

BOTTOMLAND HARDWOOD MANAGEMENT FOR WILDLIFE

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AGRICULTURE, COOPERATIVE EXTENSION SERVICE

VIC FORD CONSERVATION CONSULTING



PEDIGREE

- Mycologist (minor at Virginia Tech)
- Certification Programs (SFI, FSC)
- Creation of Westvaco Wildlife Management Area in Western KY
 - Doug Travis WMA
- Steering Committee Chair – MeadWestvaco Wildlife and Ecosystem Forest
 - 28 Thesis projects
 - 90 Citations
- Referred Articles On Songbird In Pine Plantations, Salamander Habitat In Appalachian Mountains, And Herbicide Effects On Wildlife Forage Plants.

OBJECTIVE

- To Be Able To Evaluate Bottomland Hardwood Stands For Wildlife Habitat.
- To Better Understand The Synergy Between Wildlife Habitat And Good Forest Management.
- To Understand The Practice, The Science, And The Art Of Silviculture.
- To Understand That Bottomland Hardwood Stands Are a Dynamic System.
- To Know When Active Management Is Needed.

YOU WILL NOT BE

- Foresters
 - In Arkansas, you must be a Registered Forester to assist landowners with timber management, timber harvest, and timber sales.
 - Real Estate Example
- Silviculturalist.



SILVICULTURE

Silviculture is the art and science of managing forests to meet specific needs and values, focusing on controlling the establishment, growth, composition, and quality of forest vegetation for sustainable resource management.

Values: Timber, Habitat, Water, Recreation, Grazing, Non-traditional Products (Mushrooms, Syrup, Nuts, Medicinal Plants, etc)

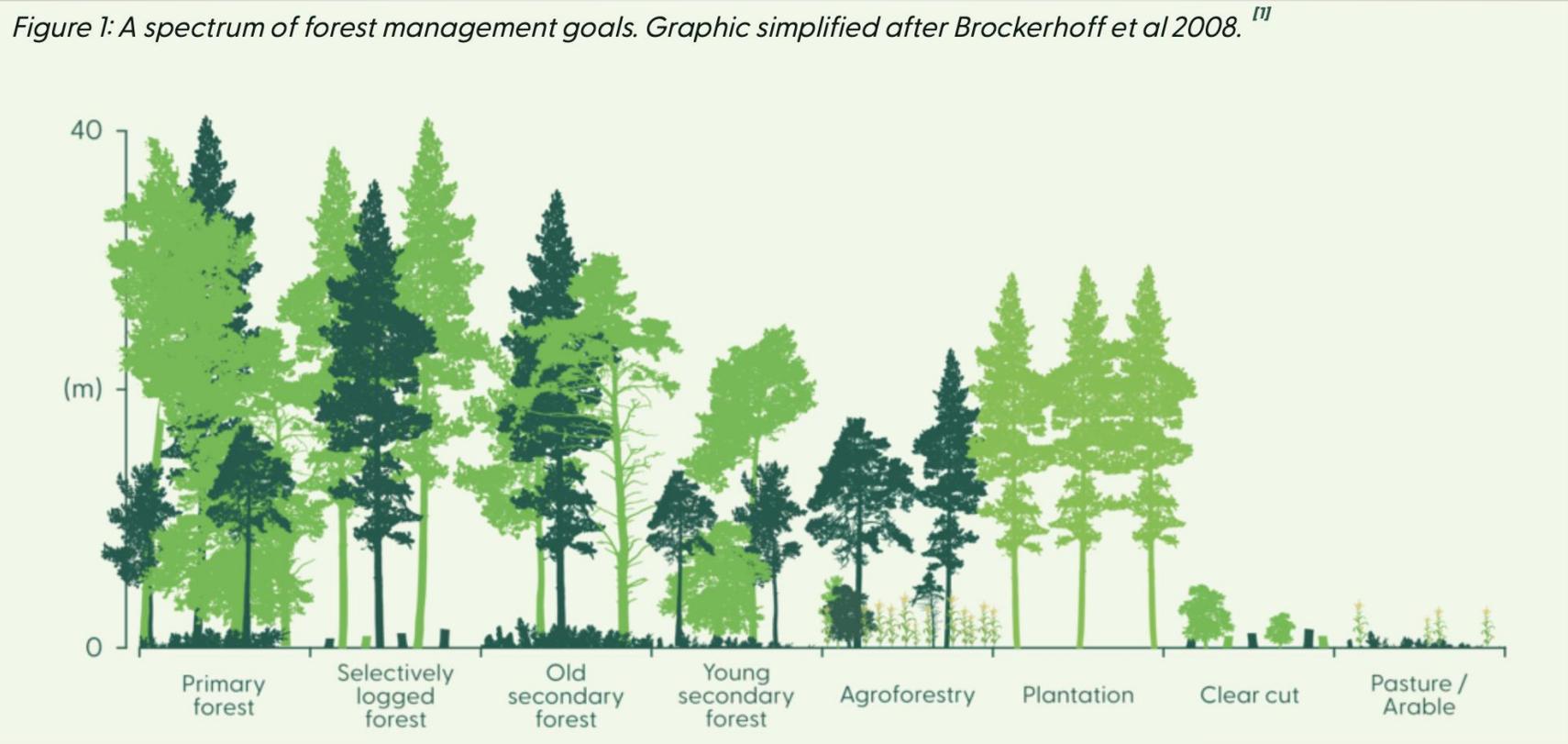
SUSTAINABLE

Values are not mutually exclusive!!! Synergism and Antagonism. Economic, Environmental, and Social



SPECTRUM OF MANAGEMENT GOALS

Figure 1: A spectrum of forest management goals. Graphic simplified after Brockerhoff et al 2008. ^[1]



Bell, F. Wayne & Parton, John & Stocker, Neil & Joyce, Dennis & Reid, Douglas & Wester, Monique & Kayahara, Gordon & Towill, Bill. (2008). Developing a silvicultural framework and definitions for use in forest management planning and practice. *The Forestry Chronicle*. 84. 10.5558/tfc84678-5.

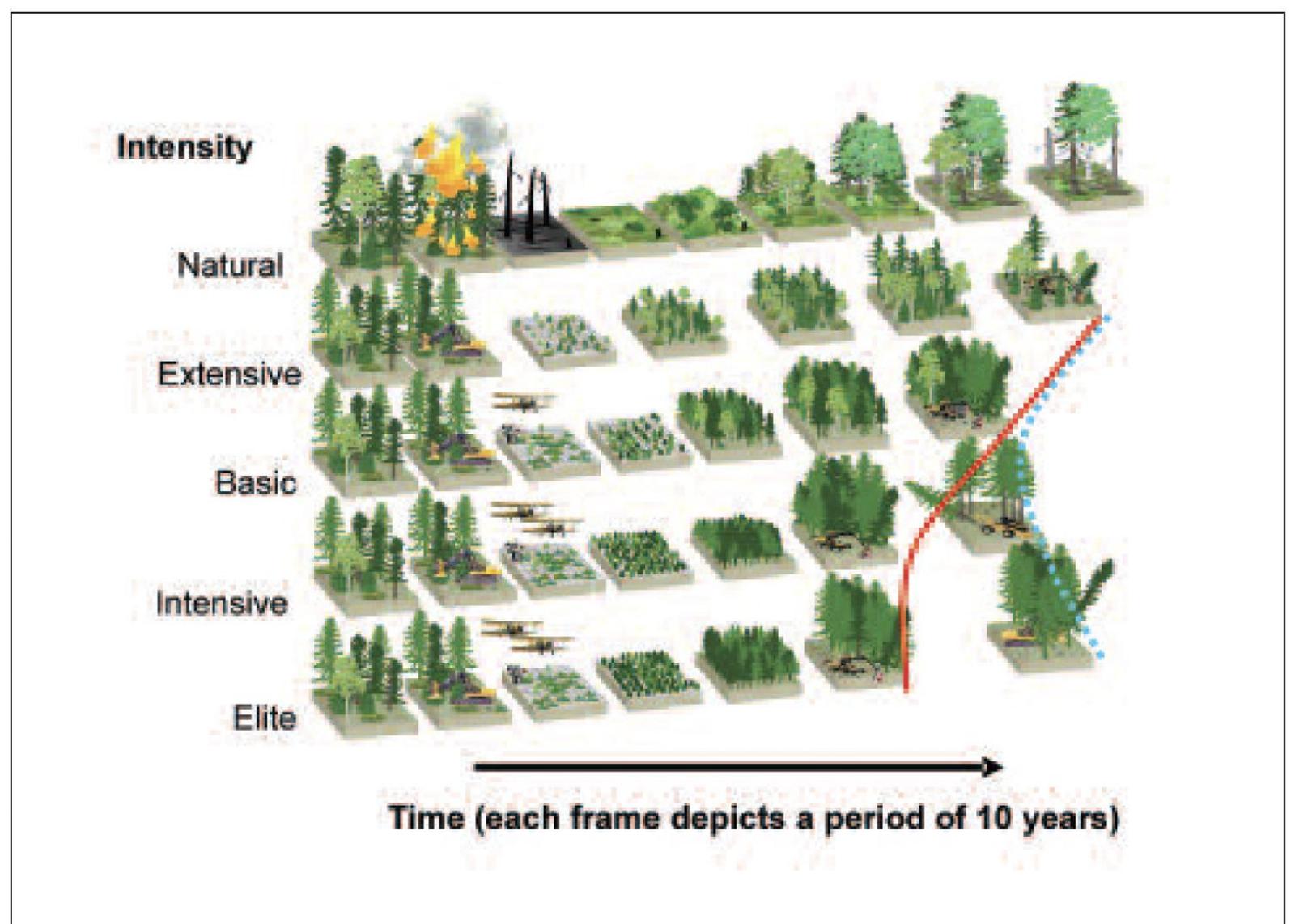
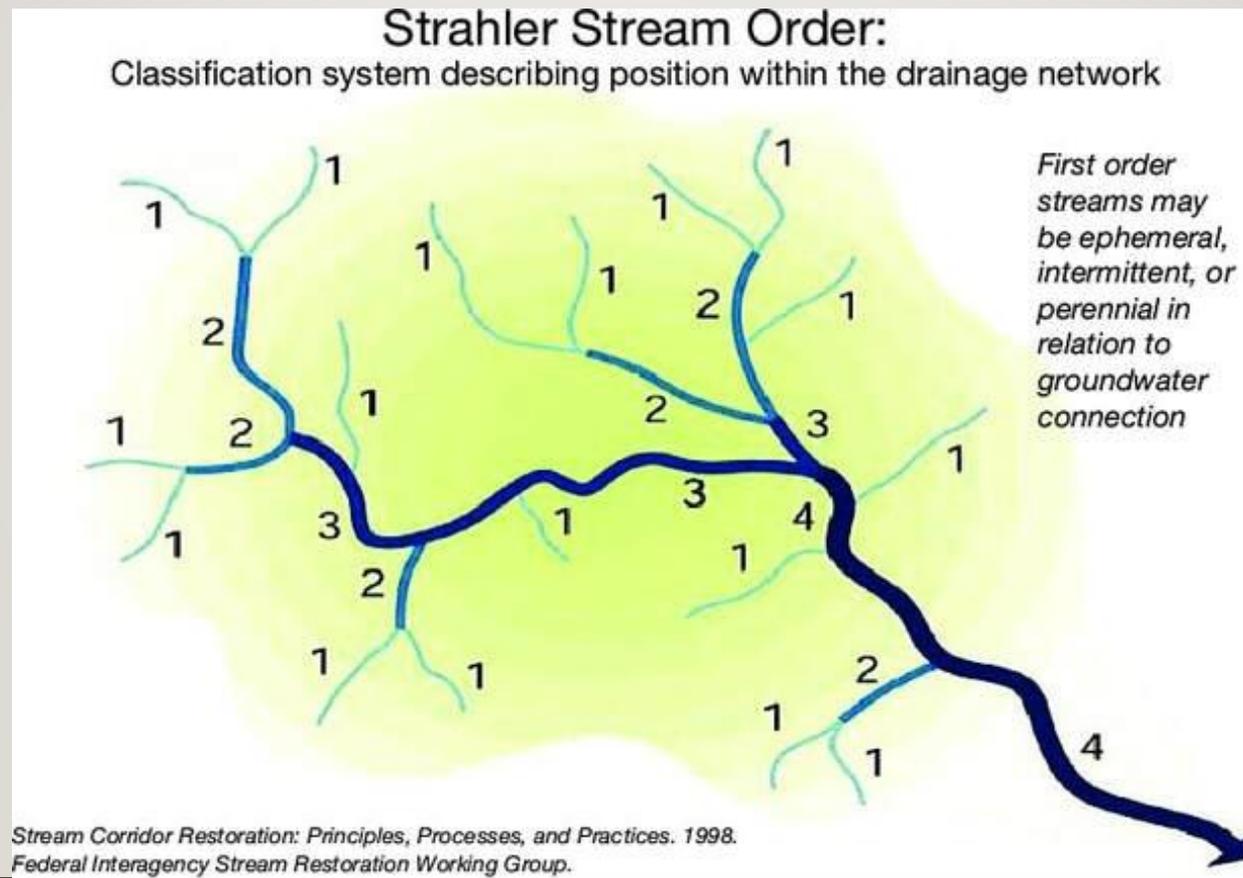


Fig. 2. Illustration of management intensities in a boreal forest showing earliest rotation (red line) and probable rotation if thinning applied (dotted blue line).

BOTTOMLAND HARDWOOD SYSTEMS

- It Is Not Rocket Science; It Is Much More Complicated!
- Actively Changing Due To Floods.
- Scale.
 - Mississippi River Bottomlands. (10,000 Acres)
 - Arkansas River Bottomlands. (1,000 Acres)
 - Secondary River Bottomlands (100 Acres)
 - Creeks, Drains, Bayous, etc. (10 acres)

STREAM ORDER (STRAHLER METHOD)

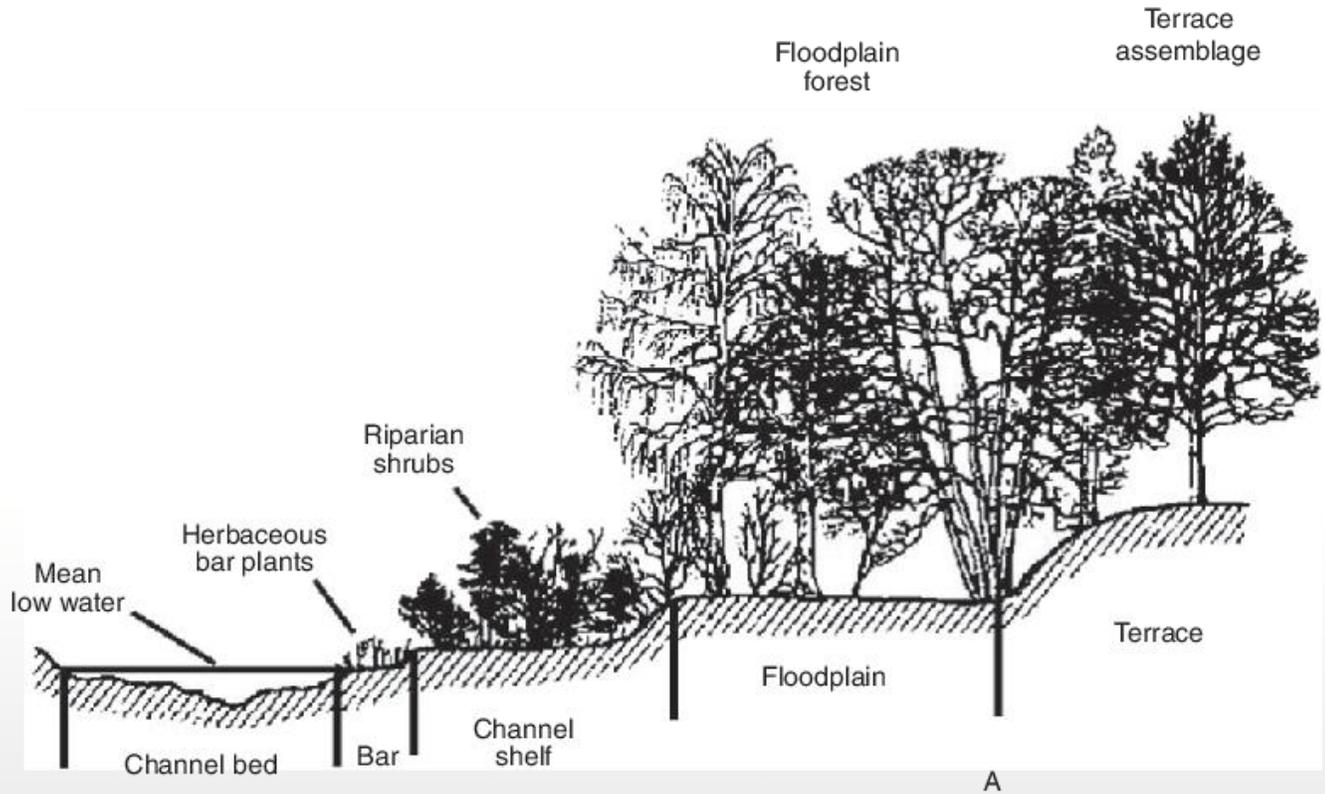


STREAM ORDER (STRAHLER METHOD)

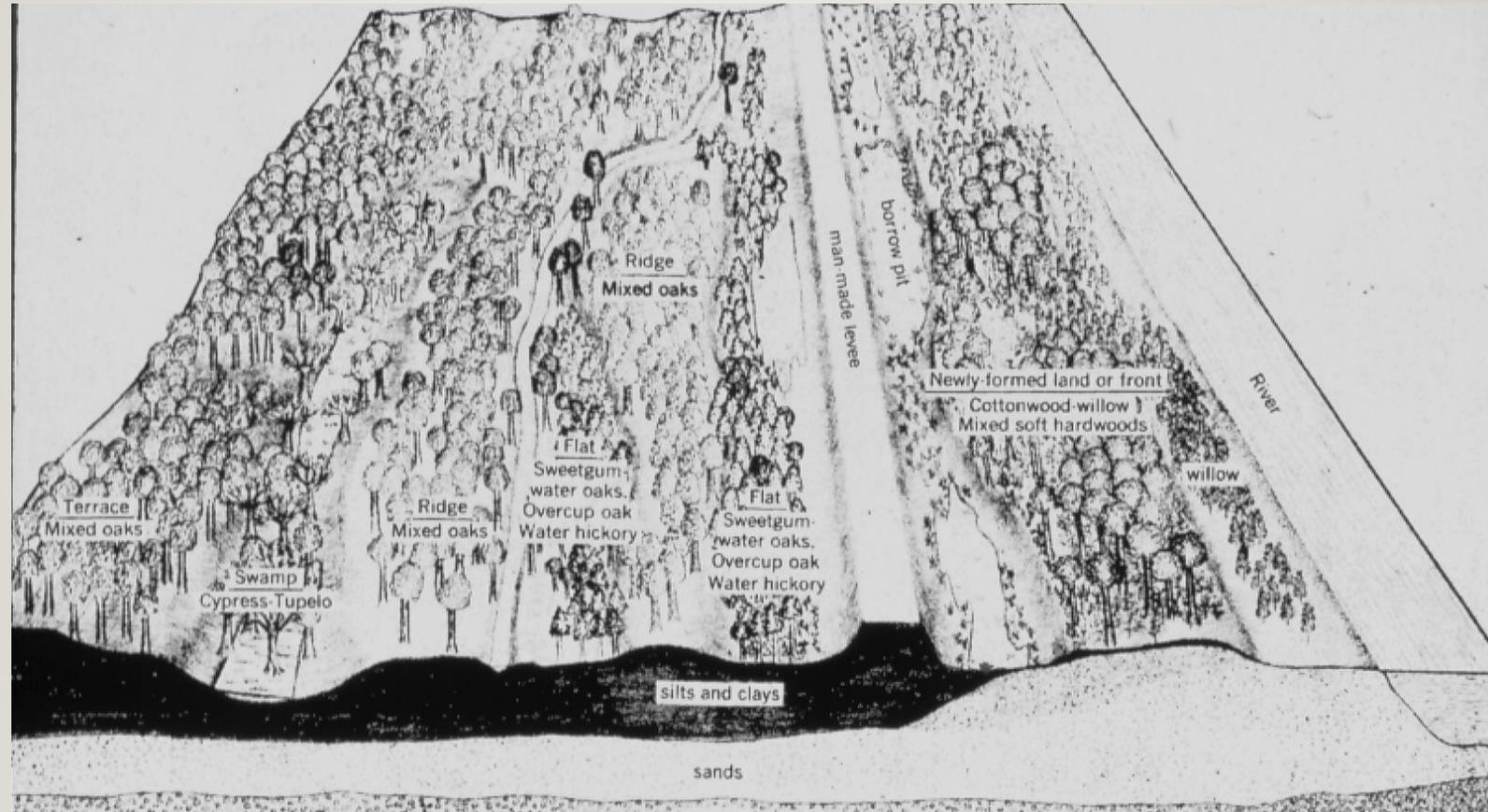
- The Amazon And Mississippi River Are 12th Order Streams.
- Bottoms Start About 3rd Or 4th Order.

GEOMORPHOLOGY

Hupp, C.R., 1983. Vegetation patterns on channel features in the Passage Creek Gorge, Virginia. *Castanea* 48(2), 62–72.



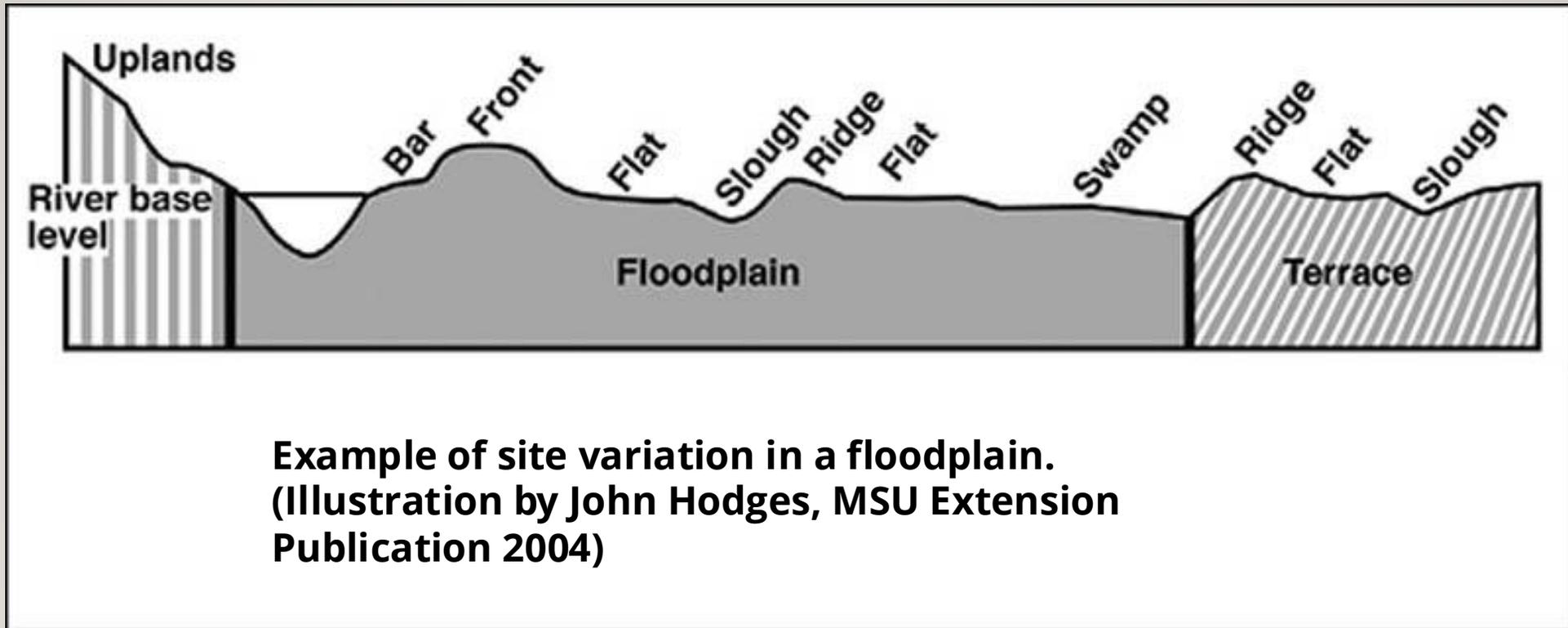
GEOMORPHOLOGY



TOPOGRAPHIC LANDFORMS

- High Or Low
- Ridges
- Sloughs or Swales
- Flats (Swamps)

TOPOGRAPHIC LANDFORMS



SOIL

- Parent Material
 - Weathered rock
 - Sediments from deposition
- Biological Material
 - Organic matter
 - Macroscopic organisms
 - Microscopic organisms

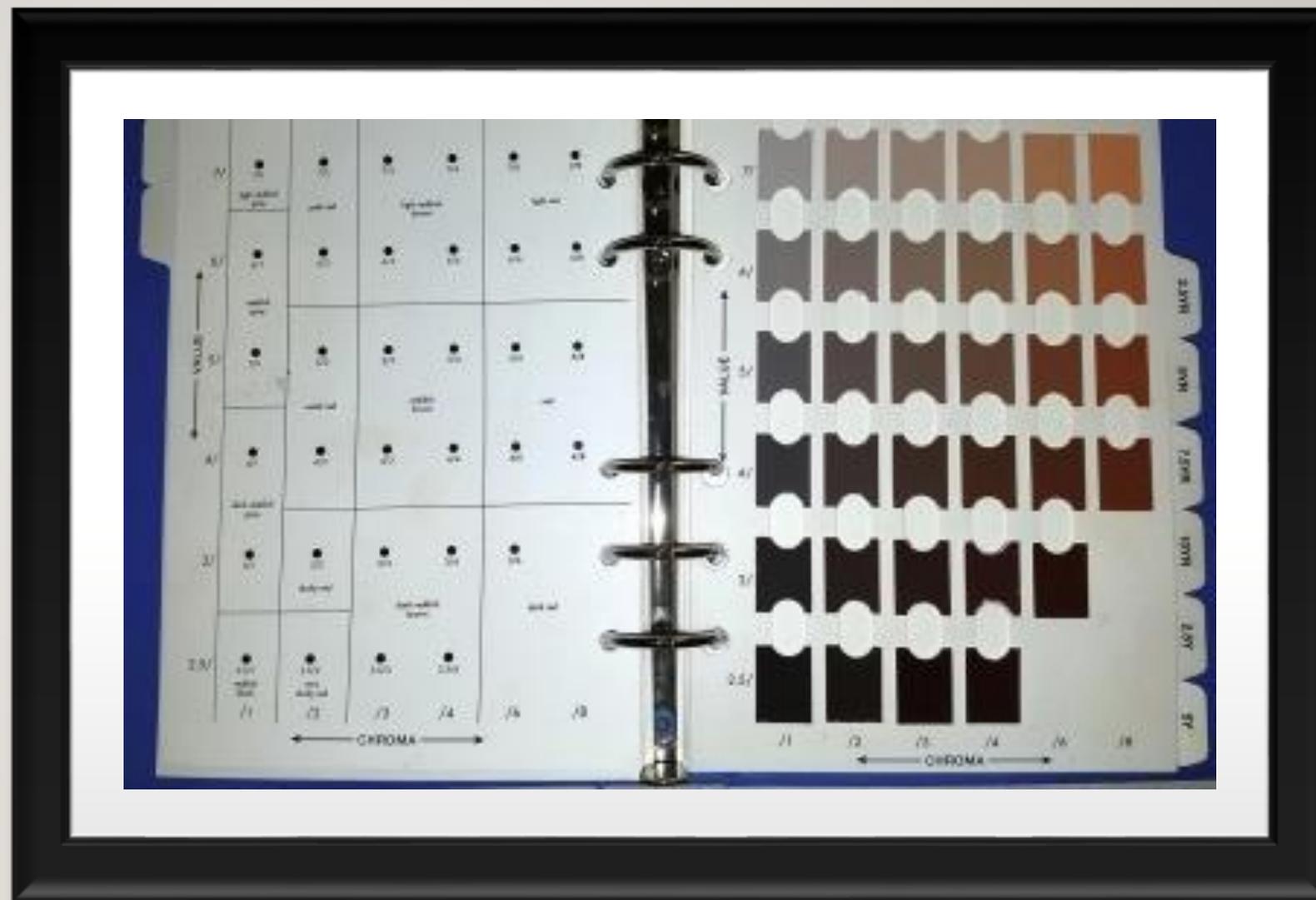
SOIL HORIZONS



SOIL HORIZONS

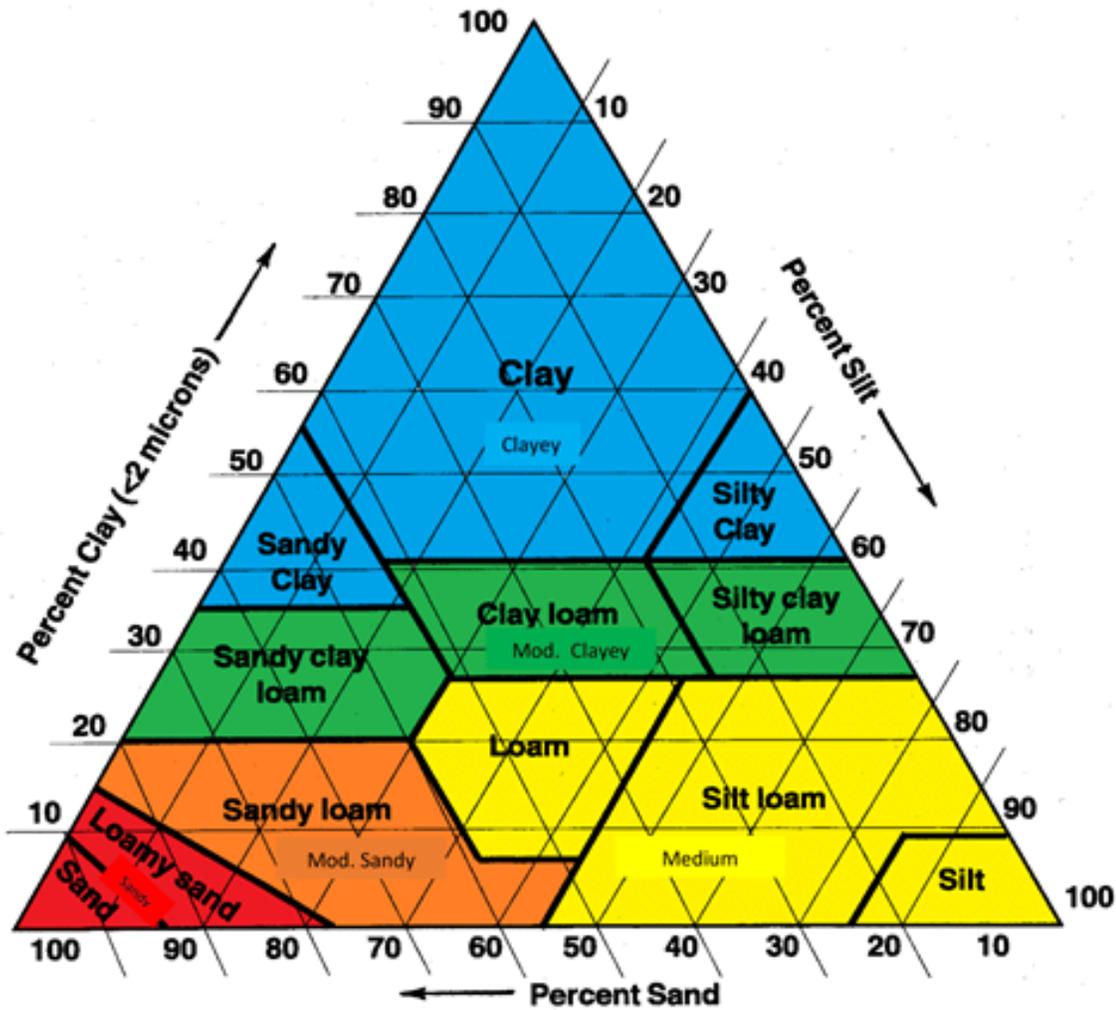


SOIL COLOR



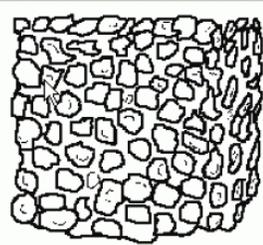
SOILS

- Texture
- Structure
- Color
 - Mottling
- Drainage Class
- Soil Chemistry
 - pH

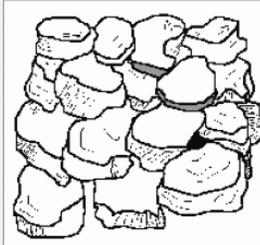


SOIL TEXTURE

SOIL STRUCTURE



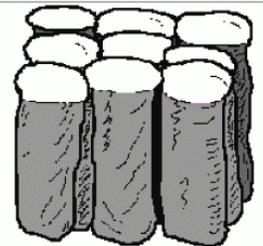
Granular: Resembles cookie crumbs and is usually less than 0.5 cm in diameter. Commonly found in surface horizons where roots have been growing.



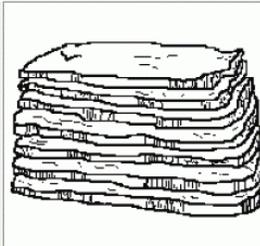
Blocky: Irregular blocks that are usually 1.5 - 5.0 cm in diameter.



Prismatic: Vertical columns of soil that might be a number of cm long. Usually found in lower horizons.



Columnar: Vertical columns of soil that have a salt "cap" at the top. Found in soils of arid climates.



Platy: Thin, flat plates of soil that lie horizontally. Usually found in compacted soil.



Single Grained: Soil is broken into individual particles that do not stick together. Always accompanies a loose consistence. Commonly found in sandy soils.

SOIL MODELING (REDOXIMORPHIC CHARACTERISTICS)

- Those formed by the reduction, translocation and oxidation of iron and manganese compounds in the soil after water saturation and desaturation.



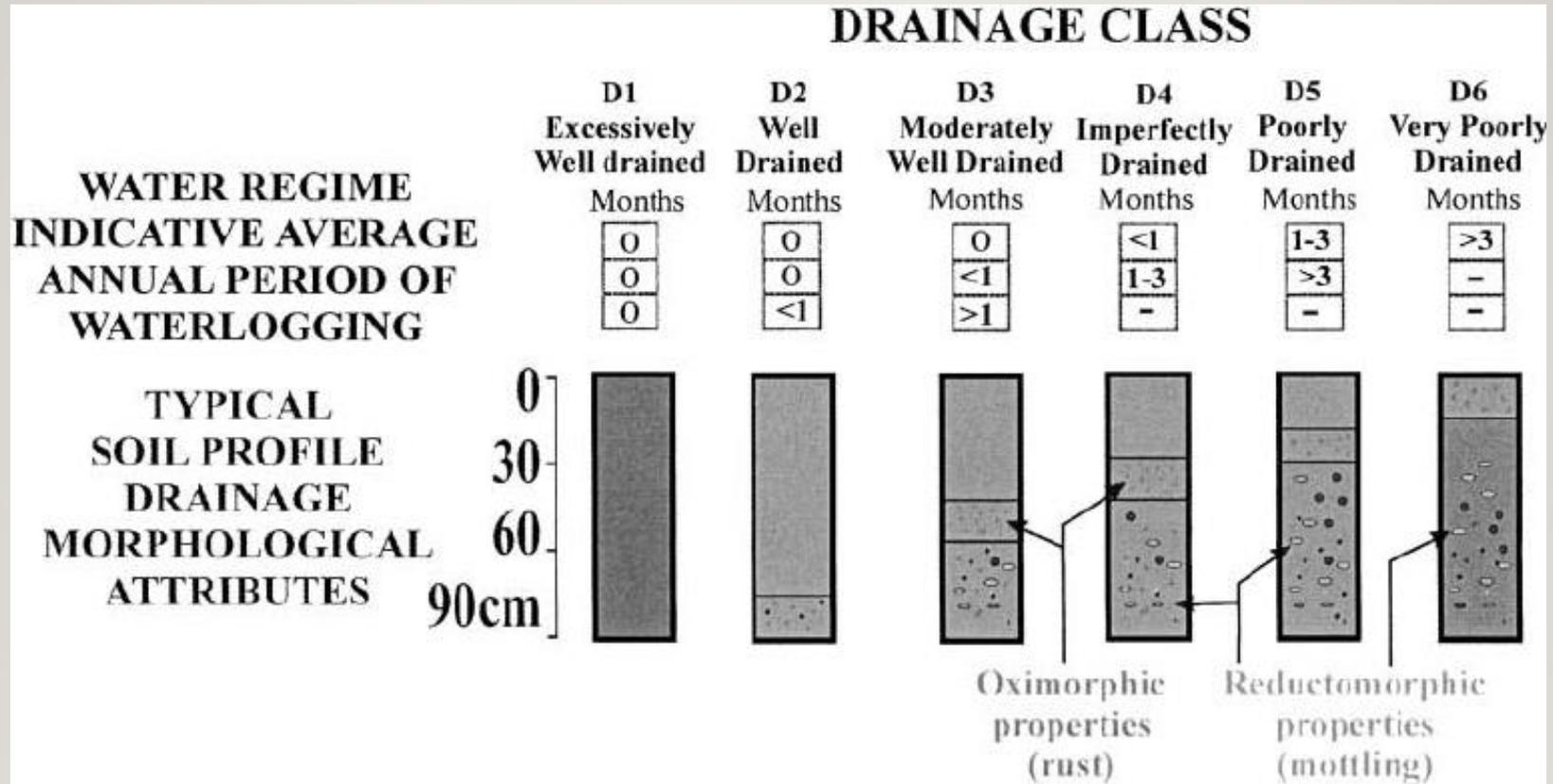
MOTTLING



Dull gray general soil background, or matrix color, and bright red-orange iron concentrations, or mottles, indicate a fluctuating water table.
Corps of Engineers



DRAINAGE CLASS



Excessively drained. Water is removed very rapidly. The occurrence of internal free water commonly is very rare or very deep. The soils are commonly coarse-textured and have very high hydraulic conductivity or are very shallow.

Somewhat excessively drained. Water is removed from the soil rapidly. Internal free water occurrence commonly is very rare or very deep. The soils are commonly coarse-textured and have high saturated hydraulic conductivity or are very shallow.

Well drained. Water is removed from the soil readily but not rapidly. Internal free water occurrence commonly is deep or very deep; annual duration is not specified. Water is available to plants throughout most of the growing season in humid regions. Wetness does not inhibit growth of roots for significant periods during most growing seasons. The soils are mainly free of the deep to redoximorphic features that are related to wetness.

Moderately well drained. Water is removed from the soil somewhat slowly during some periods of the year. Internal free water occurrence commonly is moderately deep and transitory through permanent. The soils are wet for only a short time within the rooting depth during the growing season, but long enough that most mesophytic crops are affected.

Somewhat poorly drained. Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. The occurrence of internal free water commonly is shallow to moderately deep and transitory to permanent. Wetness markedly restricts the growth of mesophytic crops, unless artificial drainage is provided.

Poorly drained. Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded.

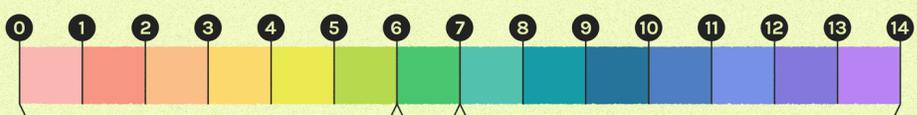


SOIL CHEMISTRY

- Macronutrients – N P K S
- Micronutrients
- pH
 - Oak pH range: 4.5-6.5

SOIL PH

Understanding Soil pH



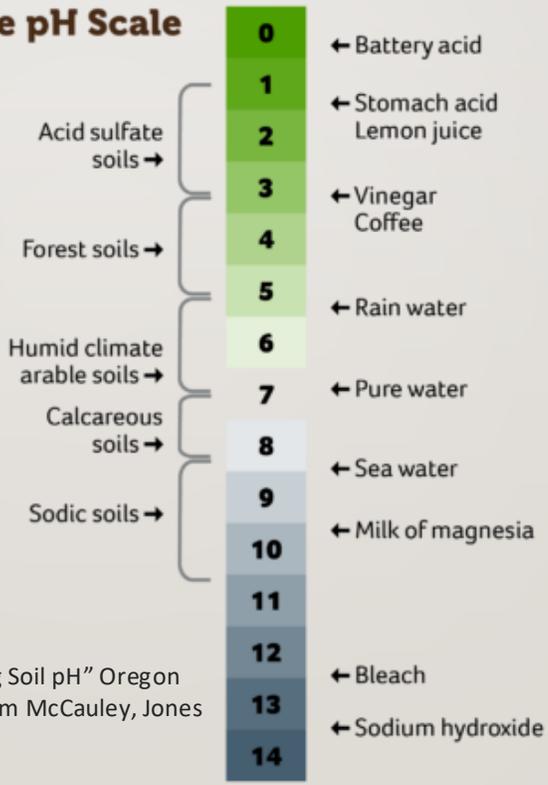
<p>ACIDIC SOIL In strongly acidic soil, organic matter builds up in the soil and sequesters nutrients, especially nitrogen, so it's not as available to plants.</p>	<p>SLIGHTLY ACIDIC TO NEUTRAL SOIL The golden in-between for most plants to thrive is a pH range of 6 to 7. With this measurement, nutrients are the most available.</p>	<p>ALKALINE SOIL Soil becomes less soluble, making it more difficult for plants to absorb nutrients.</p>
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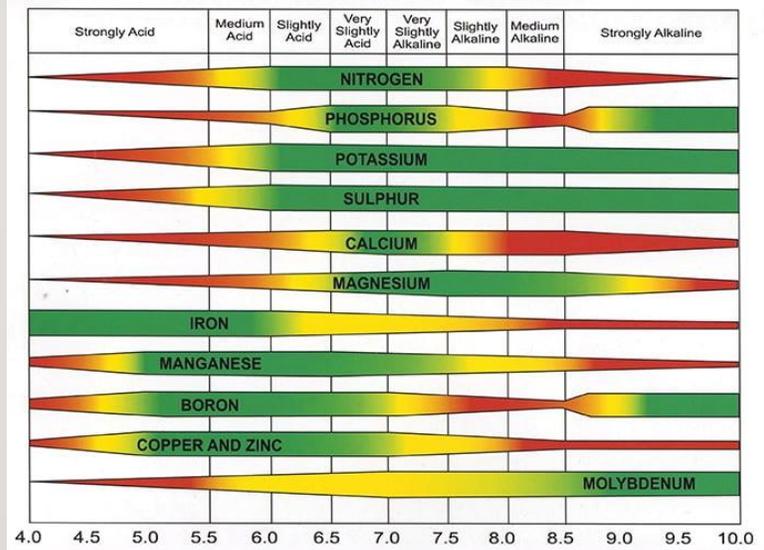
the spruce

Graphic from "Living on the Land: Managing Soil pH" Oregon State University. (Note: graphic adapted from McCauley, Jones and Olson-Rutz)

The pH Scale

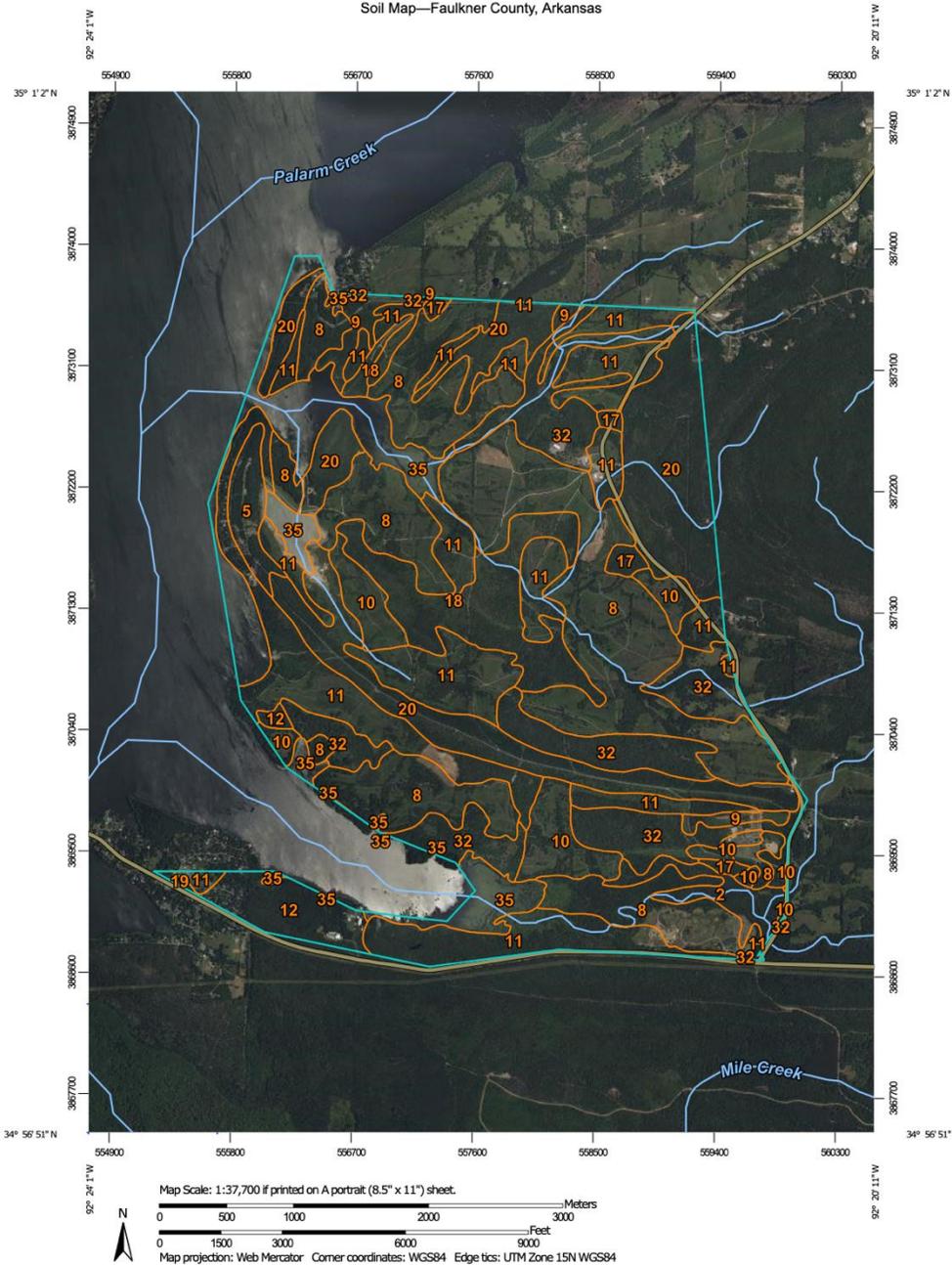


How soil pH affects availability of plant nutrients.



SOIL CLASSIFICATION (NRCS)

- The grouping of soils with a similar range of properties (chemical, physical and biological) into units that can be geo-referenced and mapped.
- Soil series is the lowest category of the national soil classification system. The name of a soil series is the common reference term, used to name soil map units. Soil series are the most homogenous classes in the system of taxonomy.
- <https://websoilsurvey.nrcs.usda.gov>
- SoilWeb app



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Amy soils, frequently flooded	68.0	1.6%
5	Enders gravelly fine sandy loam, 12 to 45 percent slopes	60.6	1.4%
8	Leadvale silt loam, 1 to 3 percent slopes	1,127.9	26.6%
9	Leadvale silt loam, 3 to 8 percent slopes	59.8	1.4%
10	Linker fine sandy loam, 1 to 3 percent slopes	187.8	4.4%
11	Linker fine sandy loam, 3 to 8 percent slopes	871.7	20.5%
12	Linker fine sandy loam, 8 to 12 percent slopes	109.4	2.6%
17	Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes	31.6	0.7%
18	Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes	248.0	5.8%
19	Mountainburg very stony fine sandy loam, 8 to 12 percent slopes	3.8	0.1%
20	Mountainburg very stony fine sandy loam, 12 to 40 percent slopes	642.6	15.1%
32	Taft silt loam, 0 to 2 percent slopes	511.3	12.0%
35	Water	322.8	7.6%
Totals for Area of Interest		4,245.4	100.0%

LIMITATIONS

- Scale
- Mapping Unit Variability
- Inclusions
- Topography
- Be Prepared To Sample.

LAYERS OF A FOREST

- Canopy
 - Tallest Trees
- Understory
 - Just below canopy
- Shrub
 - 3 ft – 16ft
- Herbaceous
 - <3 ft
- Forest floor



CLASSIFICATION OF WOODY PLANTS BY HEIGHT

- Tree > 20 ft high at maturity
- Shrub <20 ft at maturity
- Bush <20 ft and numerous stems forming a single plant
- Vine requires support.

CROWN CLASS – FIGHTING FOR LIGHT

- Dominant
 - Tallest
 - Light on all sides
- Co-dominant
 - Some light from the side
- Intermediate
 - Light from top only
- Suppressed
 - Completely shaded
- Dead

SITE

- Soils + Topography + Weather + History + Biotic Factors
- The area where a plant or stand of trees grows, considered in terms of its environment and the factors that determine the type and quality of vegetation it can support.
- Physical Location
- For Trees To Grow, They Must Be Growing On The Right Site
 - Yellow-poplar example
- 95% of planting failures of hardwoods involve planting on wrong site (75%) and lack of competition control (25%).



TOLERANCE

- Shade
- Flood
 - Standing water
 - Moving water
- Excel spreadsheet

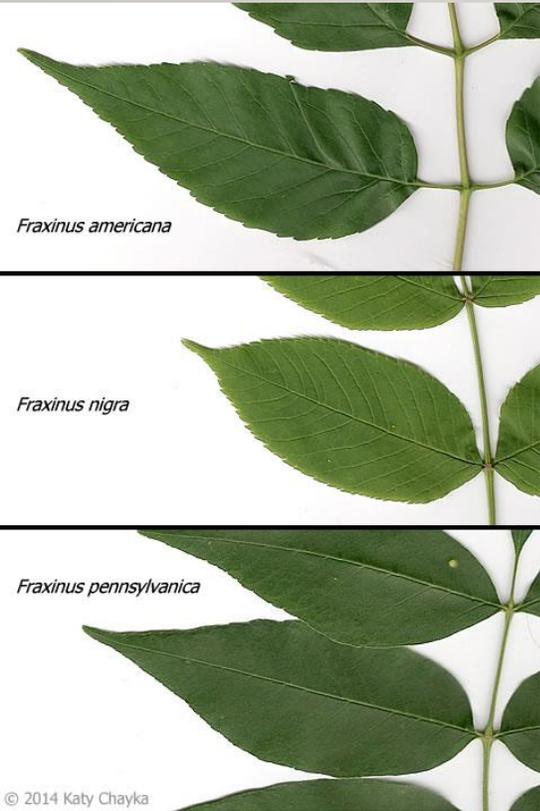
PERCENT LIVE CROWN

- Percent Of Living Crown Of Total Height
- $\text{Top Of Crown} - \text{Bottom of Crown} / \text{Total Height}$
- Estimation
- Crown is needed to produce energy. Crown percentages below 25% generally do not respond to release. Crowns percentages between 25% and 50% may take time to respond due to building a crown before adding growth.

COMMON SPECIES

- Quick Rundown
- Leaf Arrangement
 - MAD Buck
- Compound Or Simple Leaves

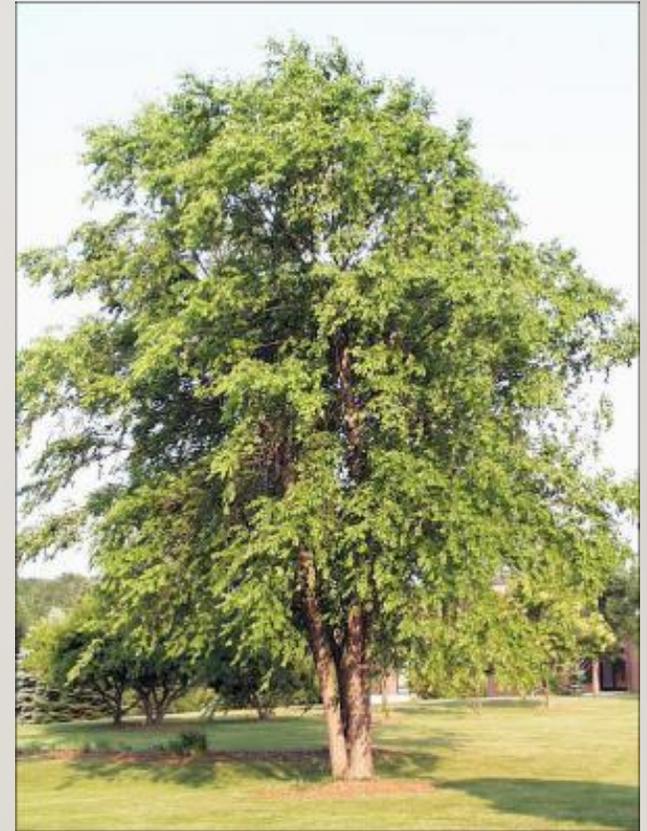
GREEN ASH



Emerald Ash Borer



RIVER BIRCH



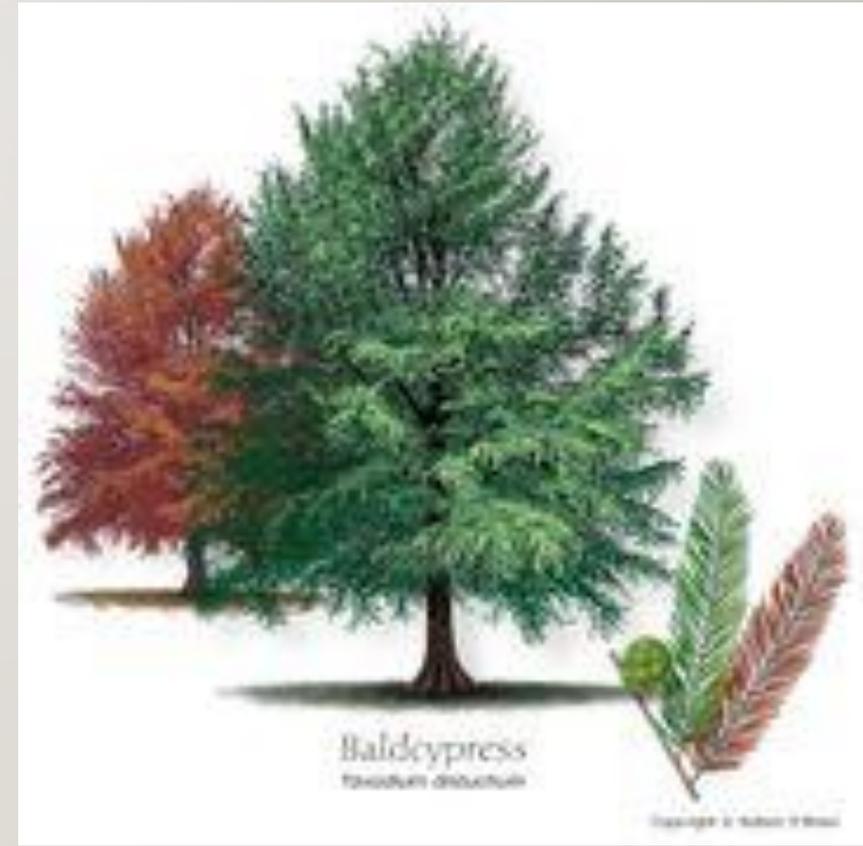
BUTTONBUSH



EASTERN COTTONWOOD



BALDCYPRESS



BALDCYPRESS



ROUGH-LEAF DOGWOOD



CEDAR ELM



Fall Fruiting

WATER ELM



Water Elm Bark

- The bark of a Planertree is usually scaly and patchy. The bark is grayish brown on the surface with reddish brown patches. (3)



Figure (2)

Figure(3)



SWEETGUM



BLACK GUM



SWAMP TUPELO



WATER TUPELO



SUGARBERRY



WATER HICKORY



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SHELLBARK HICKORY

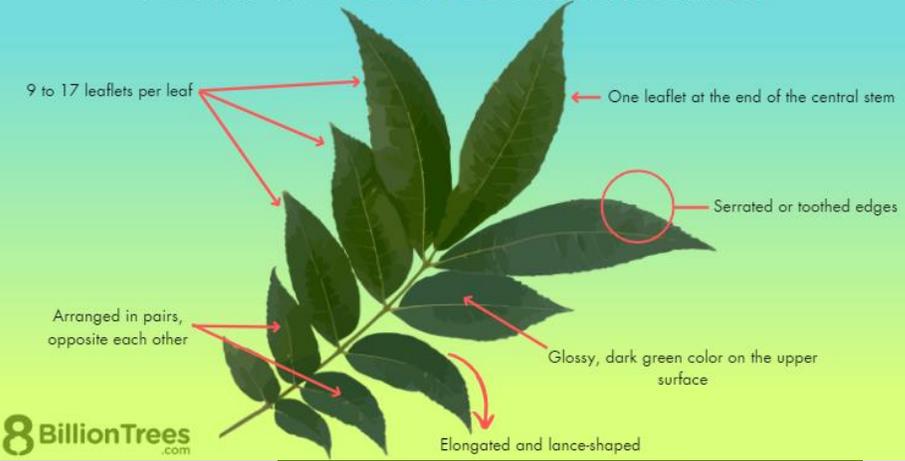


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PECAN

Pecan Tree Leaves Identification



AMERICAN HORNBEAM



HONEY LOCUST



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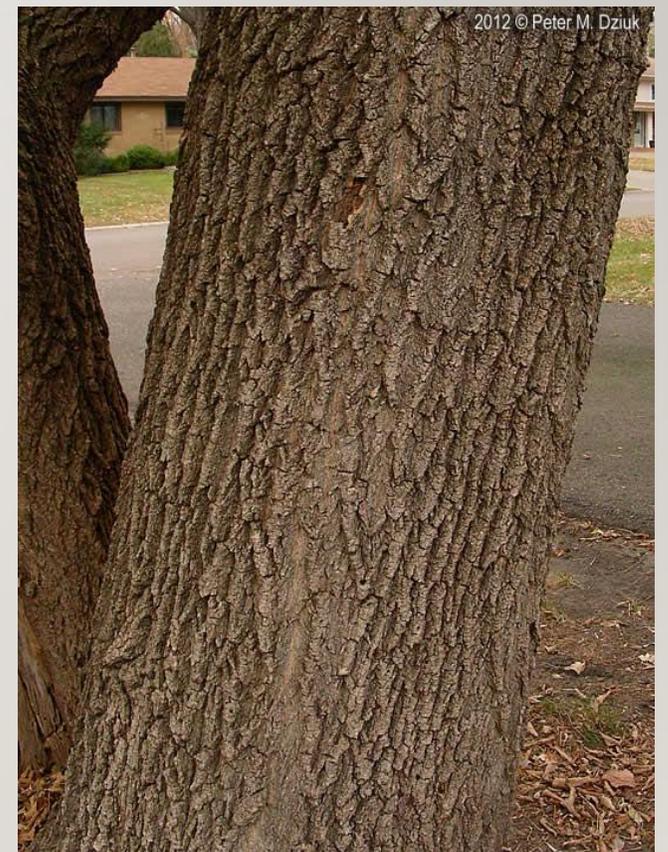


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WATER LOCUST



BOXELDER



RED MAPLE



SILVER MAPLE



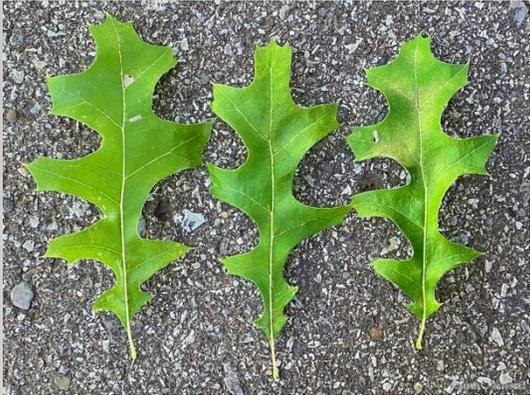
CHERRYBARK OAK



DELTA POST OAK



NUTTALL OAK



OVERCUP OAK



PIN OAK (NOT WILLOW OAK)



SHUMARD OAK



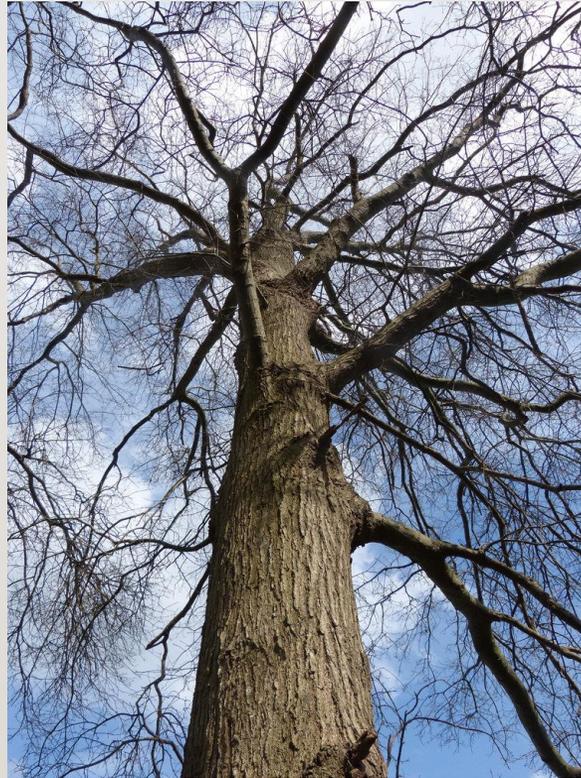
SWAMP CHESTNUT OAK (COW OAK)



WATER OAK



WILLOW OAK



PAWPAW



PERSIMMON



AMERICAN SYCAMORE



SWAMP-PRIVET



BLACK WILLOW



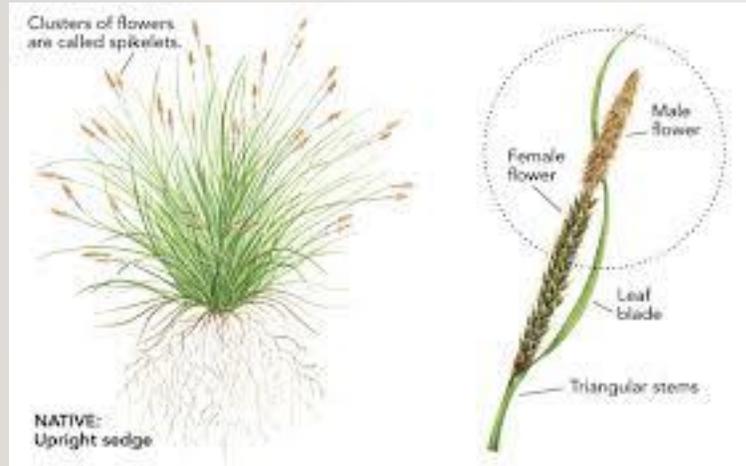
FORBS AND GRASSES



RIVER OATS (*CHASMANTHIUM LATIFOLIUM*) AKA (*UNIOLA LATIFOLIA*)



SEDGES (CAREX SPP.)



JAPANESE STILTGRASS (*MICROSTEGIUM VIMINEUM*) **INVASIVE**



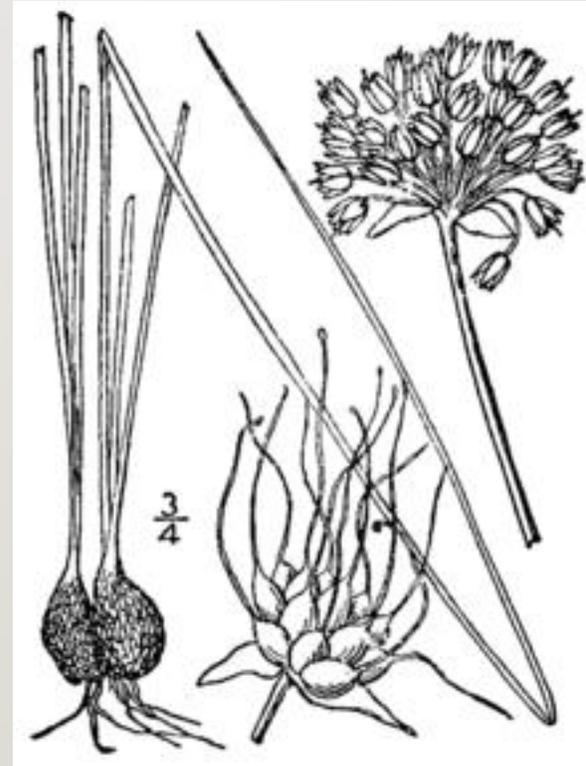
WHITE CUT GRASS (*LEERSIA VIRGINICA*)



GARLIC MUSTARD (*ALLIARIA PETIOLATE*) **INVASIVE**



WILD ONION OR WILD GARLIC (*ALLIUM CANADENSE*)



PANICLED ASTER (*SYMPHYOTRICHUM PANICULATUM*)



WILD GINGER (*ASARUM CANADENSE*)



Pipevine Swallowtail



BITTERCRESS, YELLOW ROCKET, ROCKET CRESS (*BARBAREA VULGARIS*)



POLLINATOR PLANTS

- Maples
- Oaks
- Serviceberry
- Dogwoods
- Elderberry
- Buttonbush
- Oakleaf hydrangea
- Goldenrod
- Sunflowers
- Mints
- Phlox
- Joe-Pye Weed
- Asters

INVASIVE PLANTS



CHINESE TALLOWTREE (*SAPHIUM SEBIFERUM*)



JAPANESE HONEYSUCKLE (*LONICERA JAPONICA*)



CHINESE PRIVET (*LIGUSTRUM SINENSE*)



JAPANESE KNOTWEED (*POLYGONUM CUSPIDATUM*)



CALLERY PEAR AKA BRADFORD PEAR (*PYRUS CALLERYANA*)



COMMON AGRICULTURE WEEDS





DIVERSITY

- Time
 - Preservation only happens in alcohol!
- Space
- Vertical Diversity
- Scale
 - Diversity is different for a protozoa than a mountain lion.
- Bottomland hardwood stands are diverse by nature.





CONTEXT

- Matrix
- Audubon Society
- Cowbirds

SUCCESSION

- Primary
 - New ground
- Secondary
 - Disturbance
 - Fire
 - Weather
 - Flood
 - Manmade
 - Lack of Disturbance Leads to Proliferation of Shade Tolerant Species
 - Low Wildlife Value

FIRE IN BOTTOMLAND HARDWOODS

- Once Forbidden
- Need For Regeneration To Prepare Seed Bed
- Cool Burns To Protect Cambium
- Reduce Fuel Load
- Decrease Maples And Other Thin Bark Species

AGE DISTRIBUTION

- Even Age
- Two Age
- Three Age
- Uneven Age
- Can reveal stand history.

AGE

- Hardwood stands are generally even age stands.
- Diameter distribution and stand age are two different things.
- Diameter is a function of density and ability to compete.
- Height is a function of site quality (Site Index)

REGENERATION (TIME TO START OVER)

- Artificial Regeneration
 - Planting
- Natural Regeneration
 - Seedlings and Sprouts
 - Supplemental Planting

ARTIFICIAL REGENERATION

- Match Tree Species To Site
- Weed Control
 - Mechanical
 - Chemical
- Fertility Is Not A Problem
 - Increase weed pressure

CHEMICAL APPLICATION METHODS

- Backpack
- Injection
- Spreader (Hand or Tractor)
- Ground Equipment
 - Tractor
 - Skidder
 - 4-Wheeler
- Aircraft
 - Fixed wing
 - Helicopter



Year After Treatment







NATURAL REGENERATION

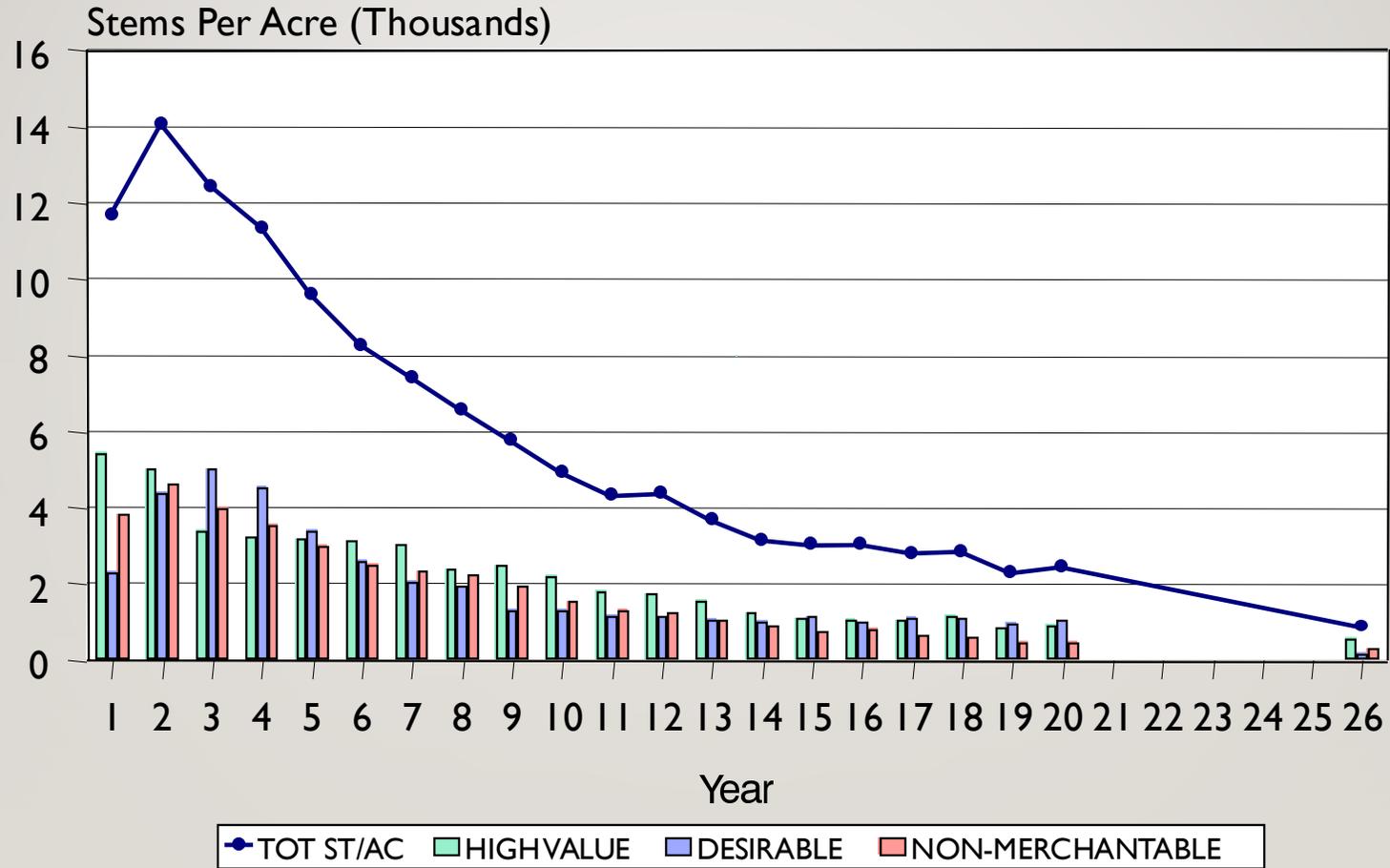
- Ensure the next stand will be stocked by desirable species.
- Seed bed preparation
- Advance regeneration

REGENERATION METHODS

- Seed Tree
 - 6-10 Trees/Acre
- Shelterwood
 - 20-200 Trees/Acre
 - Removal with one or several cuts
- Group Selection
 - ½ to 5 acres
- Single Tree Management – Uneven-aged Management

REGENERATION of PAST CLEARCUTS

RUPERT AREA of APPALACHIAN FOREST



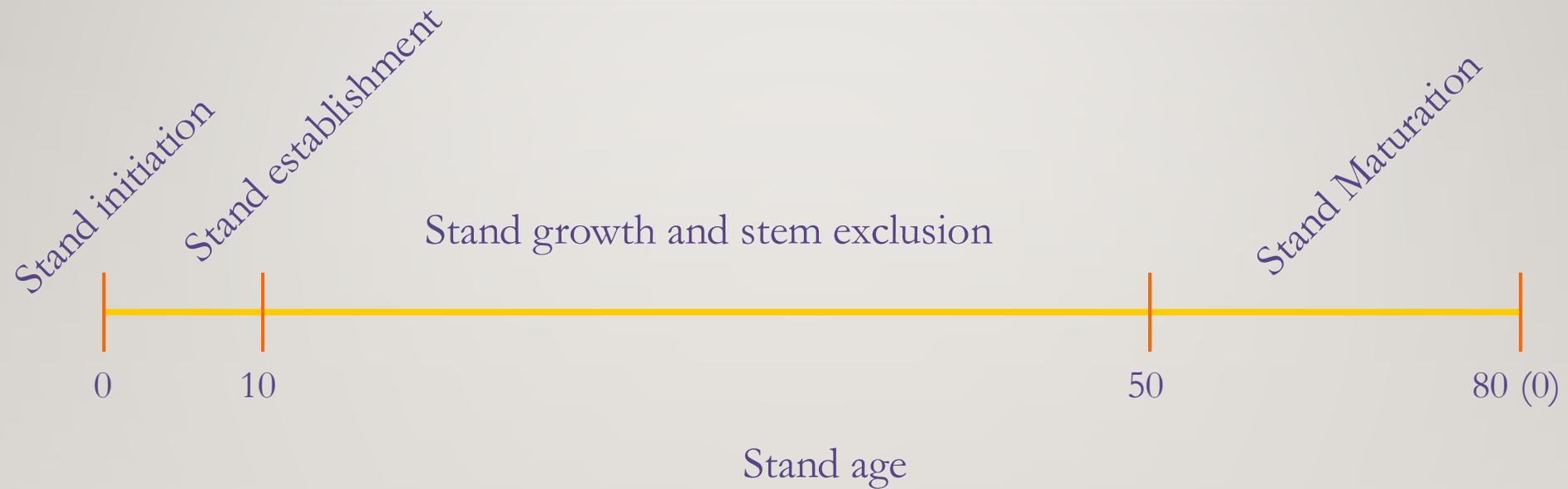


**24-Year-Old Stand Prior
to Precommercial
Thinning**



**24-Year-Old Stand After
Precommercial Thinning**

Hardwood Stand Development



HARDWOOD HERBICIDES

- **Mechanical**

- **Chainsaw**
- **“Mowing”**
- **Bulldozer**

- **Chemical**

- **Foliar spray with herbicides**
- **Basal bark applications**
- **Injection**

TIMING OF INJECTION

- **Best** = Late Growing Season/fall
- **Excellent** = Dormant Season
- **Avoid** = “Green-up” to mid-growing season



COMMON HERBICIDES

- Triclopyr – (Garlon 3a)
 - 50% concentrate and 50% water
 - Apply in a continuous frill around stem, 1 ml per 3 inches DBH
- Glyphosate – (RoundUp)
 - 5.4 lbs./gal, 40% percent concentrate and 60% water
 - Apply in a continuous frill around stem
 - Growing season best
- Imazapyr –
Arsenal AC
 - Up to 25% concentrate and 75% water
 - Apply 1ml solution per 3 inches DBH
 - Year round except during green up, fall best

BASAL BARK APPLICATIONS

- Timber Stand Improvement
 - Mid-rotation hardwood stands
 - Goal – improve species composition
- Garlon 4 herbicide
- Apply to first 12 to 15 inches of stem
- Mix with oil (follow label directions)

STREAMLINE APPLICATION



MIDROTATION TREATMENTS

- Thinning
 - Commercial
 - Noncommercial
- Stand Improvement

TYPES OF THINNING

- Low Thinning
- High Thinning (DANGER)
- Diameter Limit (DANGER)
- High Grading (Unethical)
- When Will Be The Next Harvest?
 - Harvest The Mortality

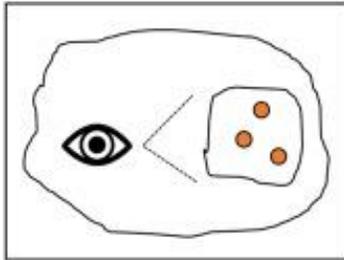
MARKED THINNINGS

- Mark A Thinning Or Logger Select

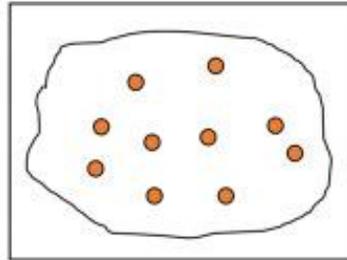
WHEN DO YOU THIN?

- When Stock Gets Over 80-90%
- You Need To Sample The Site
 - Quadratic Mean Diameter
 - In forestry, the quadratic mean diameter (QMD) is a measure of average tree diameter that's more representative of the stand's overall structure than the arithmetic mean, as it gives greater weight to larger trees.
 - $QMD = \sqrt{(\sum d_i^2/n)}$, where d_i is the diameter at breast height (DBH) of the i -th tree, and n is the total number of trees.
 - Grid Plot Sampling
 - 1/100 acre to 1/10 acre
 - Need to sample about -5 % for habitat evaluation. 10% of Timber Cruise.

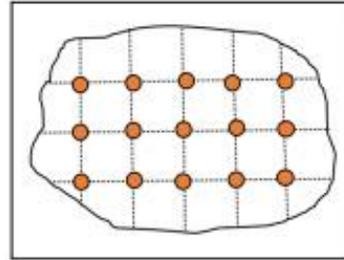
GRID SAMPLING



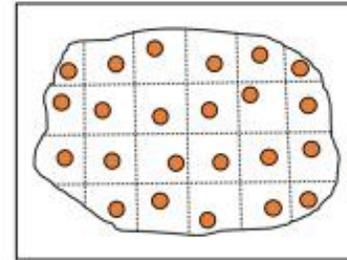
Judgemental sampling



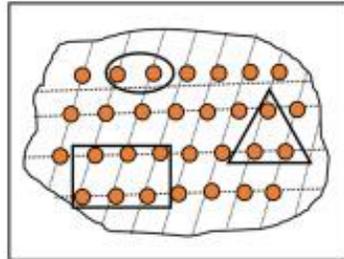
Random sampling



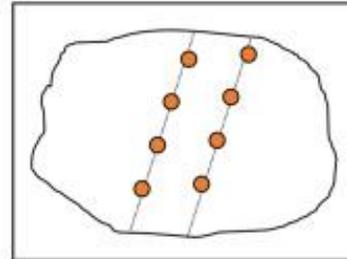
Systematic grid sampling



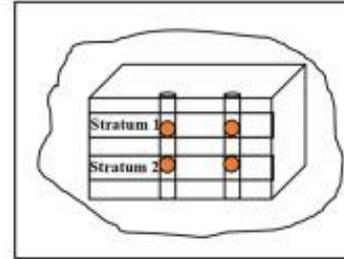
Systematic random sampling



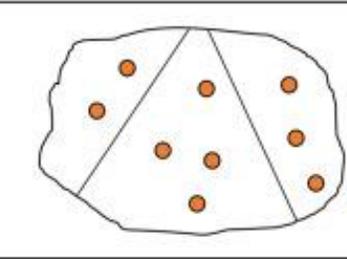
Search sampling



Transact sampling



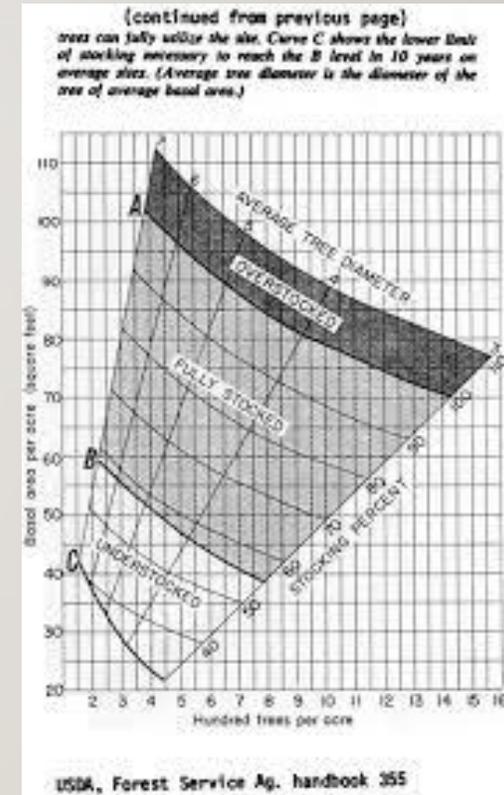
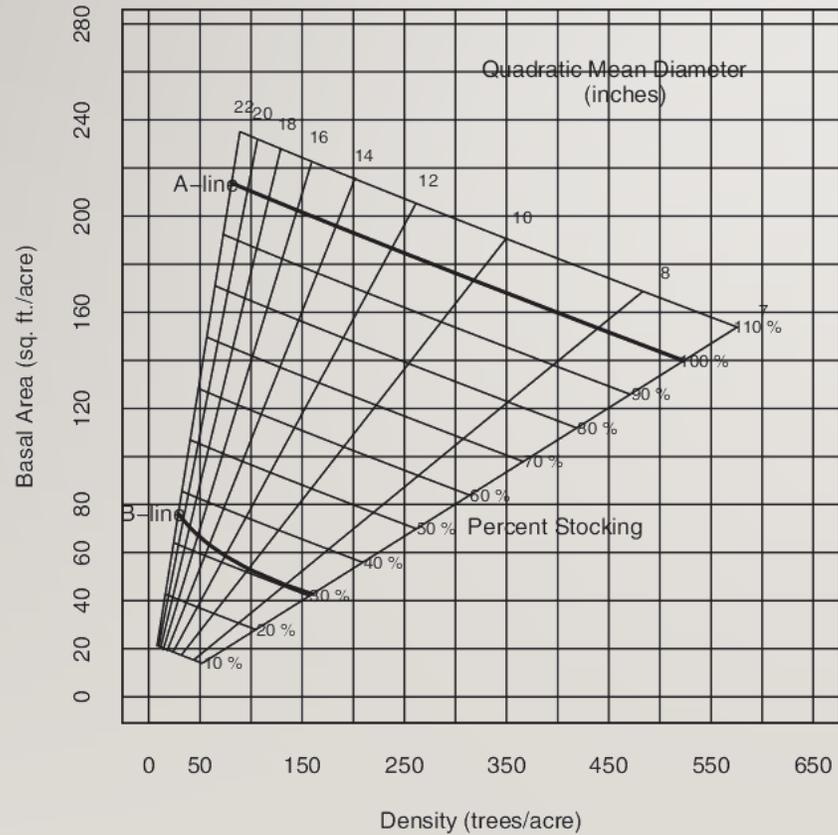
Stratified sampling



BASAL AREA PLOTS

- Variable Area Plots
 - Guage
 - Prism
 - Calculate Basal Area Directly
- Fixed Area Plots
 - Tape

GRINGRICH STOCKING GUIDE



PROBLEMS WITH OPENING STAND TOO MUCH

- Proliferation Of Forest Floor Vegetation
- Proliferation of Shrub Layer
- Entry Point For Invasives
- Epicormic Branching



DESIRED CHARACTERISTICS FOR WILDLIFE IN BOTTOMLAND HARDWOODS

HABITAT TYPE	PERCENT OF AREA	DESIRED LANDSCAPE CONDITIONS FOR WILDLIFE
Forest Cover	70-100 %	Contiguous or predominantly forested areas are desired, sometimes composed of many landowners.
Actively Managed Forest	70-95%	Forests that are managed via prescribed silvicultural treatments to meet landowner objectives.
• Regenerating Forest	≤ 10 %	Forest regeneration on areas >7 acres (e.g., where >80% of the forest overstory has been removed, not including afforestation of agricultural land)
• Shrub-Scrub	≤ 5 %	Shrubby woody vegetation (wet or dry) within bottomland forests, including forests in early seral (successional) stages.
Protected Forest	5-30 %	Forest areas that are not subject to silvicultural manipulation.

<https://www.lmvjv.org/desired-forest-conditions>



PRIMARY AND SECONDARY FACTORS

STAND FACTORS	DESIRED STAND STRUCTURE FOR WILDLIFE	CONDITIONS THAT MAY WARRANT MANAGEMENT
PRIMARY FACTORS		
Overstory Canopy Cover	60-70%	>80% or <50%
Midstory Cover	30-40%	<20% or >50%
Relative Basal Area (BA)	60-70% of maximum BA	>80% of maximum BA
SECONDARY FACTORS		
Dominant Trees	≥1/acre	
Understory Cover	25 – 40%	
Shade-Intolerant Regeneration	30 – 40% of area	
Coefficient of Variation of BA	>30%	
Older/Den/Cavity Trees	15 – 20% of BA ≥20-inch DBH	
Stressed Trees and Snags	>6 trees/acre ≥10-inch DBH or ≥2 trees/acre ≥20-inch DBH	

EVALUATION

- 1/100 acre plot (11.78 ft)
- 1/50 acre plot (16.67 ft)
- Understory Index
- Percent Live Crown (Live Crown Ratio)
- Stocking
 - Diameter
 - Number of Trees
 - Species

TOOL FOR ASSESSMENT AND TREATMENT OF REFORESTED BOTTOMLAND HARDWOOD STANDS ON WETLAND RESERVE EASEMENTS



GREENTREE RESERVOIR MANAGEMENT



RENOVATION OF GREENTREE RESERVOIRS

- Conduct An Assessment
- Develop A 100-Year Plan
- Correct The Plumbing
- Increase Plumbing Capacity if Needed
- Manage The Forest
- Replant Red Oaks
- Practice Good Water Management

LET'S GO OUTSIDE

