NATIONAL SILVICULTURE Meeting

September 10-14, 1973

"FORESTRY TO MEET SPECIAL OBJECTIVES"

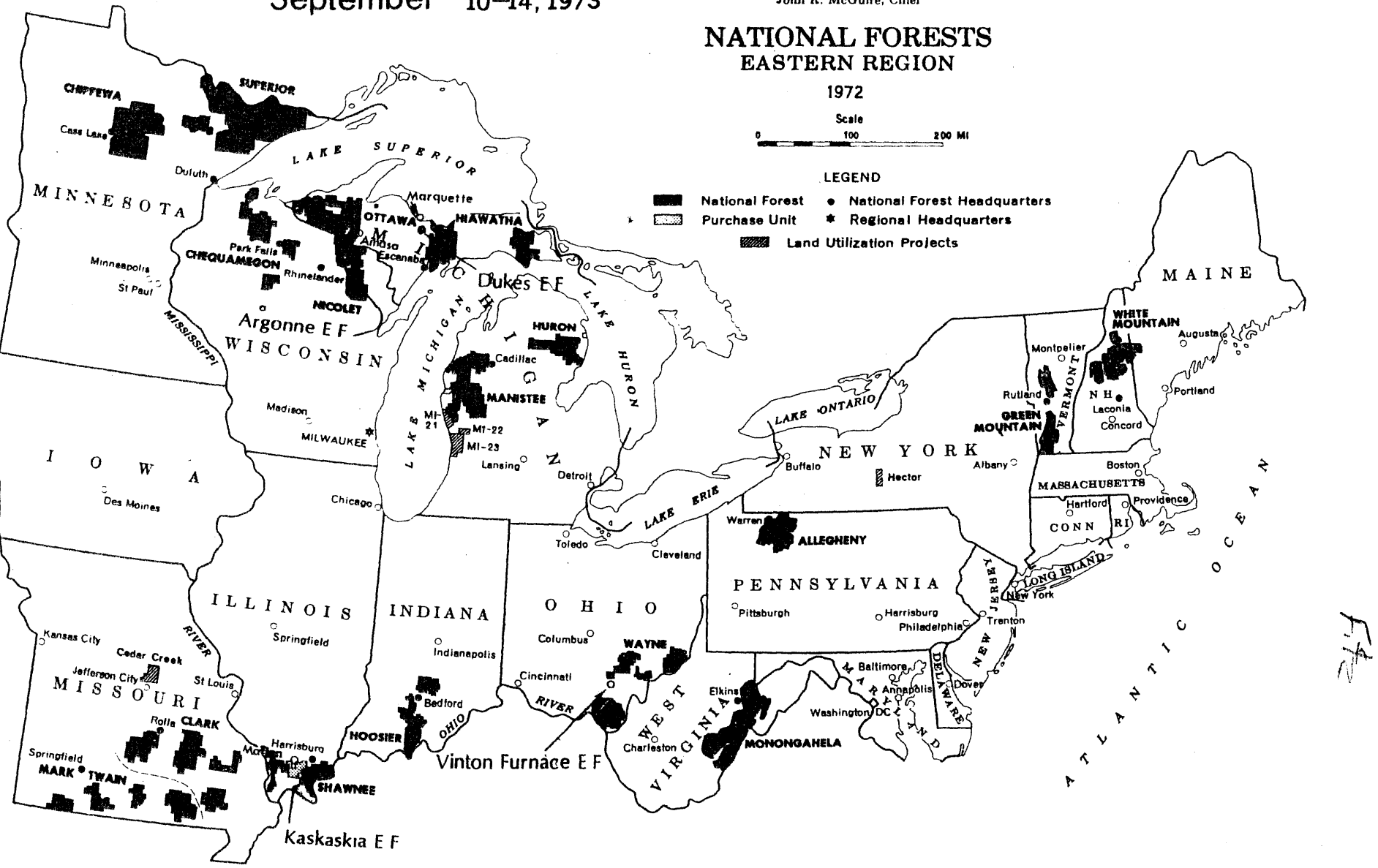
(A LOOK AT UNEVEN-AGED MANAGEMENT)

FOREST SERVICE • U.S DEPARTMENT OF AGRICULTURE
EASTERN REGION • NORTH CENTRAL FOREST EXPERIMENT STATION
AND NORTH EASTERN FOREST EXPERIMENT STATION

NATIONAL SILVICULTURE MEETING
September 10–14, 1973

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
John R. McGuire, Chief

NATIONAL FORESTS
EASTERN REGION
1972



LIST OF PARTICIPANTS
NATIONAL SILVICULTURE MEETING

Balmer, William	SA S&PF RUM
Barton, Michael	Dep. Supr. Ottawa N.F. R-9
Beaufait, William	T.M. R-1
Biddison, Donald	Rec. & Lands R-2
Bills, Jack	R-4
Blomquist, C.R.	T.M. Silv. R-9
Castles, John	T.M. ARF R-9
Chapparo, W.J.	R-3
Charter, Wilbur	T.M. R-5
Clark, Kenton	Supr. Cleveland N.F. R-5
Cravens Jay H.	Regional Forester R-9
Dale, Martin	NEFES, Columbus, O.
DeBald, Paul	NEFES, Columbus, O.
Eagleston, Donald	Soil Sci., Wayne-Hoosier N.F. R-9
Edwards, Malcolm G.	WL - R-8
Elisar, Rene	Dist. Rgr. Athens, Wayne-Hoosier N.F. R-9
Engelby, Orville	R-4
Erdmann, Gayne	NCFES, Marquette, Mich.
Eschle, John	T.M.A. Munising, Hiawatha N.F. R-9
Fitzgerald, Richard	R-6
Flechsig, Alban	T.M. Silv. Branch R-9
Fox, Walter F.	T.M. R-8
Frost, Jack	W.O. Eng.
Fulk, Thomas A.	Supr. Nicolet N.F. R-9

Gibbs, Carter	W.O. - TMR
Gilbert, Adrian	W.O. P&PA
Gingrich, Sam	NEFES, Columbus, O.
Godman, Richard	NCFES, Rhinelander, Wisconsin
Gould, Norman	T.M. ARF R-5
Hendricks, Charles	Supr. Shawnee N.F. R-9
Hornick, Jack	NA S&PF, Upper Darby, Pa.
Jacobs, Rodney	NCFES, Marquette, Mich.
Jay, Dave	W.O. - FM
Koskella, Theodore W.	Dep. Regional Forester R-3
Kuhr, John	Rec. L.A. R-9
Kuyava, John	Dist. Rgr. Munising, Hiawatha N.F. R-9
Leonard, George	W.O. - T.M.
Loftus, Nelson S.	SOFES
Lotan, James E.	Int. FES
Lyon, Duane H.	W.O. Rec.
Maloney, Ralph	W.O. - W.S.
Mann, Wayne	Supr. Chequamegon N.F. R-9
McAninch, C.D.	T.M. R-2
McGee, Charles E.	SEFES
Metzger, Fred	NCFES, Marquette, Mich.
Mikich, Arden	T.M. Shawnee N.F. R-9
Mohler, James	T.M. Hiawatha N.F. R-9
Moser, John	Purdue University
Mustian, A.P.	W.O. - T.M.
Myers, Charles	R-2
Packer, Duane	T.M. Ottawa N.F. R-9

Pearl, Robert	W.O. - T.M.
Peryam, Norman	American Can Company
Phares, Robert	NCFES, Carbondale, Ill.
Radtke, Robert	W.L. R-9
Reed, Merwyn	Supr. Hiawatha N.F. R-9
Schlesinger, Dick	NCFES, Carbondale, Ill.
Schmautz, Jack	W.O. - RM
Shalda, Ken	T.M. Chequamegon N.F. R-9
Smith, Clay	NEFES, Parsons, W. Va.
Smith, DeWilton	T.M. Plans & Inventories R-9
Smith, Edward A.	T.M. R-8
Stemple, Richard	R-4
Stone, Douglas	NCFES, Marquette, Mich.
Sullivan, Robert	T.M. R-2
Tappeiner, John	R-5
Thorne, James	W.O. - T.M.
Tubbs, Carl	NCFES, Marquette, Mich.
Train, Robert	T.M. Nicolet N.F. R-9
Tuttle, William A.	T.M. R-8
Twombly, Asa D.	T.M. R-6
Undi, Stanley	T.M. R-2
Verme, Louis	WL Michigan D.N.R.
Wahlgren, Gus	FPL, Madison, Wis.
Westerberg, Darold	W.O. - T.M.
Willard, Ralph	T.M. Wayne-Hoosier N.F. R-9

OBJECTIVES OF NATIONAL SILVICULTURE MEETING

As a matter of policy and good forest resource management, the Forest Service will manage the timber resources on the National Forests to achieve the various multiple use objectives established for the respective management units. In so doing, we are not to be bound to any particular system of management as the primary system, but we are to prescribe and use the system of management and the cutting methods associated with that system which will best fit the resource conditions and needs of the situation at hand. Consequently, we must be prepared to prescribe and apply correctly uneven-aged management and selection cutting to the same level of expertness that we can even-aged management. The purpose of this meeting is to develop between disciplines and between both the policy and decision-making levels and the doing levels better understanding of the complexities of uneven-aged management and to equip all the participants for more expert and effective application of the techniques and cutting methods available to uneven-aged management.

ACTIVITY AND TRAVEL SCHEDULE
NATIONAL SILVICULTURE MEETING - SEPTEMBER 9-14, 1973
EASTERN REGION - NCFES - NEFES

Sunday, September 9

Arrive in Marquette, Michigan. Overnight at Ramada Inn.

Monday, September 10

7:30 - 8:00 - Final registrants

8:00 - 8:15 - Call to order, announcements and introductions
- Bob Blomquist

8:15 - 8:45 - Welcome to Eastern Region - Jay Cravens

8:45 - 9:00 - Objectives of National Silviculture Meeting
- A.P. Mustian or Bob Pearl

9:00 - 10:00 - Panel: Methods of Control
U.S.F.S. - Eastern Region: DeWilton Smith
Industry - American Can Co.: Norman, "Jim", Peryam
New Concept - Purdue University: John Moser

10:00 - 10:30 - Coffee Break

10:30 - 11:45 - Panel: What do we want from our Forests?
Recreation: John Kuhr, USFS
Water and Soil: Mike Barton, USFS
White-tailed Deer: Louis Verme, Mich. D.N.R.
Other Wildlife: Bob Radtke, USFS
Timber: Mert Reed, Forest Supervisor, Hiawatha N.F.

11:45 - 12:00 - Introduction to tour - Carl Tubbs, NCFES

12:00 - 12:15 - Catch-up or Stretch

12:15 - 1:00 - Luncheon at Ramada Inn

1:00 Buses ready for loading

1:15 - 6:00 - Tour of Dukes Experimental Forest - Carl Tubbs
Return to Marquette. Overnight at Ramada Inn.

Tuesday, September 11

7:30			Buses ready for loading
7:45	- 12:00	-	Tour of Dukes Experimental Forest - Carl Tubbs
12:00	- 1:00	-	Lunch - Hiawatha N.F. - AuTrain Lake Campground
1:00	- 5:00	-	Two tour stops on Munising R.D., Hiawatha N.F. - John Kuyava or Jim Mohler Return to Marquette
5:30	- 7:00	-	Cash Bar at Ramada Inn
7:00	- 8:00	-	Banquet at Ramada Inn
8:00	-		Informal Meeting - A.P. Mustian or Bob Pearl Overnight at Ramada Inn

Wednesday, September 12

7:30			Bus and cars ready for loading
7:45	- 8:30	-	Travel to tour stops near Amasa, Michigan
8:30	- 11:00	-	Tour American Can Co.'s, Amasa Block - Jim Peryam
11:00	- 12:30	-	Travel to Iron River, Michigan and Lunch - Ottawa N.F. T&T Supper Club
12:30	- 1:30	-	Travel to Argonne Experimental Forest, Wisconsin
1:30	- 5:30	-	Tour Argonne - Dick Godman Arrive Rhinelander, Wisconsin Overnight at Holiday Inn

Thursday, September 13

7:00			Bus ready for loading for Shuttle to airport Load aircraft - Convair 580
7:30	- 10:10	-	Depart Rhinelander and travel to Columbus, Ohio, Port of Columbus Airport. Breakfast to be served in flight.

10:10 - 12:30 - Travel to Vinton Furnace Experimental Forest by bus.
Lunch - Wayne-Hoosier N.F. at V.F.E.F.

12:30 - 4:00 - Tour Vinton Furnace - Sam Gingrich

4:00 - 6:00 - Travel to Columbus
Load airplane

6:00 - 6:20 - Travel to Marion, Illinois

6:20 - 7:00 - Shuttle from Marion-Herrin airport to motel
Overnight at Ramada Inn

Friday, September 14

7:15 Bus ready for loading

7:30 - 12:45 - Travel to and tour Kaskaskia Experimental Forest - Bob Phares
Return to Marion

12:45 - 1:30 - Luncheon at Ramada Inn

1:30 - 3:00 - Wrap-up session - A.P. Mustian or Bob Pearl

3:00 - 6:00 - Load bus, travel to St. Louis International Airport, St. Louis, Missouri, and unload.

EXCERTS FROM REGIONAL FORESTER
JAY CRAVENS' WELCOMING ADDRESS
NATIONAL SILVICULTURE MEETING

Welcome to the Eastern Region. Once again we are pleased to host a National Timber Management Meeting. You are the folks who can be most instrumental in resolving some of our knotty land management problems. We hope this meeting will be as successful as was the National Timber Management Inventory and Planning Meeting held in Milwaukee in May 1972.

Our major effort on this trip is to present to you the underlying Research efforts and data which either support or do not support unevenaged management procedures. Out of this you will also learn why alternatives to the exclusive use of the uneven-aged system have come to be recognized, recommended, and supported both by Research people and the NF's people of this Region. You should also become much more knowledgeable of the "why's" of uneven-aged management and where it properly might be used and where and why it probably should not be used. Before I go further and comment on where we are going, what we are going to see, and some of the problems encountered, let me tell you about the working relationships between Research, NF's & SPF people. We work very closely together here in this Region. All of our marking guides for our various timber types, for both hardwoods and softwoods, are based largely on Research results and recommendations. Most of our marking guides are a joint product of NF's and Research as well as S&PF. You will also notice that most of our discussions and observations will be on some of our Experimental Forests, beginning here at Dukes, because this is where our studies have been made and this is where the supporting data have been developed. You will be listening to such Research experts as Carl Tubbs here at Dukes; Dick Godman at the Argonne Experimental Forest on the Nicolet; Sam Gingrich at Vinton Furnace in Ohio, and Bob Phares at Kaskaskia in Illinois.

That will wind up the weeks tour. There are many other stands, Experimental Forests and areas that could be visited. Research studies and results appear consistent wherever you may go. But regardless of where you go and what you see or are told, I believe you will reach several conclusions.

First, hardwood silviculture is very complex and there is no one simple on-the-spot solution.

Secondly, we must rely on Research to lead the way for us with factual studies of causes and results and then base our cutting guides on these results.

Thirdly, neither the selection system nor an even-aged management system is a panacea for hardwood management. There are many elements to be considered.

Our panel discussions will bring to light a good many of these and will set the stage for some very interesting discussions out in the field.

Within practical management and acceptable operating costs, we must consider many facets such as the objectives of management, size of ownership, desirable growing stock, stand condition, site, aspect, age-class, operating budget, training level of foresters and administrators, etc. All of these must be considered before reaching a tentative conclusion as to the proper silvicultural treatment for any given stand. And the, after having factored out all this, we may be forced to prescribe a different treatment because of multiple-use considerations or because Mother Nature by one storm or insect or disease epidemic or public reaction has instantly changed the situation for us. This is why we find hardwood silviculture so interesting challenging and at times controversial. I'm sure our critics do not recognize, and probably do not choose to recognize, how complex hardwood silviculture really is. As you well know a quick answer to a complex problem is most apt to be simple, direct and wrong.

Last but not least, I'll cut you into a basic that may not have occurred to you. I was schooled and had a great experience, some 15 years as a timber beast, in conifer management in the West. Though the setting and situation here in the eastern hardwoods seems different, keep in mind that the basics are the same. Each stand must be analyzed in keeping with the management objectives for the area, the silvics of the species, the stand condition, etc., before a decision is reached prior to the time of management manipulations for whatever purpose.

So please keep these things in mind during your observations and on the tour. I think you will find the coming week a most interesting one and a mentally challenging one. We will be interested in your reactions and interactions after you have had time to assimilate and digest all the things you will have observed and heard during the coming week.

Again, welcome to the Eastern Region. Enjoy your stay.

PANEL PRESENTATIONS: METHODS OF CONTROL

PRESENT SYSTEM OF INVENTORY AND MANAGEMENT PLANS CONTROL IN REGION 9

DeWILTON C. SMITH, CHIEF, PLANS & INVENTORIES BRANCH
DIVISION OF TIMBER MANAGEMENT, EASTERN REGION, USFS

INVENTORY

1. Partial permanent plot remeasurement for growth, mortality, total volume check and statistical analysis.
2. Compartment examination of a 10% random sample of compartments by districts for TSD, treatments, deferrals, and other coordination measures.

MANAGEMENT PLAN

1. Selection of management objectives
2. Coordination
3. Silvicultural systems
4. Environmental statement

CONTROLS

1. Records
2. Reports
3. Updates

NORTHERN HARDWOOD MANAGEMENT ON AMERICAN CAN COMPANY LANDS

NORMAN J. PERRYAM, AREA #3 SUPERINTENDENT
AMERICAN CAN COMPANY
AMASA, MICHIGAN

Management and regulation of the cut on this land base of approximately 30,000 acres can be broken down into three phases.

1. Starting in 1930 "Selective Logging" put into practice. 1930-1950 cutting in virgin old-growth hardwood.

   Logging done by railroad. Influenced by economic conditions.

   Regulation based on "percent of cut".

2. Begin 1958 Cycle 2 cutting. Cull hardwood market and "sanitation cut".

   Basal area guide and growth plots as a control.

3. Cycle 3 1971 basal area control; angle gauge use modified; cutting pulpwood from small diameter trees. High grade, high value crop trees.

A SYSTEM OF EQUATIONS FOR THE COMPONENTS OF FOREST GROWTH

JOHN W. MOSER, JR., ASSOCIATE PROFESSOR OF FORESTRY
PURDUE UNIVERSITY, WEST LAFAYETTE, INDIANA

ABSTRACT

Most applications of differential equations to growth and yield prediction have provided either net or gross estimates of stand attributes such as basal area and volume. The present study utilizes a system approach to approximating the dynamics of tree movement through progressive diameter classes. Coupled with tree movement are the associated attributes of basal area and cubic-foot volume. In addition, mortality by size class and ingrowth into the smallest size class are considered. The resulting system is a set of sixty-six first-order differential equations which, when solved simultaneously, provides estimates for the components of forest growth by number of trees, basal area, and cubic-foot volume for six diameter size classes. Forest managers may utilize this approach to growth estimation through a computer program by specifying a set of initial stand conditions which would be obtainable from permanent or temporary plots or from stand examination information. Currently, efforts are being directed toward the application of this system to the northern hardwood type in Michigan's upper peninsula.

PANEL PRESENTATIONS: WHAT DO WE WANT FROM OUR FORESTS?

ESTHETICS AND RECREATION
JOHN F. KUHR, REGIONAL LANDSCAPE
ARCHITECT, DIVISION OF RECREATION,
RANGE, ENVIRONMENTAL AND WILDLIFE
MANAGEMENT, EASTERN REGION, USFS

What do we want from our Forest in Esthetics and Recreation?

Viewing pleasant scenery and an opportunity to commune with nature is a simple summarization of what man expects when he visits the Forests of the Eastern Region. These two activities must be continuously considered when we, as resource specialists, scientifically manage the timber and other resources for human consumption.

Variety, more than any other word, best describes the character of the landscape that affects the esthetic and recreation on experience in the Forests. Acceptable variety is very desirable. Too little or too much will create monotony or unpleasant effects.

In our Eastern hardwood stands, variety in timber composition and arrangements are key determinants in providing the desirable visual effects and recreation atmosphere. Both even-age and uneven-age managements are appropriate methods in accomplishing these objectives. However, forethought and discretion must be used when using both methods, in order to achieve the desired visual harmony and ecological balance of the Forests.

WATER YIELD AND QUALITY

MICHAEL A. BARTON, DEPUTY FOREST SUPERVISOR
OTTAWA NATIONAL FOREST, EASTERN REGION, USFS

You have asked that I "describe the composition and arrangement of the Forest best suited" to the production of quality water. The answer is simple and impractical. Instead I would like to take this opportunity to compare the impact of uneven-aged management and even-aged management upon the water resource. This approach will allow you to return to your various Regions and Forests and determine how your timber management can contribute to the needs of the people in your part of the country.

I will discuss how our management influences water yields and quality of flows. Run-off (water yield) results from precipitation minus the water used in transpiration and interception. Land managers can produce increases in water yield by influencing these two factors. The most change results from reducing transpiration by removing vegetation. The amount of water yield increase is proportional to the proportion of watershed cut and the basal area removed. The duration of the increase can be related to the amount. In addition, afforestation and species conversion can influence water yield.

The quality of flows may be separated into physical quality and chemical quality. Physical quality consists of temperature, turbidity, sediment load, and color. Undisturbed forest floors generally yield flows of physical high quality. Degradation of flows is directly proportional to the amount of disturbance. Uneven-aged management usually produces less sediment than even-aged management. However, the primary source of sediment is skid-trails and roads. Therefore, the frequency of re-entry is important. Timber harvest does not have to mean degradation. The key is sale design and administration.

There is considerable controversy regarding chemical quality and timber harvest. In my opinion there is a negligible long term effect from sustained yield management. There may be a short term effect while the ecosystem is regaining equilibrium.

WHITE-TAILED DEER

Louis J. Verme, Biologist in Charge
Cusino Wildlife Research Station
Michigan DNR
Shingleton, Michigan

"Even-age silviculture, either through clearcutting or the shelterwood system, is strongly advocated for managing northern hardwoods stands lying within or adjacent to conifer deeryards in the Lake States Region. The primary objective here is to provide a continuous superabundance of nutritious forage for deer wintering in browsed-out yards. This program can be accomplished with little or no loss in timber production. Uneven-age forest management is in order for upland sites utilized by deer for summer range. It is recommended, however, that the timber harvests be heavy enough to promote profuse, rapidly-growing reproduction, because this forage has a higher nutritive value compared to that struggling under appreciable shade. Timber stand improvement practices ought not remove all of the so-called "weed tree" species, since a proper mixture in the whitetail's diet is highly desirable. In short, sensible intergration of deer and timber interests in northern hardwoods is not so difficult as we sometimes believe to be the case."

WILDLIFE

Robert E. Radtke, Branch Chief
Wildlife and Range; Division of Recreation,
Range, Environmental and Wildlife Management
Eastern Region, USFS

Wildlife is a product and a management objective that the public wants from our National Forests. Coordination of wildlife and timber is essential to best achieve this objective.

The management of forest vegetation effects the habitat of the various wildlife species. Both even-aged and uneven-aged silviculture produce a type of habitat which supports a characteristic type of vegetation -- and associated wildlife species. Both systems, or how they are applied can adversely effect certain groups or species of wildlife.

The "carrying capacity" of northern hardwoods to support many of the more popular game species, such as deer, grouse, hare, and woodcock is reduced under UAM, than is possible under EAM, since these forms of wildlife favor vegetation associated with an open environment and an early stage of succession. Where management objectives are directed toward benefiting deer, grouse, snowshoe hare and woodcock, this can best be achieved through EAM. Northern hardwood areas adjacent to deer yards should be managed primarily through the application of EAM silviculture.

Likewise a variety of wildlife species is dependent upon the vegetation characteristic of UAM and the mature forest. Management needs to recognize the needs of these species.

Forest management must be directed towards creating habitat diversity, reflected by both UAM and EAM silviculture. Management -- through periodic thinnings, harvest, and regeneration -- plus a balanced combination of mature forests and vigorous young forests, provides the varieties of habitat and food required by a variety of wildlife species.

A coordinated timber-wildlife program, to be effective, must be directed toward achieving a wide variety of ecological conditions, which favor a variety of native wildlife species.

TIMBER

Merwyn O. Reed, Forest Supervisor
Hiawatha National Forest, Eastern Region, USFS

The Timber Management objective is to produce a sustained yield of high value products.

Soil types are an important consideration. Hetergenous soil types found in the East are not all suited to producing high value products.

Different management practices must be applied to various types to maximize quality.

Northern hardwoods are cut selectively. If yellow birch is desired, even-age management should be applied.

Red and white pine are managed under the even-aged system, including intermediate cuts.

Pulpwood and/or low value types are managed as even-aged with no intermediate cuts. Fully stocked stands are most desirable for short rotation species.

TOUR OF DUKES EXPERIMENTAL FOREST
IN MICHIGAN'S UPPER PENINSULA
September 10-11, 1973

ALL-AGED FORESTRY (UNEVEN-AGED MANAGEMENT)
BASIC GOALS AND MECHANICS

In the northern hardwood type selection forestry (uneven-aged management) is used to:

(1) Produce sustained yields of high quality sawlogs and veneer along with fiber material.
(2) To enhance esthetics.
(3) To protect lake shores, stream banks, watersheds.
(4) To convert from less tolerant (or less aggressive) to more tolerant species.
(5) Any combination of the first four silvicultural goals.

Silvicultural goals are to:

(1) Develop an all-size distribution of trees in stands.
(2) Develop high quality trees (no or little active species discrimination).
(3) Keep stand and individual growth at optimum levels.
(4) Keep mortality at a minimum.

Silvicultural practices and limits to attain these goals:

(1) Use of marking rules to choose trees to harvest or leave on a priority basis.
(2) Use of basal area guides to develop optimum structure for growth and quality or conversely to limit the harvest to protect the productiveness of the site.

Modifications made to accomplish certain silvicultural or management goals include:

(1) Group selection.
(2) Variations in stocking.
(3) Variations in structure.
(4) Variations in cutting cycle.

SILVICAL CHARACTERISTICS OF SOME ASSOCIATED
SPECIES IN THE LAKE STATES
NORTHERN HARDWOOD

SPECIES	TOLERANCE	ESTABLISHES ON UNDISTURBED FOREST FLOOR	PLACE IN SUCCESSION	COMPETITIVE ABILITY	RESPONSE TO RELEASE	FORM	VALUE	LONGEVITY
Sugar Maple	Very Tolerant	Easily	Climax	Aggressive	Very Good	fair poor	high	long-lived
American Beech	Very Tolerant	Easily	Climax	Aggressive	Good	fair poor	mod.	long-lived
Yellow Birch	Moderately Tolerant	Occasionally	Subclimax	Poor	Fair	mod.	very high	long-lived
Eastern hemlock	Very Tolerant	Occasionally	Subclimax	Fair	Good	good	low	long-lived
Red Maple	Tolerant to Moderately	Easily on most sites	Subclimax	Good	Good	fair poor	high	moderate
American Basswood	Moderately Tolerant	Poorly	Climax	?	Good	good	high	moderate
American Elm	Moderately Tolerant	Easily on most sites	Subclimax	?	Good	fair	high	moderate

SUMMARY OF RECOMMENDATIONS
(From Station Paper NO. 56 LSFES,
"Marking Guides for Northern Hardwoods Under
the Selection System" by
Carl Arbogast, Jr.)

Stand condition	Stand description before cutting	Recommended treatment
1. Fully regulated.	All elements of structure stocked in excess of recommendations.	Harvest mature timber. Reduce stocking of timber (10"+) to 70 square feet of basal area per acre, poles to 15 square feet, and saplings to 10 square feet.
2. Overstocked with sawtimber but understocked with smaller timber.	Stand is parklike and free of "underbrush". Abundant small reproduction may be present. Commonly found in virgin stands.	Reduce dominant sawtimber portion of stand to 70 square feet of basal area per acre. Remove poles that will not produce high-quality timber in the future.
3. Understocked with sawtimber but overstocked with smaller timber.	Most commonly found in second-growth stands. Stand has even-aged appearance.	Reduce stand to 85 square feet of basal area in poles and sawtimber together. Remove cull and defective overstory trees. Cut only poor growing stock in overstory. After defective overstory trees have been removed, reduce stand to desired stocking by cutting in pole-sized portion of stand. If no sawtimber is present, reduce poles to 75 to 85 square feet of basal area per acre.
4. Understocked throughout entire structure.	Open, brushy stands. Grass, sod, or raspberries and other brush species predominant in understory.	No cutting recommended.
5. Overstocked with sawtimber; hemlock and/or yellow birch predominate.	Stand structure similar to No. 2 above with either hemlock, yellow birch, or both predominant.	1. Make initial cut leaving 100 to 110 square feet of basal area per acre of sawtimber-sized trees. 2. Make planned salvage 3 to 5 years after initial cut. 3. At time of salvage, reduce sawtimber to 80 square feet per acre. 4. Subsequent cuts similar to those recommended for stand condition No. 2.

Dukes: Stop #1. SILVICAL CHARACTERISTICS, ECOLOGY, TYPICAL STAND AND MARKET CONDITIONS.

1. Principal **dominant** species of climax are shade tolerant (sugar maple - Am. beech).
2. Associated tree species are also shade tolerant to varying degrees (yellow birch, red maple, eastern hemlock, balsam fir, white ash).
3. These associated species are found in varying mixtures in preclimax associations (hemlock-yellow birch) and range from very tolerant (hemlock and fir) to moderately tolerant (yellow birch).
4. Most of these species are long lived, prolific seeders. Most require shade for establishment. Some like beech, sugar maple and red maple are capable of establishing themselves on duff while others often require mineral soil. Competition plays an important role in species composition.
5. Most species are capable of withstanding suppression either as seedlings or large trees or both for protracted periods and respond well to release.
6. Markets for high quality (sawlogs and veneer) are always available. The quality differential is always large. Grade is, to a large extent, dependent on size and partly dependent on stand density which influences branching (the major quality determinant). Markets for low quality material are developing rapidly.
7. Three categories of stands exist. Even-sized "second" growth. Two storied "second" growth. Uneven-sized stands of old or second growth. Note: Beginning stand structure has little to do with the choice of a management system.

Dukes: Stop #2. NATURAL STAND DEVELOPMENT

1. There is a continuous cycling of sugar maple reproduction in the understory. Average age of seedlings - 12 years; oldest - 35 years.
2. Natural mortality in the overstory creates small openings which eventually fill in the overstory.
3. Essentially, this is the simple basis for the individual tree selection system practiced in northern hardwoods.
4. Note: either naturally or through forestry practices this procedure leads to stands of "climax" species. Examples, hemlock-hardwood, mixed conifer hardwood, white pine-hardwood all proceed to sugar maple - the speed of succession is controlled partly by site factors.

Dukes: Stops #3 - 6. OLD GROWTH STUDIES
(overstocked with sawlogs, understocked with poles)

Nature practices selection on a survival basis; we must modify this to meet our aims by choosing trees to be cut and controlling stocking. There are a large number of ways of choosing trees and controlling stocking. Examples, 22 inch diameter limit, 12 inch diameter limit, 5 inch diameter limit.

Take home; (1) diameter limits do not control quality, may make excessively large openings, but is cheap and easy. Best practice high diameter. (2) Large trees left after diameter limits are too exposed, epicormics persist, crowns are "set", quality is low. Heavy cutting in any stand leads to the same condition.

Group selection (1/10 to 1/2 acre) has been used to increase the proportion of less aggressive, less tolerant species. This is difficult on some sites, easy on others. However, group selection is difficult to manage on all sites. Best practice - use in conjunction with individual tree selection, scarify openings.

Various selection practices have been used. (Remove defective trees, remove percent of merchantable volume, remove "mature" trees, harvest growth). None of these are suitable to consistently obtain growth and quality either because they are not amenable to systemization, are not measureable or do not take important factors into account. For example, in an overstocked stand, cutting a volume equivalent to growth will result in leaving the stand in an overstocked condition. Cutting "growth" in an understocked stand (understocked in an essential size class) will result in a continuation of understocking and poor growth. A continuation of the latter practice can ultimately cause harvestable tree numbers to diminish to zero.

Subsequently, stand stocking of the experiments here were translated to basal area which measurement forms the basis for controlling the harvest, developing stand structure and the growth potential of these forests.

Dukes: Stop #7. REGULATED STAND

Structure here is good with saplings, poles, small and large sawtimber represented. Stand history; first cut in late 30's. Subsequently cut three times; twice to 70 sq. ft. 10"+ and the last cut to 50 sq. ft. Original volume removed, 3-5 thousand on the ground. Harvests on 200 similar acres in 1955-1965 equalled about $15 per acre per year.

Dukes: Stop #8. GROWING STOCK LEVELS

Choices of stocking are relatively great to gain owner objectives. Ninety square feet = high cash, low percent return on market value of standing trees. 50 square feet = high percent, lower cash. Cutting cycle can be manipulated from 5 to 15 years. Browse production dwindles as management continues, esthetics improve. Cut concentrates in sawlog class.

Dukes: Stop #9. ESTIMATING GROWTH, John Moser

Use of current inventory data can be used to estimate growth.

Dukes: Stop #10. POLE SIZE STANDS

Basal area control ensures continued production. However, cuts should focus on the predominant size class to develop structure. Erdmann's model shows examples of results of various combinations of cuts in poles and sawlogs.

Even-sized stands can be regulated in one to three cutting cycles depending on initial conditions.

Dukes: Stops #11 through ? REGENERATION

Even-age practice. Shelterwood, clearcutting contrasted to group and individual tree selection. Heavy cutting does not ensure representation of less "tolerant" species. Key to reproduction is advanced reproduction. Some forms of clearcutting are really shelterwoods, multiple shelterwoods approach selection, heavy selection approaches shelterwood.

TOUR OF STANDS ON MUNISING
RANGER DISTRICT, HIAWATHA N.F.
September 11, 1973

Both of the areas we will be visiting were cut when there was a thriving market for charcoal wood. With the exception of a minor amount of sawlog material all of the wood was cut up into 12 inch chunks for charcoal blocks. Thus, utilization was very good. On the Rock River Road Sale the volume included large beech culls. Marking instructions for both stands were to leave a residual basal area of 80 sq. ft. We have no way to check this accurately at this point in time but assume this was done. Some details for the individual sales follows.

Johnson Lake Tower Sale.

Cutting was done between 1967 & 1969
Year of stand origin - around 1900
B.A. prior to marking - 120 sq.ft./A.
B.A. cut - 40 sq.ft./A.
Acres in sale - 590
Volume cut - 49 MBM and 6000 cords
Number of trees - 61,490
Value - $4,000

Rock River Road Sale.

Cutting was done between 1965 & 1967
Year of stand origin - around 1880 (?)
B.A. prior to marking - 110-120 sq.ft./A.
B.A. cut - 30-40 sq.ft./A.
Acres in sale - 100
Volume cut - 30 MBM and 940 cords
Number of trees -
Value - $605
None of the large white pine was cut because of lack of market. Hemlock was not cut as a wildlife coordination measure.

Recently angle-gauge plots were taken in these two areas. This data is presented below and compared to Eyre and Zillgitt's recommended basal area distribution.

	Eyre and Zillgitt	Johnson Lake Tower	Rock River Road
	Square feet of basal area.		
Saplings	8	20	12
Poles 5"-9" d.b.h.	16	65	75
Small sawlogs 9"-15"	22	40	45
Large sawlogs 15"+	26	15	10
Large sawlogs 20+	20	0	0
Total 5"+	84	120	130
Total 10"+		55	55

TOUR OF AMERICAN CAN COMPANY LANDS
AMASA, MICHIGAN
September 12, 1973

Stop 1 This is a stand very untypical of American Can's hardwood holdings. It is a relatively young stand and probably the nearest example of a natural, even-aged hardwood stand in the area.

Stop 2 Block 4. Scheduled for cutting in 1975. Last cut in 1962. Note absence of certain D.B.H. classes.

If time permits, comparison with adjoining lands can be made.

Stop 3 Block 2. Cut for 3rd time in 1972. Scheduled for cut in 1984.

TOUR OF ARGONNE EXPERIMENTAL FOREST
IN NORTHERN WISCONSIN
September 12, 1973

Argonne Stop No. 1. FULLY REGULATED STAND

Stand originated following commercial cutting about 1905. Sugar maple averages site index 65, typical for the species in the Lake States, with stand conditions illustrating characteristics of second-growth northern hardwoods upon reaching fully regulated structure.

Initial cut made in 1947 with periodic cuts in 1958 and 1968. Recommended structure for all-aged management achieved in third cycle cut. First two cuttings made to slightly lower than recommended levels to speed up structure development. Future cuts will harvest 100 percent of growth at 10-year intervals. Roads are established and yields should consist primarily of better quality, higher value sawlogs with some pulpwood but is adaptable to a flexible market. Net board foot growth expected to average about 350 board feet per acre per year. Larger trees increasing in diameter at rate of 2-1/2 - 3 inches every 10 years.

Regeneration - Developing in "holes" where needed and still contains a mixture of species, although tolerant sugar maple is predominant. Browse production appears to have stabilized at 100-200 lbs. per acre and should continue at this level under present management.

Quality - Larger trees (residuals from 1905 cutting) have set merchantable lengths because of forking, crown break-up, large limb sizes and frequent epicormic sprout development. Smaller trees growing into and through larger tree crown layer have greater merchantable length potential, less forking and clearer holes than overstory trees. Increase in tree size is commensurate with stem quality and grade improvement expected in fully regulated stands for all species.

Argonne Stop No. 2. METHODS OF CUTTING IN POLE-SIZE NORTHERN HARDWOODS

The study compares several methods of cutting on regeneration, growth and yield and quality development in second-growth stands that developed following heavy commercial cutting about 1905. This replication consisted primarily of pole-sized trees. A typical mixture of species with average site index for northern hardwoods in the Lake States.

Cutting methods being evaluated consist of:

1. No cutting
2. Selection cutting-90 square feet.
3. Selection cutting-75 square feet.
4. Selection cutting-60 square feet.
5. Crop tree release
6. 8" stump diameter limit
7. Group selection
8. Block clearcut-5" and larger.
9. Block clearcut-1" and larger.
10. Strip clearcut-5" and larger.
11. Strip clearcut-1" and larger.
12. Shelterwood

Initial treatments made in 1951. Selection cuttings continued on 10-year cutting cycle, crop tree release on 20-year cycle and group selection terminated after 2nd cut. Shelterwood overstory removed after 8 years. Other cuttings being remeasured periodically.

Regeneration - Fully stocked on control, selection cuttings and shelterwood. Moderate stocking in 5" limit block and strip cuttings and poor in 1" limit and group selection.

Ref: -Metzger, F. T. and C. H. Tubbs. 1971. The influence of cutting method on regeneration of second-growth northern hardwoods. Journal of Forestry (69), 559-564.

Growth Response - Net growth was correlated with total stocking and stand structure over 15-year period (attached graph) with highest board foot growth occurring in selection cutting leaving 90 square feet of basal area.

Ref: -Erdmann, G. G. and R. R. Oberg. ____. Fifteen-year results and management implications from six cutting methods in second-growth northern hardwoods. North Central Forest Experiment Station. In press.

Quality Improvement - Stem defect frequency and type varied by species, treatment and position in the first two logs. Forking, crown size and diameter growth rates were related to residual stand density 15 years after the initial cut.

Ref: -Godman, R. M. and D. J. Books. 1971. Influence of stand density on stem quality in pole-size northern hardwoods. North Central Forest Experiment Station Research Paper NC-54, 7 pp.

Argonne Stop No. 3. GROWING STOCK LEVELS - TREE QUALITY STUDY AND SHELTERWOOD CUTTING

Studies illustrate species variation and response affecting regeneration, growth and quality development.

Quality improvement of young stands is influenced by both stocking and stand structure, therefore by the silvicultural system that is used. Most hardwood species are extremely responsive to cutting method although some effects do not show up for a period of years.

Forking is a common problem in opposite branched species particularly sugar maple and white ash. The terminal bud is lost about every 3-5 years and the opposite branches compete for light creating an acute-angled fork. Correction of forking is achieved in part by density of the stand and to a large extent by stand structure in species that do not exhibit strong apical dominance.

Epicormic sprouting is a serious problem in most hardwood species. The frequency of sprouting is associated with crown class but is more strongly correlated with crown area for trees of a given size. Control of sprouting can be achieved through crown development and position in the stand.

Other factors influencing tree quality that appear to be associated with the silvicultural system include bird peck, winter sunscald, fork breakage and probably frost cracking in some areas. Periodic growth is markedly influenced by cold weather because hardwood species shrink with colder temperature to the extent that 5-year growth can be underestimated by nearly 50 percent depending on the species.

Shelterwood cuttings are, at present, the most reliable method of establishing even-aged stands of northern hardwoods for the Lake States. This method provides an overstory to retard herbaceous competition, assure full stocking and early development of the regeneration.

This cutting illustrates the initial cut recommended under the system and regeneration response that can be expected. The residual trees in the overstory also illustrate tree form and quality problems that will be encountered with an even-aged system in northern hardwoods.

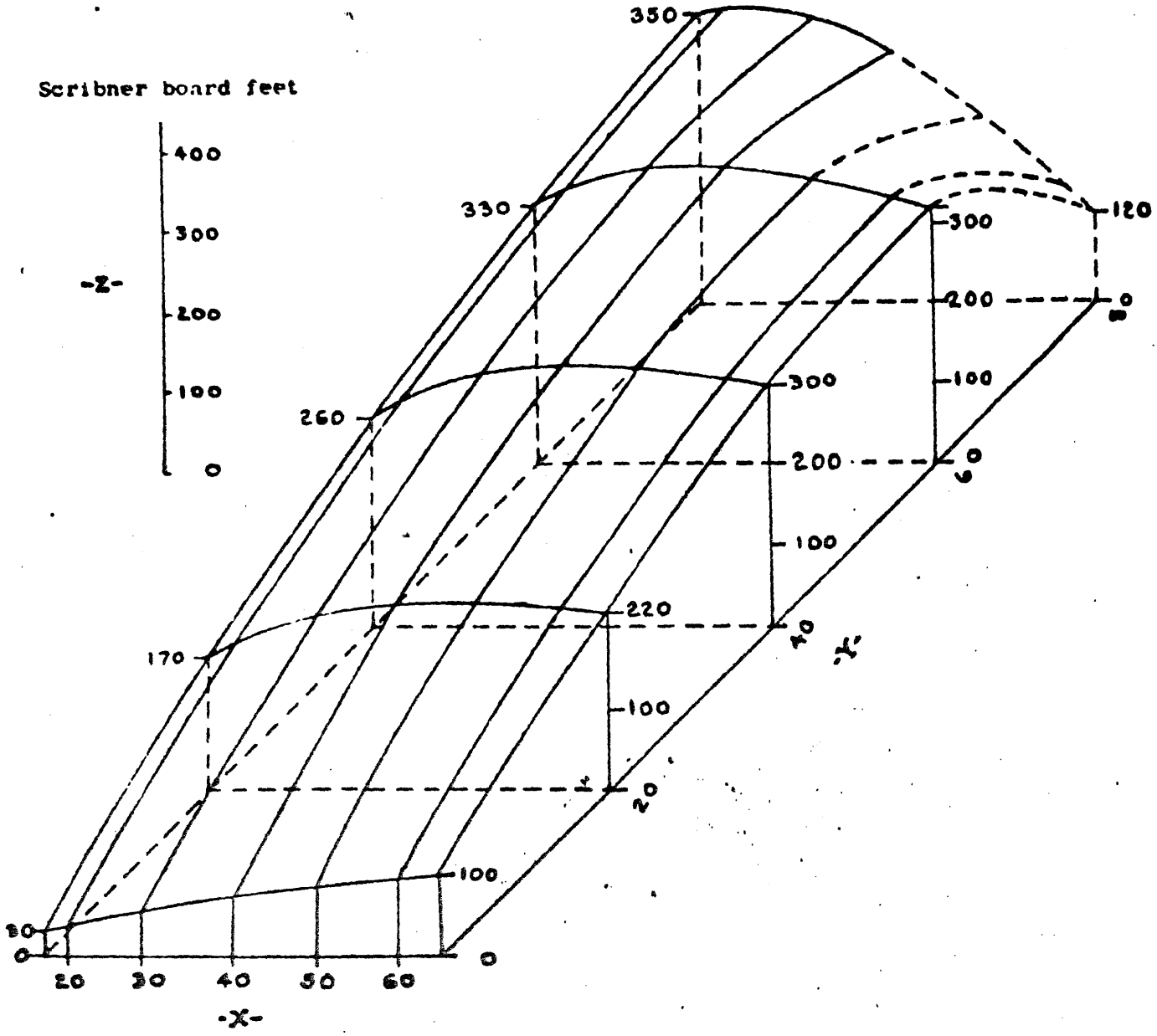


Figure 5.-- Relation of periodic annual Scribner net board-foot growth (Z) to beginning basal area of all trees 4.6 to 9.5 inches d.b.h. (X) and beginning basal area of all trees 9.6 inches d.b.h. and larger (Y).

TOUR OF VINTON FURNACE EXPERIMENTAL FOREST
IN SOUTHERN OHIO
September 13, 1973

Background: The Vinton Furnace Experimental Forest is an outdoor laboratory of 1200 acres owned by the Mead Corporation and made available to the Northeastern Forest Experiment Station to conduct research in timber management. The research conducted here applies to the upland oak forest type where oaks are the predominant species.

History: During the Civil War, Southeastern Ohio thrived as a center of iron and steel production. To provide the vast supplies of charcoal needed by the iron industry, local wood was cut at a furious pace. Each 5 cords of wood yielded 200 bushels of charcoal. But in 1860, one furnace alone burned 300,000 bushels of charcoal, and there were more than 40 furnaces to supply. So, the nearby forests were virtually stripped of trees to meet this tremendous need for wood, not once but several times.

For more than half a century some of the best iron in the world flowed from Southeastern Ohio's smelters -- including that used in making Civil War artillery, such as the famous "Swamp Angel." Then, the discovery of richer, more abundant ores in Michigan and Minnesota brought the heyday of Ohio's iron industry and the indiscriminate cutting of her forests to an end.

Vinton Furnace Stop No. 1. COMMERCIAL CLEARCUTTING

In this system, every tree that was large enough to make an 8 foot sawlog 10 inches in diameter was cut. The removal involved two-thirds of the basal area in the forest and all the sawtimber volume. What remained after harvest was a poorly stocked stand of low quality trees. Reproduction is good on the lower slopes; poor on the upper slopes.

Vinton Furnace Stop No. 2. DIAMETER LIMIT CUT

No Timber Stand Improvement - In this plot every merchantable tree that exceeded the diameter set for its species was cut. The limit set for each species included: yellow-poplar, 20 inches; white oak, 18 inches; black, red, and chestnut oaks, 16 inches; scarlet oak, 14 inches; and hickory, 12 inches. These cutting diameters were selected so that larger trees of the more valuable species would be left for further growth and seed production.

About 30 percent of the basal area and one-fourth of the sawtimber volume on the area were removed in the first cut. A second cut was taken in the winter of 1961. Because no stand improvement work was done, the residual stand contains many low quality trees. Reproduction in this plot is similar to the selection plots.

Vinton Furnace Stop No. 3. SELECTION CUT

No Timber Stand Improvement - Foresters took only merchantable trees that were mature, damaged, or defective in this operation. They removed one-third of the basal area and about 20 percent of the merchantable volume, but, as in the first two plots, many culls and undesirable trees remain. A second cut was made in this plot in the winter of 1961. No timber stand improvement was done here. Reproduction is poorly developed and while adequate in numbers, includes no yellow poplar.

Vinton Furnace Stop No. 4. COMPLETE CLEARCUT

All trees merchantable for sawlogs and pulpwood were removed. In addition, everything else over 4-1/2 feet tall was cut and left on the ground. Thus, all of the basal area and volume was removed. Obviously, it will be a long time before the plot yields another harvest cut, but the quality of the reproduction is excellent, growth is rapid, and none of the growing space is being wasted by residual trees. Thinnings will be done in the stand periodically, so as not to lose tree vigor and to recover intermediate products. The plot contains much yellow-poplar and, after only 15 years since the cut, basal area has increased 60 square feet.

Vinton Furnace Stop No. 5. SELECTION CUTTING

With Timber Stand Improvement - In an operation similar to that on Plot 3, half of the basal area and about 40 percent of the sawtimber volume were removed from this plot. Defective trees and undesirable species were later killed. Reproduction is good, but its growth has diminished as the residual stand closed. Quality of many residual trees declined greatly after this heavy cut.

Vinton Furnace Stop No. 6. COMMERCIAL CLEARCUT

With Timber Stand Improvement - In this plot, as in Plot 1, commercial clearcutting was done. But culls and undesirable species were removed here. The stand that remains is grossly understocked and will not produce good quality wood, because of the great amount of branching along the lower trunks of the trees. Reproduction, however, is excellent, except in the areas dominated by residual trees.

Vinton Furnace Stop No. 7. SMALL TRACT MANAGEMENT

A one-half acre opening made as part of a small tract management study. In order to obtain the desired reproduction cutting was done by clearcutting in patches. This study contained three tracts of about 50 acres in each tract. The stands are managed on a nominal 80-year rotation with cutting intervals of 1, 5, and 10 years. For the 1-year-cutting-cycle tract, 1/80 of the area was clearcut each year, on the 5-year-cutting-cycle 1/16 of the area was clearcut and on the 10-year-cutting-cycle the total area cut at each interval was 1/8 of the total area.

Vinton Furnace Stop No. 8. THINNING AND INTERMEDIATE STAND MANAGEMENT

A 40-year old stand thinned twice to a minimum desired stocking of 60%.

Vinton Furnace Stop No. 9. SELECTION CUTTING

The cut in the selection tract was set at 500 board feet per acre, and cuts were made whenever the trees in the stand were large enough for lumber had attained that amount. The first cut was made during the winter of 1956-57. A second cut was made in 1959; a third, in 1962-63.

Vinton Furnace Stop No.10. SHELTERWOOD CUTTING

The first cut was a combination preparatory and seed cut. A preparatory cut removes only intermediate and suppressed trees from the understory to develop conditions on the ground favorable for natural seeding. A seed cut removes some of the trees in the overstory to let in light and to aid in establishing new seedlings. Carried out together, the first preparatory and seed cut removed two-thirds of the basal area and one-half of the sawtimber volume.

Reproduction has not developed in the selection tract. The shelterwood tract had good reproduction initially, but in recent years has become increasingly dominated by tolerant species.

Vinton Furnace Stop No.11. SIZE OF OPENING (Group Selection)

36 plots were installed: 18 on good sites (site index for black oak 70 to 85), and 18 on poorer sites (site index 50 to 65). (Site index means that dominant black oaks are between 70 and 85 feet tall at 50 years of age.) Circular plots of one-eighth, one-fourth, one-half, one, three, and five acres were established on each site class. All merchantable timber on the plots was harvested. All non-merchantable trees larger than about 2 inches in diameter were killed. A count of reproduction has been kept on 800 sample milacres in the plots.

Since the original cutting, all species have increased in both numbers and distribution, except for red and black oaks on the good sites and, possibly, the white oak on the poorer sites. On both sites, yellow-poplar increased the most.

From the study it appears that site quality makes quite a difference in the number of stems of oaks, yellow-poplar, red maple, black gum, sassafras, sourwood, and brush species, like witch-hazel and alder. It also appears that site quality affects the numbers of ash, cherry, aspen, elm, and other trees.

Size of opening seems to make little difference in the number of seedlings per acre. However, seedlings grow slower in the smaller openings, because more of the area is shaded by the surrounding stand.

This study makes it apparent that size of opening (at least down to 1/4 acre) is not critical in obtaining adequate desirable reproduction following clearcutting; however, reproduction will grow better on larger openings than small ones.

TOUR OF KASKASKIA EXPERIMENTAL FOREST
IN SOUTHERN ILLINOIS
September 14, 1973

The Kaskaskia Experimental Forest is located in Hardin County, Illinois, on the extension of the Ozark plateau region. This area has not been glaciated. The soils are cherty silt loams, and productivity is largely dependent upon moisture availability. Oak site index can vary from 55 on the ridge tops to 85 in the coves; these extremes can occur within a distance of a few hundred feet on the landscape. The lower slopes, north- and east-facing slopes, and coves are much more productive than the upper slopes, south- and west-facing slopes, and ridge tops. The climate is typically continental, with hot-humid summers, cool winters, and an average of 43 inches of rainfall. The growing season is 200 days, and there is often a 3-4 week period with little or no rain during July and August.

Forest types include S.A.F. types 40, 52, and 53. This area is in the transition zone between the zeric oak-hickory type to the west and the mesic mixed hardwood to the east. Yellow-poplar, maple, and northern red oak are generally confined to the moister sites, while post oak is found on the drier sites. The other red oaks, white oak, and hickory occur on most sites in varying proportions.

The major cutting operation in the area probably took place around 1890, and fires were very common in the area prior to the introduction of fire prevention programs by state and federal agencies.

The present stands are unbalanced, uneven-aged stands with 2 to 4 age groups predominating. The black, scarlet, and red oaks are presently the dominant species, but are not regenerating well under uneven-aged management. Therefore, changes in species composition are inevitable in these stands in the future--with management or without management. The current merchantable volume growth of 100 to 300 bd. ft./acre/year is a function of the faster growing oak group, and may be reaching its peak rate at the present time.

The tour will consist of four stops, including both managed and unmanaged stands. The potential changes in stand structure and composition will be discussed in relation to the silvicultural systems that were imposed at each stop.

List of stops

#1 Compartment 17 is one of 38 compartments of an extensive management study designed to test several variations of even-aged and uneven-aged management and the long-term development of the stands. This compartment was cut three times at 8-year intervals, and cull trees were removed at each cut.

#2 Compartment 21 is similar to compartment 17 except that cull trees were not removed.

#3 The Natural Area is an example of a stand that has developed without disturbance or management for at least the last 40 years, and illustrates the changes that can occur without management.

#4 The Good Farm Woodlot was designed to demonstrate the possibility of making an annual cut on a small woodland, using intensive silviculture.

Stop #1

Kaskaskia Experimental Forest

Location: Compartment 17 Size: 26.9 acres

Management system: Uneven-aged, rotation length 80-100 years (18" d.b.h.), 8-year cutting cycle.

Silvicultural system: Small-group selection, cull removal.

This stand was first brought under management in 1950. In 1952, a 100% inventory of all trees 4.5" d.b.h. and larger was made, and 432 board feet/acre (1/4" International Rule) of merchantable timber was harvested. All cull trees were killed, as well as some trees between 5 and 10 inches d.b.h. considered to be undesirable growing stock. In 1960, 534 board feet/acre were harvested, and 512 board feet/acre were harvested in 1968. Trees selected for harvest were above the rotation size, poor risk, or low quality. Growth of the non-cull trees over a 16-year period has been .76 square feet of basal area per acre per year, or 140 board feet per acre per year.

Stand characteristics: (Data from 100% inventories)

Table 1.--Number trees per acre before cutting

D.b.h. class	Sound 1952	Sound 1968	Change	Cull 1952	Cull 1968	Change
5- 7	43.5	31.1	-12.4	14.8	2.8	-12.0
8-10	29.3	22.2	- 7.1	4.7	.5	- 4.2
11-17	23.2	32.5	+ 9.3	2.5	.3	- 2.2
18+	4.2	3.3	- .9	.8	.1	- .7
Total	100.2	89.1	-11.1	22.8	3.7	-19.1

Table 2.--Merchantable volume (board feet/acre)

Species	1952	1968	Harvested
Hickory	382	200	192
White oak	529	959	192
Scar., Bl., Red oaks	1823	2636	1005
Post oak	88	120	44
Misc.	118	80	45
Total	2940	3995	1478

Table 3.--Species composition (percent)

Species	No. trees		Merchantable volume	
	1952	1968	1952	1968
Hickory	17	21	13	5
White oak	27	33	18	24
Scar., Bl., Red oaks	43	35	62	66
Post oak	8	9	3	3
Misc.	5	2	4	2

Notes:

Stop #2

Kaskaskia Experimental Forest

Location: Compartment 21 Size: 29.4 acres

Management system: Uneven-aged, rotation length 80-100 years (18" d.b.h.), 8-year cutting cycle.

Silvicultural system: Small-group selection, no cull removal.

This stand was brought under management in 1952. A 100% inventory of all trees 4.5" d.b.h. and larger was made, and 559 board feet/acre (1/4" International Rule) of merchantable timber was harvested. No cultural treatments were carried out. A second harvest in 1960 removed 709 board feet/acre, and a third harvest in 1968 removed 571 board feet. Trees marked for harvest were either above rotation size, poor risks to survive until the next planned harvest, or poor quality. Growth of the non-cull trees during the 16-year period has been 1.36 square feet of basal area per acre per year, and 150 board feet per acre per year.

Stand characteristics: (Data from 100% inventories)

Table 1.--Number trees per acre before cutting

D.b.h. class	Sound 1952	Sound 1968	Change	Cull 1952	Cull 1968	Change
5-7	25.5	33.2	+ 7.7	16.5	11.7	-4.8
8-10	17.8	20.7	+ 2.9	8.0	6.6	-1.4
11-17	24.7	30.2	+ 5.5	5.5	6.7	+1.2
18+	4.9	4.4	- .5	2.0	2.5	+ .5
Total	72.9	88.5	+15.6	32.0	27.5	-4.5

Table 2.--Merchantable volume (board feet/acre)

Species	1952	1968	Harvested
Hickory	380	242	221
White oak	443	686	184
Scar., Bl., Red oaks	2153	2867	1361
Post oak	32	81	18
Misc.	158	162	55
Total	3166	4038	1839

Table 3.--Species composition (percent)

Species	No. trees		Merchantable volume	
	1952	1968	1952	1968
Hickory	13	15	12	6
White oak	24	32	14	17
Scar., Bl., Red oaks	53	44	68	71
Post oak	5	4	1	2
Misc.	5	5	5	4

Notes:

Stop #3

Kaskaskia Experimental Forest

Location: Natural Area Size: 17.9 acres

Management System: Protection from fire, grazing, and cutting.

Silvicultural system: None

This old growth oak-hickory stand is located in the unglaciated hill country of southern Illinois. A majority of the trees are either over 160 years old or between 80-100 years old. The older trees show an abrupt increase in growth rate between 1880-1890, coinciding with the settlement of the hill country and the rapid expansion of the railway system. We assume that a major disturbance occurred about 1880, and that this disturbance was most likely a heavy cut for railroad ties. Since the purchase of the area in 1934 by the Forest Service, the stand has been protected from fire, grazing, and cutting.

Stand characteristics: (Data from eight 1/4-acre permanent plots)

Table 1.--Number trees (1.6" d.b.h. and larger) per acre by height classes

Height (ft.)	1935	Mortality	Ingrowth	1965	Net Change
101-125	1.5	0.0	7.0	8.5	+ 7.0
76-100	35.5	4.0	17.0	42.0	+ 6.5
51-75	51.5	16.5	17.5	33.5	-19.0
26-50	139.5	90.0	60.5	92.5	-47.0
<26	130.0	77.5	105.5	165.5	+35.5
All	358.0	188.0	-	342.0	-17.0

Table 2.--Basal area/acre by height classes

Height (ft.)	1935	1965	Change
101-125	5.73	28.34	+22.61
76-101	49.86	71.27	+21.41
51-75	22.02	14.79	- 7.23
26-50	16.59	8.29	- 8.30
<26	4.45	4.91	+ .46
All	98.65	127.60	+28.95

Table 3.--Species composition (percent)

Species	No. trees : 1935	No. trees : 1973	Basal area : 1935	Basal area : 1973
Yellow-poplar	2.6	2.7	16.1	17.8
White oak	12.6	7.5	15.1	16.8
Hickory	12.3	5.4	13.6	9.5
Black oak	6.0	4.0	12.7	16.9
Scarlet oak	4.6	2.7	11.6	13.5
Black gum	6.6	5.9	9.0	6.1
Dogwood	19.8	5.9	6.6	0.8
Florida maple	17.9	43.5	4.9	11.3
Sassafras	8.1	0.5	4.2	0.2
Red oak	1.7	1.5	2.7	4.5
Other timber	3.3	11.5	1.6	1.9
Other non-timber	4.5	8.9	1.8	0.7

Notes:

Stop #4

Kaskaskia Experimental Forest

Location: Good Farm Woodlot Demonstration Size: 23.7 acres

Management system: Uneven-aged, 3-year cutting cycle, 130 year rotation (25" d.b.h.).

Silvicultural system: Single tree selection, cull removal.

Management of this stand was initiated in 1949. The area was divided into 3 compartments, and each compartment inventoried and cut in successive years. By 1957, the over-mature, poor risk, and low-quality timber had been removed, and harvesting was suspended until 1962. The last cut was made in 1968. During the period 1949-1968, a total of 17 harvestswere made and 3,010 board feet/acre (1/4" International Rule) removed. An average of 81 cull trees per acre were killed.

Stand characteristics: (Based on 100% inventories of trees 4.5" d.b.h. and larger, and on 120 milacre sample plots of trees less than 4.5" d.b.h.)

Table 1.--Changes in stand parameters

Year	Stand prior to	No. trees per acre	Basal area per acre	Average d.b.h.	Stocking percent	Average bd.ft./acre
1949	1st cut	164.4	80.8	9.5	72	4,098
1952	2nd cut	134.3	71.9	9.9	62	4,114
1955	3rd cut	115.6	65.7	10.2	58	4,294
1961	4th cut	114.1	70.8	10.7	62	5,182
1964	5th cut	99.9	63.6	10.8	56	4,767
1967	6th cut	91.7	61.6	11.1	52	5,192
1971	Inventory only	101.8	67.6	10.3	58	6,143

Table 2.--Species composition (percent)

Species	1949 inventory		1971 inventory	
	No. trees	bd.ft. vol.	No. trees	Bd.ft. vol.
Hickory	11	15	13	5
White oak	42	20	52	45
Bl., Scar., Red oak	24	45	17	35
Yellow-poplar	1	5	2	5
Misc.	22	15	16	10

Table 3.--Reproduction (percent of no. of trees)

Species	1957	1972
Hickory	13	9
White oak	9	6
Bl., Scar., Red oak	9	5
Yellow-poplar	2	3
Misc.	48	45
Non-timber	19	32

Notes:

AESTHETIC FORESTS FOR URBAN AREAS

by
WILLIAM T. PLASS AND STEPHEN G. BOYCE

During colonial times, the magnificient forests of the eastern United States provided the settlers with essential raw materials for food, clothing, shelter, and industry. Furthermore, the forest, as an integral part of the settler's environment, helped to mold the philosophy, principles, and personalities of these vigorous, rural people with inquisitive and concerned minds.

But the inspirational impact of the forest on our lives diminished as population increased and more people moved from rural areas to large metropolitan centers. As society became more industrialized, progressively fewer individuals had an opportunity to enjoy a forest environment and even fewer appreciated the magnificence of the forests of colonial times. It is conceivable the time may come when a majority of our population will have no opportunity to visit a forest stand, and a visit to a forest similar to those of colonial times will be a rare experience indeed. This need not be so. Near and within many of our major metropolitan centers in the eastern United States are wooded areas that could be set aside, managed, and developed to recapture many of the aesthetic qualities of an old-growth forest. These could even include stands that have been heavily cut or burned. With time, protection, and cultural treatment the aesthetic appeal of these stands can be restored so that they will provide future urban generations with more rather than less opportunity to visit a forest stand.

RECOVERY OF AN ILLINOIS FOREST

The results of a 30-year study in southern Illinois demonstrate how a forest stand, heavily cut about 1880, can once again acquire most of the aesthetic qualities of colonial times. The stand in this study is an 18-acre area in the unglaciated hill country of Hardin County, Illinois. It is managed, protected, and used for research by the Forest Service of the U.S. Department of Agriculture.

Age determination in 1965 indicated that a majority of the trees in the study area fall into two general age classes: those that are about 80-90 years old and those well over 100 years old. The older trees are yellow-poplar, blackgum, hickory, white oak, and black oak.

Increment cores from these older trees show an abrupt increase in growth after 1880. Since these dates correspond with the age of

the younger trees, this was probably the date of a major cutting. This date coincides with the period of rapid settlement and early lumbering of the hill country along the Ohio River.

During this period the nation's growing railway system required large quantities of hewn ties. The possibility of the stand being cut then for ties could explain the present species composition of the residual stand because the large yellow-poplar, blackgum, and hickory left were not preferred for ties. The residual white oak and black oak, as indicated by increment cores, were less than 12 inches in diameter at breast height and presumably were too small to be cut for ties at that time.

When the U.S. Forest Service purchased the tract in 1935, there was no evidence of cutting after 1880, and many of the older trees had grown to an impressive size. The decision was made then to preserve the tract as an example of an old-growth hardwood forest. Under Forest Service ownership, the stand has been protected from fire, grazing by domestic animals, and cutting. The only physical improvements have been a system of gravel trails. Visitors have voluntarily respected the intent of these trails and have not trampled the intervening low plant growth.

GROWING AESTHETIC FORESTS

This Illinois forest stand was heavily cut about 85 years ago, yet today it is aesthetically appealing because of the many tall trees of large diameter. On the average, there are over 6 trees per acre that are more than 25 inches in diameter and over 100 feet tall.

In winter the massive crowns and huge trunks are silhouetted on the sky. In summer one first notices the deep shade, then the dense low understory of maple and other tolerant species. Projecting through this lower layer, stems of the dominant oaks, hickories, and yellow-poplars appear as great cathedral columns supporting a thick roof of branches and leaves. Today the stand probably is similar in many ways to the forests of colonial times.

Because protection was the only management practice, 50 to 80 years were required for the present aesthetic qualities to develop. With other management practices it would be possible to speed the growth of aesthetic forest stands. For example, the early cutting of trees destined to die would increase the growth of the overstory and permit the early development of an herbaceous and shrubby flora. And by careful periodic cutting, desirable tree species could be maintained in the stand.

From ecology and forestry much is already known about the growth and development of forest stands and trees. The kinds of soils that result in the greatest height growth are known. The knowledge for changing stand density to increase diameter growth is available; which mixtures of species are compatible is known.

The recovery of this Illinois stand without management illustrates the potential for developing and managing selected forest stands for aesthetic values. A forest does not necessarily lose its aesthetic appeal, usefulness, and beauty after disturbance, and the 18 acres of the Illinois stand heavily cut 85 years ago, demonstrate how rapidly forests can recover after disturbance. Therefore, under protection and wise management, forests with high aesthetic values within or near a majority of the major metropolitan centers of the eastern United States could be developed.

Kaskaskia Experimental Forest
Southern Illinois

NATIONAL SILVICULTURE MEETING

September 14, 1973

Schedule

7:30 a.m.	Leave Ramada Inn for KEF
9:00 a.m.	Stop #1. Compartment #17. Oak Compartment Management Study. Oak Hickory Type. Uneven-age management. Cut 3 times at 8-year intervals. Cull trees removed.
9:20 a.m.	Leave Compartment #17.
9:30 a.m.	Stop #2. Compartment #21. Oak Compartment Management Study. Same treatment as Compartment #17, except cull trees not removed.
9:50 a.m.	Leave Compartment #21.
10:10 a.m.	Stop #3. KEF Natural Area. Unmanaged mixed hardwood stand.
10:30 a.m.	Leave Natural Area.
10:40 a.m.	Stop #4. Good Farm Woodlot. Oak hickory type. Managed on an individual tree selection system. Frequent light cuts.
11:10 a.m.	Return to Marion
12:30 p.m.	Arrive Ramada Inn, Marion
12:45 p.m.	Lunch

Background Information

The Kaskaskia Experimental Forest is located in Hardin County, Illinois, on the extension of the Ozark plateau region. This area has not been glaciated. The soils are cherty silt loams, and productivity is largely dependent upon moisture availability. Oak site index can vary from 55 on the ridge tops to 85 in the coves; these extremes can occur within a distance of a few hundred feet on the landscape. The lower slopes, north- and east-facing slopes, and coves are much more productive than the upper slopes, south- and west-facing slopes, and ridge tops. The climate is typically continental, with hot-humid summers, cool winters, and an average of 43 inches of rainfall. The growing season is 200 days, and there is often a 3-4 week period with little or no rain during July and August.

Forest types include S.A.F. types 40, 52, and 53. This area is in the transition zone between the xeric oak-hickory type to the west and the mesic mixed hardwood to the east. Yellow-poplar, maple, and northern red oak are generally confined to the moister sites, while post oak is found on the drier sites. The other red oaks, white oak, and hickory occur on most sites in varying proportions.

The major cutting operation in the area probably took place around 1890, and fires were very common in the area prior to the introduction of fire prevention programs by state and federal agencies.

The present stands are unbalanced, uneven-aged stands with 2 to 4 age groups predominating. The black, scarlet, and red oaks are presently the dominant species, but are not regenerating well under uneven-aged management. Therefore, changes in species composition are inevitable in these stands in the future--with management or without management. The current merchantable volume growth of 100 to 300 bd. ft./acre/year is a function of the faster growing oak group, and may be reaching its peak rate at the present time.

The tour will consist of four stops, including both managed and unmanaged stands. The potential changes in stand structure and composition will be discussed in relation to the silvicultural systems that were imposed at each stop.

Stop #1

Kaskaskia Experimental Forest

Location: Compartment 17 Size: 26.9 acres

Management system: Uneven-aged, rotation length 80-100 years (18" d.b.h.), 8-year cutting cycle.

Silvicultural system: Small-group selection, cull removal.

This stand was first brought under management in 1950. In 1952, a 100% inventory of all trees 4.5" d.b.h. and larger was made, and 432 board feet/acre (1/4" International Rule) of marchantable timber was harvested. All cull trees were killed, as well as some trees between 5 and 10 inches d.b.h. considered to be undesirable growing stock. In 1960, 534 board feet/acre were harvested, and 512 board feet/acre were harvested in 1968. Trees selected for harvest were above the rotation size, poor risk, or low quality. Growth of the non-cull trees over a 16-year period has been .76 square feet of basal area per acre per year, or 140 board feet per acre per year.

Stand characteristics: (Data from 100% inventories)

Table 1.--Number trees per acre before cutting

D.b.h. class	Sound 1952	Sound 1968	Change	Cull 1952	Cull 1968	Change
5- 7	47.4	31.1	-16.3	14.8	2.8	-12.0
8-10	31.2	22.2	- 9.0	4.7	.5	- 4.2
11-17	23.2	32.3	+ 9.1	2.5	.3	- 2.2
18+	4.2	3.3	- .9	.8	.1	- .7
Total	106.0	88.8	-17.2	22.8	3.7	-19.1

Table 2.--Number of trees per acre

Species	Poles 4.5" - 10.4"		Sawtimber: Small 10.5" - 17.4"		Sawtimber: Large 17.5"+		Total	
	1952	1968	1952	1968	1952	1968	1952	1968
Hickory	14.6	16.4	2.6	1.9	0.8	0.0	18.0	18.3
White oak	23.1	18.6	4.8	10.1	0.8	0.7	28.7	29.4
Red oaks	29.2	11.3	13.8	17.9	2.4	2.5	45.4	31.7
Post oak	7.2	5.8	1.2	1.9	0.1	0.1	8.5	7.8
Misc.	4.6	1.1	0.9	0.5	0.1	0.0	5.6	1.6
Total	78.6	53.2	23.2	32.3	4.2	3.3	106.0	88.8

Table 3.—Basal area (sq. ft.) per acre

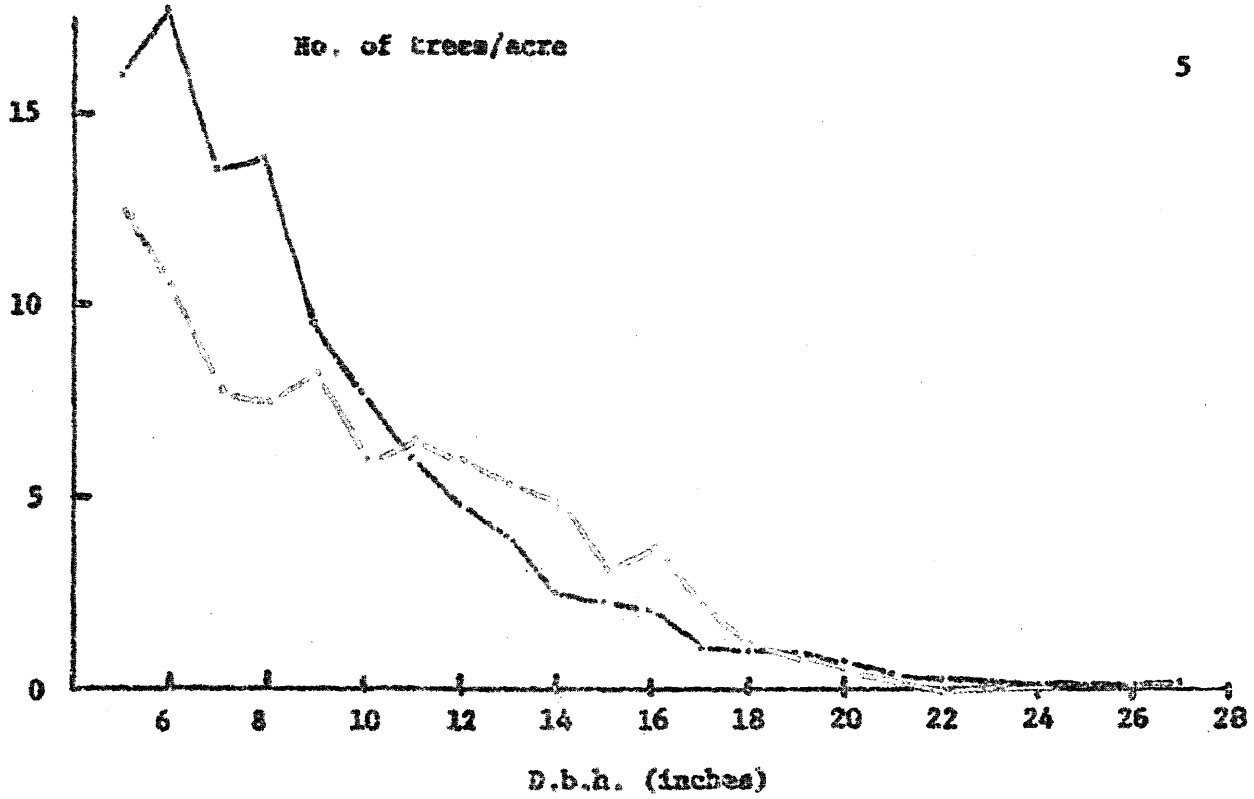
Species	Poles 4.5" - 10.4"		Sawtimber Small 10.5" - 17.4"		Sawtimber Large 17.5"+		Total	
	1952	1968	1952	1968	1952	1968	1952	1968
Hickory	3.3	4.1	2.6	1.9	1.7	0.1	7.6	6.1
White oak	6.7	5.6	4.5	9.7	1.8	1.3	13.0	16.6
Red oaks	9.5	4.0	13.0	18.5	5.3	5.0	27.8	27.5
Post oak	2.0	1.8	1.2	1.7	0.2	0.1	3.4	3.6
Misc.	1.1	0.2	0.8	0.5	0.3	0.1	2.2	.8
Total	22.6	15.6	22.1	32.3	9.4	6.6	54.1	54.6

Table 4.—Marchantable volume (board feet/acre)

Species	1952	1968	Harvested
Hickory	382	200	192
White oak	529	959	192
Red oaks	1,823	2,636	1,005
Post oak	88	120	44
Misc.	118	80	45
Total	2,940	3,995	1,478

Table 5.—Distribution of number of trees, basal area, and volume by species (percent)

Species	No. trees 1952	No. trees 1968	Basal area 1952	Basal area 1968	Marchantable volume 1952	Marchantable volume 1968
Hickory	17	21	14	11	13	5
White oak	27	33	24	30	18	24
Red oaks	43	35	52	51	62	66
Post oak	8	9	6	7	3	3
Misc.	5	2	4	1	4	2


No. of trees/acre
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10
5
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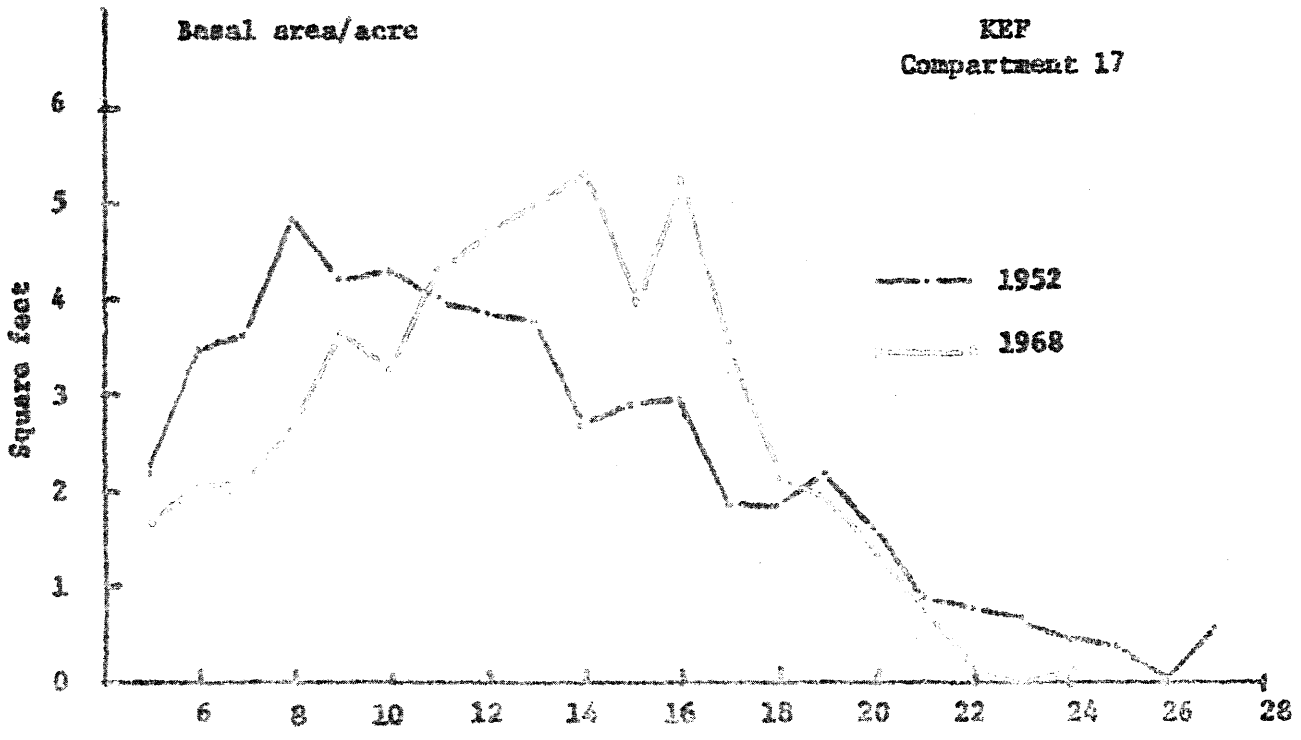
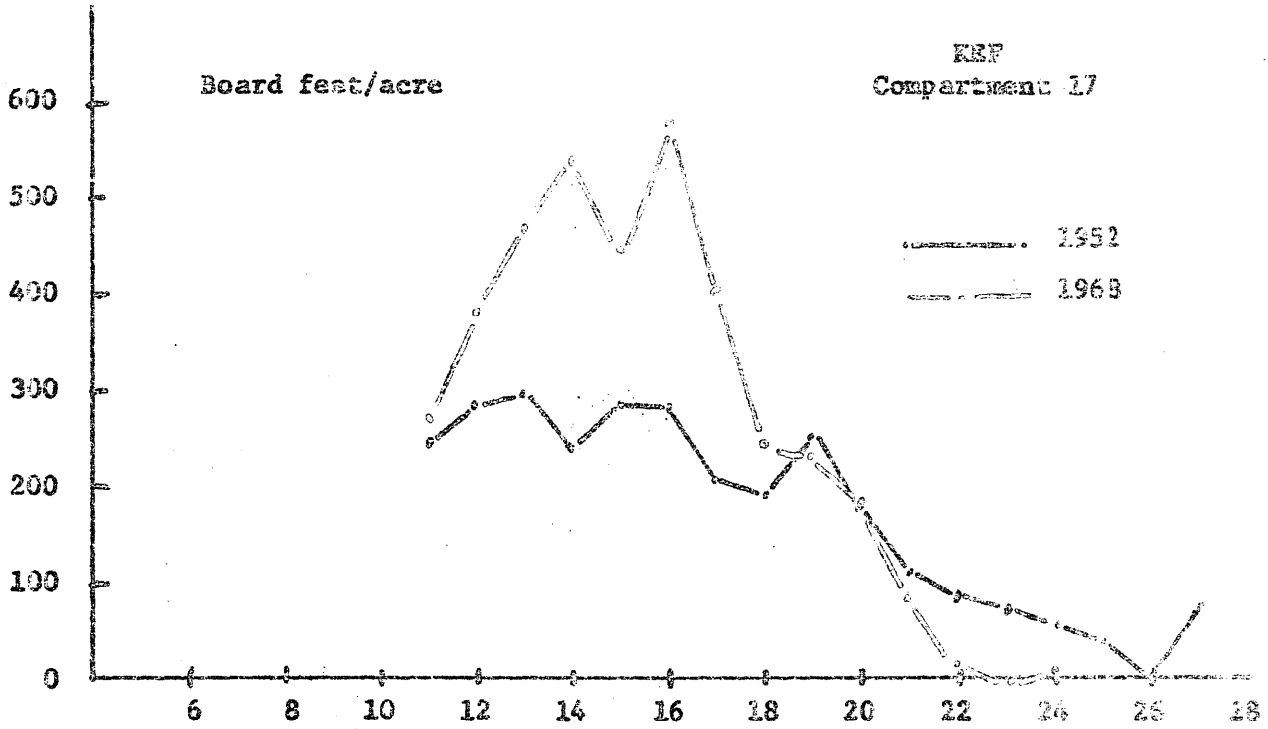
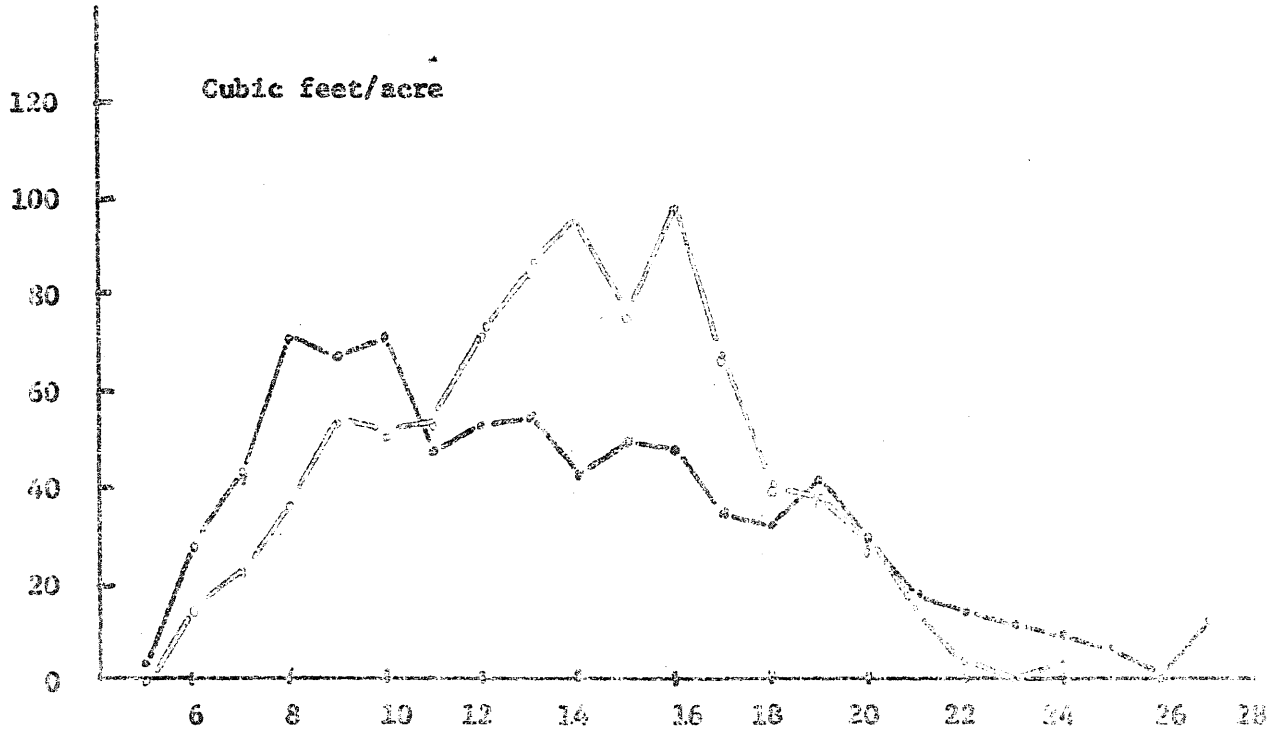
6
8
10
12
14
16
18
20
22
24
26
28
D.b.h. (inches)


Basal area/acre
KEF
Compartment 17
1952
1968
Square feet
6
5
4
3
2
1
0
6
8
10
12
14
16
18
20
22
24
26
28


Board feet/acre
KRF
Compartment 17
1952
1963
600
500
400
300
200
100
0
6
8
10
12
14
16
18
20
22
24
26
28


Cubic feet/acre
120
100
80
60
40
20
0
6
8
10
12
14
16
18
20
22
24
26
28
D.b.h. (inches)

Stop #2

Kaskaskia Experimental Forest

Location: Compartment 21 Size: 29.4 acres

Management system: Uneven-aged, rotation length 80-100 years (18" d.b.h.), 8-year cutting cycle.

Silvicultural system: Small-group selection, no cull removal.

This stand was brought under management in 1952. A 100% inventory of all trees 4.5" d.b.h. and larger was made, and 559 board feet/acre (1/4" International Rule) of marchantable timber was harvested. No cultural treatments were carried out. A second harvest in 1960 removed 709 board feet/acre, and a third harvest in 1968 removed 571 board feet. Trees marked for harvest were either above rotation size, poor risks to survive until the next planned harvest, or poor quality. Growth of the non-cull trees during the 16-year period has been 1.36 square feet of basal area per acre per year, and 150 board feet per acre per year.

Stand characteristics: (Data from 100% inventories)

Table 1.--Number trees per acre before cutting

D.b.h. class	Sound 1952	Sound 1968	Change	Cull 1952	Cull 1968	Change
5- 7	25.5	33.2	+ 7.7	16.5	11.7	-4.8
8-10	17.8	20.7	+ 2.9	8.0	6.6	-1.4
11-17	24.7	30.5	+ 5.8	5.5	6.7	+1.2
18+	4.9	4.4	- .5	2.0	2.5	+ .5
Total	72.9	88.8	+15.9	32.0	27.5	-4.5

Table 2.--Number of trees per acre

Species	Poles 4.5" - 10.4" 1952	Poles 4.5" - 10.4" 1968	Sawtimber Small 10.5" - 17.4" 1952	Sawtimber Small 10.5" - 17.4" 1968	Sawtimber Large 17.5"+ 1952	Sawtimber Large 17.5"+ 1968	Total 1952	Total 1968
Hickory	6.4	10.7	2.8	2.5	0.7	0.1	9.9	13.3
White oak	12.8	20.9	4.2	6.9	0.7	0.6	17.7	28.4
Red oaks	19.6	16.9	15.5	18.3	3.4	3.6	38.5	38.8
Post oak	2.6	2.6	0.6	1.5	0.0	0.0	3.2	4.1
Misc.	1.9	2.8	1.5	1.3	0.1	0.1	3.5	4.2
Total	43.3	53.9	24.7	30.5	4.9	4.4	72.9	88.8

Table 3.--Basal area (sq. ft.) per acre

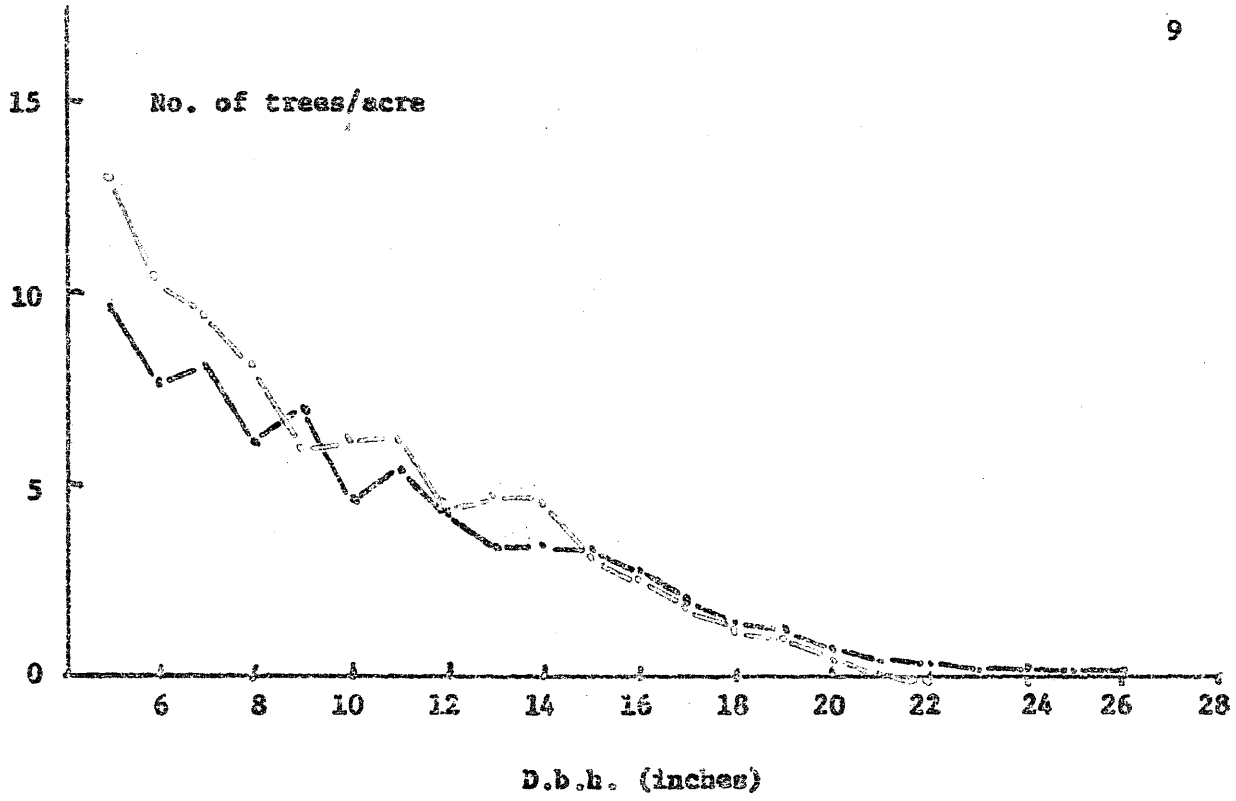
Species	Poles 4.5" - 10.4" 1952	Poles 4.5" - 10.4" 1968	Sawtimber Small 10.5" - 17.4" 1952	Sawtimber Small 10.5" - 17.4" 1968	Sawtimber Large 17.5"+ 1952	Sawtimber Large 17.5"+ 1968	Total 1952	Total 1968
Hickory	1.7	2.8	3.1	2.6	1.3	0.2	6.1	5.6
White oak	3.5	5.7	4.0	6.7	1.7	1.2	9.2	13.6
Red oaks	6.2	5.4	15.8	19.2	7.4	7.3	29.4	31.9
Post oak	0.8	0.8	0.6	1.4	0.0	0.0	1.4	2.2
Misc.	0.6	0.7	1.4	1.3	0.3	0.2	2.3	2.2
Total	12.3	15.5	24.9	31.1	10.7	8.8	48.4	55.4

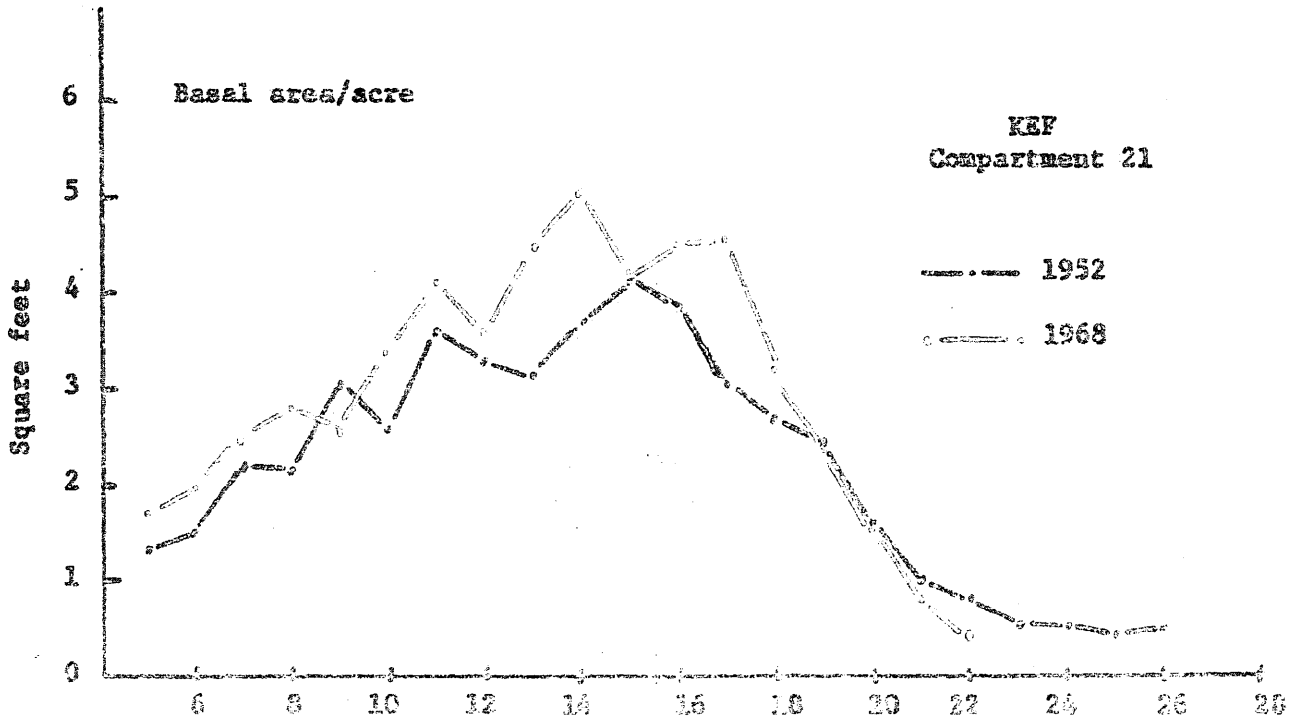
Table 4.--Merchantable volume (board feet/acre)

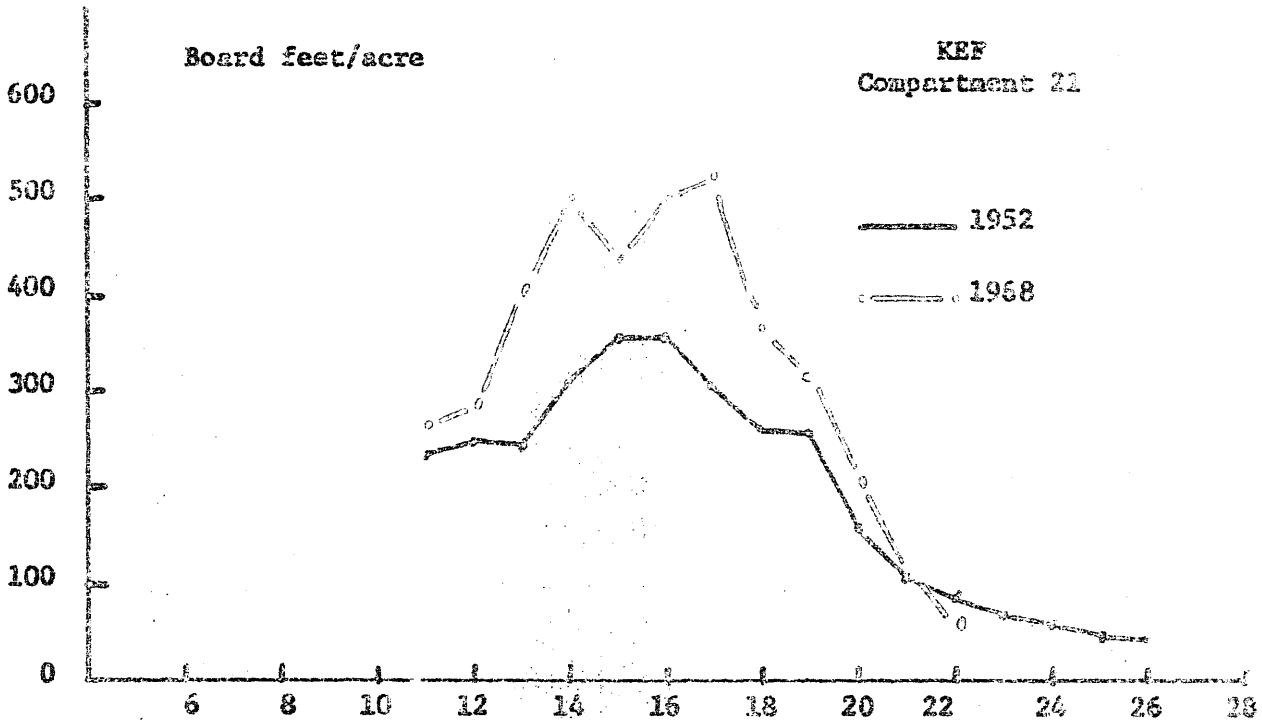
Species	1952	1968	Harvested
Hickory	380	242	221
White oak	443	686	184
Red oaks	2,153	2,867	1,361
Post oak	32	81	18
Misc.	158	162	55
Total	3,166	4,038	1,839

Table 5.--Distribution of number of trees, basal area, and volume by species (percent)

Species	No. trees 1952	No. trees 1968	Basal area 1952	Basal area 1968	Merchantable volume 1952	Merchantable volume 1968
Hickory	13	15	13	10	12	6
White oak	24	32	19	25	14	17
Red oaks	53	44	60	57	68	71
Post oak	5	4	3	4	1	2
Misc.	5	5	5	4	5	4


No. of trees/acre
15
10
5
0
6
8
10
12
14
16
18
20
22
24
26
28
D.b.h. (inches)


Basal area/acre
KEF
Compartment 21
1952
1968
Square feet
6
5
4
3
2
1
0
6
8
10
12
14
16
18
20
22
24
26
28


Board feet/acre
KEF
Compartment 21
1952
1968
600
500
400
300
200
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6
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22
24
26
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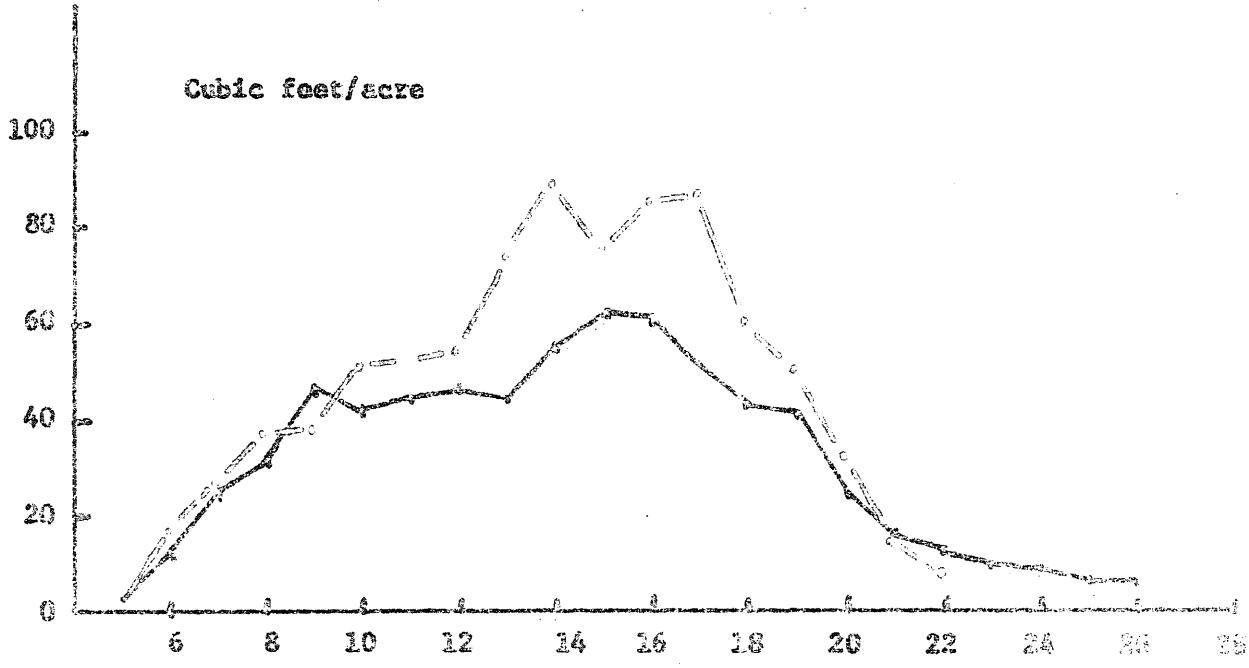

Cubic feet/acre
100
80
60
40
20
0
6
8
10
12
14
16
18
20
22
24

Compartment study--general information

Compartment number	Treatment code	Acreage	Total BF per acre	No. actual cuts	Total vol. cut/acre	Bd. ft. growth/ acre/year
MH 6	ULLI	19.7	5,120	2	1,947	189
29		23.5	3,280	1	1,317	174
34		17.7	7,620	2	3,063	178
5	ULSI	16.6	4,780	3	1,898	174
11		11.9	3,820	3	1,776	234
38		20.2	6,399	4	2,878	203
7	USLI	15.9	5,448	3	3,349	225
19		21.8	5,735	3	3,758	259
31		22.9	5,052	2	2,171	175
3	USSI	21.4	3,702	5	2,806	201
15		20.7	5,532	5	3,693	173
36		13.6	7,575	4	3,574	165
9	USSEx	10.3	4,568	5	2,801	166
23		14.2	6,364	5	5,375	302
27		31.5	4,561	5	3,591	251
OH 28	ULLI	16.0	2,390	1	921	104
13	ULSI	14.6	2,429	2	994	220
24		26.0	2,687	2	1,049	67
4	USLI	27.2	2,263	2	1,972	131
30		19.0	1,987	1	1,032	140
12	USSI	19.3	1,996	2	923	150
17		26.9	2,940	3	1,432	127
21	USSEx	29.4	3,166	3	1,839	53
33		13.5	4,520	2	1,467	174

Kaskaskia Experimental Forest

Location: Natural Area Size: 17.9 acres

Management system: Protection from fire, grazing, and cutting.

Silvicultural system: None

This old growth oak-hickory stand is located in the unglaciated hill country of southern Illinois. A majority of the trees are either over 160 years old or between 80-100 years old. The older trees show an abrupt increase in growth rate between 1880-1890, coinciding with the settlement of the hill country and the rapid expansion of the railway system. We assume that a major disturbance occurred about 1880, and that this disturbance was most likely a heavy cut for railroad ties. Since the purchase of the area in 1934 by the Forest Service, the stand has been protected from fire, grazing, and cutting.

Stand characteristics: (Data from eight 1/4-acre permanent plots)

Table 1.--Number of trees per acre

Species	Saplings 1.6" - 4.5"				Poles 4.6" - 10.4"			Sawtimber: Small 10.5" - 17.4"			Sawtimber: Large 17.5"+		
	1935 Stand	Ingrowth	Mortality	1973 Stand	1935 Stand	Mortality	1973 Stand	1935 Stand	Mortality	1973 Stand	1935 Stand	Mortality	1973 Stand
Red oak group	4.0	0.0	4.0	0.0	23.0	12.0	1.0	16.5	3.5	11.0	1.0	0.5	12.5
Yellow-poplar	1.0	0.5	1.0	0.5	4.0	1.0	1.0	1.0	0.0	1.5	3.5	0.0	5.0
White oak	27.0	1.5	20.5	5.5	11.0	2.5	7.5	5.0	1.0	4.0	2.0	0.0	5.5
Hard maple	53.5	110.0	28.0	111.5	8.0	0.0	28.5	1.0	0.0	4.5	0.0	0.0	0.0
Hickories	30.0	1.0	26.5	3.5	11.0	4.0	6.5	4.0	1.0	3.5	2.0	0.5	2.5
Misc. timber	27.5	79.5	49.0	55.5	12.0	6.5	7.5	5.5	2.0	3.0	1.0	0.0	2.0
Misc. non-timber	72.0	39.5	67.0	43.0	33.5	32.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0
Total	215.0	232.0	196.0	219.5	102.5	58.5	54.5	33.0	7.5	27.5	9.5	1.0	27.5

Table 2.--Total number of trees per acre

Species	Trees/acre				Percent survival1/	
	1935	1958	1973	Mortality	1935-1958	1935-1973
Red oak group	44.5	29.0	24.5	20.0	65	55
Yellow-poplar	9.5	7.5	8.0	2.0	79	79
White oak	45.0	26.5	22.5	24.0	58	49
Hard maple	62.5	136.0	144.5	28.0	90	74
Hickories	47.0	28.5	16.0	32.0	56	34
Non-timber	46.0	69.5	68.0	57.5	48	36
Misc. non-timber	105.5	51.0	45.5	99.5	18	11
Total	360.0	348.0	329.0	263.0	52	40

1/ Percent of trees present in 1935 and alive at end of period.

Table 3.--Average growth rates

Species	Average d.b.h.					Growth per tree per year				
	1935	1940	1958	1965	1973	1935-40	1940-58	1958-65	1965-73	Avg. 1935-73
Red oaks	11.2	12.3	16.0	17.0	18.2	.23	.19	.17	.13	.18
Yellow-poplar	17.0	17.6	20.3	21.3	22.6	.12	.14	.17	.14	.14
White oak	8.3	8.7	10.5	10.9	11.5	.10	.09	.07	.07	.08
Hard maple	3.3	3.6	5.0	5.3	5.9	.07	.07	.05	.07	.07
Hickory	8.1	8.4	9.5	9.8	10.2	.05	.06	.04	.05	.05
Black gum	8.0	8.2	8.7	8.9	9.1	.03	.03	.03	.02	.03
Dogwood	2.7	2.9	3.5	3.5	3.7	.04	.03	.01	.02	.02

Table 4.--Basal area distribution of stand

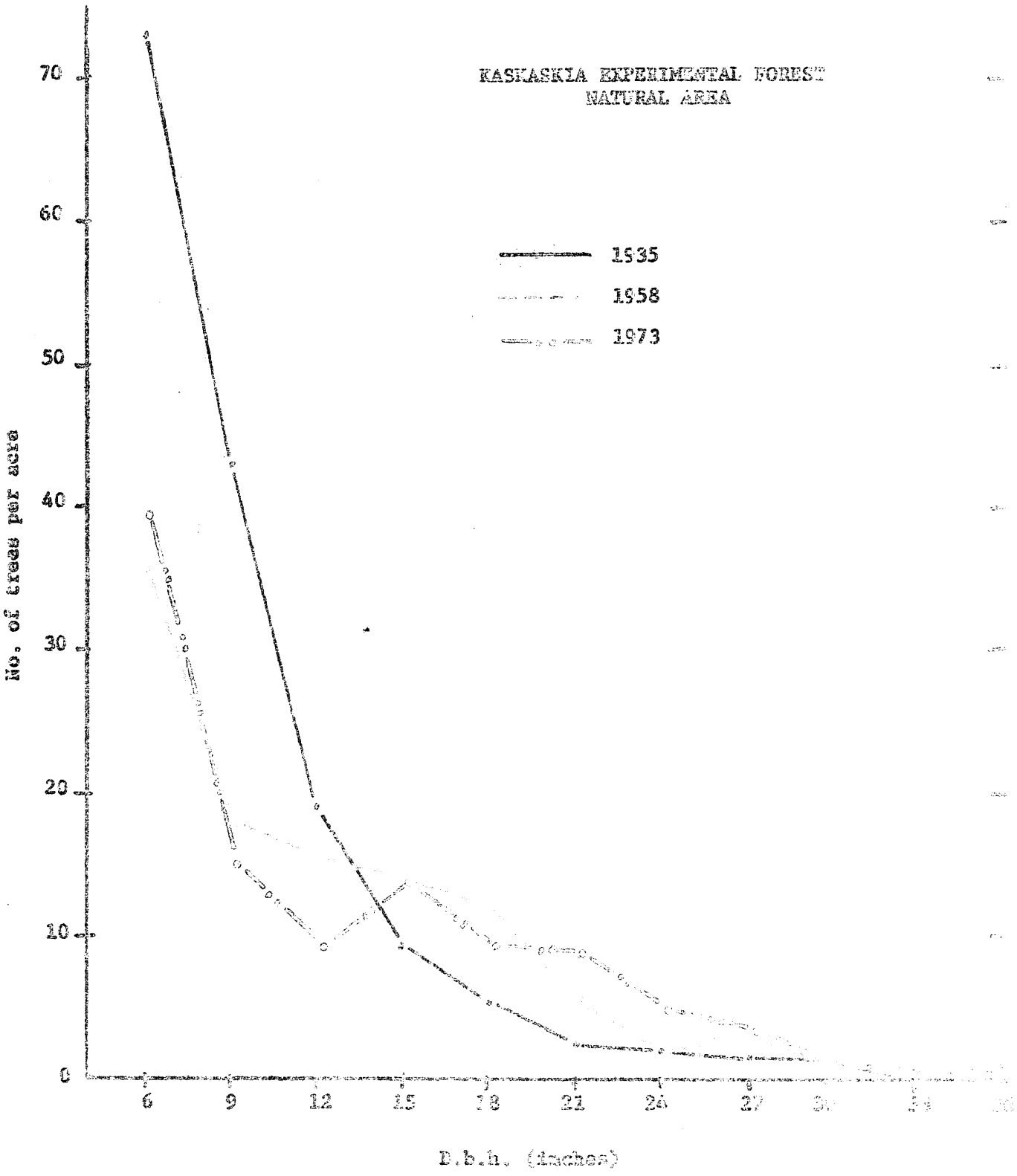
D.b.h. class	Square feet			Percent of total		
	1935	1958	1973	1935	1958	1973
1.6 - 4.5	9.2	8.6	9.2	9.3	7.0	6.7
4.6 - 10.4	27.5	17.2	14.9	27.8	14.0	10.8
10.5 - 17.4	36.7	50.4	42.9	37.2	40.9	31.3
17.5+	25.4	46.9	70.2	25.7	38.1	51.2
Total	98.8	123.1	137.2	100.0	100.0	100.0

Table 5.--Board-foot [illegible] of trees

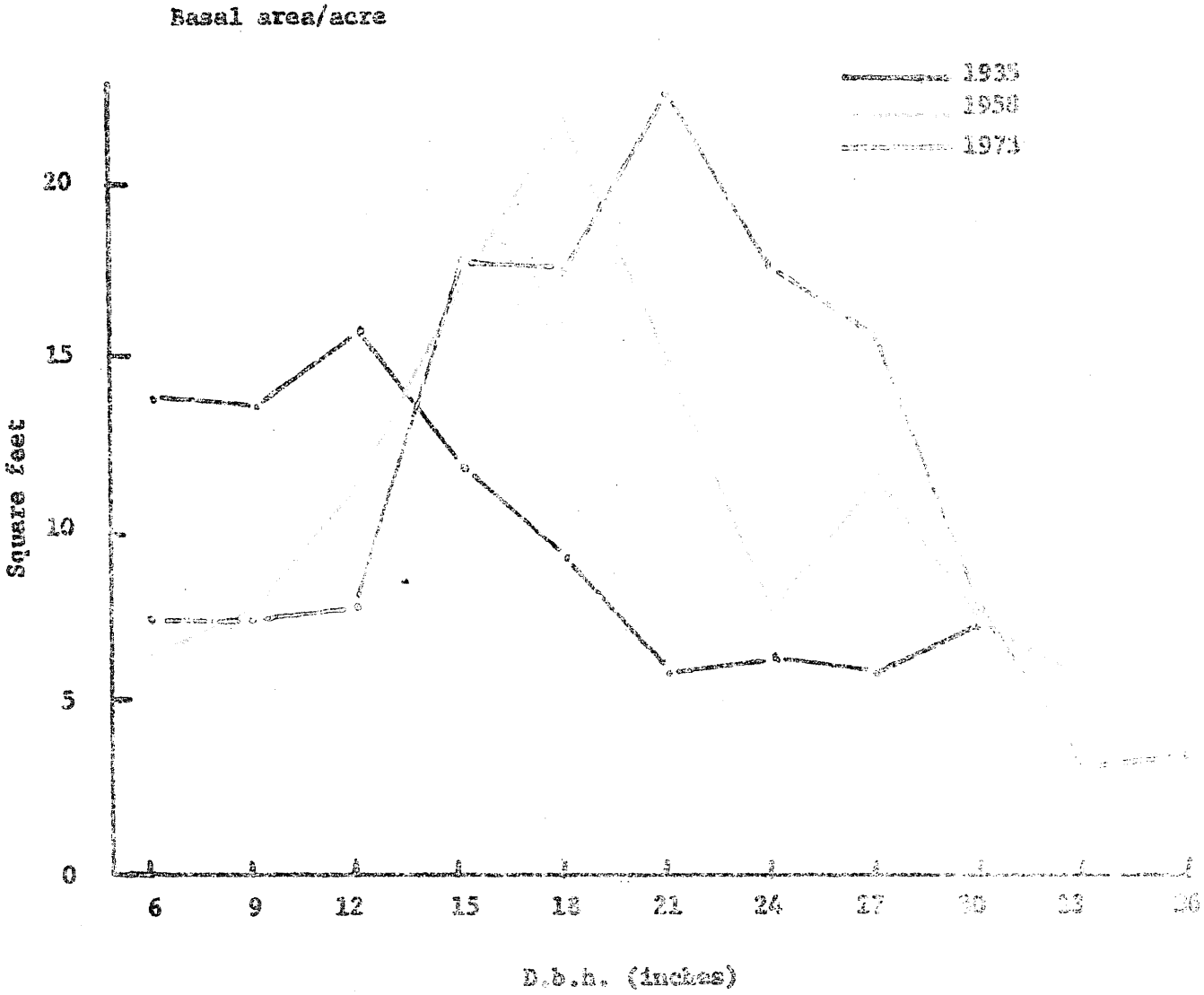
D.b.h.	Board-foot volume			Percent of total		
	1935	1958	1973	1935	1958	1973
12	1,584	1,237	744	19.5	9.1	4.6
15	1,468	2,100	2,173	18.0	15.4	13.4
18	1,221	2,931	2,355	15.0	21.5	14.5
21	855	2,241	3,348	10.5	16.5	20.6
24	949	1,155	2,748	11.7	8.5	16.9
27	974	1,848	2,612	12.0	13.6	16.1
30	1,082	1,117	987	13.3	8.2	6.1
33		973	573		7.2	3.6
36			680			4.2
Total	8,133	13,602	16,220	100.0	100.0	100.0

Table 6.--Distribution and age of seedlings

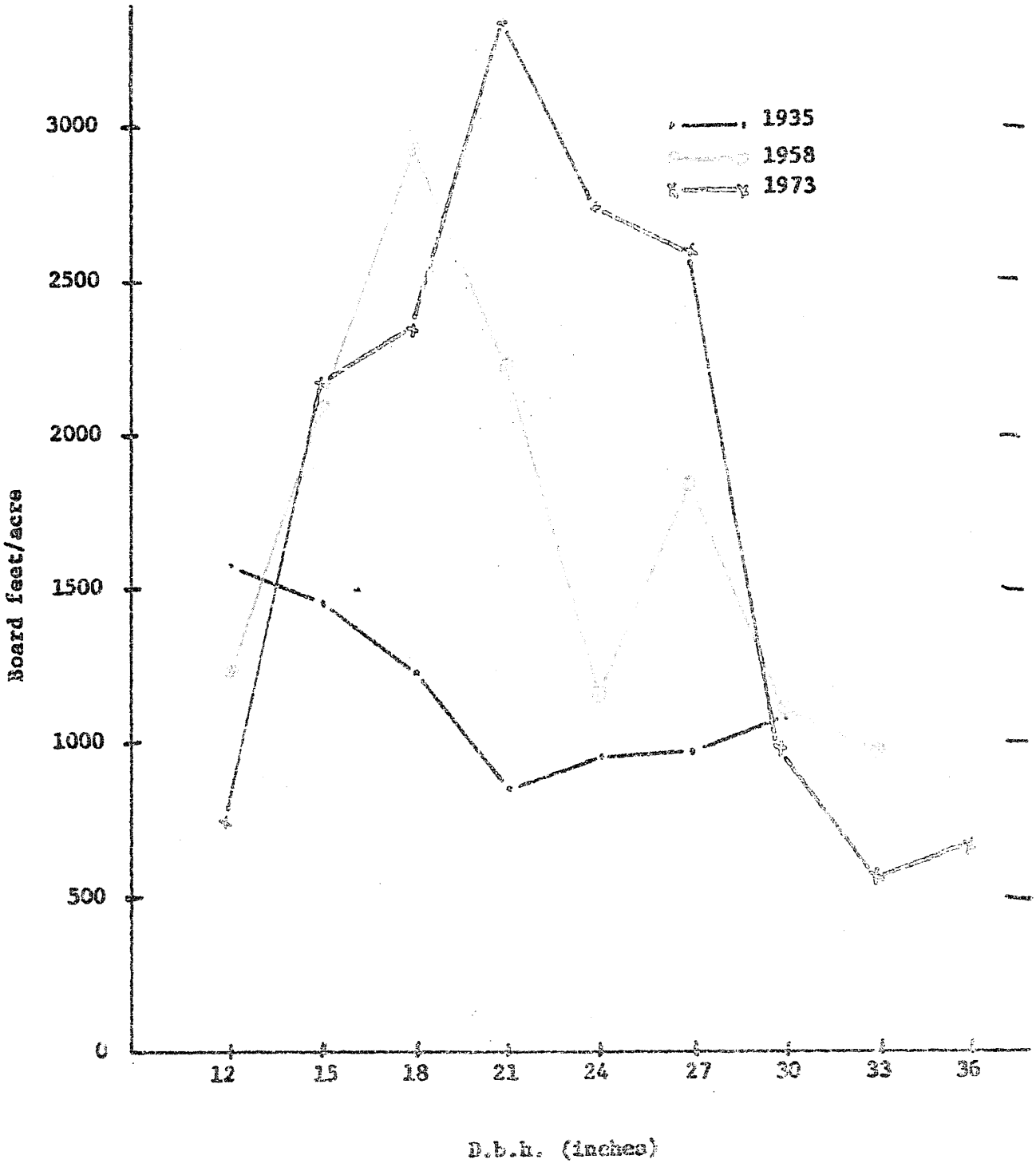
Species	Number Seedlings Present 1973	Number new seedlings 1973	No. seedlings older than 10 years	No. seedlings becoming saplings between 1935 and 1973
Hard maple	680	230	450	90
Ash spp.	680	270	410	0
Elm spp.	2,860	2,590	270	0
Hickory	360	140	230	0
Ironwood	90	0	90	90
White oak	90	0	90	0
Red oak	90	45	45	0
Dogwood	270	230	45	0
Yellow-poplar	230	230	0	0
Beech	0	0	0	45
Misc. timber	450	410	45	0
Misc. non-timber	1,000	910	90	0


KASKASKIA EXPERIMENTAL FOREST
NATURAL AREA
1935
1958
1973
No. of trees per acre
70
60
50
40
30
20
10
0
6
9
12
15
18
21
24
27
D.b.h. (inches)

KEF
Natural Area



KEF
Natural Area



Stop #4

Kaskaskia Experimental Forest

Location: Good Farm Woodlot Demonstration Size: 23.7 acres

Management system: Uneven-aged, 3-year cutting cycle, 130 year rotation (25" d.b.h.).

Silvicultural system: Single tree selection, cull removal.

Management of this stand was initiated in 1949. The area was divided into 3 compartments, and each compartment inventoried and cut in successive years. By 1957, the over-mature, poor risk, and low-quality timber had been removed, and harvesting was suspended until 1962. The last cut was made in 1968. During the period 1949-1968, a total of 17 harvests were made and 3,010 board feet/acre (1/4" International Rule) removed. An average of 81 cull trees per acre were killed. Volume growth has averaged 225 board feet/acre/year.

Stand characteristics: (Based on 100% inventories of trees 4.5" d.b.h. and larger, and on 120 milacre sample plots of trees less than 4.5" d.b.h.)

Table 1.--Changes in stand parameters

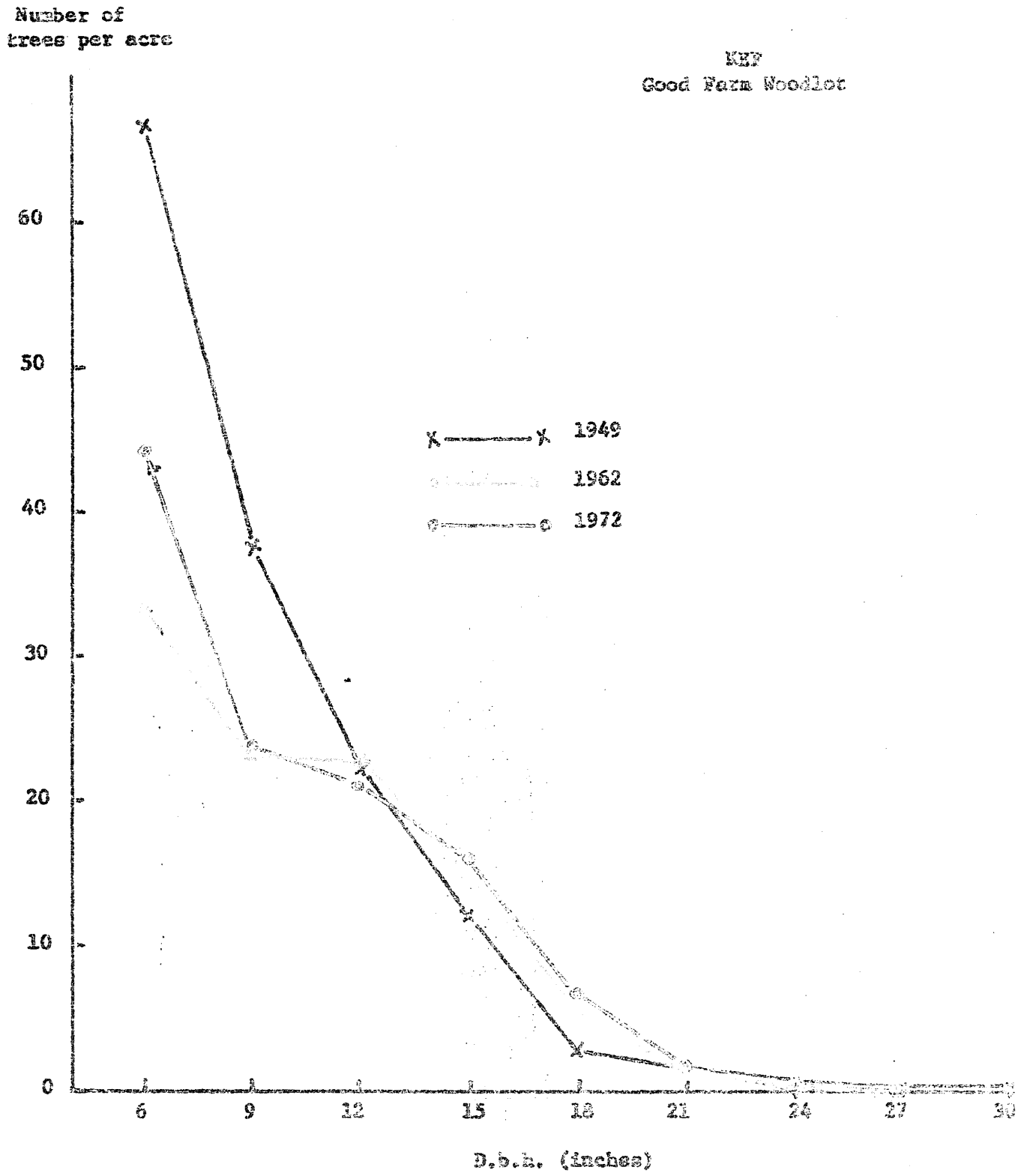
Year	Stand prior to	No. trees per acre	Basal area per acre	Average d.b.h.	Average volume harvested	Average bd.ft./acre
1949	1st cut	144.3	73.2	9.5	520	4,100
1952	2nd cut	134.3	71.9	9.9	520	4,110
1955	3rd cut	115.6	65.7	10.2	440	4,290
1961	4th cut	114.1	70.8	10.7	500	5,180
1964	5th cut	99.9	63.6	10.8	590	4,770
1967	6th cut	91.7	61.6	11.1	440	5,190
1972	Inventory only	114.5	71.9	10.3	-	6,360

Table 2.--Species composition

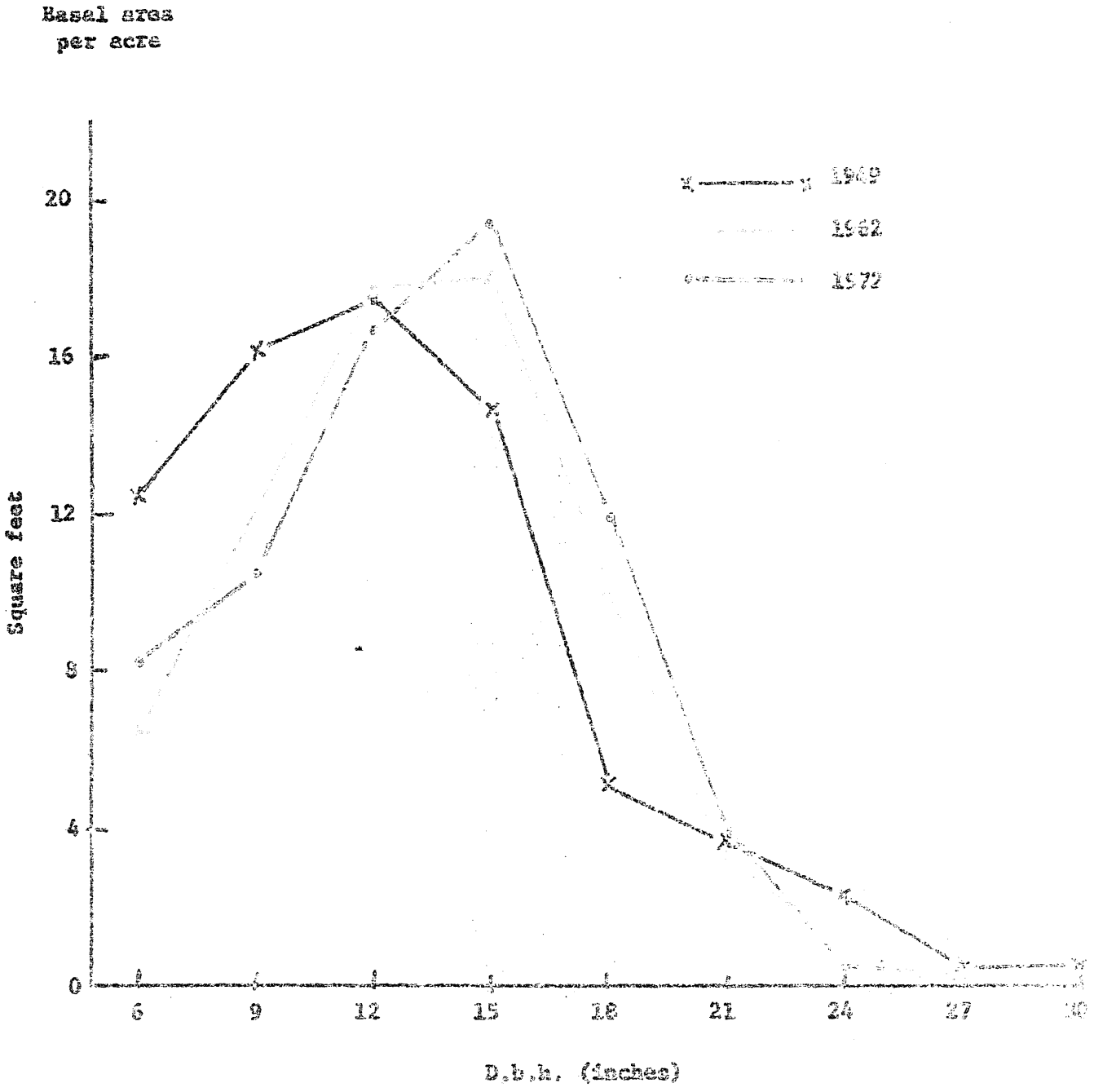
Species	No. of trees 1949	No. of trees 1972	Basal area 1949	Basal area 1972	Bd.ft. volume 1949	Bd.ft. volume 1972
Hickory	16.1	14.3	7.9	5.8	520	340
White oak	60.5	55.4	24.6	35.2	930	2,840
Red oaks	35.0	17.9	25.3	18.9	1,780	2,240
Yellow-poplar	1.2	2.2	1.2	2.0	140	260
Misc.	31.4	24.7	14.1	10.0	730	680
Total	144.3	114.5	73.2	71.9	4,100	6,360

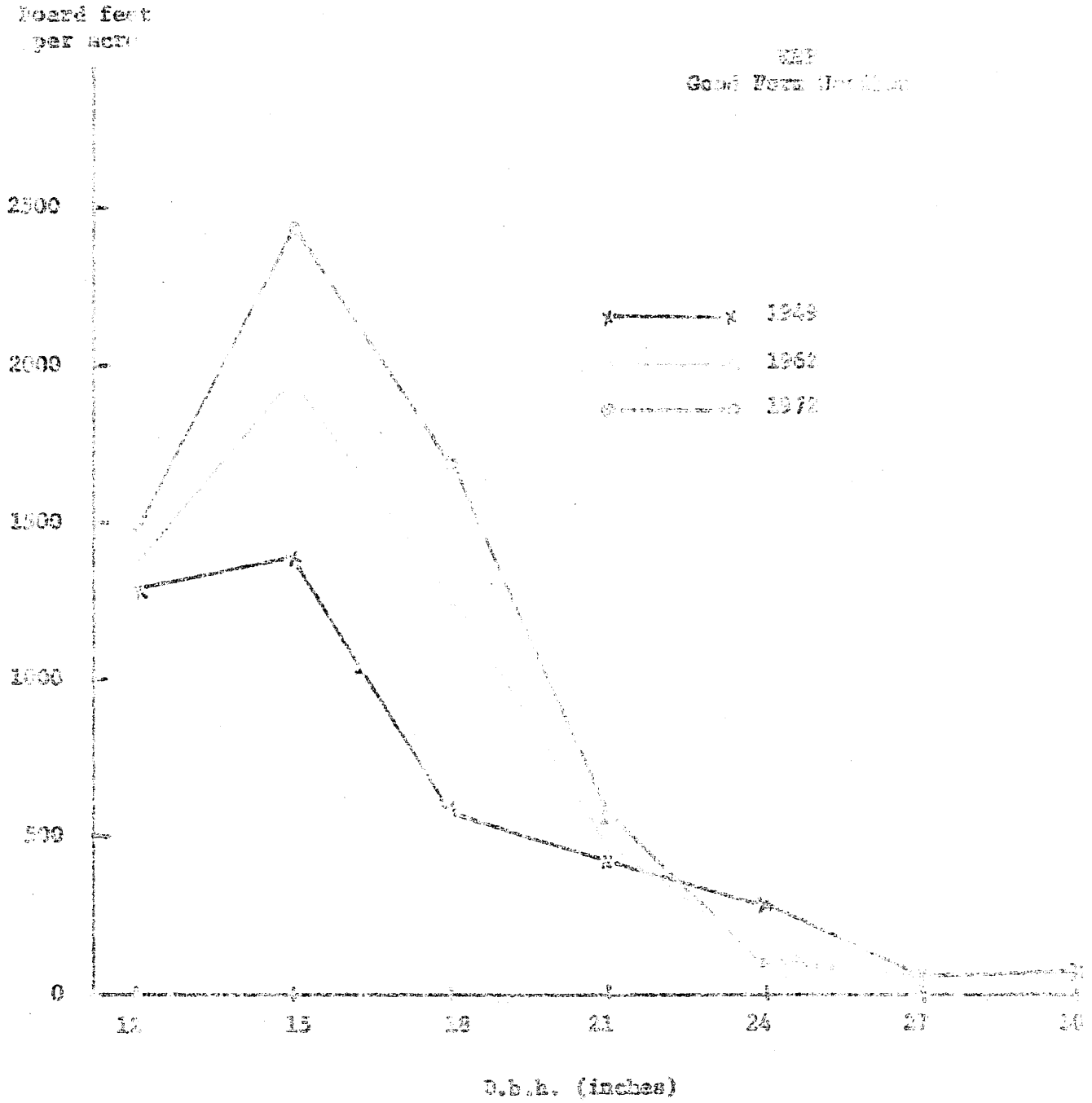
Table 3.--Reproduction

Species	Seedlings		Saplings		Total of all sizes	
	1957	1972	1957	1972	1957	1972
Hickory	1,100	540	100	10	1,200	550
White oak	700	320	100	20	800	340
Red oaks	800	290	-	-	800	290
Yellow-poplar	200	190	-	-	200	190
Misc. timber	4,200	2,530	100	70	4,300	2,600
Non-timber	1,700	1,810	-	30	1,700	1,840
Total	8.700	5,680	300	130	9,000	5,810


Number of trees per acre
KEY
Good Farm Woodlot
1949
1962
1972
60
50
40
30
20
10
0
6
9
12
15
18
21
24
27
30
D.b.h. (inches)

KEF
Good Farm Woodlot




Board feet
per acre
2500
2000
1500
1000
500
0
15
18
21
24
27
D.b.h. (inches)