



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

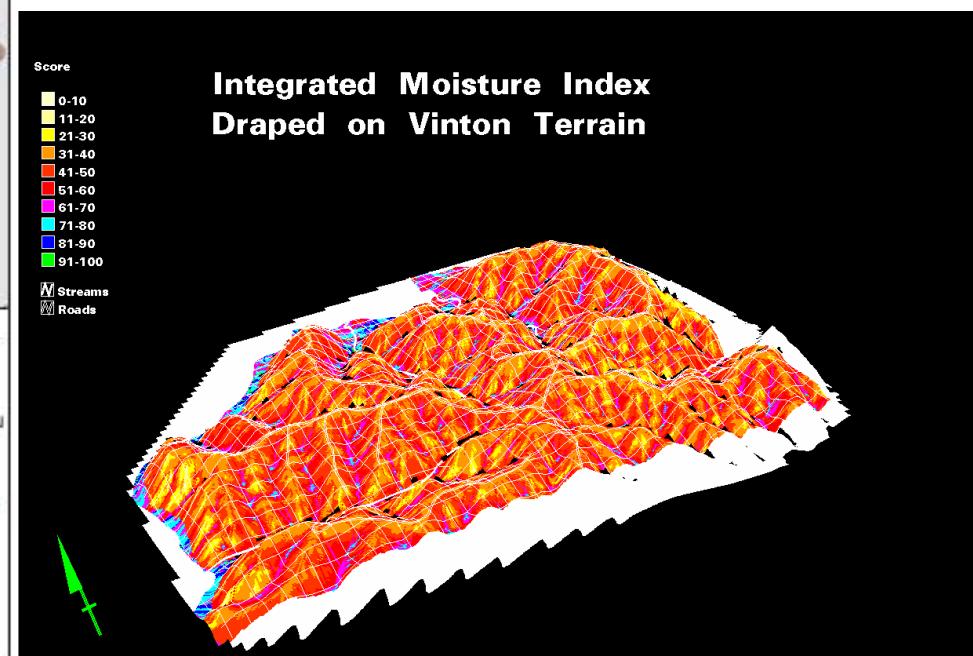
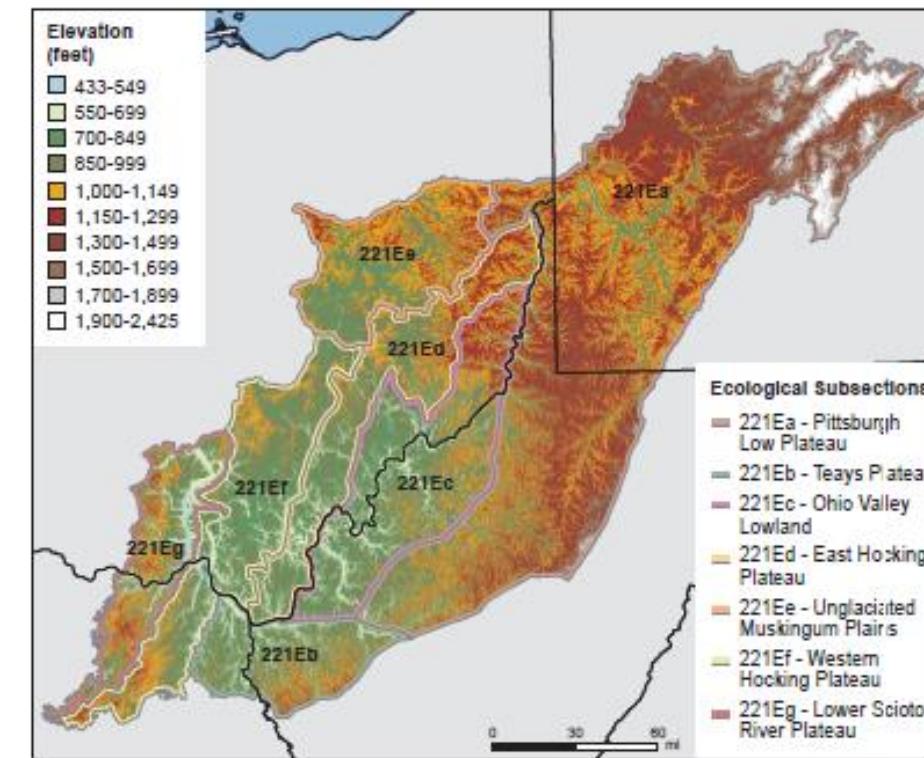
Ohio Hills Forest Ecology and Dynamics



Ohio Hills Adaptive Silviculture for Climate
Change
Workshop
May 23-25, 2022

Todd Hutchinson
USDA Forest Service, Northern Research Station
Delaware, OH

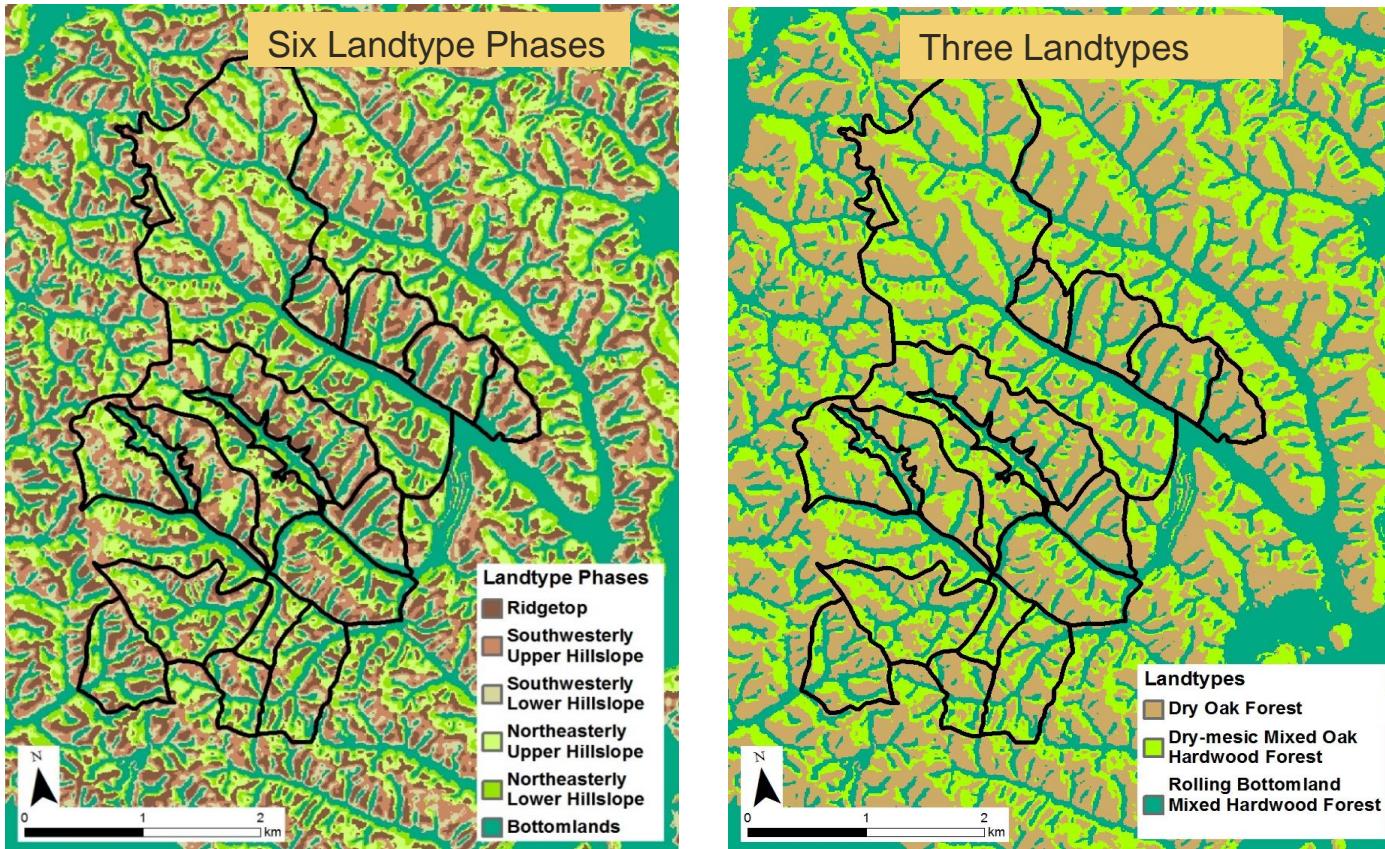
Southern Unglaciated Allegheny Plateau



- Western Hocking Plateau
 - Topography
 - Bedrock Geology
 - Soils
 - Forests

Iverson et al. 2019

Ecological Land-types

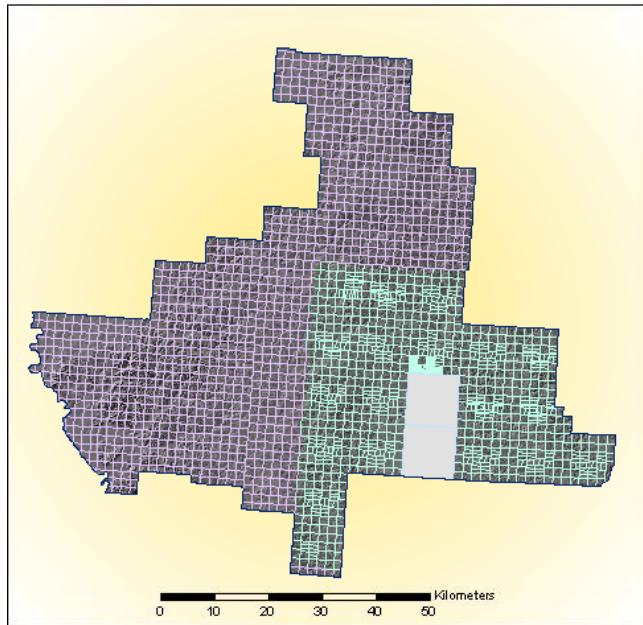


- Dry Oak Forest (42%)
- Dry-mesic Mixed Oak Hardwood Forest (27%)
- Rolling Bottomland Mixed Hardwood Forest (31%)

Iverson et al. 2019

Presettlement Vegetation

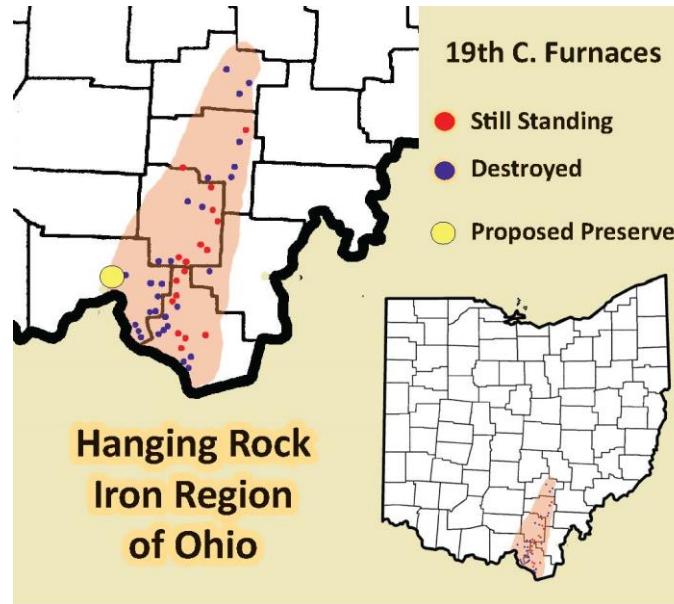
Lots	Meaning trees	Individ uals	Lands descrip tion	Quality of Lands here	
				From A to B Hill land & timber	From B to C Hill land with soil
39	White oak	48	120 0	25	From A to B Hill land & timber
	Gum	14	103 11	26	Oak, Hickory, Chestnut, Sugartree &
41	White oak	31	144 6	22	From B to C Hill land with soil
	Hickory	24	172 11	27	Simp. Oak, N. Walnut, Gum, S. Poplar,
4	White oak	30	132 0	42	From C to D Level with land generally
	White oak	15	306 11	63	Simp. Oak, Cherry, Plum, Chestnut, Sycamore, &c.



Species/ Group	Witness trees (%) Ca. 1800
White oak	34.1
Hickories	13.9
Red oak group	12.9
American beech	10.3
Sugar maple	4.6
Red maple	3.4
Yellow-poplar	2.9
Cherry, Aspen, Elm, Ash, Buckeye	4.6

Dyer and Hutchinson, 2019

Post-settlement land-use: charcoal iron industry

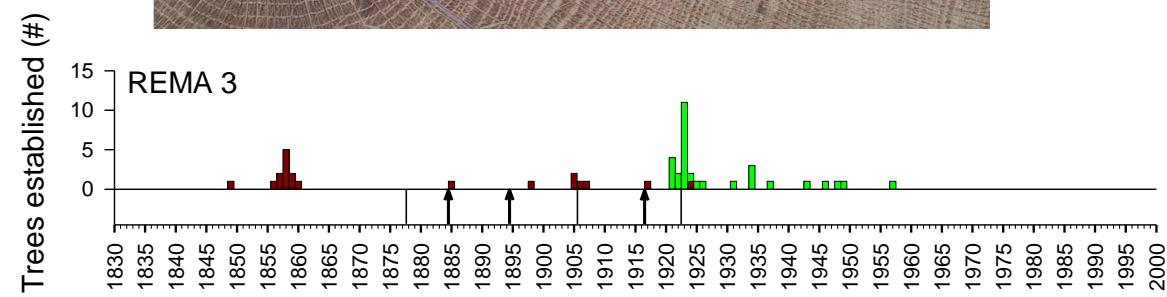


"Nearly all the hill lands in this and the three adjoining townships has been cut over once, and in some instances twice to procure timber for the charcoal furnaces. Most of this land is allowed to grow up again, and in from 25 to 30 years produces timber fit to cut for charcoal purposes. But the injuries by fire, cattle and trespasses reduces the area every time the land is cut over. No effort has been made to get the land set in timber, where it failed to come of itself. No effort would be needed if cattle could be kept from it. The lands are valued for taxation at from

Leue, 1886

Forest regrowth 20th century, fire history

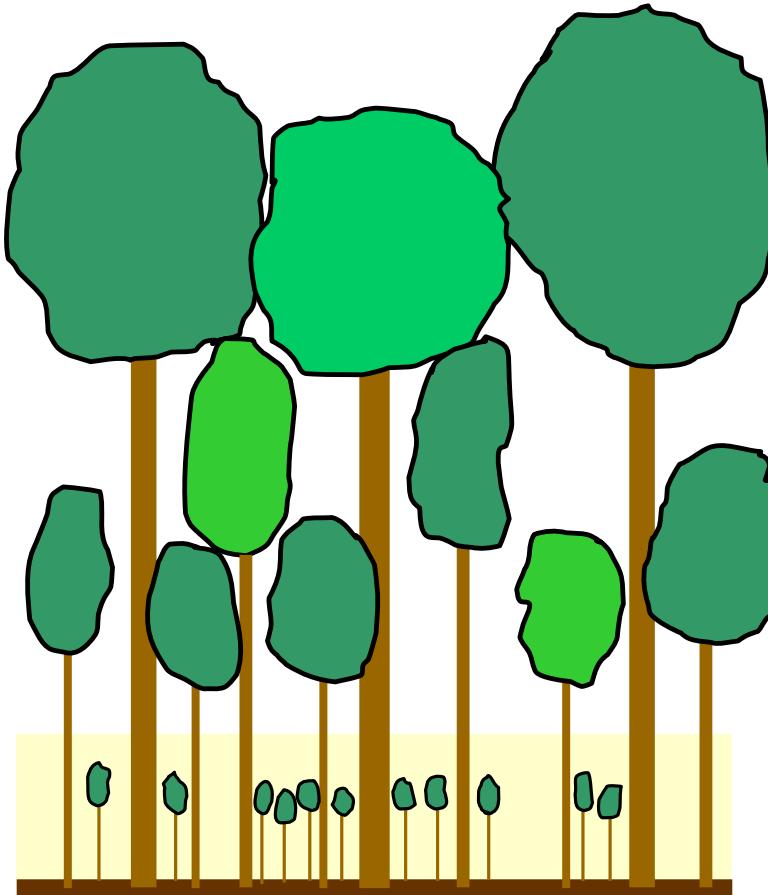
Study	Forest	Site	Fires, #	Fire period	Mean FRI
Sutherland 1997	Vinton Furnace	Oreton	11	1871-1927	5.4
McEwan 2007	Vinton Furnace	Watch Rock	8	1875-1934	8.4
McEwan 2007	Vinton Furnace	Raccoon	6	1889-1935	6.4
McEwan 2007	Vinton Furnace	Ball Diamond	9	1878-1931	6.6
McEwan 2007	Vinton Furnace	Arch Rock	5	1900-1936	9.0
McEwan 2007	Tar Hollow	Eagle Mills	10	1917-1936	2.1
McEwan 2007	Shawnee	Shawnee	9	1889-1931	5.3
Hutchinson 2008	Vinton Furnace	REMA 2	7	1877-1933	9.3
Hutchinson 2008	Vinton Furnace	REMA 3	6	1878-1923	9.0
Hutchinson 2008	Zaleski	ZAL 2	5	1870-1928	11.8
Hutchinson 2019	Shawnee	McAtee Run	34	1796-1941	4.1



Hutchinson and others 2008

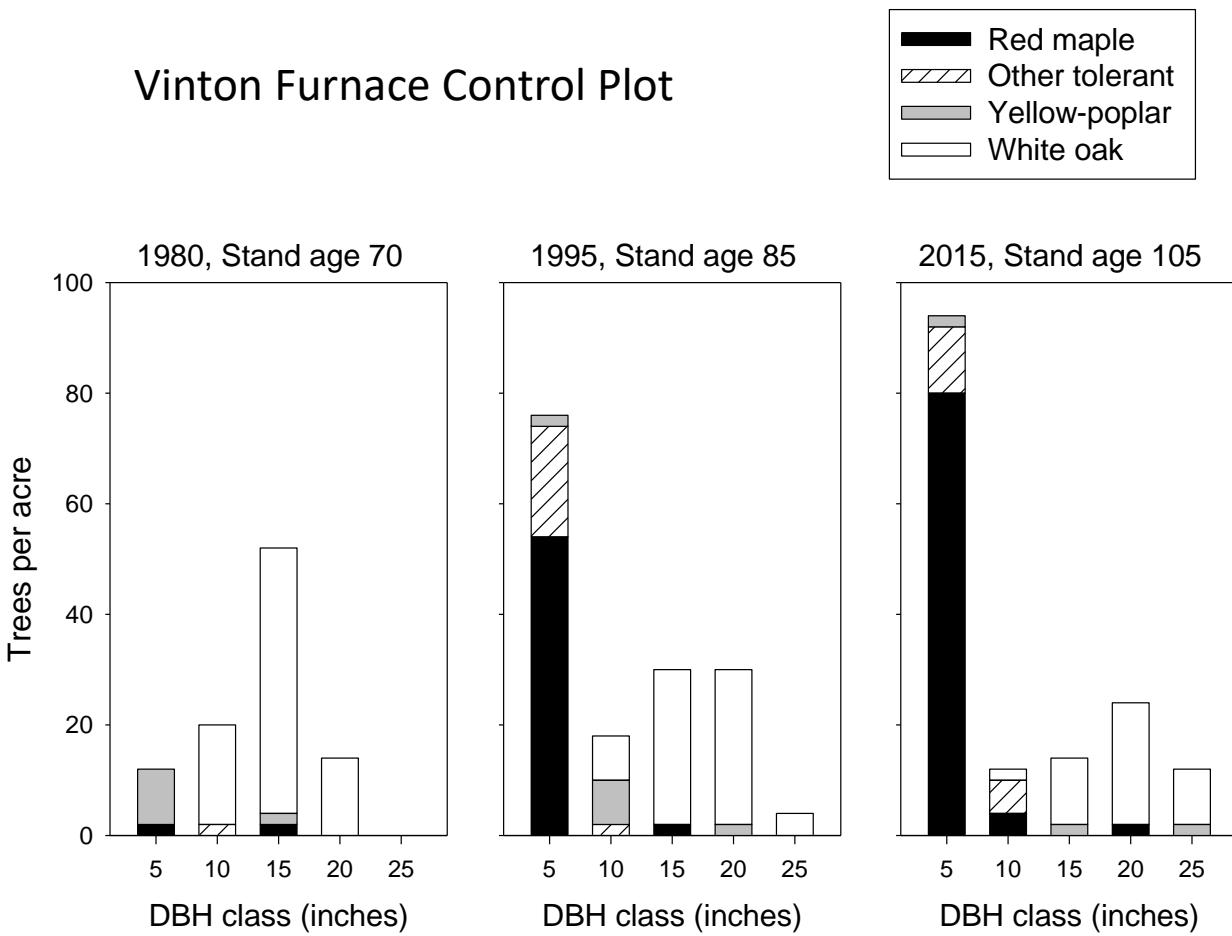
Current Forest Structure and Composition

- Overstory (>10" DBH)
 - White oak, *Quercus alba*
 - Chestnut oak, *Quercus montana*
 - Black oak, *Quercus velutina*
 - Hickories, *Carya* spp.
 - Scarlet oak, *Quercus coccinea*
 - Yellow poplar, *Liriodendron tulipifera*
- Midstory (1-10" DBH)
 - Red maple, *Acer rubrum*
 - Sugar maple, *Acer saccharum*
 - Blackgum, *Nyssa sylvatica*
 - Beech, *Fagus grandifolia*
 - Sourwood, *Oxydendrum arboreum*

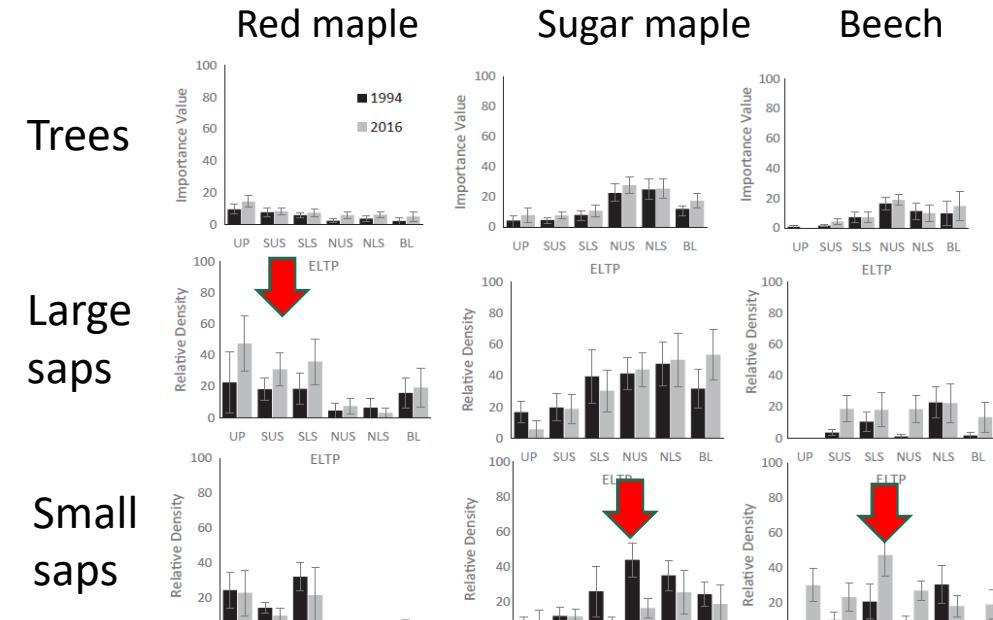


Midstory development and change

Vinton Furnace Control Plot



Wayne NF ECS Plots



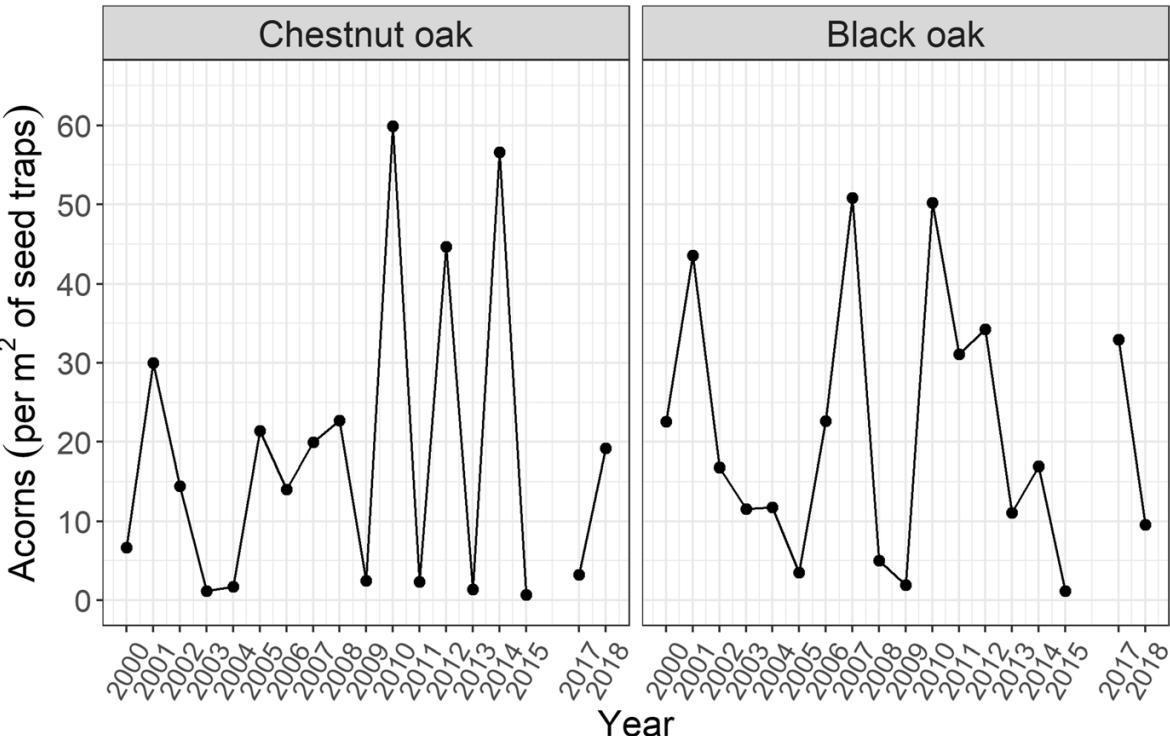
Palus et al. 2018, Radcliffe et al. 2020

Drivers of shifts in species composition?



- **Fire exclusion**
 - Abrams 1992, Nowacki and Abrams 2008, Alexander et al. 2021
- **Climate: Precipitation/drought intensity**
 - McEwan et al. 2011, Novick et al. 2022
- **Atmospheric deposition/soil nutrient supply**
 - Thomas et al. 2010, BasiRad et al. 2015, DeForest and Snell 2019, Royo et al. 2021

Oak regeneration process, acorn production



- Weather
- Resources
- Super-producers

Smith et al. 2021, Smith et al. 2022

Seedling survival and development



Intrinsic accumulation

- Ridges, upper slopes, S-aspect
- Low moisture/nutrient availability
- ~5% full sunlight
- Less understory competition

Johnson et al. 2009. Ecology and Silviculture of Oaks

Seedling survival and development



Recalcitrant accumulation

- Mid-lower slopes, N & E aspects
- High moisture/nutrient availability
- ~2% full sunlight
- Greater understory competition

Johnson et al. 2009. Ecology and Silviculture of Oaks



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Seedling survival and development



2% full sunlight

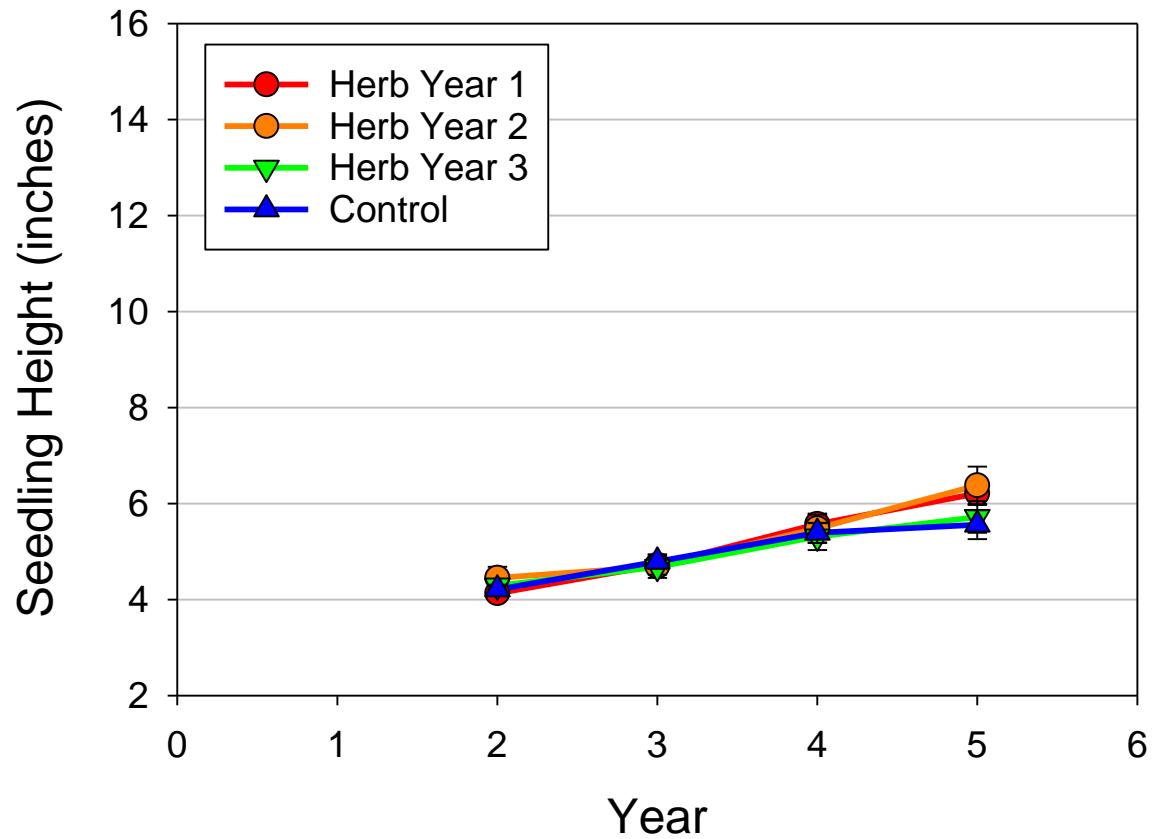
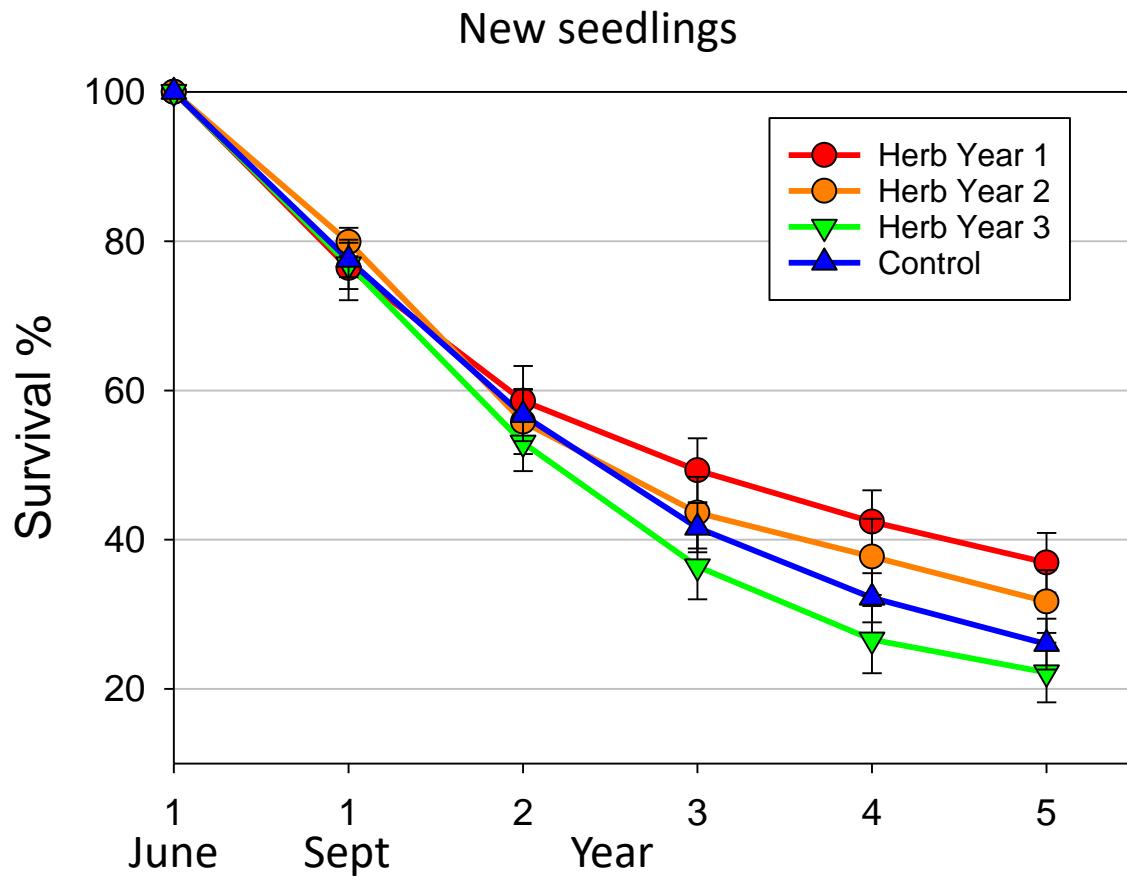


18 % full sunlight



White oak cohort, 2015

White oak cohort

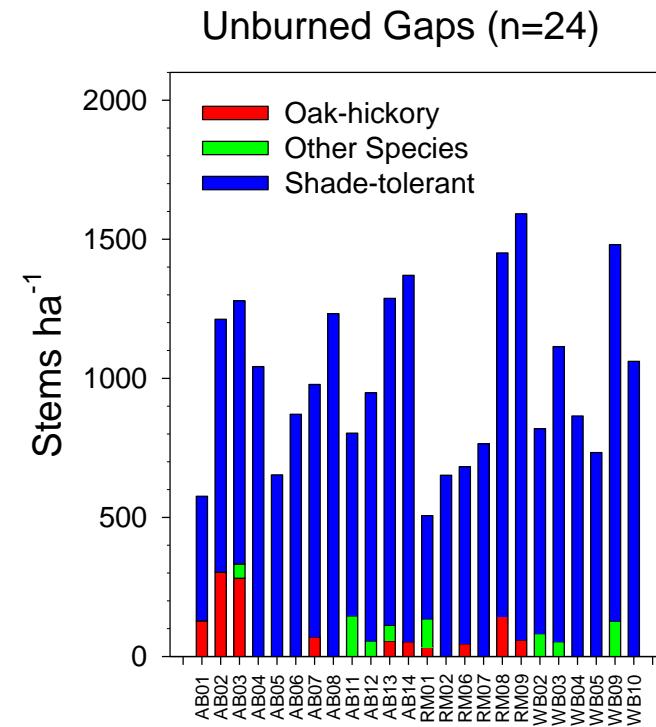


Tree regeneration in canopy gaps

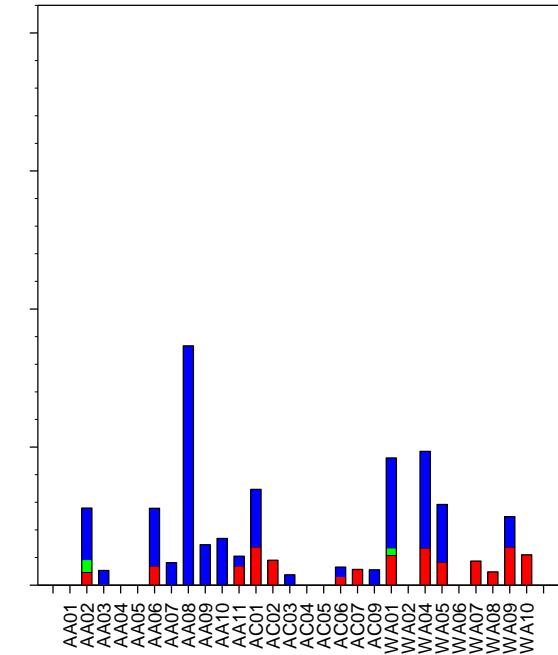


2003 White oak decline

Saplings/poles 1-8" DBH, year 5



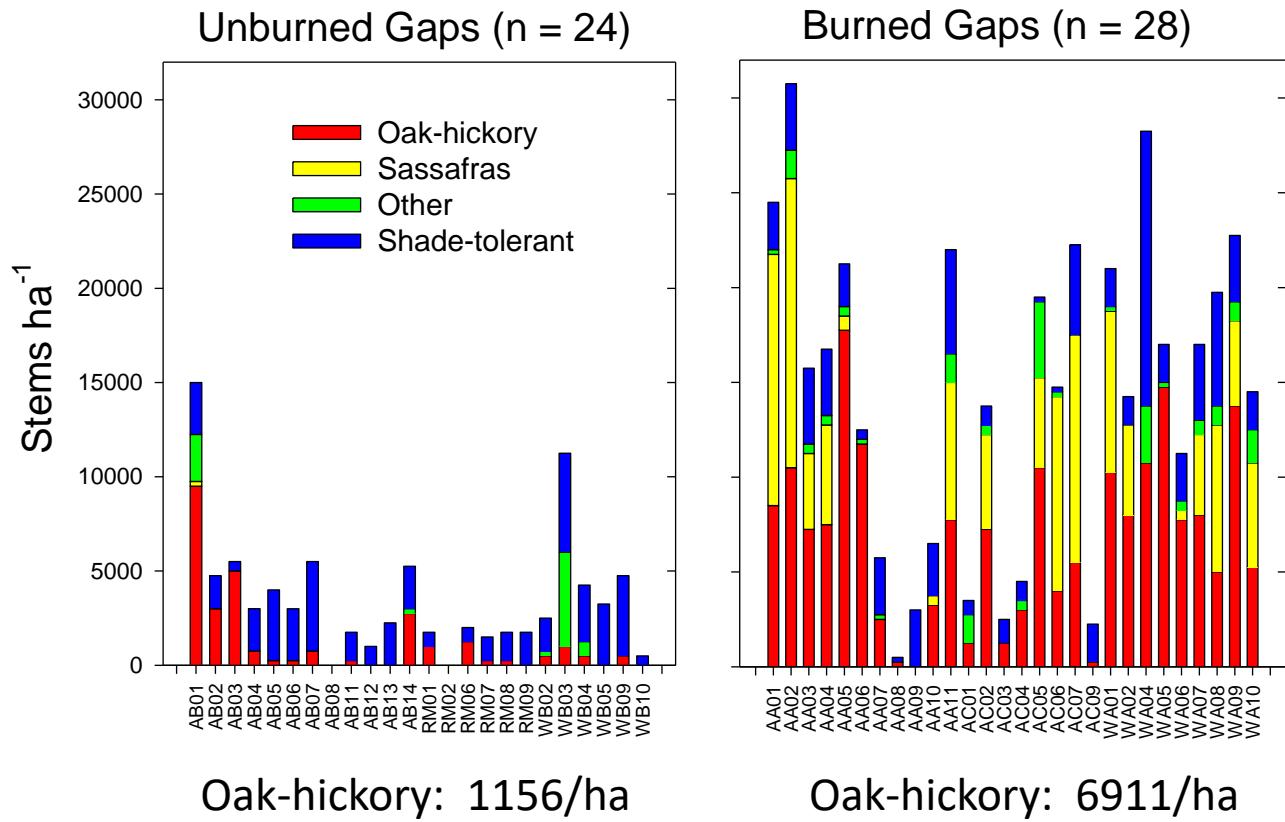
Burned Gaps (n=28)



Hutchinson et al. 2012

Tree regeneration in canopy gaps

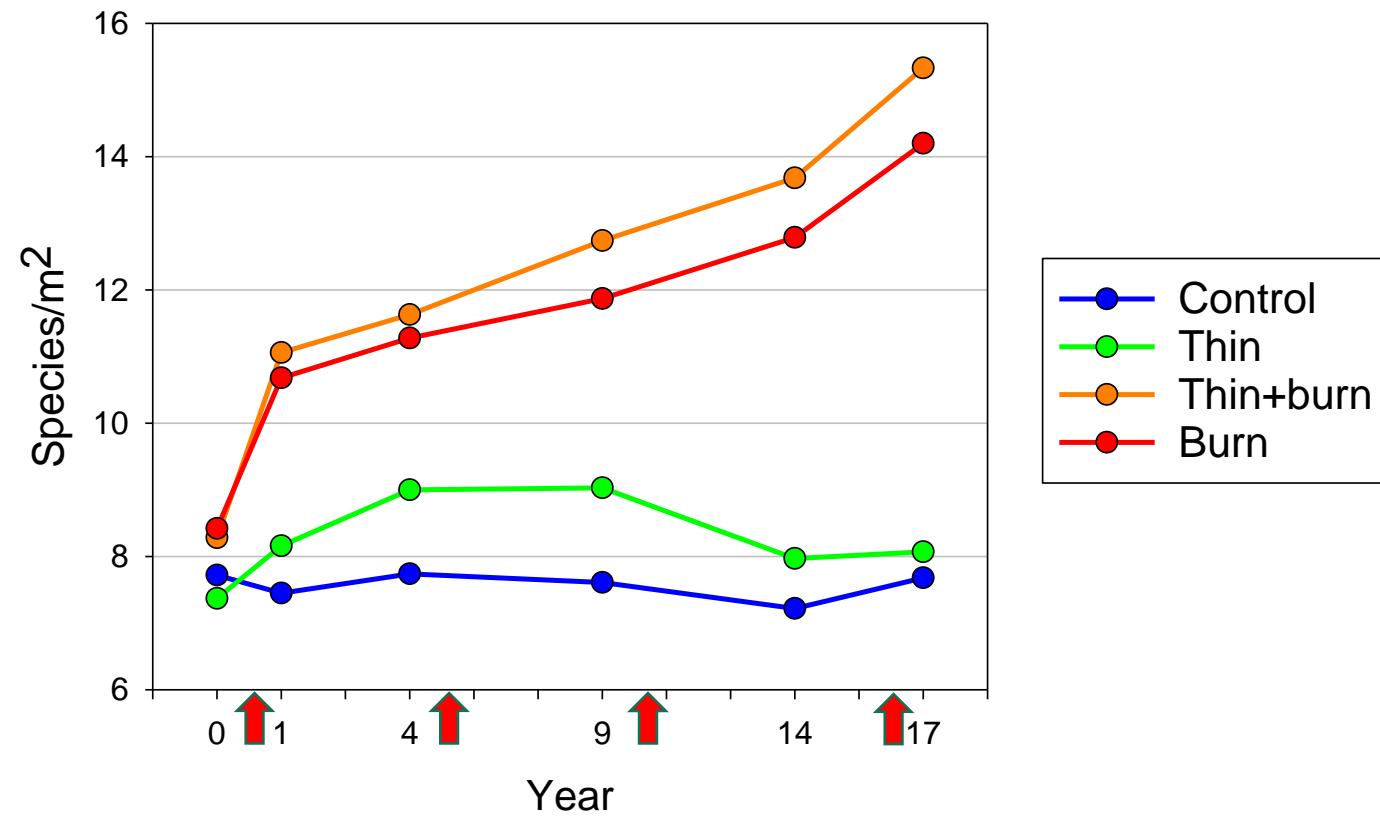
Seedlings >2' tall, year 5



Herbaceous-layer vegetation

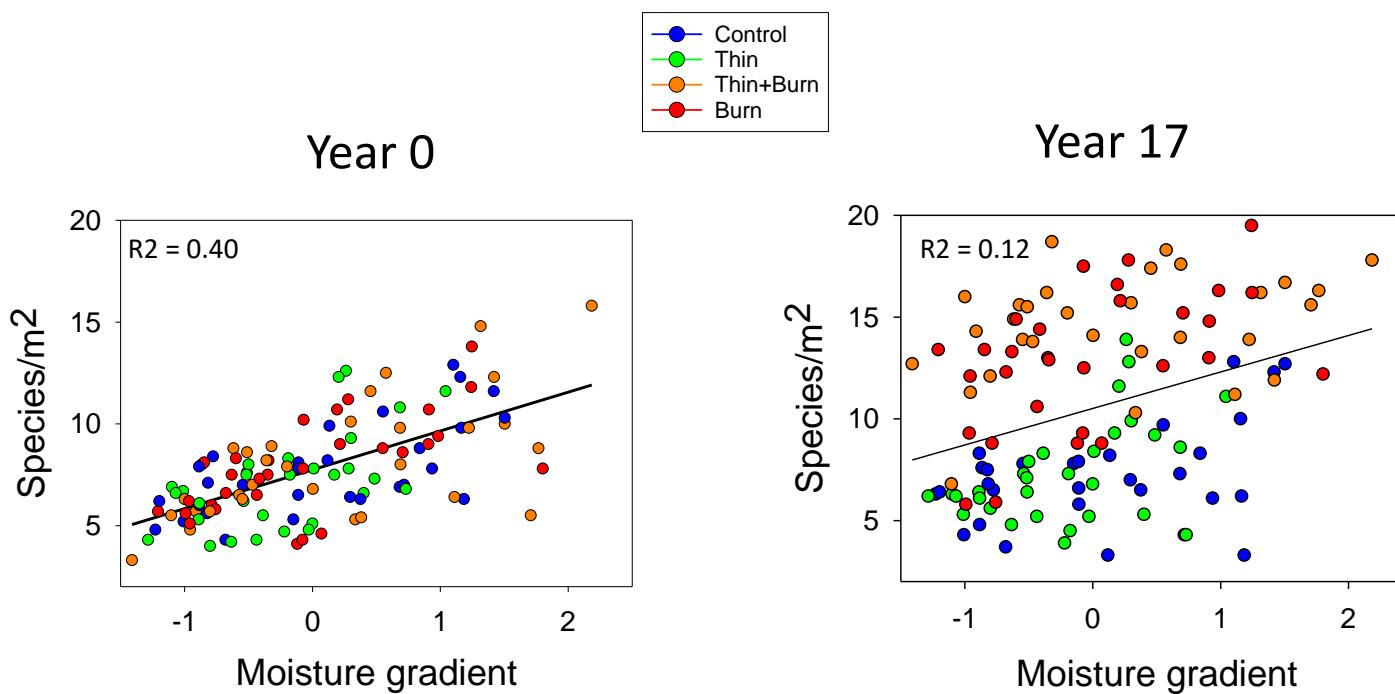


Herbaceous-layer vegetation, Fire and Fire Surrogate Study



Hutchinson et al. 2021

Herbaceous-layer vegetation, Fire and Fire Surrogate Study





Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Questions/Comments ?

