

SIGNIFICANCE OF PIEDMONT FORESTS: SILVICULTURE PRESCRIPTIONS IN AN ECOLOGICAL CONTEXT



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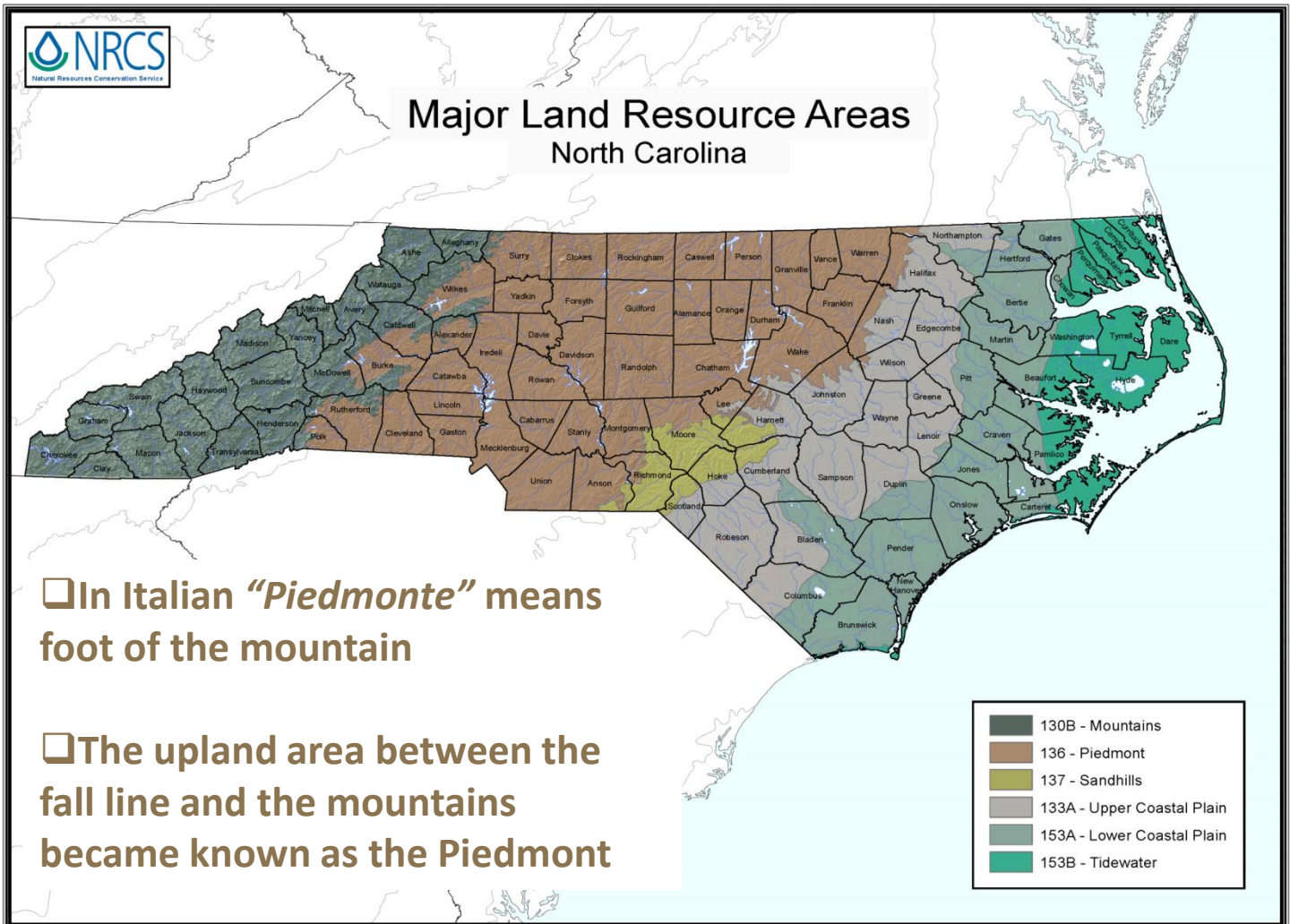
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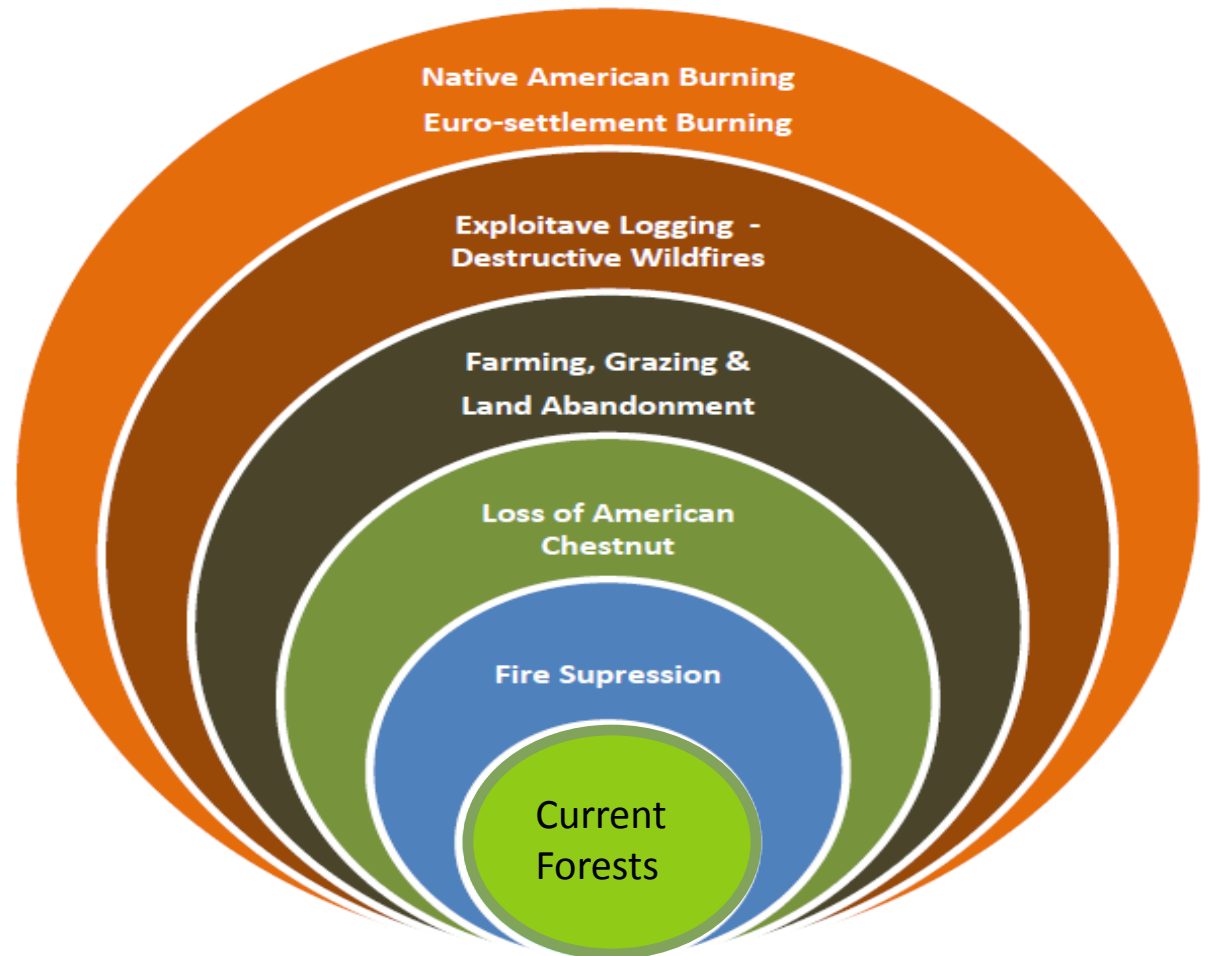
PRESENTATION COMPONENTS

- ③ History & Current Conditions
- ③ Important Values
- ③ Ecological Forestry Concepts
- ③ Appropriate Management Systems

PIEDMONT REGION



HISTORIC ANTHROPOGENIC INFLUENCES THAT HAVE SHAPED NORTH CAROLINA FORESTS



HUMAN HISTORY IN THE PIEDMONT

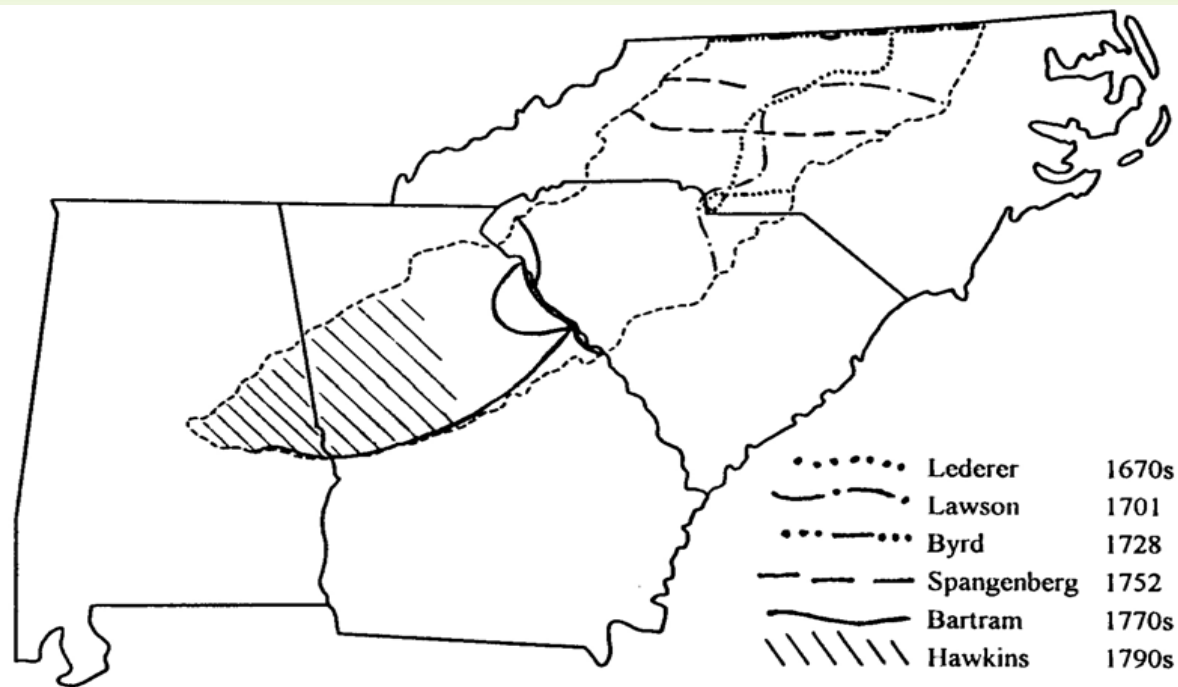
(KAY MOSS - JOURNEY TO THE PIEDMONT PAST SOURCE BOOK)



- ◎ In the Central Piedmont we are looking at a human history that is at least 10,000 years old
 - ◎ Native Americans (1.5 to 2 million in the SE)
- ◎ Newcomers from Europe – Spanish Exploration of the Piedmont
 - ◎ Hernando de Soto Expedition (1539-1543)
 - ◎ Juan Pardo Expeditions (1566-1568)
- ◎ The Naturalists & Travelers
 - ◎ John Lawson, William Byrd II, Bartrams, Michaux, Audubon
- ◎ Settling the Wilderness
 - ◎ Settlers newly arrived from Europe ventured away from coastal areas in their search for land and opportunity (1730-1775)
 - ◎ Great Wagon Road

PRESETTLEMENT CONDITIONS

Juras 1997 – The Presettlement Piedmont Savanna



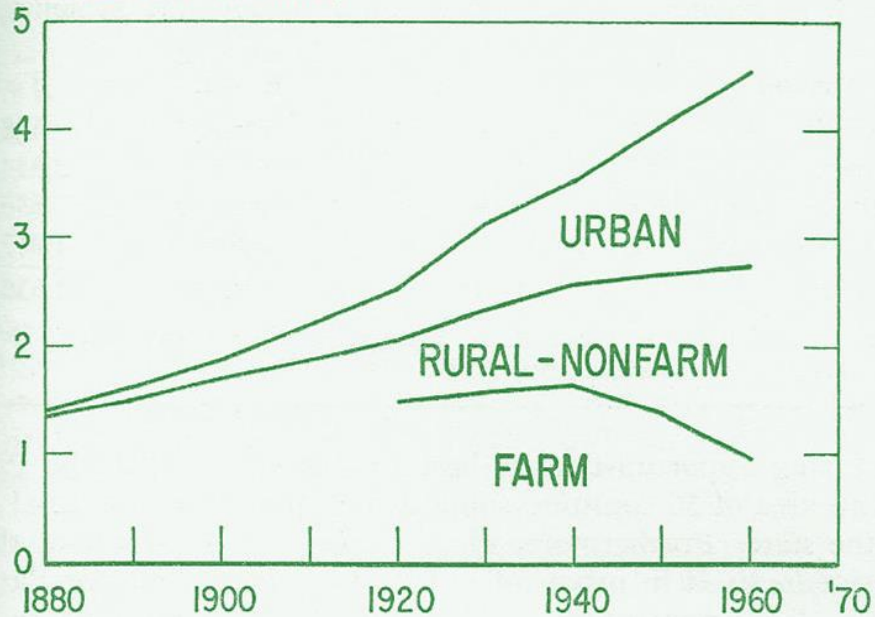
There cannot be a richer Soil, no Place abounding more in Flesh and Fowl, both wild and tame, besides Fish, Fruit, Grain, Cider, and many other pleasant Liquors; together with several other Necessaries for Life and Trade

HISTORIC NC EVENTS & INFLUENCES

- ◎ A Crown Colony, (1729-1775)
 - ◎ By 1770 most of the Coastal Plain and Piedmont Regions had been populated
- ◎ The Revolutionary War (1775-1783)
- ◎ The Civil War (1861-1865)
 - ◎ Ironworks for furnaces & forges
- ◎ Railroads began in the late 1840's
 - ◎ Plank Roads (1849-1856), Atlantic Railroad – Greensboro to Morehead City in 1858
- ◎ Dams for Electric Hydro Power after 1900's
- ◎ Soil Conservation Programs in 1950's

POPULATION HISTORY IN NC

POPULATION (Millions)



Year	Population
1850	869,039
1870	1,071,361
1890	1,617,949
1910	2,206,287
1930	3,170,276
1940	3,571,623
1950	4,061,929
1960	4,556,155
1970	5,082,059
1980	5,881,766
1990	6,628,637
2000	8,049,313
2010	9,535,483
2015	10,042,802

POPULATION GROWTH & LAND-USE CHANGE

About 2/3 of the Population of North Carolina is concentrated around it's largest cities in the middle third of the State

FIGURE 2d-3. Population by census tract (square mile) in North Carolina.

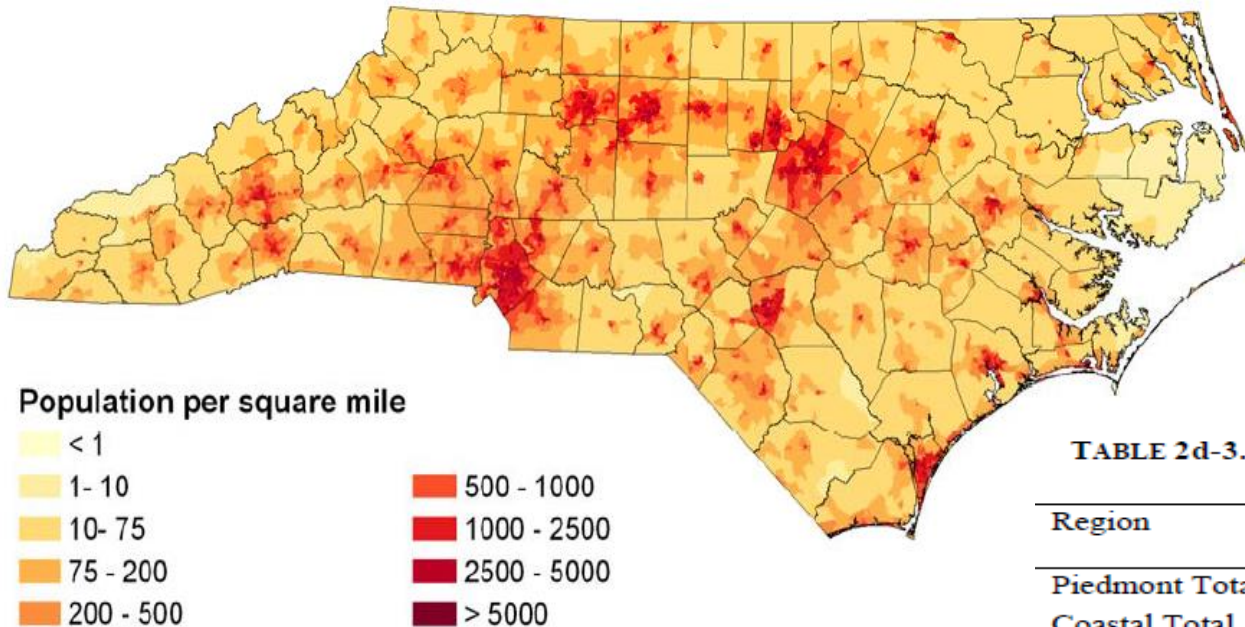


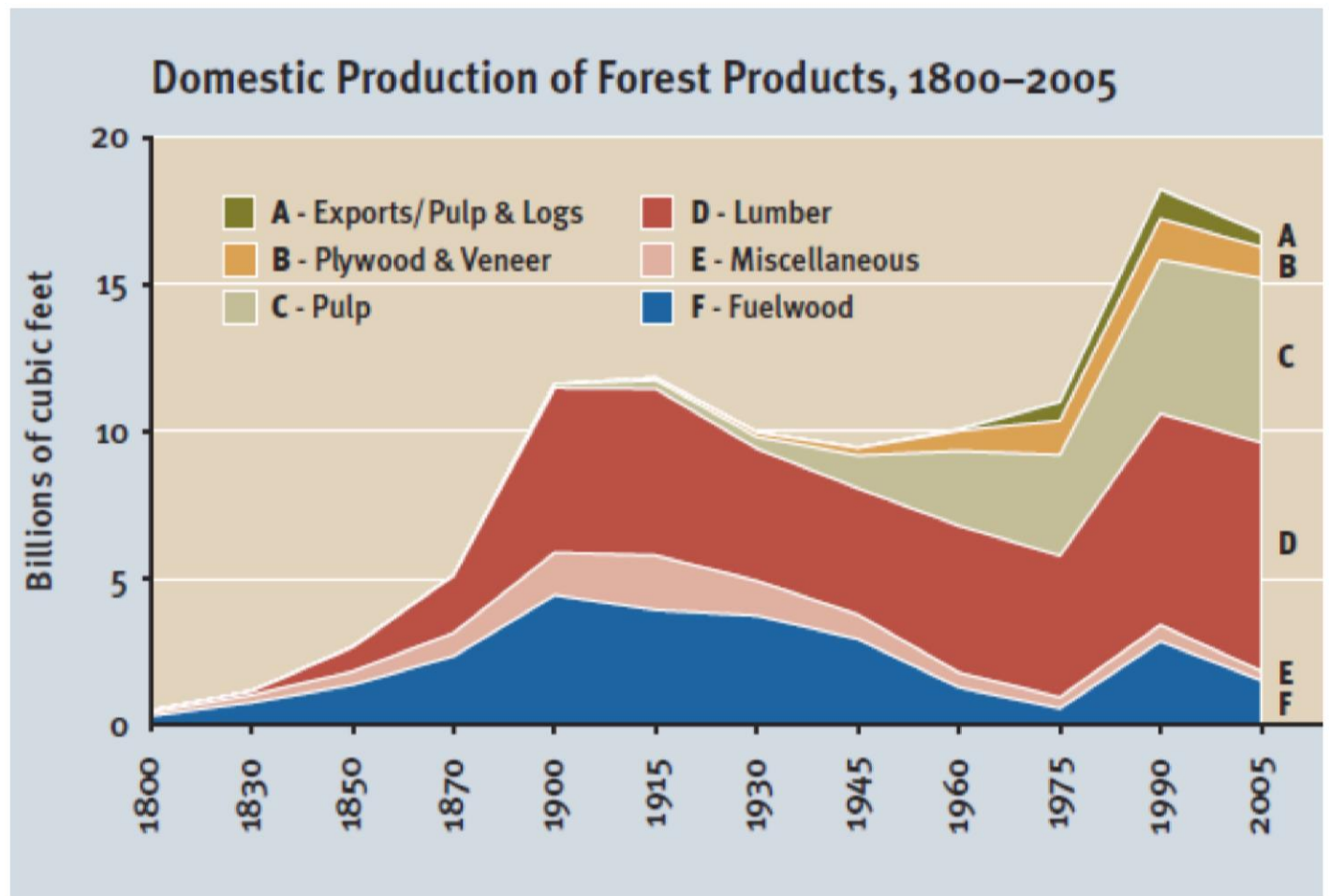
TABLE 2d-3. Development projections by county groupings, 2007-2027

Region	Projected Increase in Developed Acres	Percent Change
Piedmont Total	1,400,700	44%
Coastal Total	207,000	28%
Mountains Total	184,800	22%
Rural	461,600	28%
Urban	1,272,200	42%
Total	1,733,900	38%

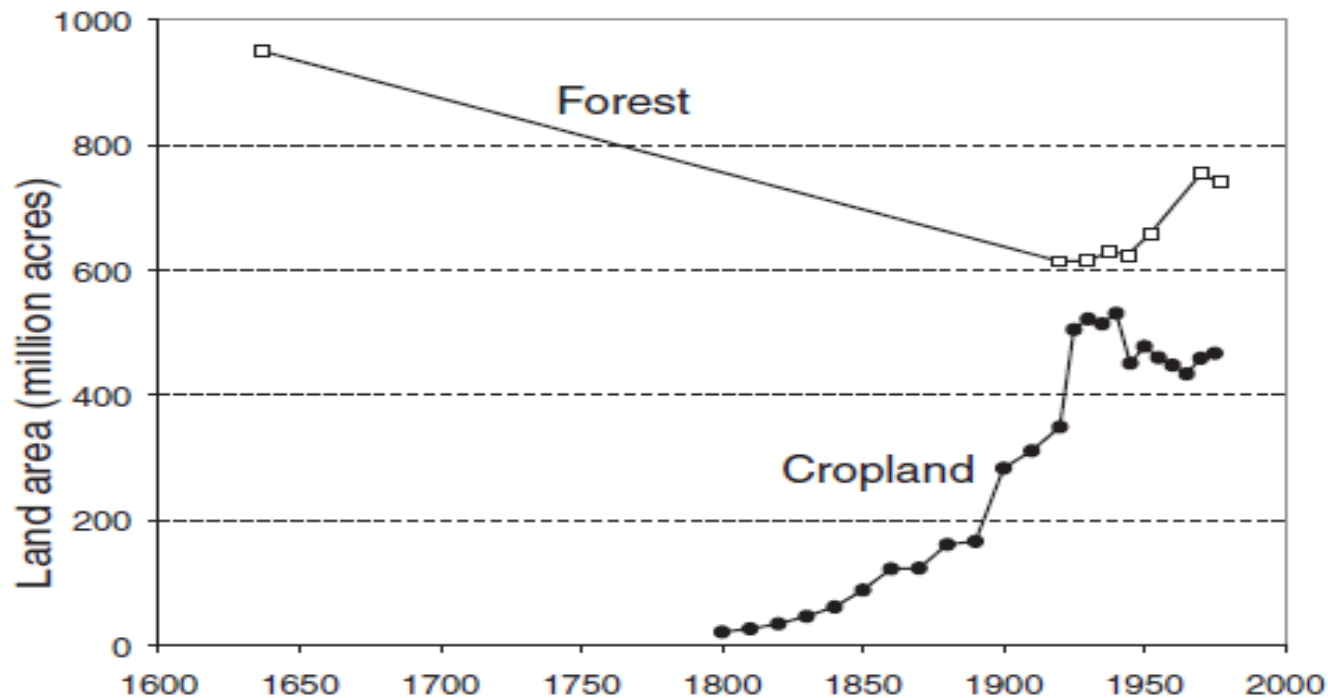
Created by: A. Bailey, NC DFR, 2010

Source: Ouzts, 2007

CONSUMPTION OF US FORESTS



AGRICULTURAL AND FOREST HISTORY IN THE US

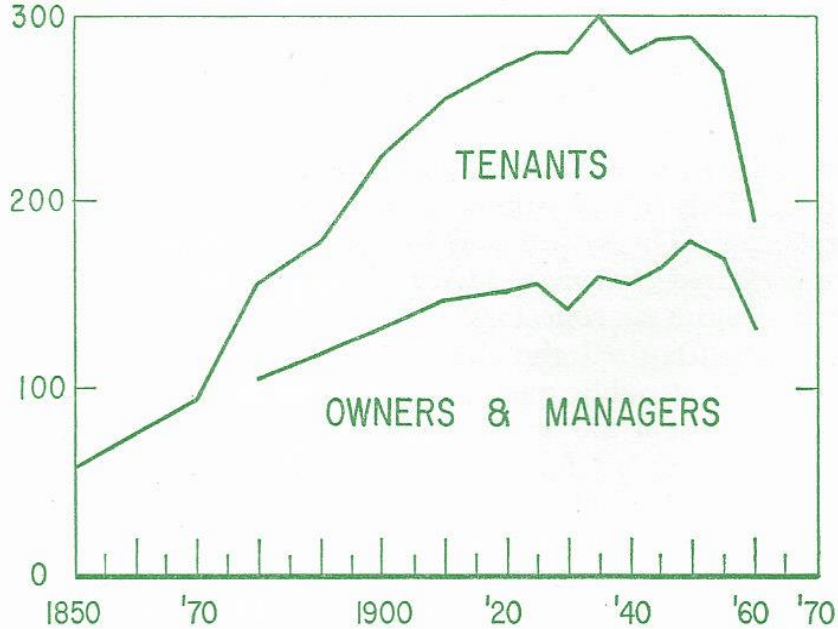


Clawson 1979 – Forests in the long sweep of American History

In 1790, roughly 93% of the US was rural, most of them farmers.
By 1990, only 200 years later, barely 2% of our population are farmers

FARM HISTORY IN NC

NUMBER OF FARMS



Year	# Farms	Acres in Farm (million)
1850	56,963	21.0
1870	93,565	19.8
1890	178,359	22.3
1900	224,637	22.7
1910	253,725	22.4
1920	269,763	20.0
1930	279,708	18.0
1940	278,276	19.3
1950	288,508	18.8
1959	190,567	15.9
1969	119,386	12.7
1982	72,792	10.3
2002	53,930	9.0
2015	48,800	8.3

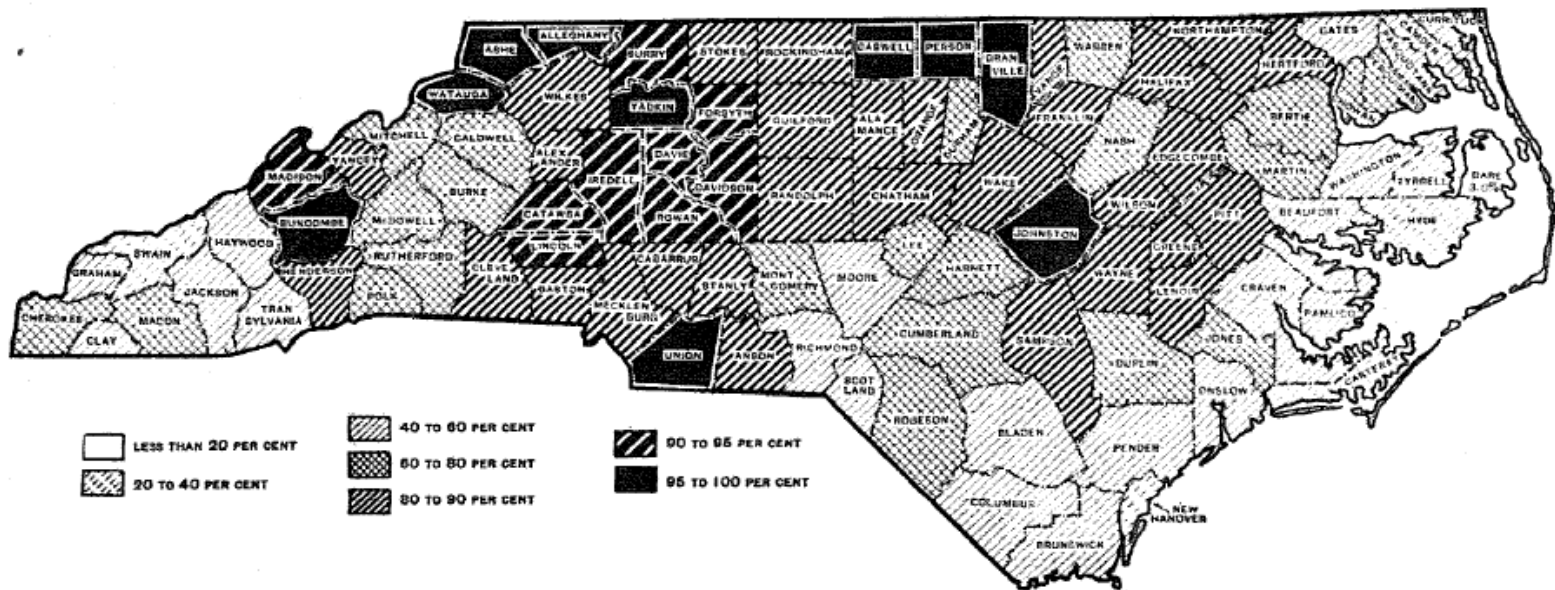
AGRICULTURAL HISTORY IN NC

PER CENT OF LAND AREA IN FARMS, AND AVERAGE VALUE OF FARM LAND PER ACRE, IN NORTH CAROLINA, BY COUNTIES: 1910.

PER CENT OF LAND AREA IN FARMS.

[Per cent for the state, 71.9.]

The per cent of land area in farms, when less than 20, is inserted under the county name.

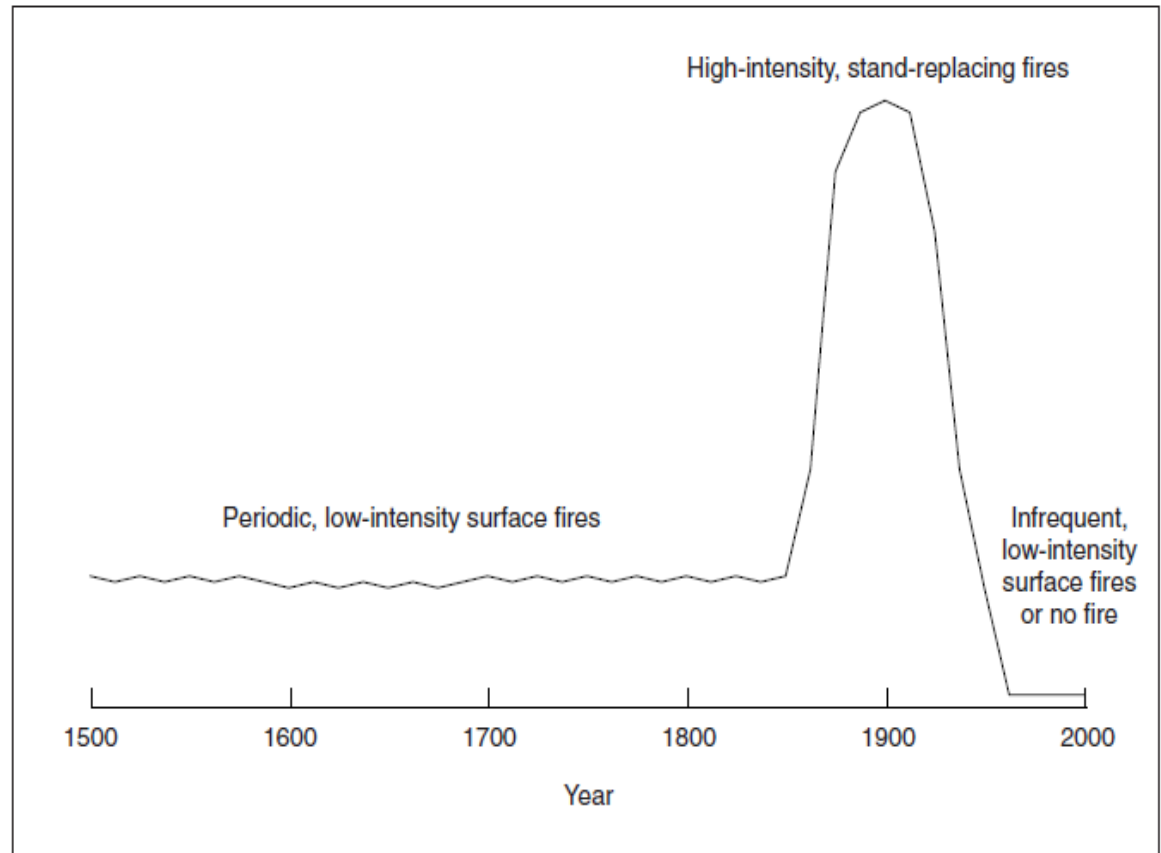
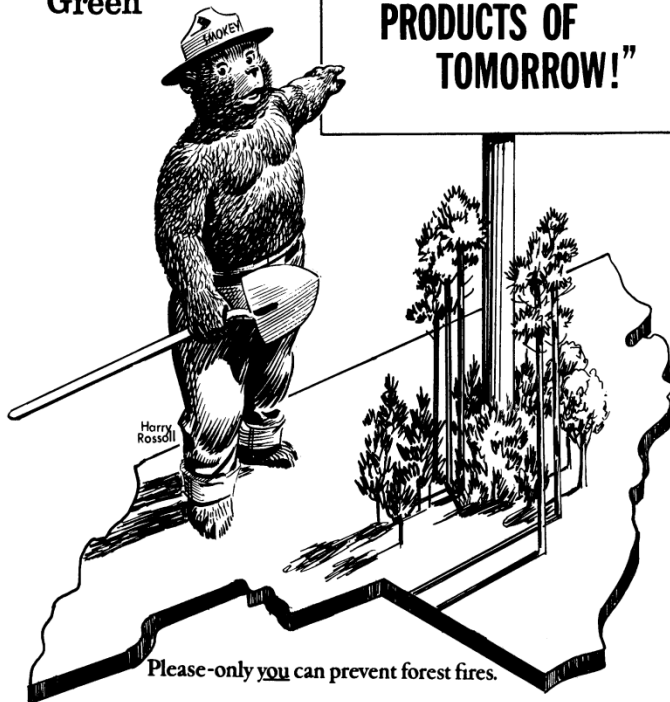


The land surface area of North Carolina is approximately 31,193,600 acres. Of this area 22,439,129 acres or 71.9% are included in farms

CONCEPTUAL MODEL OF FIRE HISTORY IN EASTERN US

Keep
North
Carolina
Green

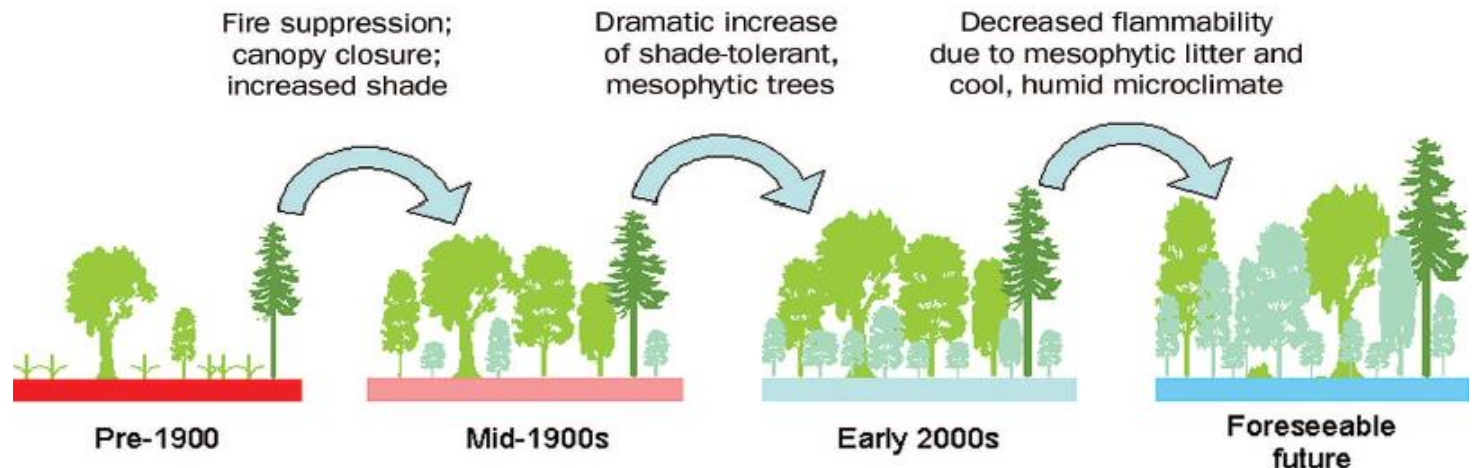
“PROTECT TREES--
THE FOREST
PRODUCTS OF
TOMORROW!”



Conceptual model of the changes in fire regimes for the mixed-oak forests of the Appalachian Mountains (**Brose et. al. 2001**)

THE DEMISE OF FIRE HAS RESULTED IN THE “MESOPHICATION” OF FORESTS IN THE EASTERN US

Fire importance



Mesophication



NC FOREST TYPES IN THE PIEDMONT (FIA 2013, 2015)

2015 Data in Table

Table 2—Area of timberland by ownership and survey unit, North Carolina, 2013

Category	Southern	Northern	Pied- mont	Moun- tains	State
	Coastal Plain	Coastal Plain			
	<i>million acres</i>				
National forest	0.04	0.10	0.09	0.96	1.18
Other Federal	0.22	0.04	0.04	0.00	0.31
State and local government	0.40	0.16	0.26	0.16	0.98
Forest industry	0.30	0.59	0.11	0.03	1.03
Individual	2.76	1.97	4.02	2.24	10.99
Other corporate	1.38	0.68	0.79	0.55	3.40
Total	5.10	3.54	5.31	3.94	17.89

Forest Type Group	Area of Timberland (Acres)
Loblolly-Shortleaf Pine	1,535,743
Oak-Pine	799,625
Oak-Hickory	2,699,988
Oak-gum-Cypress	125,566
Elm-Ash-Cottonwood	262,489
Other/Non-Stocked	35,885
Total	5,490,810

92.6% of Piedmont Timberland Area is Privately owned

NC FOREST TYPES IN THE PIEDMONT (FIA 2015)

Forest Type	Area of Timberland (Acres)
Loblolly Pine	1,088,270
White Oak/Red Oak Hickory	566,417
Yellow Poplar/WO & RO	470,882
Sweetgum/Yellow Poplar	420,347
Loblolly Pine/Hardwood	395,502
Virginia Pine	333,072
Mixed Upland Hardwoods	306,193
Total	5,490,810

VALUE OF PIEDMONT FORESTS



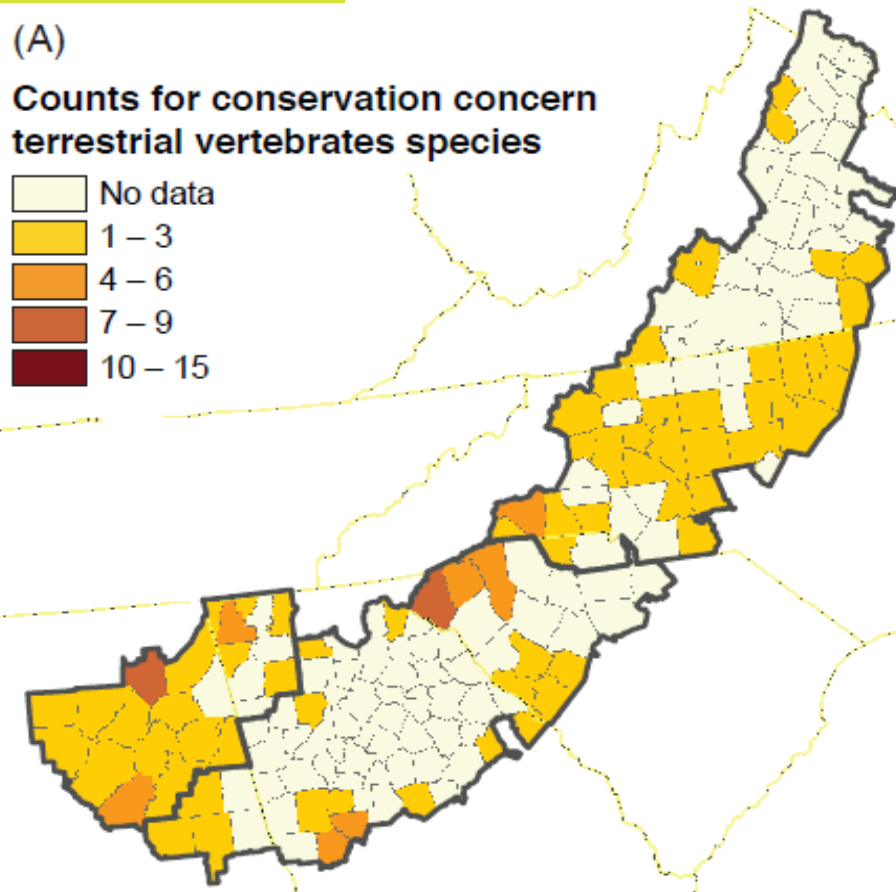
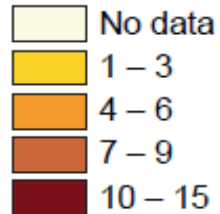
VALUE OF PIEDMONT FORESTS (HABITAT)

Source: Outlook for Piedmont Forests, Sub-regional Report

The proportion of vertebrate species at risk varies among taxonomic groups in the Piedmont: 53% are amphibians, 22% are reptiles, 19% are mammals, and 6% are birds

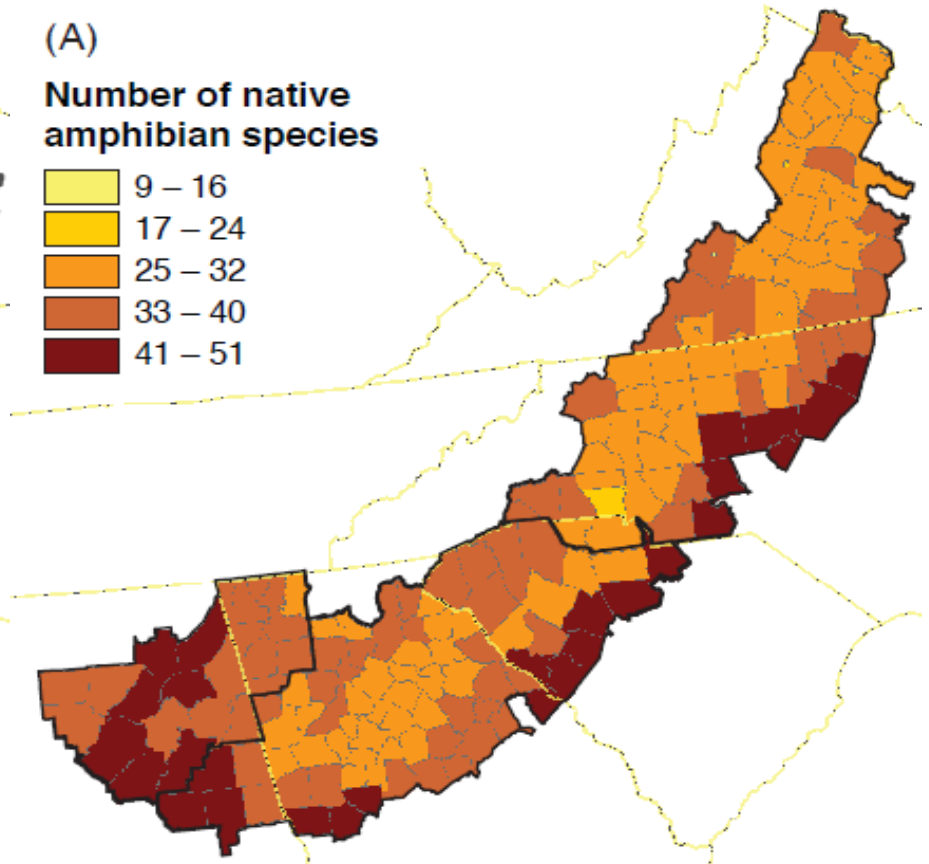
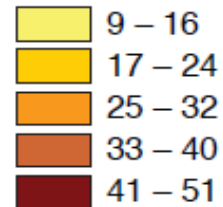
(A)

Counts for conservation concern
terrestrial vertebrates species

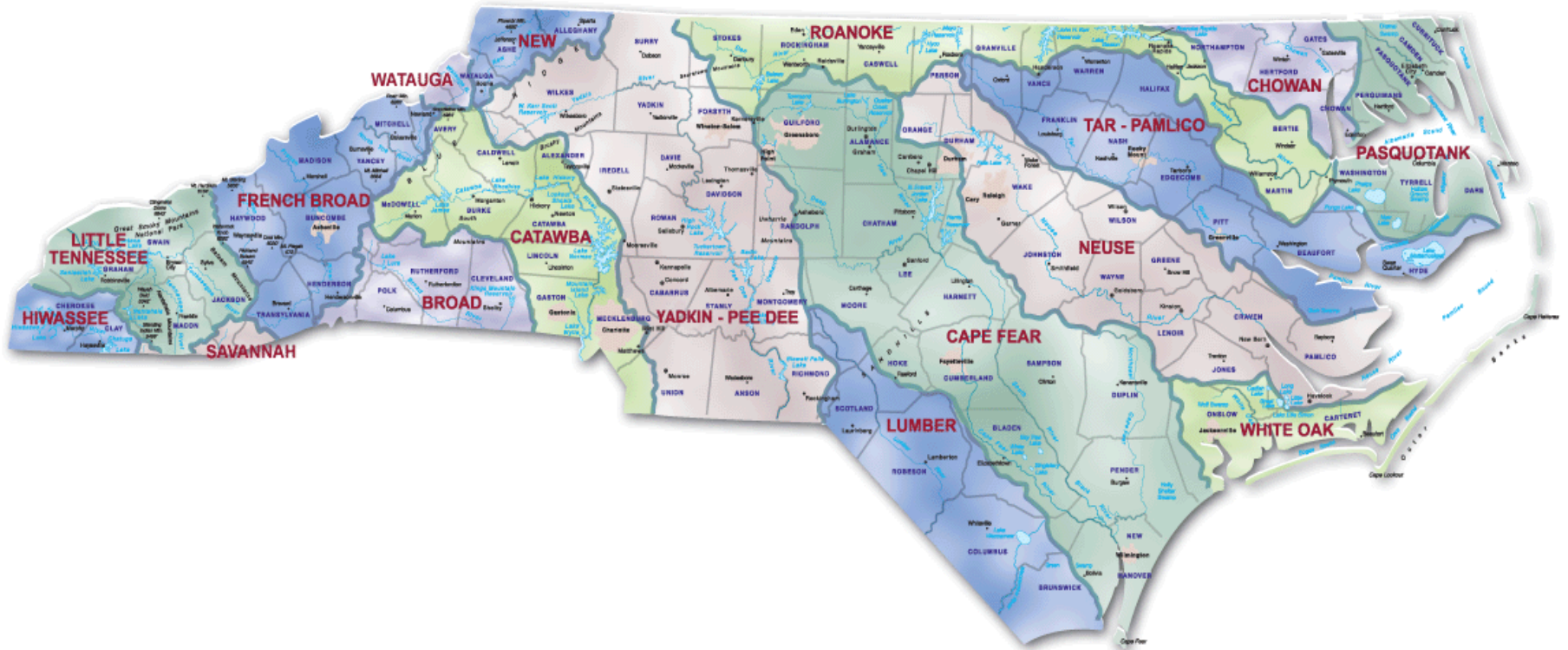


(A)

Number of native
amphibian species

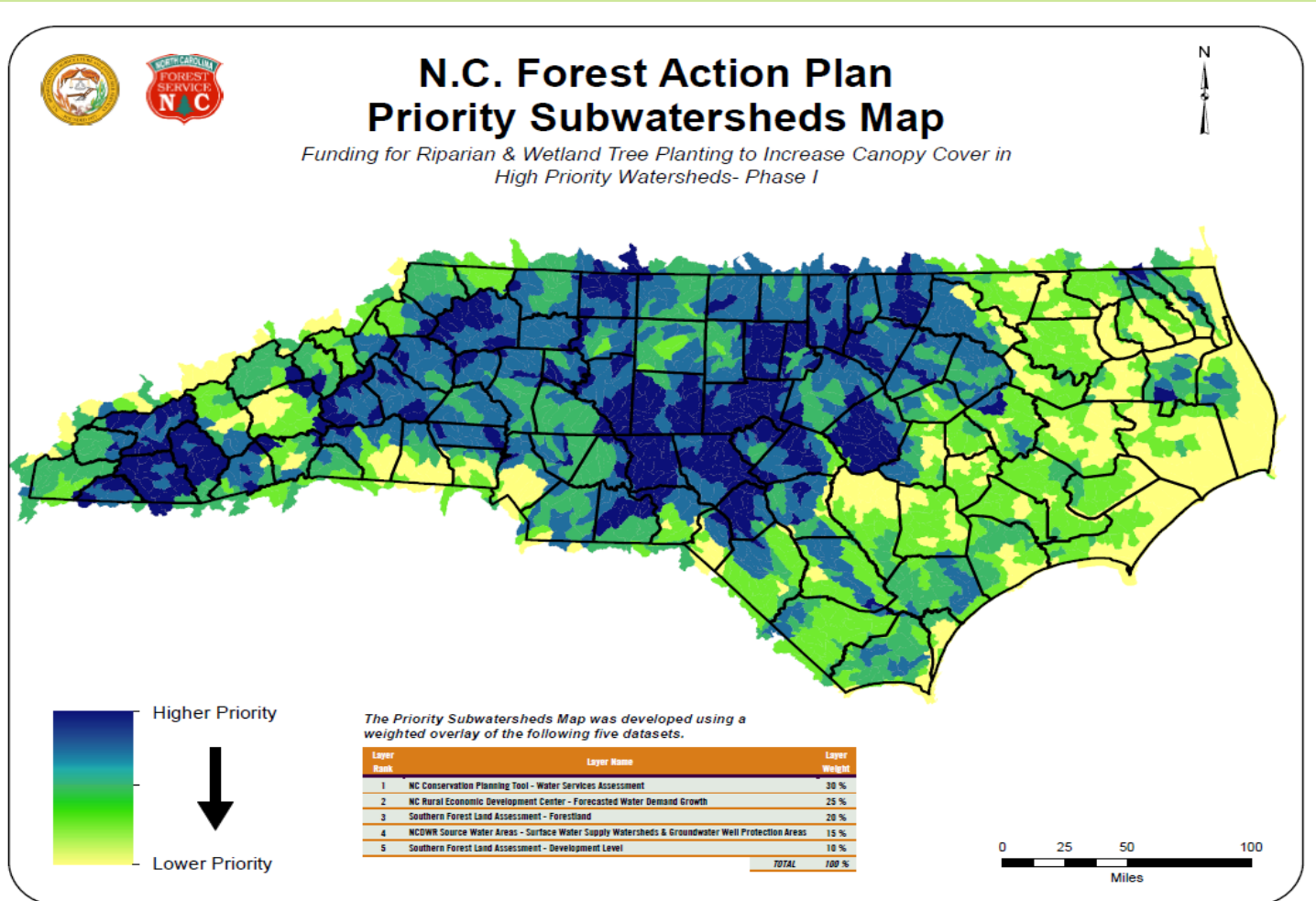


VALUE OF PIEDMONT FORESTS (WATER QUALITY/QUANTITY)

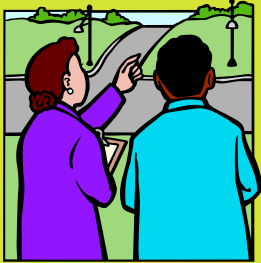


Piedmont Forests protect and enhance some of the larger River Basin systems within North Carolina

VALUE OF PIEDMONT FORESTS (WATER QUALITY/QUANTITY)



MANAGEMENT PRACTICES FOR FORESTRY & WILDLIFE



- ① Given the decreasing trend in size of forest holdings and the socioeconomic status of new owners (higher income, highly educated), social amenities will likely take precedence over management objectives that emphasize timber production.
- ② New owners likely will have different backgrounds and ownership objectives and be less aware of the potential value and benefits of good forest management than previous owners.
- ③ Natural resources professionals who educate and serve these new forest owners will need to apply different approaches to better understand landowner's objectives and to meet their changing resource management needs.

ECOLOGICAL FORESTRY CONCEPTS

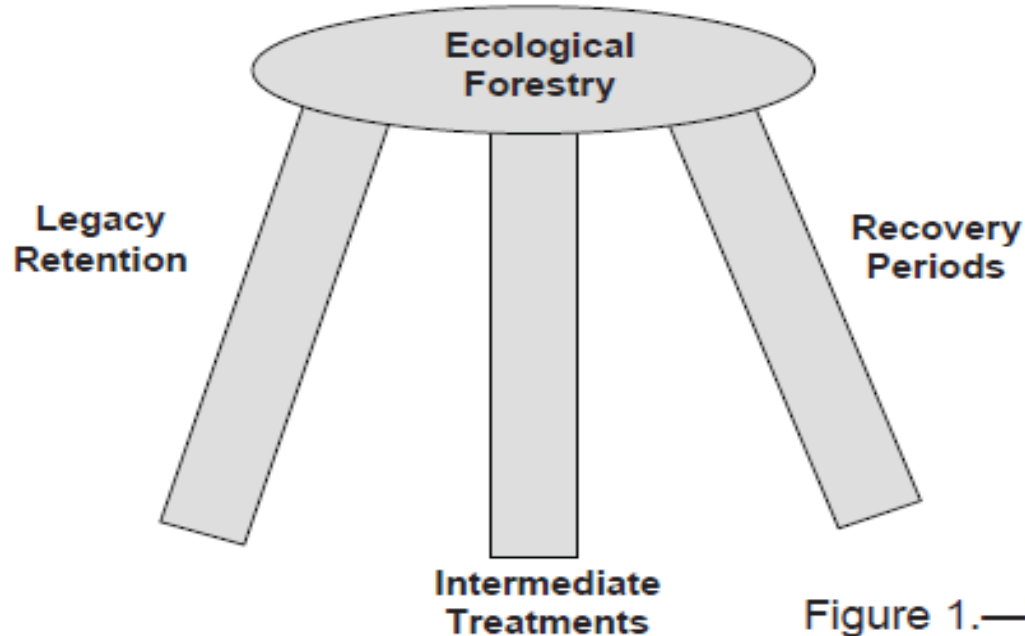
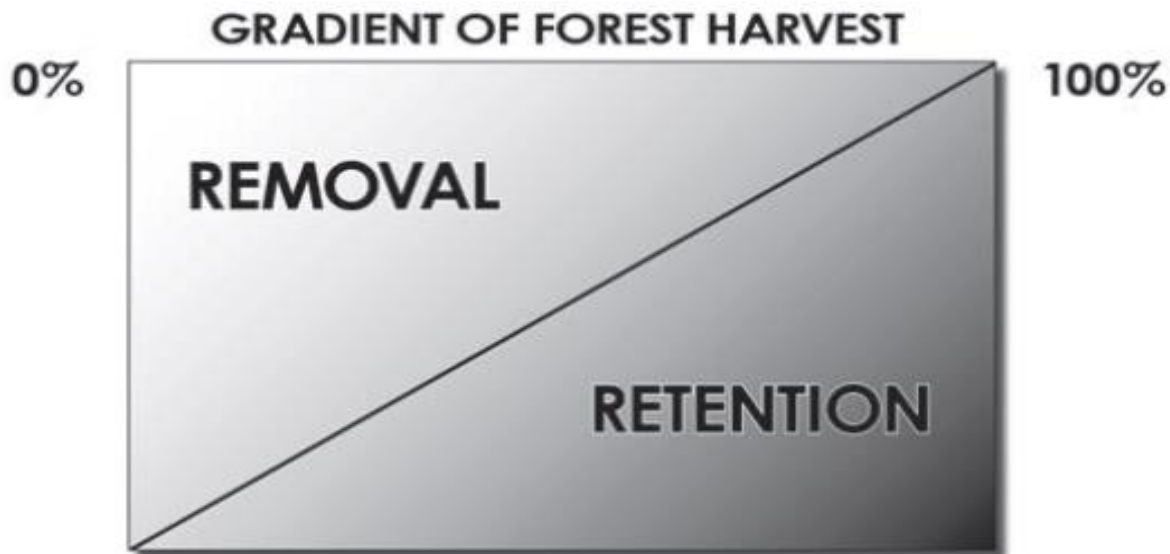


Figure 1.—The three-legged stool of ecological forestry.

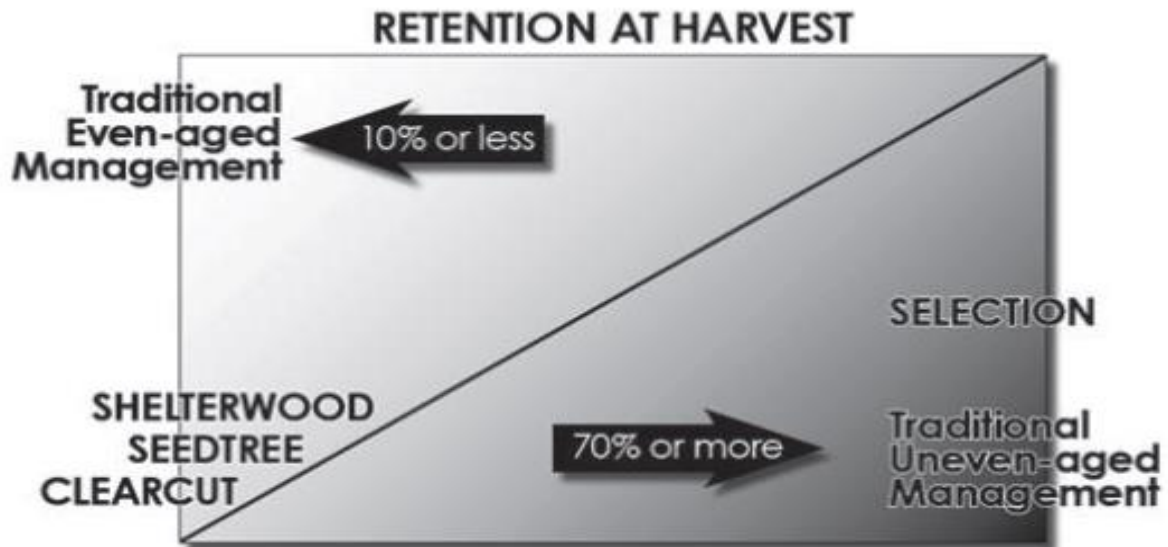
1. Retention of Biological Legacies at Harvest
2. Intermediate Treatments that Enhance Heterogeneity
3. Allowances for appropriate Recovery Periods between Regeneration Harvests

Franklin et. al. 2007 – Natural Disturbance and Stand Development Principles for Ecological Forestry

(a)



(b)



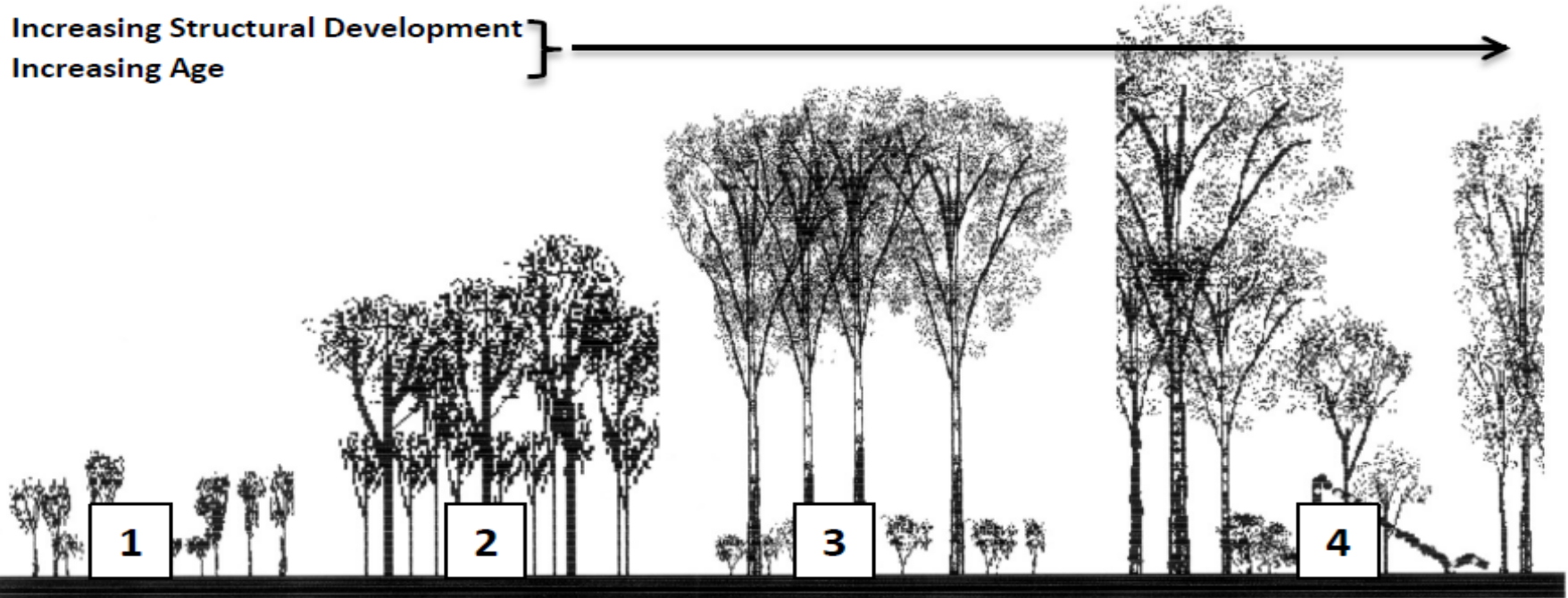
CAN ECOLOGICAL FORESTRY PRINCIPLES BE APPLIED TO PIEDMONT FOREST TYPES?

- ⊙ Modifications of any Silvicultural Systems are possible, acceptance & implementation are the real challenges
- ⊙ Ecological Forestry can be Practiced, but will involve tradeoffs
- ⊙ Education of Other Benefits vs. Costs
 - ⊙ Unique Landowners and/or Tracts

FOREST STAND DEVELOPMENT PHASES

ADAPTED FROM JOHNSON ET. AL. 2009

Increasing Structural Development
Increasing Age



1
(a) Stand Initiation
(b) Young Forest Habitat
(c) Early Successional

(a) Stem Exclusion

3
(a) Understory Reinitiation
(b) Mature Forest

4
(a) Complex Stage
(b) Late Structural Conditions
(c) Old Growth Conditions

ALTERNATIVE SILVICULTURAL SYSTEMS TO CLEARCUTTING & SELECTION SYSTEMS



- ◎ Shelterwood Systems
- ◎ Two-Age Systems
 - ◎ Deferment Cuts
- ◎ Group Selection
 - ◎ Leave Residuals, Variable Density Thinning (VDT) between Groups
- ◎ Lengthen Rotation Ages
 - ◎ Raise cutting diameters



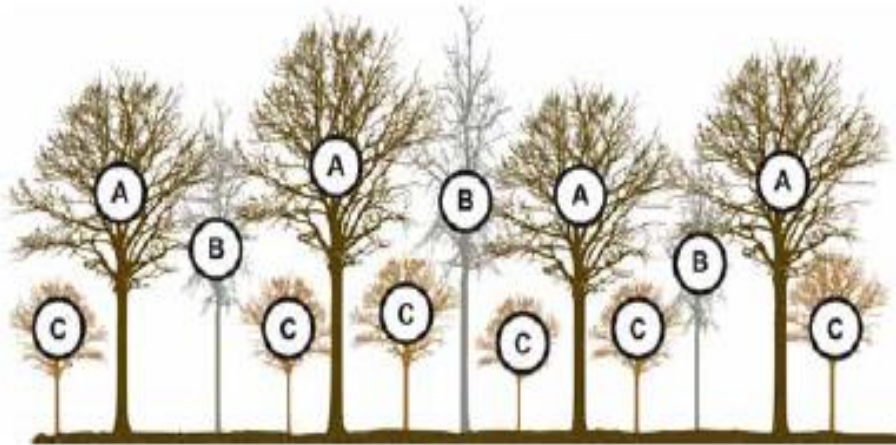
APPROPRIATE SILVICULTURAL SYSTEMS

SHELTERWOOD CONCEPTS

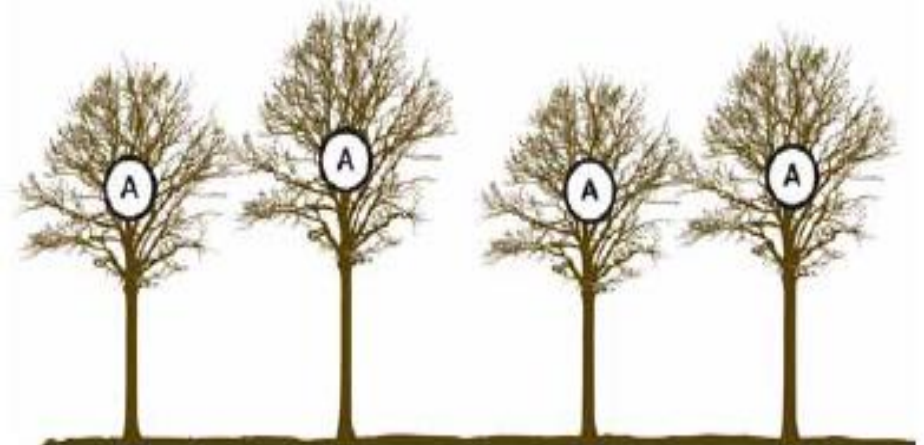
- ① The Shelterwood Method involves gradual removal of the stand overstory, usually in Two or more cuts.
- ① Involves a Sequence of Prescriptions, Events, and Targets
- ① Requires Professional oversight (Forester), monitoring, and patience
 - ① Marking Guides, Regeneration Surveys, Education
- ① Conducive to Incorporating Biological Legacies into Harvest Prescriptions

APPROPRIATE SILVICULTURAL SYSTEMS

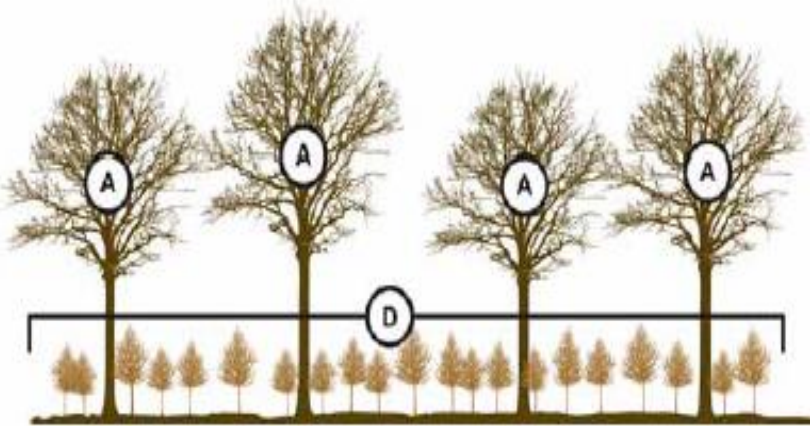
SHELTERWOOD & BURN TECHNIQUE



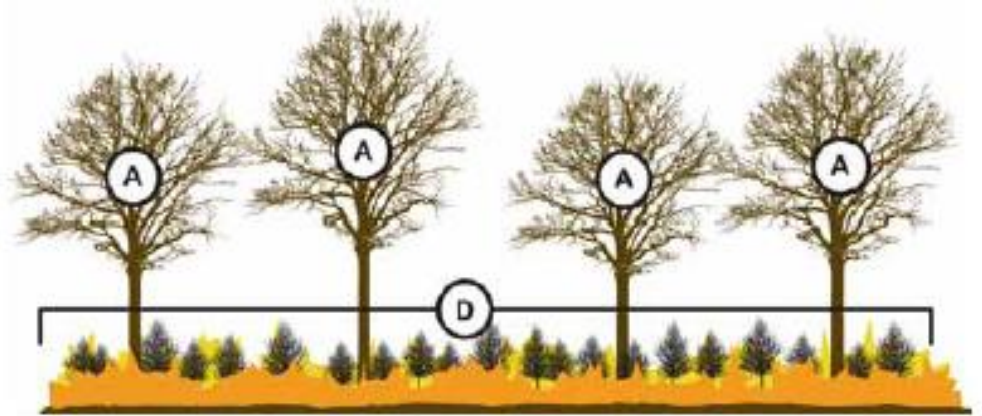
1.



2.



3.



4.

APPROPRIATE SILVICULTURAL SYSTEMS

SHELTERWOOD & BURN TECHNIQUE



APPROPRIATE SILVICULTURAL SYSTEMS

SHELTERWOOD & BURN TECHNIQUE



APPROPRIATE SILVICULTURAL SYSTEMS

TWO-AGED SYSTEMS



PRESCRIBED BURNING IN HARDWOOD STANDS



- ◎ Fire can have both a positive or negative benefit
- ◎ Can be an effective tool to promote oak regeneration & recruitment
- ◎ Fire Frequency is important
 - ◎ Multiple Burns vs Single Burn
- ◎ Timing of Fire Important
 - ◎ Dormant Season vs Growing Season

APPROPRIATE SILVICULTURAL SYSTEMS

TWO-AGED SYSTEMS



- ◎ Shelterwood with Reserves
 - ◎ Scattered or Small Groups of Older Trees (Long Lived)
 - ◎ Maintaining Species at Risk
- ◎ Deferment Harvest
 - ◎ Defer a portion of the overstory
 - ◎ Leave between 10-20 Sq. Ft. BA
- ◎ Provides for Structural components that are lacking in complete harvest areas

APPROPRIATE SILVICULTURAL SYSTEMS

TWO-AGED SYSTEMS



Should not be Applied as a Substitute for
Diameter Limit cutting or High-grading



APPROPRIATE SILVICULTURAL SYSTEMS

TWO-AGED SYSTEMS



FINAL THOUGHTS

(*EHRHARD FROST 2006*)

- ⊙ Prescriptions are nothing more than working hypothesis with uncertain outcomes
- ⊙ Maintain a functioning forest first and implement treatments that preserve future options and opportunities
- ⊙ Design silvicultural techniques and schedules that promote the development of species and structures that will naturally evolve over time on a site and reflect natural disturbance patterns while benefitting targeted species

Questions?

