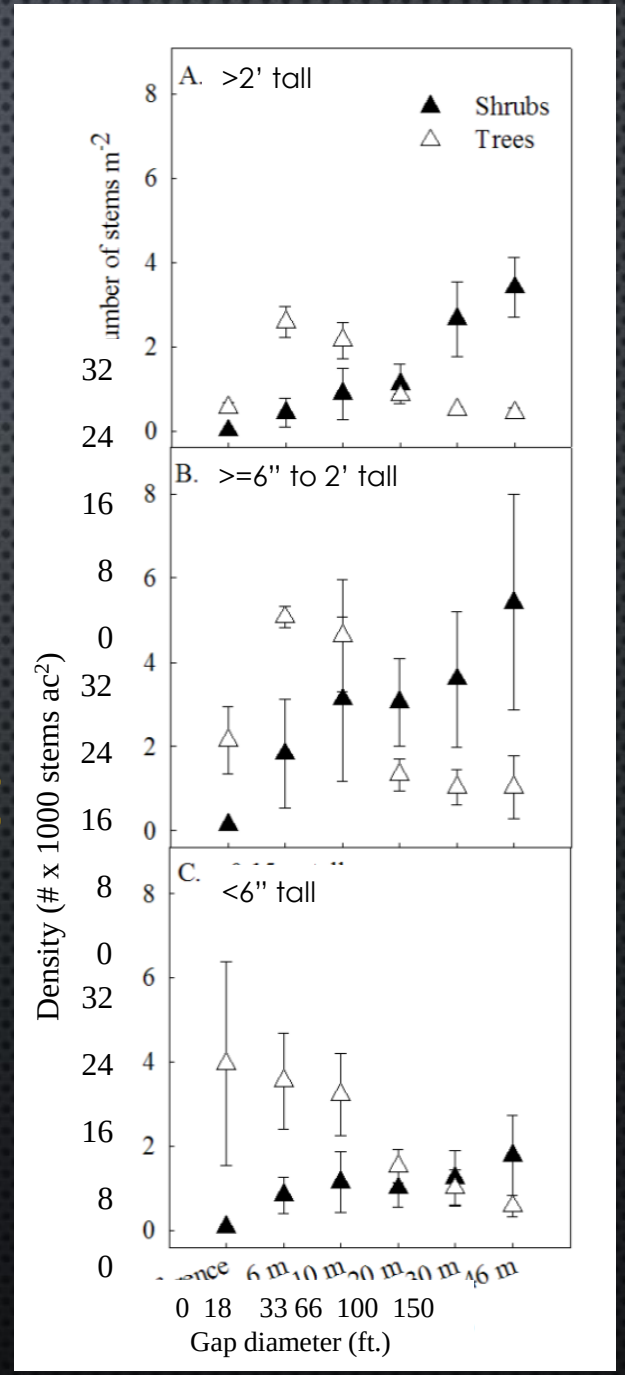
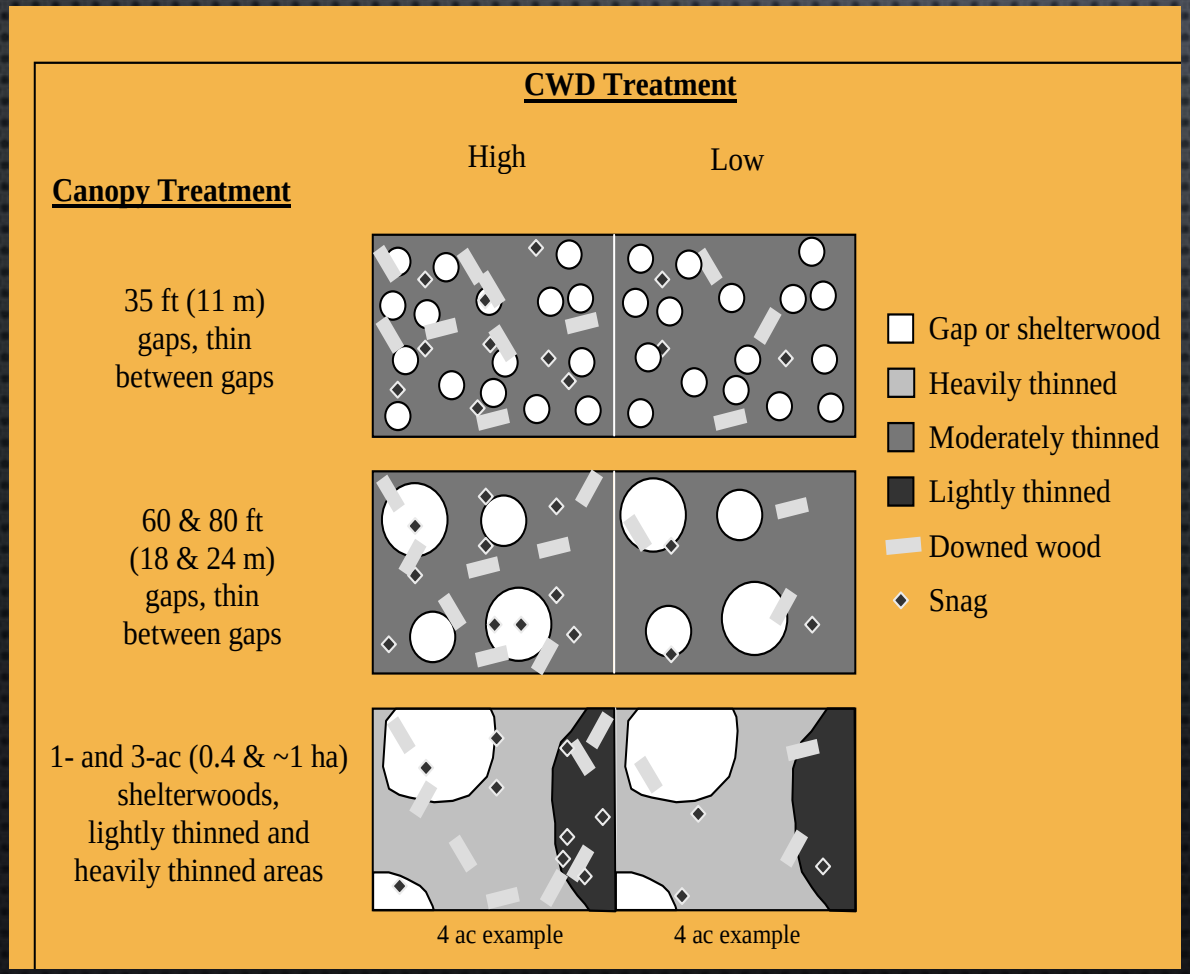
CANOPY GAPS



Year 12

*KERN, C.C., D'AMATO, A.W. AND STRONG, T.F. 2013 FOR. ECOL. MANAGE., **304**, 110-120.*

STRUCTURE MANAGEMENT (E.G., WILDLIFE)



Collaboration with Wisconsin DNR, estab. 2008

Study in-progress

Outline – Argonne Experimental Forest

- A story of a place that advance forest sustainability
- Who, What, Where, Why, & How
- Now what?
- Your opportunity

NOW WHAT?

Argonne Experimental Forest

IMAGINE … MORE FOR FOREST SUSTAINABILITY

- ARGONNE EXPERIMENTAL FOREST IS THE PLACE

PROPOSAL

- Maintain Foundational long-term studies
- Continue current studies
- Continue Tours

Photo by T. Strong

FUTURE RESEARCH

- NHW Regen Issues
  - Sedge manipulations
  - Worm treatments
  - Browse severity
- Sapling form and quality development
- Cedar regeneration
- Assisted migration

Photo by C. Storm

FUTURE OUTREACH

- VIRTUAL TOURS
- MARTELOSCOPE
  - A TIMBER MARKING COURSE

Outline – Argonne Experimental Forest

- A story of a place that advance forest sustainability
- Who, What, Where, Why, & How
- Now what?
- Your opportunity

IMAGINE … MORE FOR FOREST SUSTAINABILITY

- ARGONNE EXPERIMENTAL FOREST IS YOUR PLACE

DRAWBACKS

- Research capacity
- Staffing
- Funding
- Location
- One voice
- Useless information
- Waste of time

BENEFITS

- MANY VOICES
- REGIONAL RESOURCE
- RELEVANT RESEARCH
- CONTINUING EDUCATION
- GATHERING PLACE

BENEFITS

- Collaboration
  - Subject-matter experts
- Partnerships
  - Staffing, Match funds
- Formal research
  - High priority regional issues
- Case studies
  - Individual, local issues
- Cross-site research

Photo by T. Strong

Outline – Argonne Experimental Forest

- A story of a place that advance forest sustainability
- Who, What, Where, Why, & How
- Now what?
- Your opportunity

Summary

- Argonne experimental forest
  - Foundational research to NHW silviculture
  - Available to meet new research & education needs

IMAGINE MORE … FOR FOREST SUSTAINABILITY

- YOUR IDEAS? YOUR PLACE

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715-362-1123

cckern@fs.fed.us

Rhinelander, WI 54501

USDA FOREST SERVICE

NORTHERN RESEARCH STATION

5985 Highway K,

IMAGINE MORE … FOR FOREST SUSTAINABILITY

- YOUR IDEAS? YOUR PLACE

- CONTACT: CHRISTEL KERN
  - 715-362-1123
  - cckern@fs.fed.us

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Thank you!