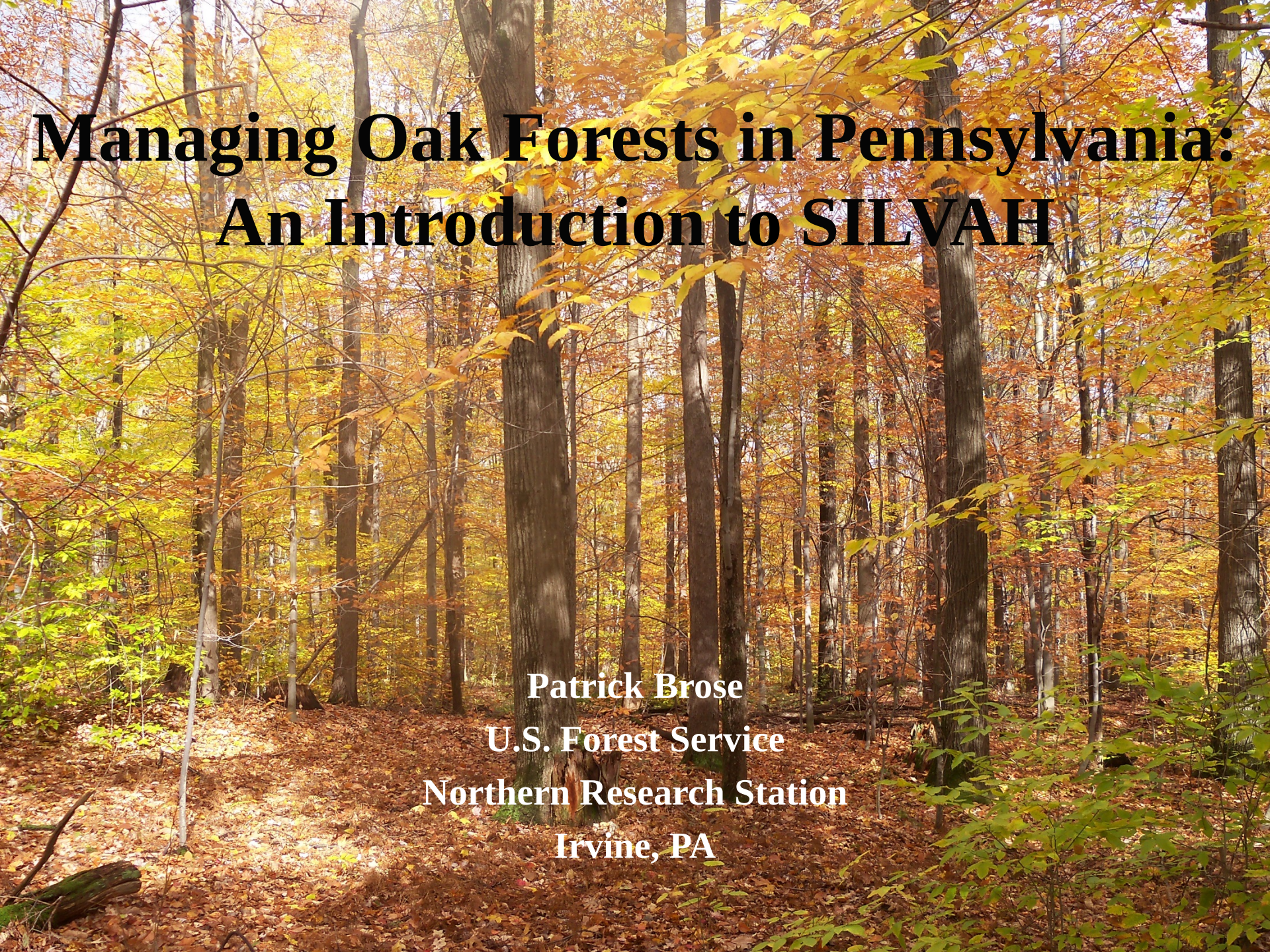
Managing Oak Forests in Pennsylvania: An Introduction to SILVAH



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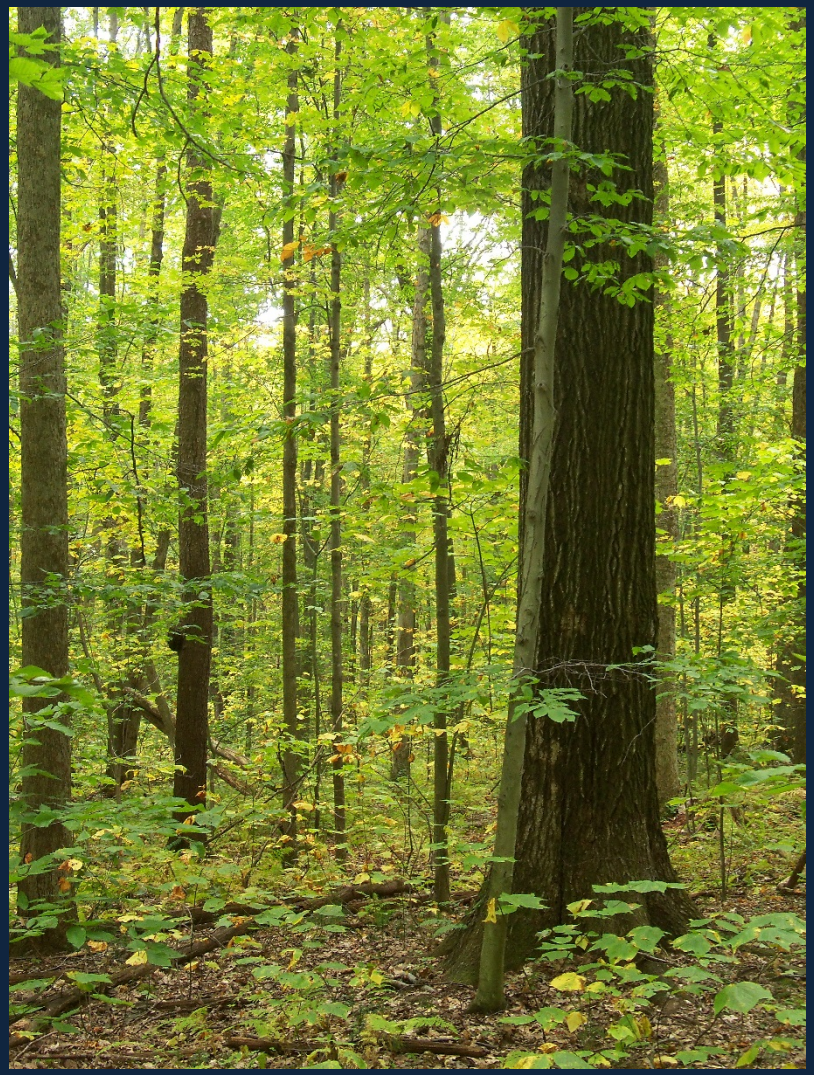
Pennsylvania's Forests

- PA has about 17 million acres of forest.
- 5 million acres (29%) owned by various agencies & forest industry. These are generally well managed.
- 12 million acres (71%) is in private ownership.
- ~ 250,000 owners.
- Average length of ownership is 7 years.
- Average size is 20 acres and trending downward.
- These forests tend to be unmanaged and/or exploited.

Pennsylvania's Oak Forests

- **Northern red oak stands growing on old white pine sites. Stands may be nearly pure NRO or just have a few super-dominant NRO.**
- **Most common in northern PA.**
- **Deep loamy soils on level terrain. Highly productive sites (oak SI_{50} > 75 feet).**



Pennsylvania's Oak Forests

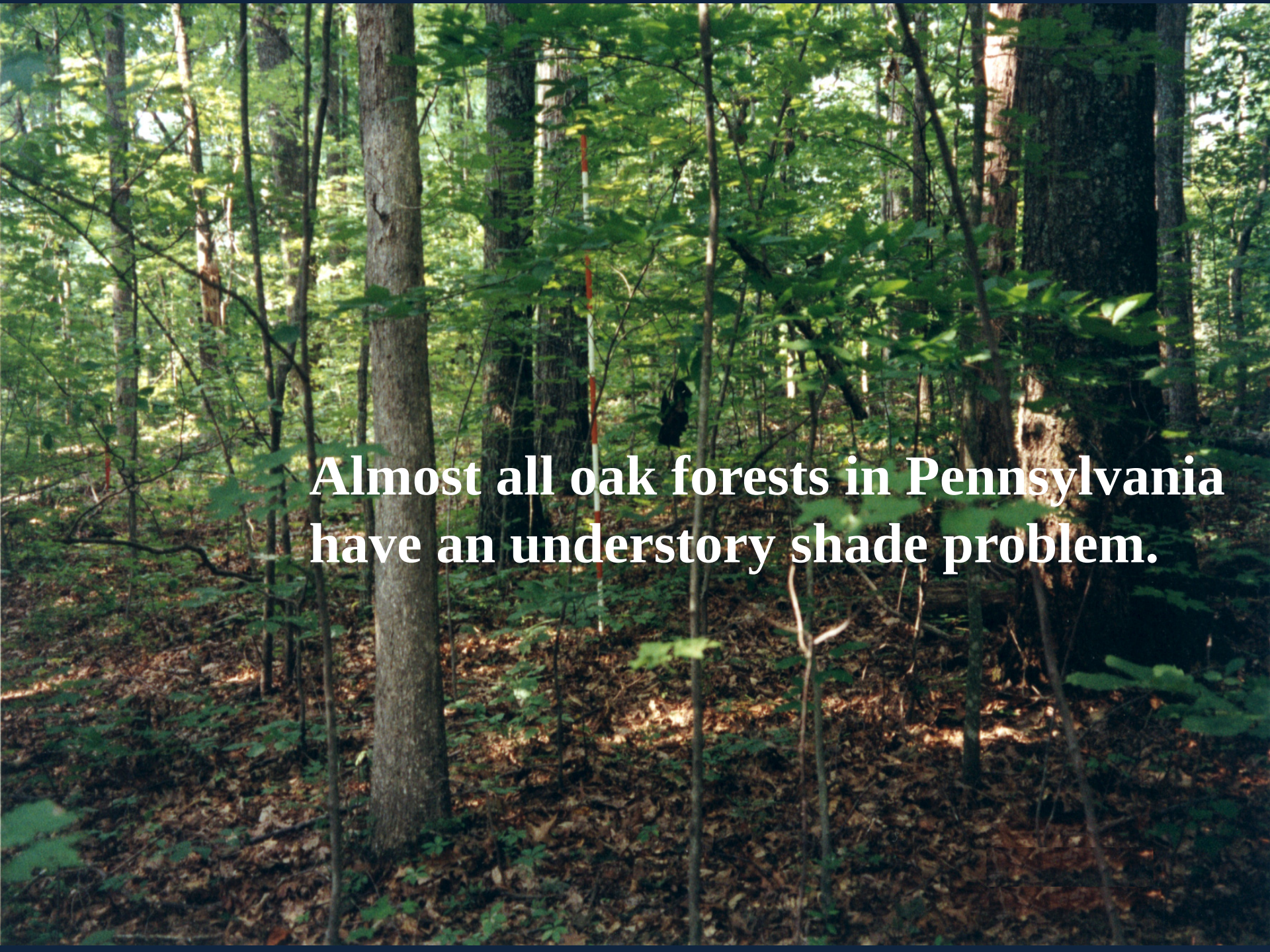
- **Mixed oak forests.**
- **Generally dominated by white and black oak, but numerous other species present.**
- **Found throughout PA on intermediate sites with loam soils.**
- **Moderate productivity (oak SI_{50} ~ 65 feet).**

Pennsylvania's Oak Forests

- **Chestnut oak forests with heath understories.**
- **These were American chestnut stands.**
- **Found on dry ridges and upper slopes. Thin rocky soils.**
- **Low productivity (oak SI_{50} ~ 55 ft.**

Current Conditions of PA's Oak Forests


Fire is no longer an important ecological disturbance


Almost all oak forests in Pennsylvania
have an understory shade problem.

New Threats to Pennsylvania's Oak Forests

Reintroduction & mismanagement of white-tailed deer.

Introduction of exotic pests.

Expansion of interfering vegetation.

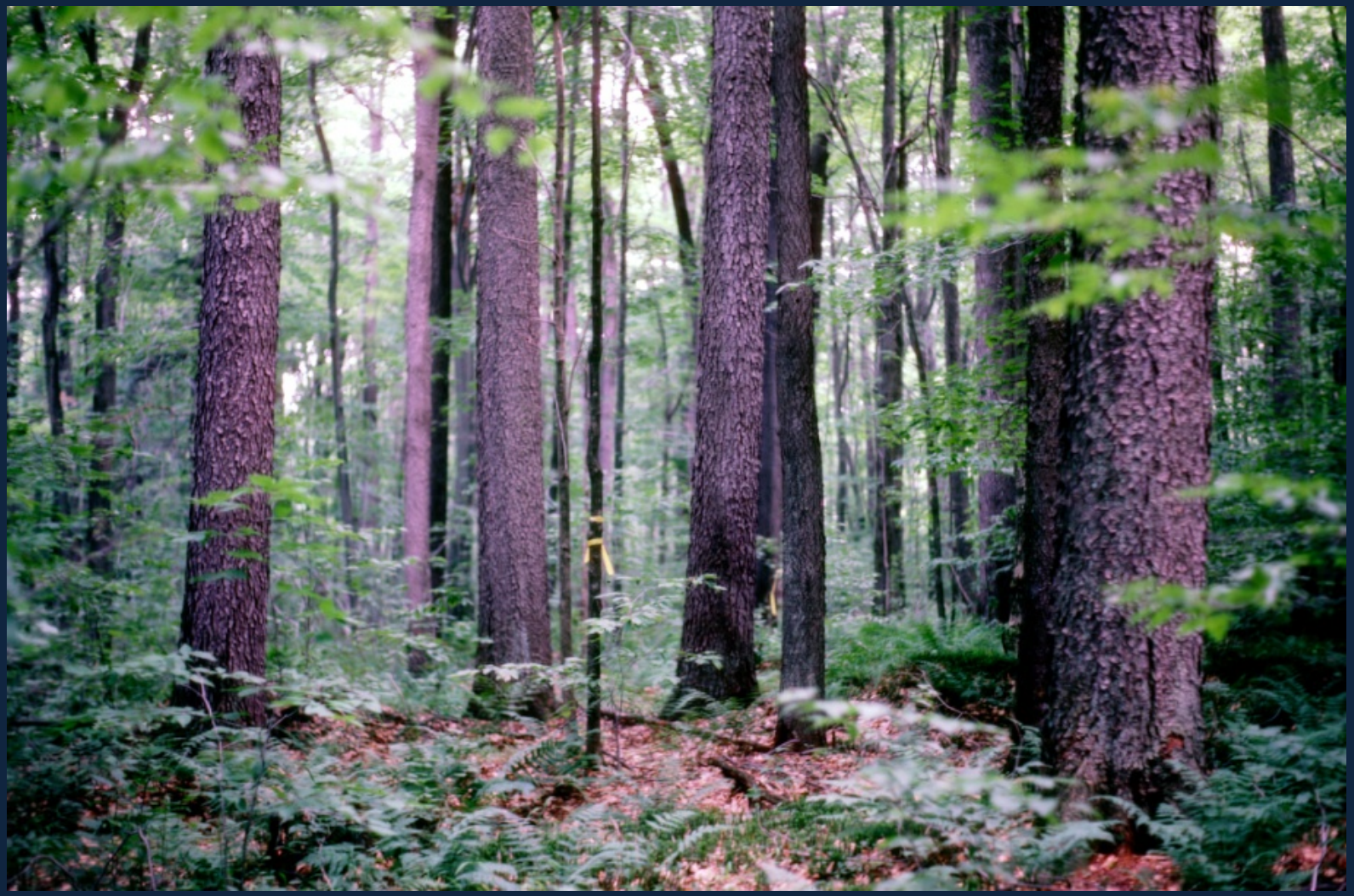
Given the current conditions – How do we sustain and restore the oak forests?


Use SILVAH to grow oaks

What is SILVAH?

- An acronym for **Silv**iculture of **A**llegheny **H**ardwoods.
- A computerized decision-support system containing a series of dichotomous decision charts.
- Uses inventory data to navigate through the charts to a recommended prescription.
- How did it originate?

SILVAH started in northern PA about 50 years ago



Origins of SILVAH

- **In the 1960s, hardwood forestry switched from uneven to even-aged management. In nearly all places, this was a resounding success.**

- **However, northern PA was an exception. There, 50% of all timber harvests failed to create a new forest.**

Origins of SILVAH

- **Forest industry, forest management agencies, and forest landowners banded together and advocated for increased silviculture research by the Forest Service R&D.**

- **This led to Dave Marquis coming to the Warren Forestry Lab to oversee research into why even-aged silviculture was failing.**

Origins of SILVAH

- Dave organized a research team and within a few years they had identified the obstacles to forest regeneration and the key indicator of likely forest regeneration success.

- Obstacles = deer, interfering vegetation, and overstory shade.

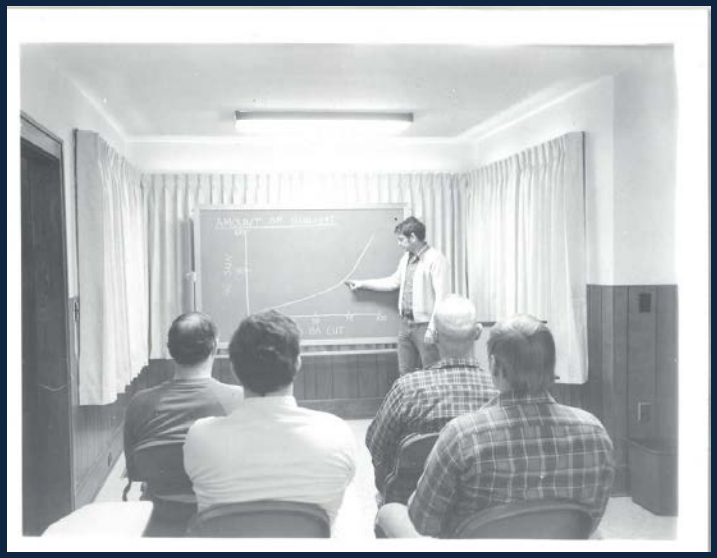
- Key indicator = presence of advanced seedlings.

Origins of SILVAH

- By the late 1970s, enough research results had accumulated for the making of management guidelines.
- The lab began holding 1-week training sessions at the Kane Expt. Forest.
- The sessions consisted of indoor lectures, outdoor exercises, and field trips.

Origins of SILVAH

- Initial classroom work required all calculations to be done by hand.
- One of the instructors, Rich Ernst, programmed a handheld calculator with the equations so the instructors could stay ahead of the students and quickly check their work.
- Those programmable equations evolved into the current SILVAH software.

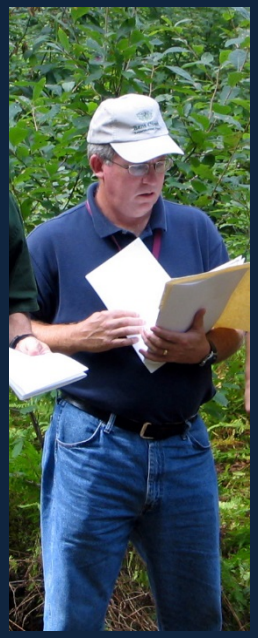


Origins of SILVAH

- **The original SILVAH focused on Allegheny hardwood and northern hardwood forests.**

- **In 2000, The PA Bureau of Forestry pushed for increased SILVAH research to make it more applicable to oak forests.**

- **The Warren Lab partnered with the Morgantown WV Lab to undertake this major revision.**



Origins of SILVAH

- **Interim guidelines were quickly formulated from the oak scientific literature and expert input from field foresters.**

- **Training sessions began in 2002.**

- **The SILVAH program went through several updates. It is now version 7.0.**

Success of SILVAH

- Since the late 1970s, more than 1400 foresters have taken Allegheny Hardwood session. More than 800 foresters have taken the oak session in the past 13 years.
- In northern PA, the forest regeneration success rate has risen from 50% to 90%.
- Land management agencies in at least 6 eastern states have adopted part or all of the SILVAH system.

How Does SILVAH Work?

- **SILVAH consists of three major parts.**
  - **An inventory of overstory and understory conditions.**
  - **Analysis of the inventory data.**
  - **Using the results of the data analysis to navigate the decision charts to a recommended prescription.**

- **Considered to be a supplement to, not a substitute for, a forester's professional judgement.**

What Does The Inventory Include?

- Species mix of the reproduction

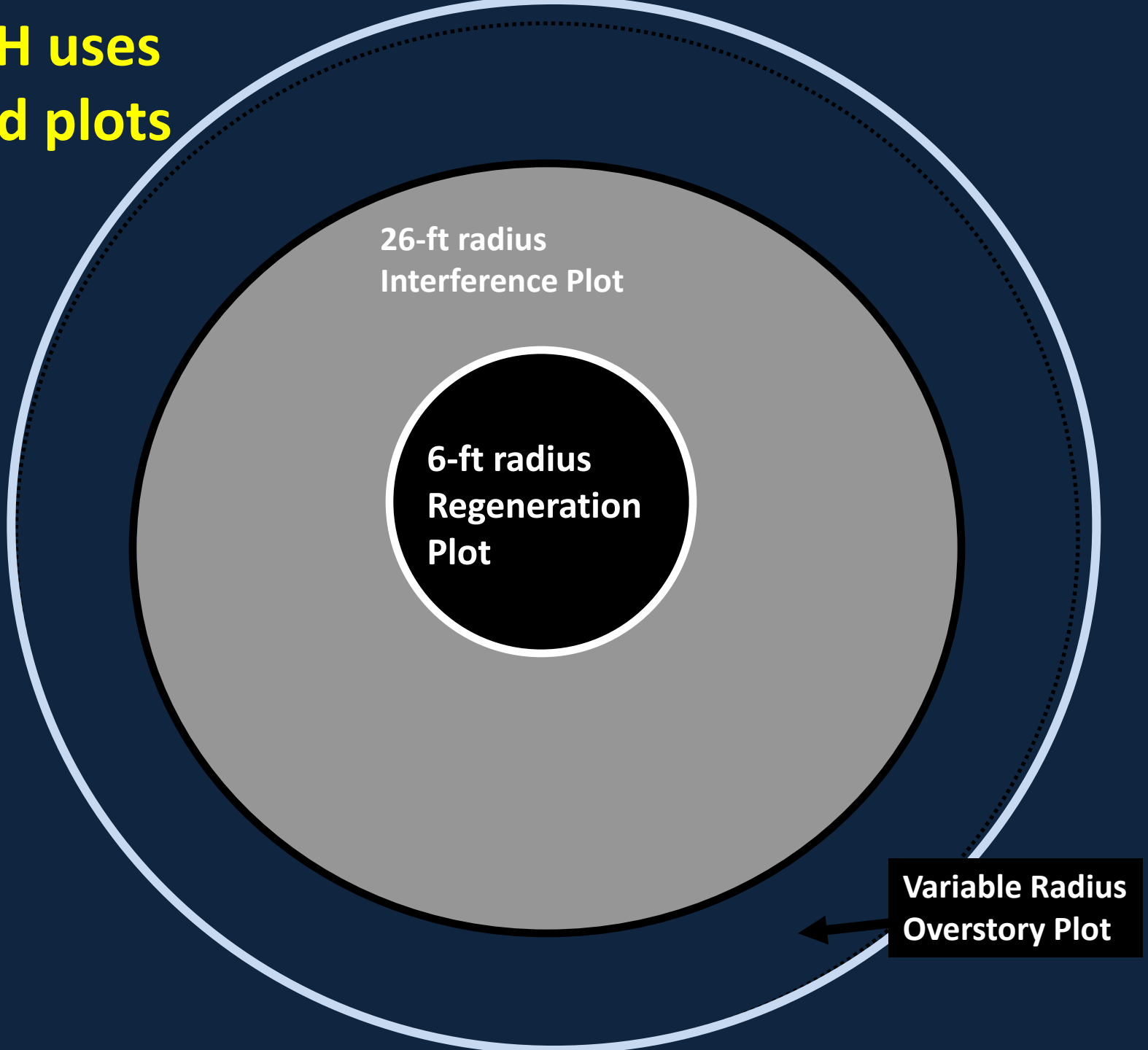
- Number of stems
- Competitive status

- Interfering plants
- Site limitations

- Spatial distribution

- Deer impact
- Site quality
- Overstory metrics (basal area, trees per acre, stocking, gross & net volumes/value)

SILVAH uses nested plots



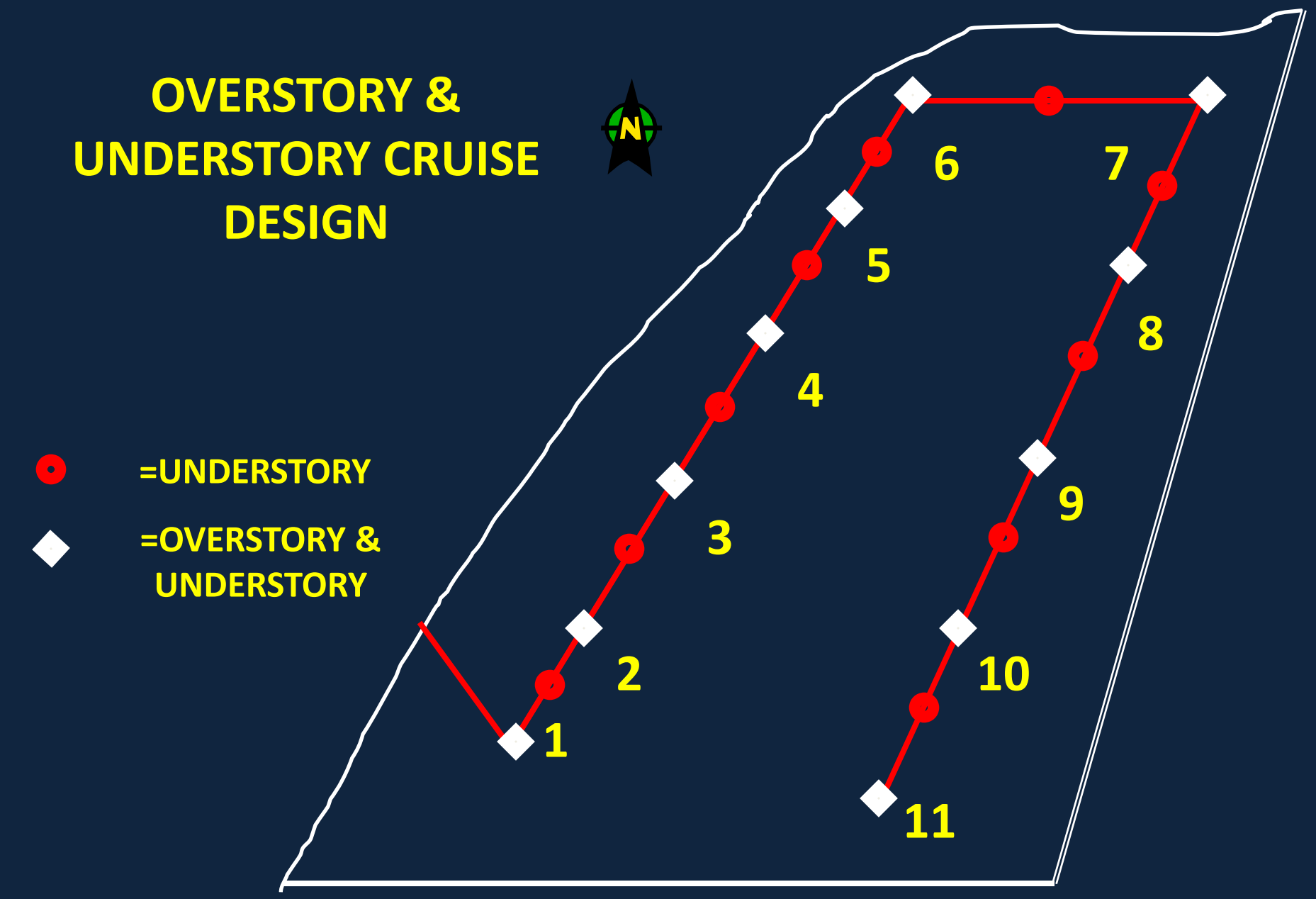
How Many Plots?

- Stands >10 acres – 20 regeneration & interference plots + 2 additional such plots for each additional 5 acres.

- Generally, half as many overstory plots as regeneration plots.

- Stands < 10 acres – 2 regeneration & interference plots per acre.

OVERSTORY & UNDERSTORY CRUISE DESIGN



- Collecting overstory and understory data is a hassle.
-
- Synthesizing the data into a coherent format is tough.
-
- Both are essential for good forest management.

- So how does SILVAH approach data collection and synthesis?

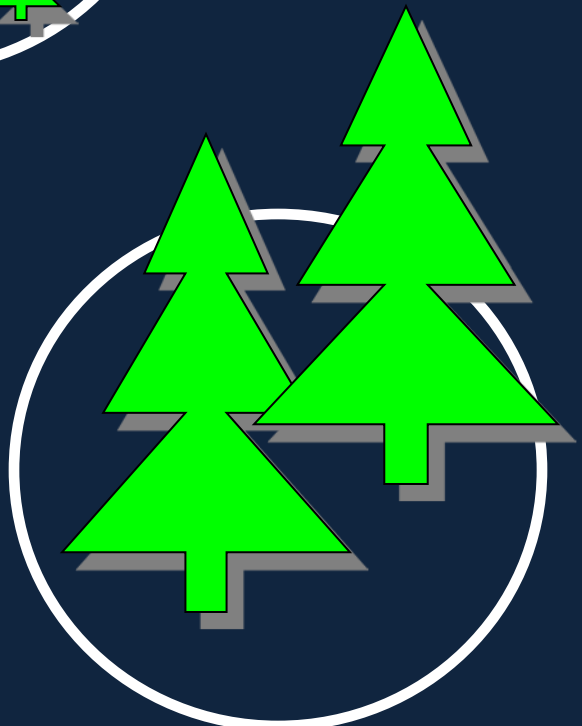
SILVAH uses the "Stocked Plot" approach to collecting and synthesizing inventory data

- For seedlings, SILVAH combines the key reproduction variables of density and height.
- Stem counts are weighted by size, i.e., a tall seedling is counted as multiple small seedlings.
- For each species there are minimum sizes and numbers/plot.
- A plot is considered stocked or not stocked based on the weighted number of seedlings.
- Stocked plot = desirable reproduction will likely occupy that spot in a new stand.
- The proportion of stocked plots in a stand helps determine the appropriate silvicultural treatment.

All These Are Stocked Plots

25 Small Seedlings

10 Large Seedlings



2 Saplings

1 Pole

Mixed Oak — Understory Inventory

Identification Data
Owner
Forest Name
County
Compartment
Stand Area
Year of Origin
Deer Impact unknown very high high mod. low very low

Site Index	
Site Index Species	
Site Class	
Restrictions on Silvicultural System? None No clearcut No even-aged No multi-tree gaps	
Prescription Chart? No./Allegheny Hdwd. Mixed Oak	
Start Regenerating? Yes Yes, if stand is mature No	
Increase Oak? Yes No	Residuals Desired? Yes No

Comments:

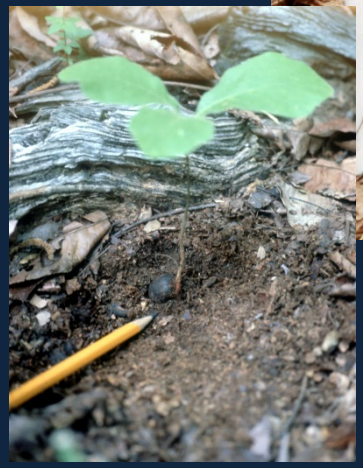
USDA Forest Service, NRS, Warren, PA

Regeneration & Interference

	Plot Number										
6 ft. plot	Competitive Oak (#)										
	Established oak (#)										
	New oak (#)										
	Black cherry (#)										
	Conifers (#)										
	Yellow-poplar (#)										
	Other desirable (#)										
	Saplings (spp. code)										
	Residuals (spp. code)										
	Tall Woody Interf. (spp. code)										
26 ft. plot	Low Woody Cover (%)										
	Low Woody Interference (spp. code)										
	Fern Cover (%)										
	Grass/Sedge Cover (%)										
	Grapevine (#)										
	Site Limitations (1-3)										
	Deer Impact (1-5)										
	NNIS (spp. code)										

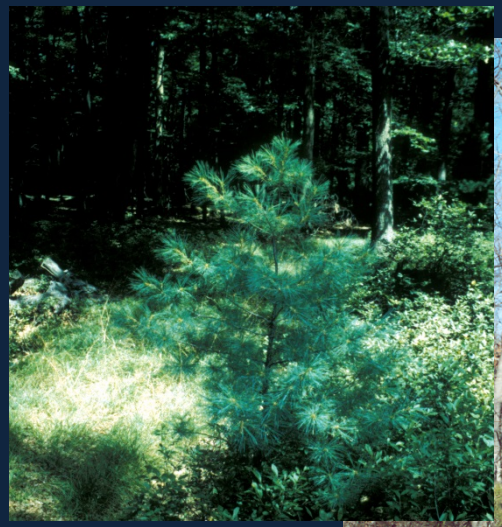
Overview of Seedling Inventory Procedures

- Done on the 6-foot plot.
- All oaks are tallied together using 3 size classes.
  - <6 inches tall
  - 6 inches to 3 feet tall
  - > 3 feet tall
- Hickory and walnut are also tallied using these size classes.



Overview of Seedling Inventory Procedures

- All conifers are tallied together (eastern white pine, hemlock, spruce, and the yellow pines).
- Must be at least 6 inches tall to be counted.
- Conifer seedlings more than 1 foot tall count double.



Overview of Seedling Inventory Procedures

- The size criteria for other hardwoods are in the process of being revised.
- Until recently, desirables such as black cherry, cucumber tree, red maple, sugar maple, and yellow-poplar only needed to be 2 inches tall to be counted. Those > 1' tall were counted twice.
- Now, preliminary results from ongoing research suggest that the minimum size needs to be at least 1 foot.

Overview of Seedling Inventory Procedures

- Seedlings of undesirable tree species are the last thing tallied on the regeneration plot.

- In PA, undesirables include American beech, black birch, black gum, pin cherry, and striped maple.

- Depending on location, black cherry and red maple may also be considered undesirable.

Overview of Interference Inventory Procedures

- Interfering herbaceous plants such as ferns and grasses and interfering shrubs such as mountain laurel have their cover estimated on the 26’ plot.

Overview of Overstory Inventory Procedures

- A 10-factor prism is used to determine which of the surrounding trees are in the plot.
- “In” trees are identified to species, measured for DBH, and rated on quality (AGS or UGS).
- Can collect more detailed overstory data if desired.

Stand-Level Data

- Collected intermittently throughout the stand.
- Deer Impact and Site Quality.
- Deer Impact rated on a 1 to 5 scale with 1 = no deer problem and 5 = extreme deer problem.
- Site Quality is oak site index or how many sawlogs (1, 2, >2) in the dominant trees.

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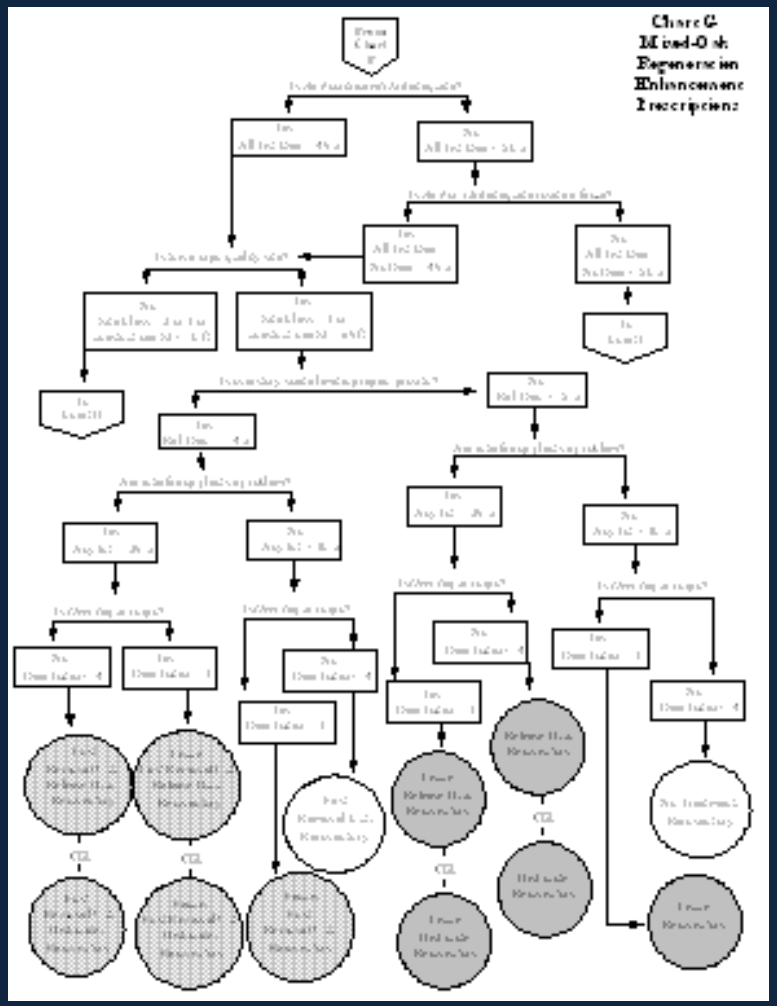
After the Inventory

Data Entry



Determining a Prescription

QUESTIONS ?