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The Intersection of Forest Management & Rx Fire

David Ray, TNC

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Some assumptions for this talk…

- Prescribed fire is being used as a conservation/ restoration practice
  - Timber production is unlikely to be enhanced by the use of fire
- The questions of where, when, and how often are important
  - Large or adjacent blocks and a long term view
- Multidisciplinary, requiring input from foresters
  - Natural disturbance paradigm of Ecological Forestry

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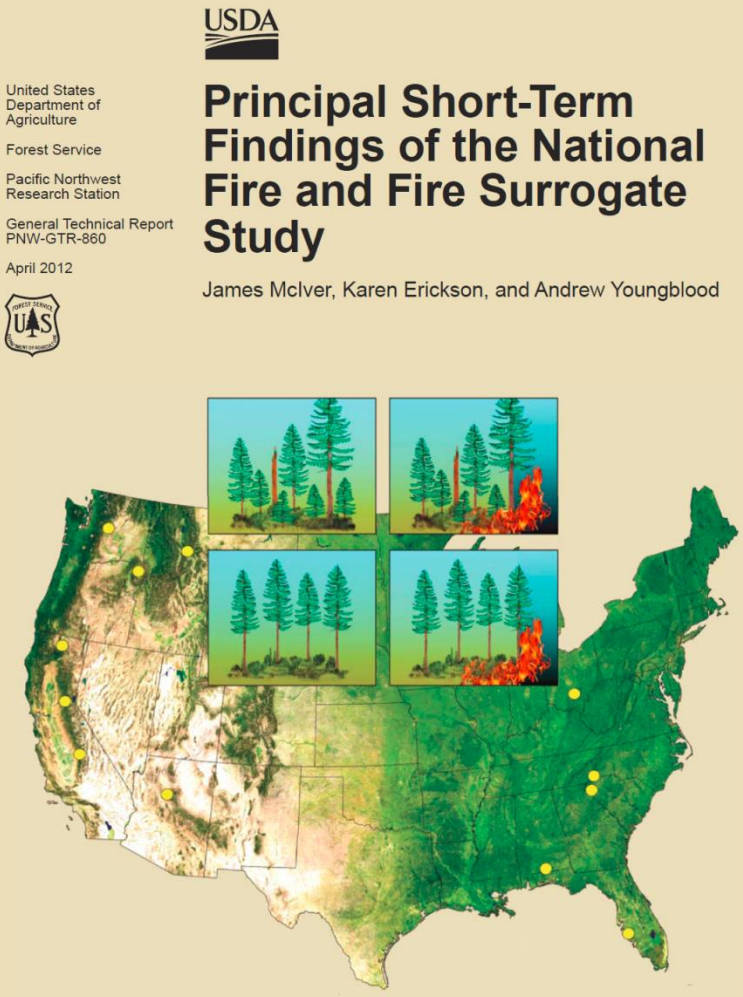
Fire and Fire Surrogate Study



- **Costs and ecological consequences of different fuel reduction treatments**
- Mechanical / Fire / Fire & Mechanical / Control
- 12 sites across the country
  - Mechanical treatments are not good surrogates for fire in relation to most ecosystem components and recommend that fire should be used where possible.
  - Ecosystem components show strong site-specific responses that are not broadly applicable.

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Selected Ecological Effects

-McIver et al. 2012

- Fire
  - ✓ Decreased soil moisture favoring xeric species
  - ✓ Increased patchiness leading to nutrient heterogeneity and plant diversity
- Mechanical
  - ✓ Similar to the controls for ecological effects
  - ✓ Carbon and nitrogen dynamics altered, but not as for fire
  - ✓ More mesic conditions maintained
  - ✓ Within stand patchiness not altered
- Fire & mechanical
  - ✓ Distinct differences between East and West, and within the East, mainly related to snags and post burn fuel loads
  - ✓ Similar to burn treatment but with more dramatic ecological effects
  - ✓ Enhanced resilience of overstory, but also exotic species

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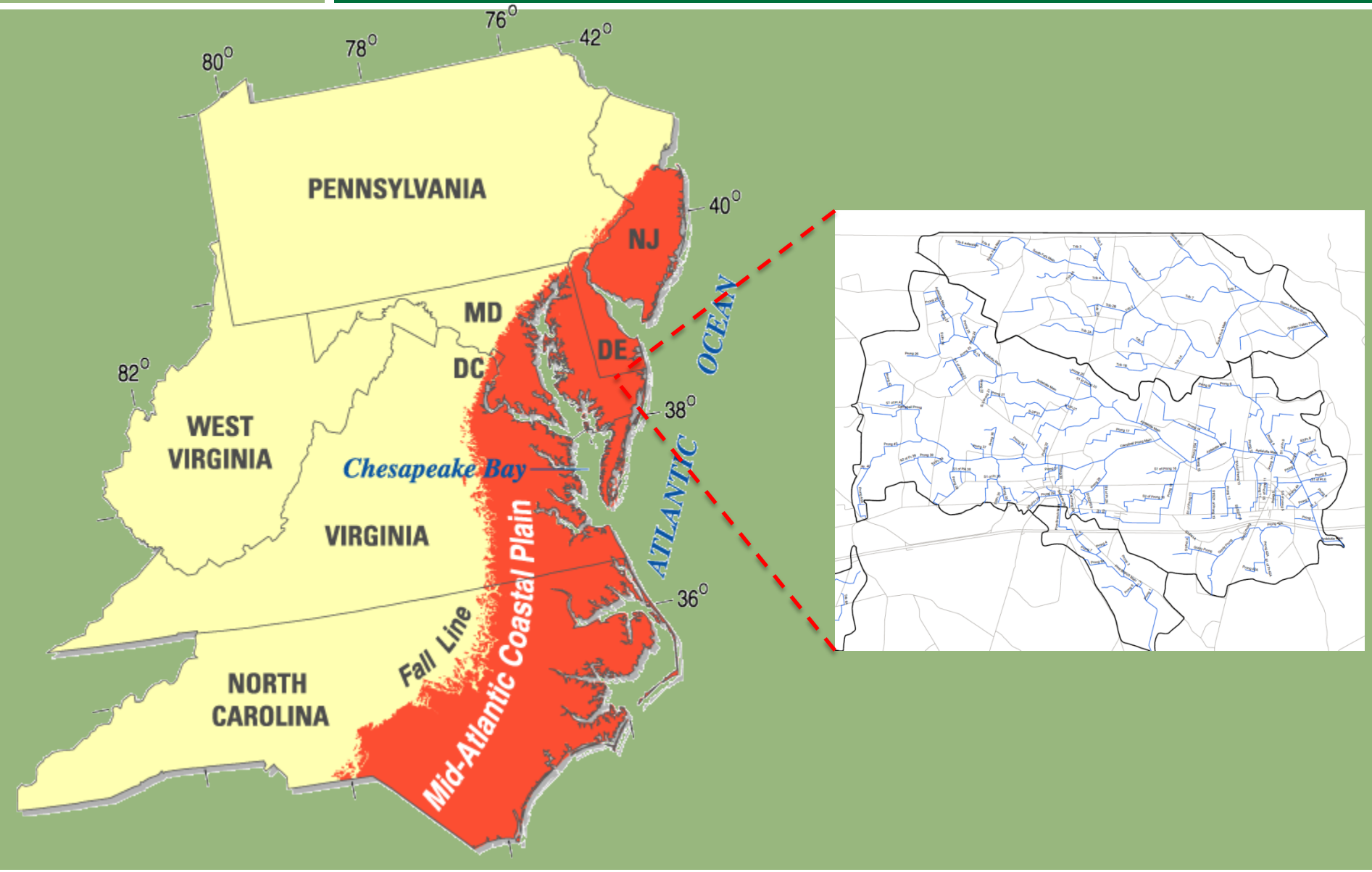
Mid-Atlantic Coastal Plain



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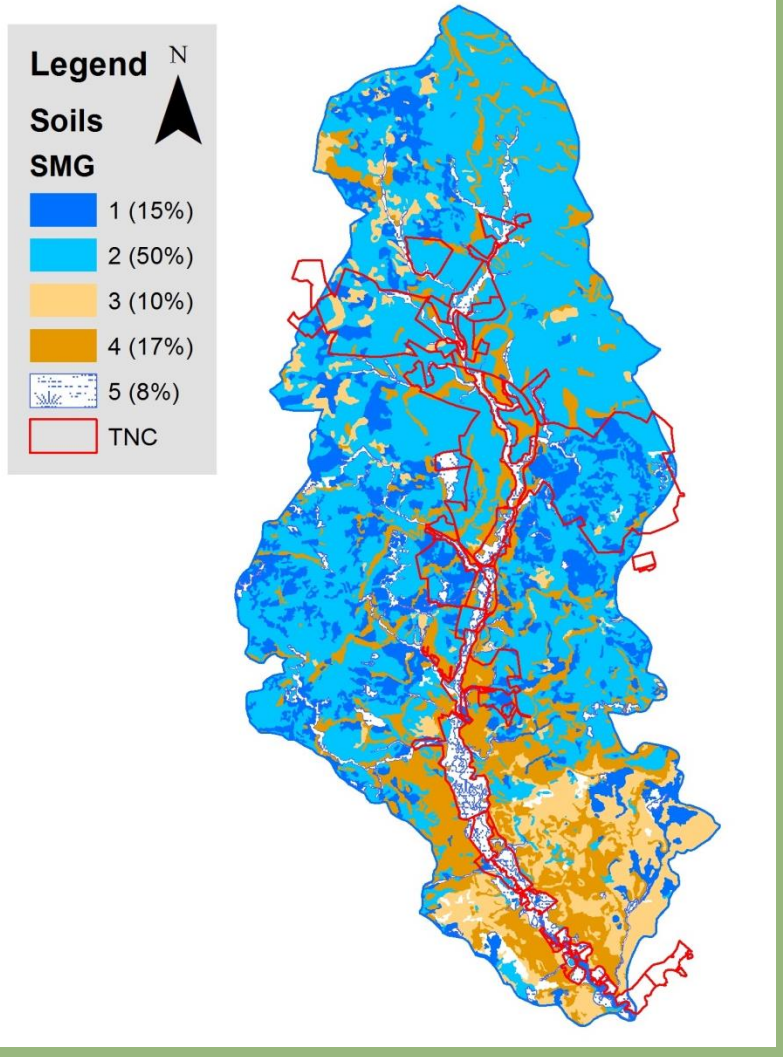
Soils and Operability Considerations



SMG	Acres	% Total	Soil drainage & operability
1	6,325	15	-PD & VPD w/heavy subsoils -Can support equipment when wet
2	21,759	50	-PD & VPD w/medium textured subsoils -Can NOT support equipment when wet
3	4,230	10	-WD & MWD coarse and medium textured soils -Generally operable, highly productive
4	7,464	17	-Deep sandy soils -Always operable, not highly productive
5	3,653	8	-Low elevation, PD & VPD organic floodplain soils -Not operable

Soil Management Groups (SMGs) used by DNR Forestry

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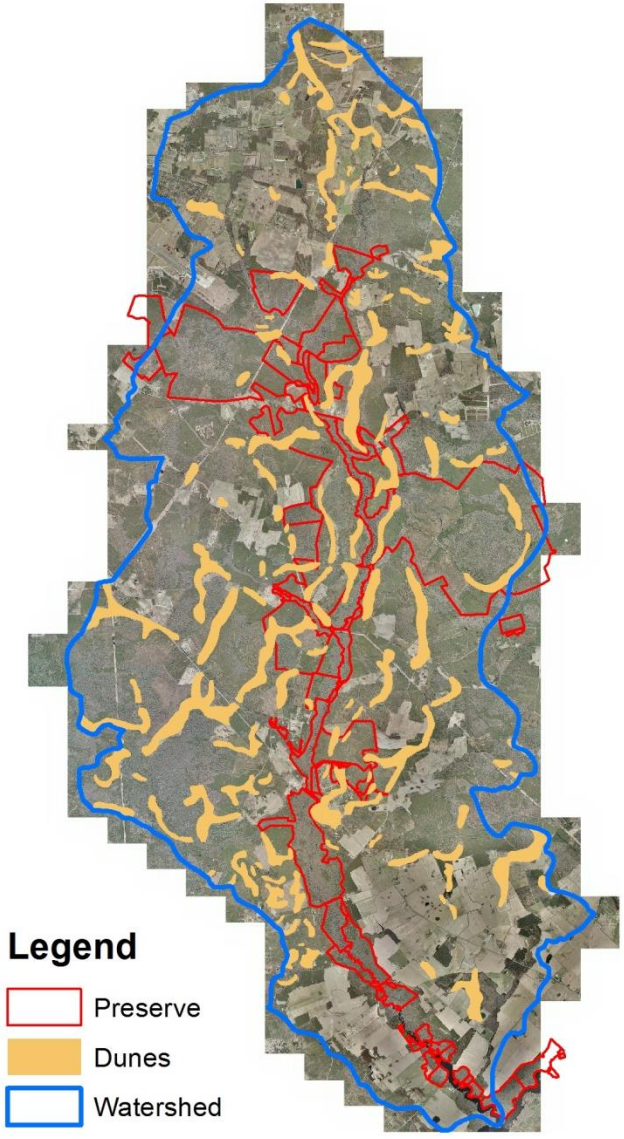
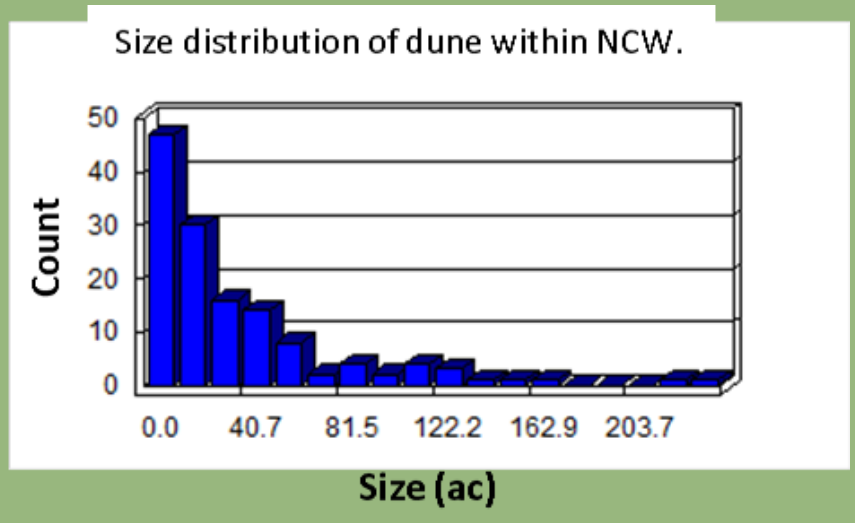
Inland Dunes / Sand Ridges



- Associated with the Parsonsburg Sand Formation
- Formed 13,000 to 30,000 YBP at the time of the LGM
- Excessively drained and nutrient poor ‘sugar sand’
- Occupy ~12% of the watershed area
- Highly developed and altered



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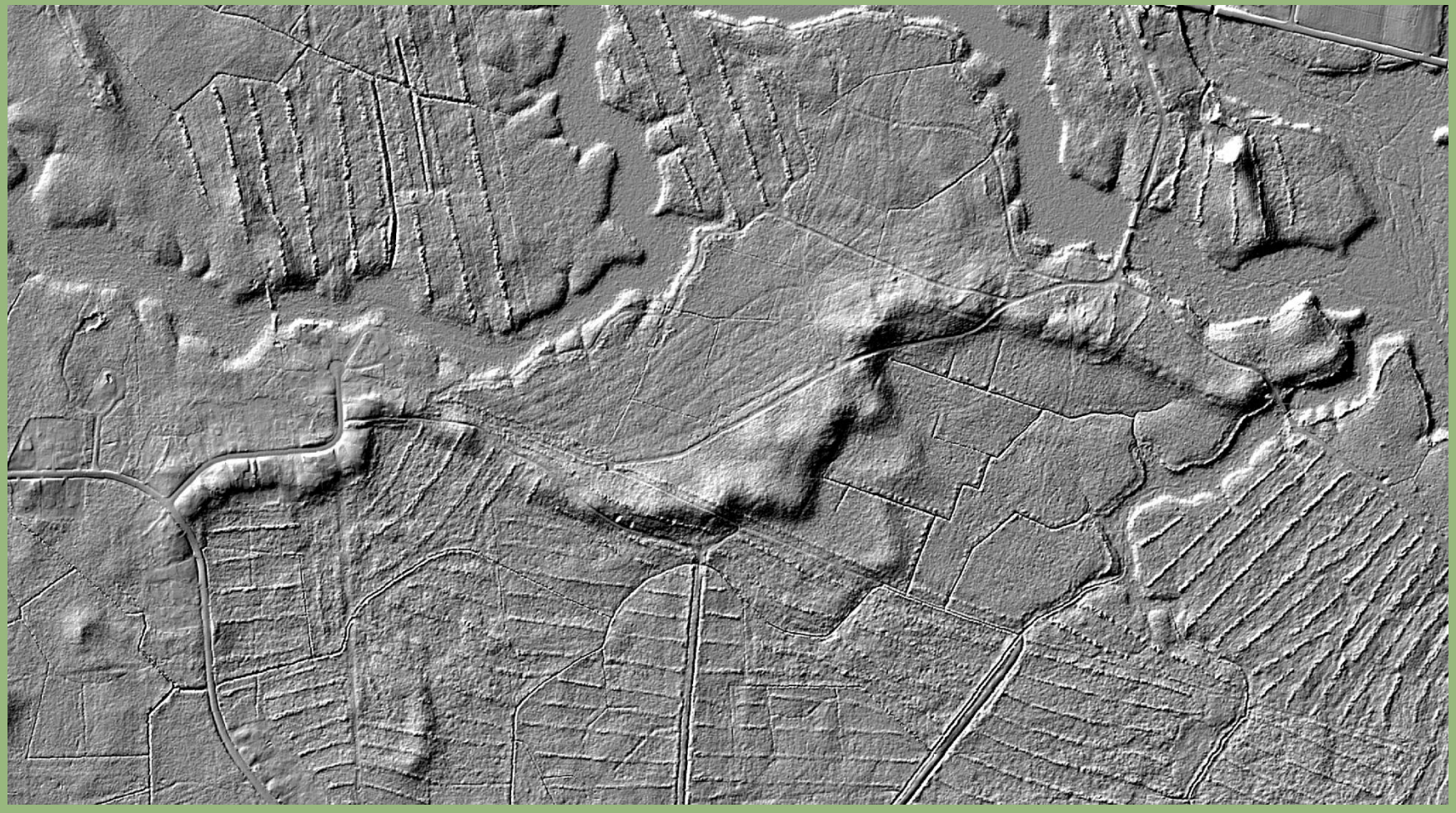
‘High Elevation’ Inland Dune, from Lidar



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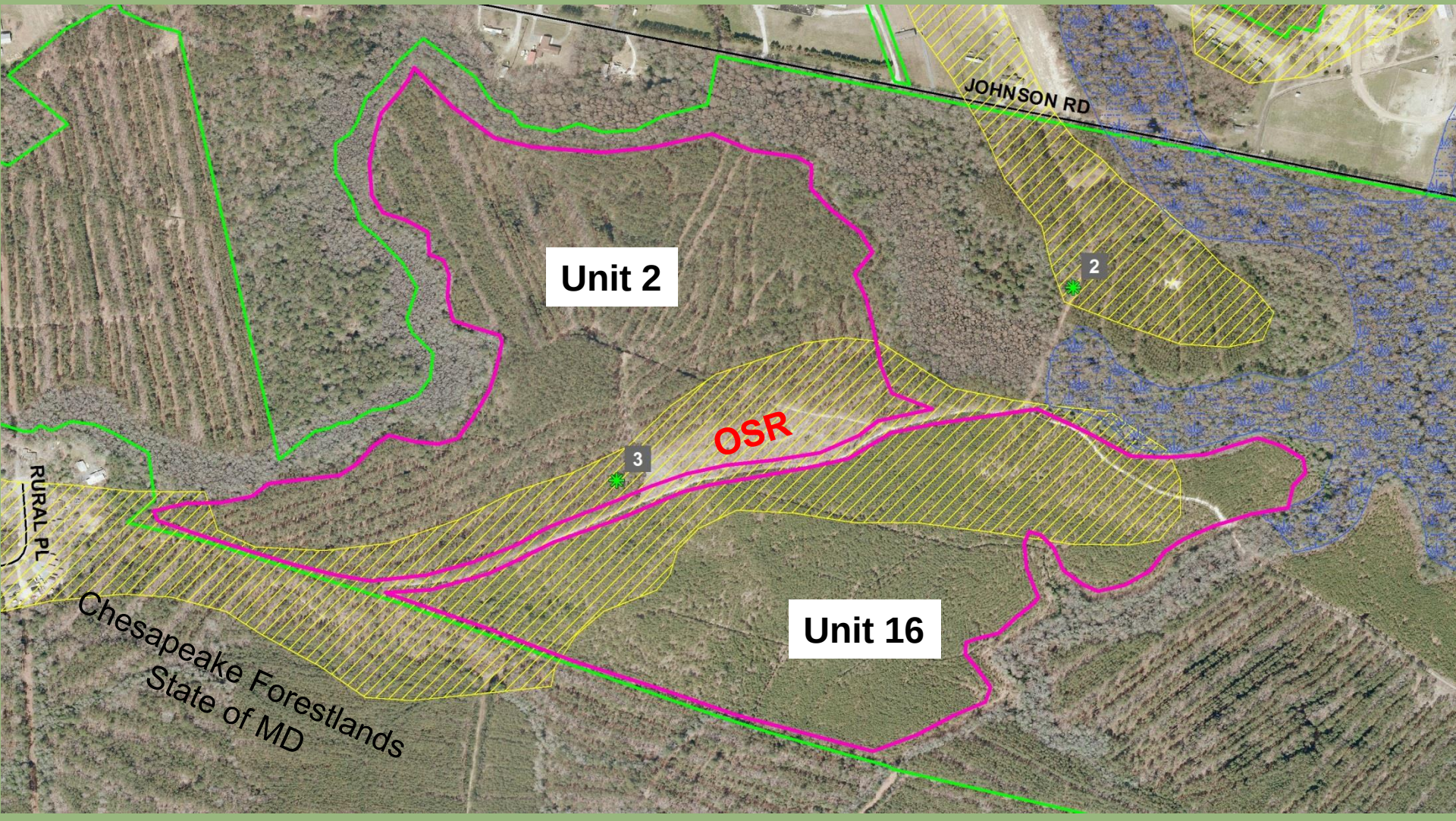
Colocation of Inland Dunes and Burn Units



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Oak Dominated Woodland Structure

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Delmarva Piney Woods?

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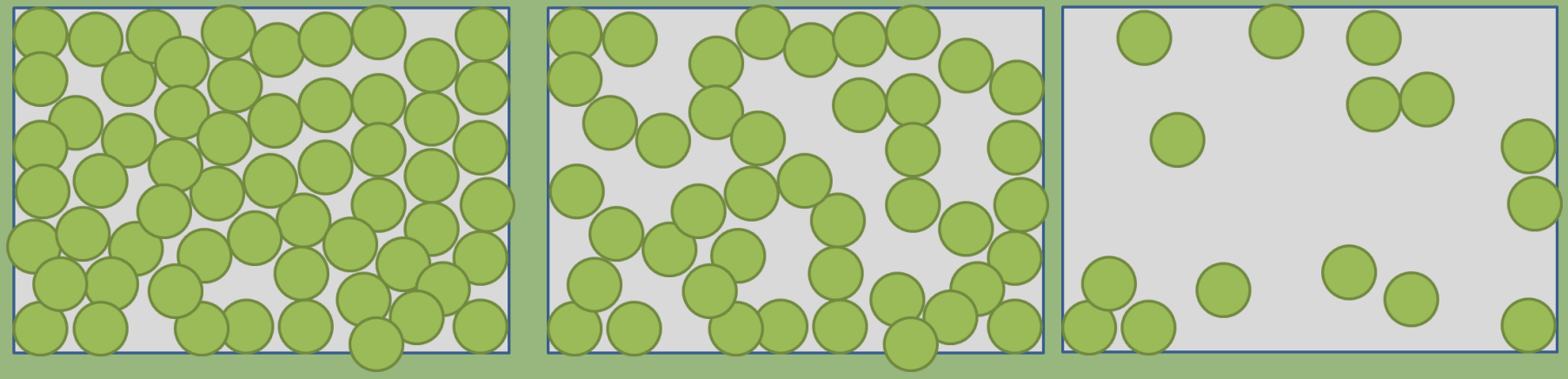
Tree density and ecosystem structure

Forest

Woodland

Savanna



← Forestry

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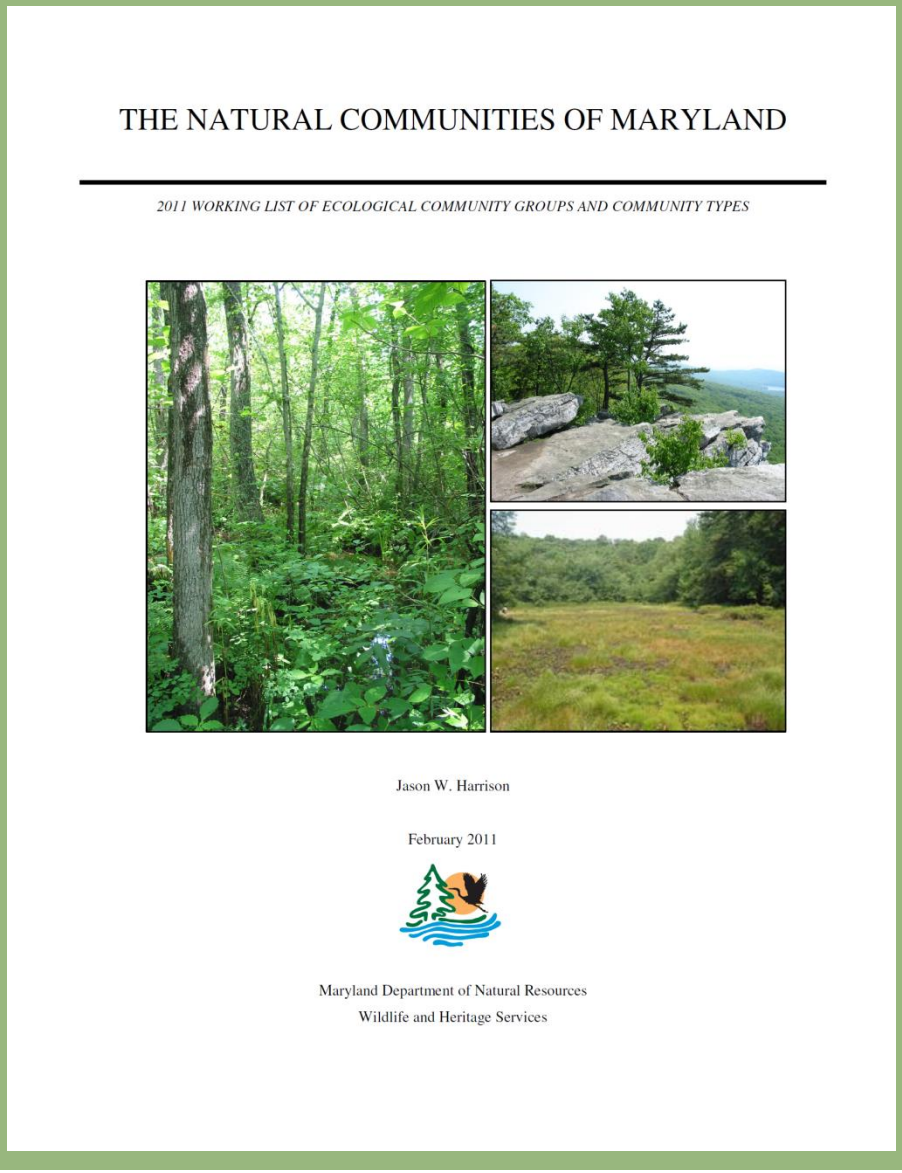
Fire Adapted Natural Communities


THE NATURAL COMMUNITIES OF MARYLAND

2011 WORKING LIST OF ECOLOGICAL COMMUNITY GROUPS AND COMMUNITY TYPES

Jason W. Harrison

February 2011

Maryland Department of Natural Resources
Wildlife and Heritage Services

DRY-MESIC FORESTS & WOODLANDS

- Coastal Plain Oak - Loblolly Pine Forest
- Mixed Oak – Heath Forest

DRY FORESTS & WOODLANDS

- Coastal Plain Pine – Oak Woodland
- Inland Sand Dune & Ridge Woodland

	Summation of the Flora				
Life Form	**Common**	**Frequent**	**Occasional**	**Rare**	**Total**
Herb	15	7	11	12	**45**
Grass	11	5	3	2	**21**
Tree	9	5	1	1	**16**
Shrub	4	1	5	2	**12**
Sedge	3	3		1	**7**
Vine	3				**3**
Fern			2		**2**
Cactus	1				**1**
Orchid			1		**1**
Grand Total					**108**

W. McAvoy

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Canopy openness within this landscape

- Agriculture
- Thinned and regenerating forests
- Power transmission lines

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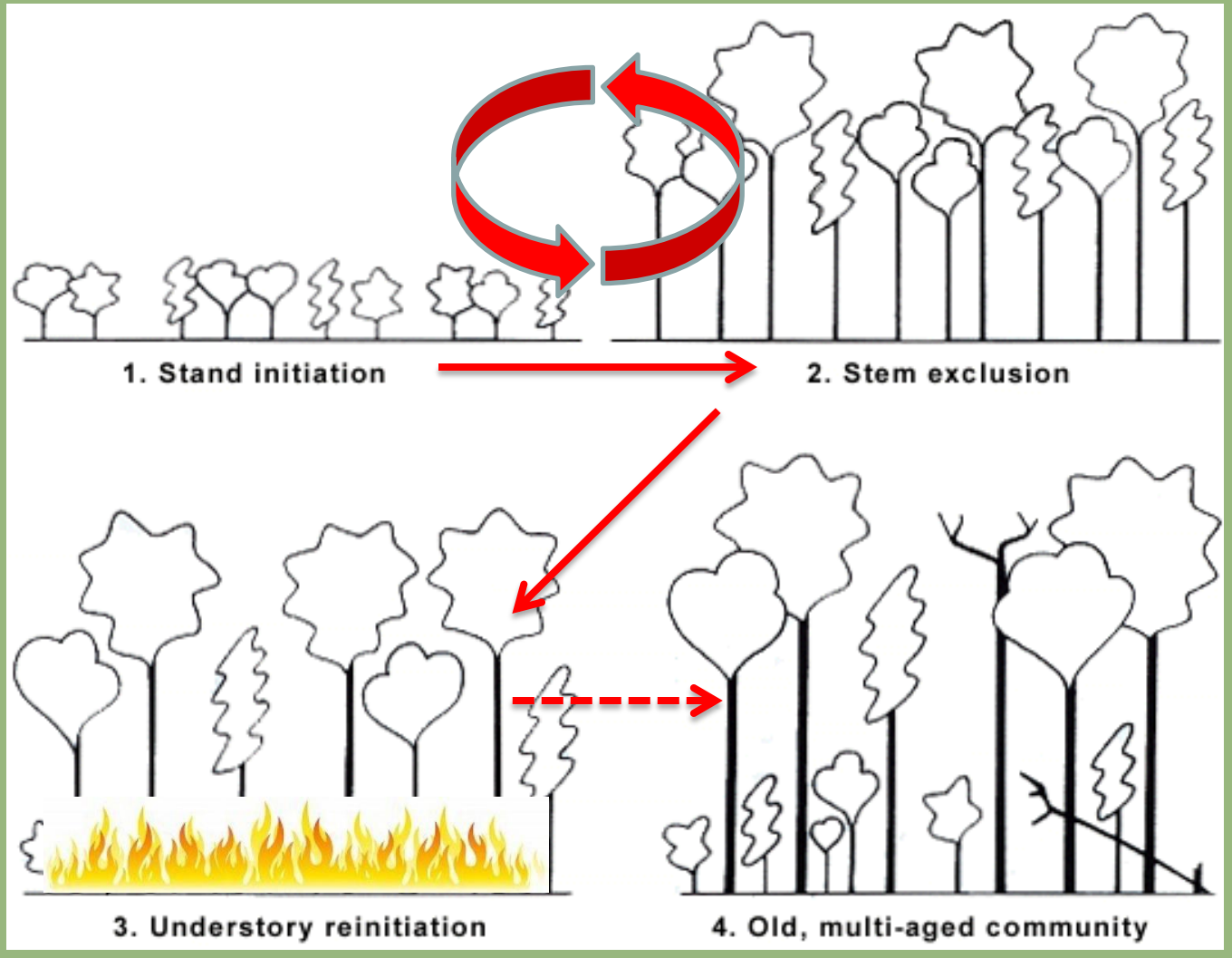
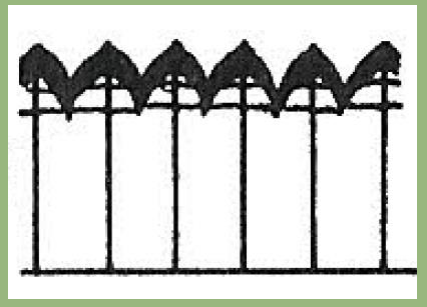
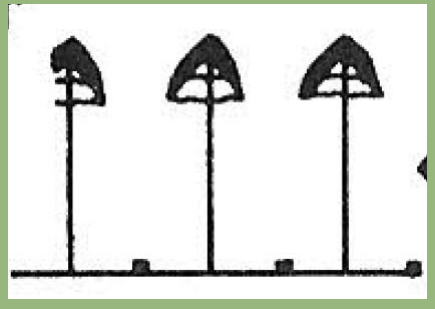
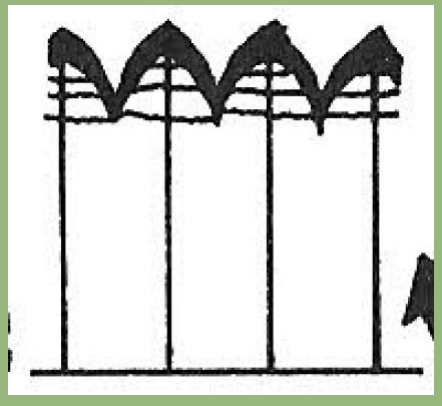
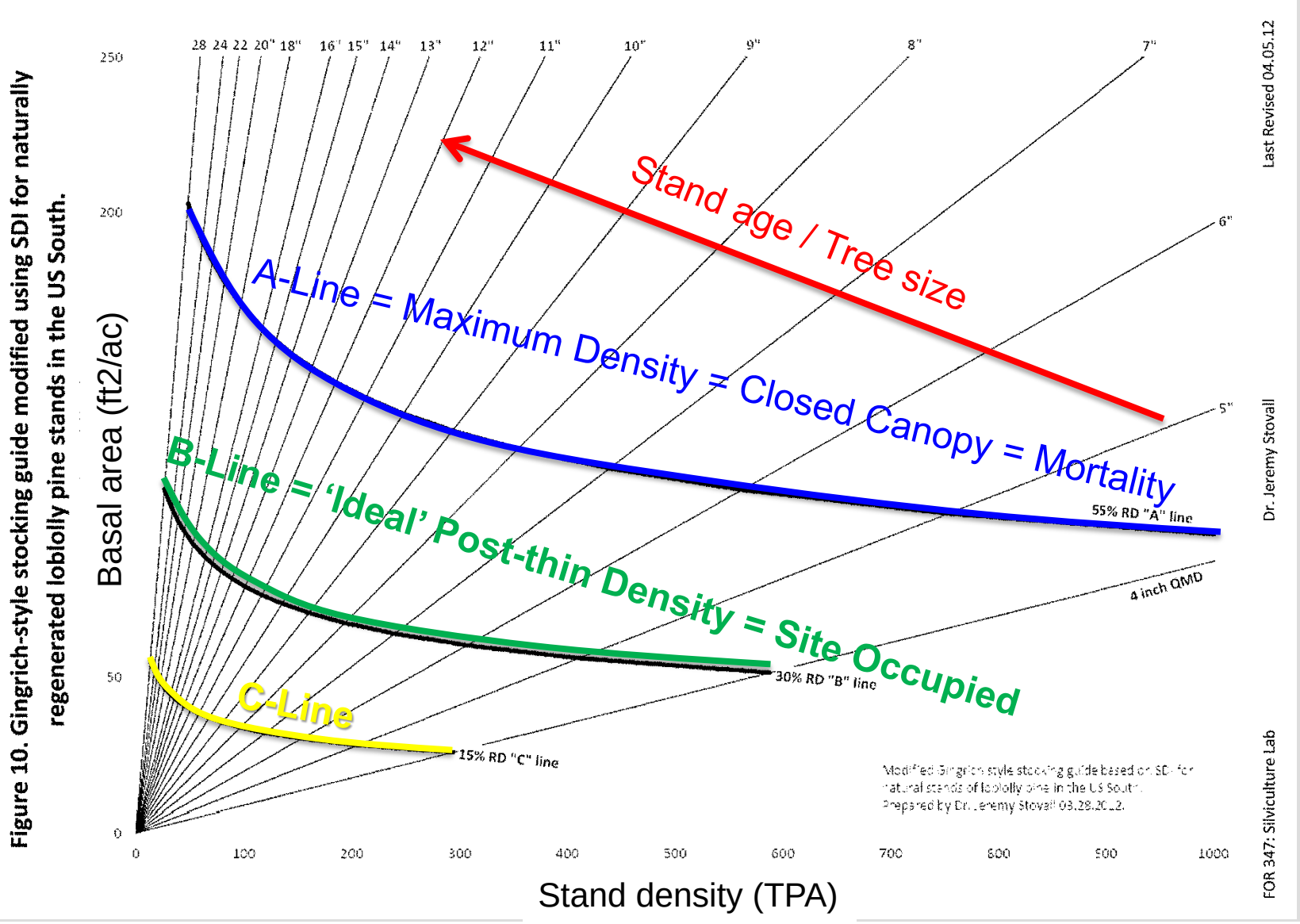
Forest Stand Development (Oliver and Larson, 1996)











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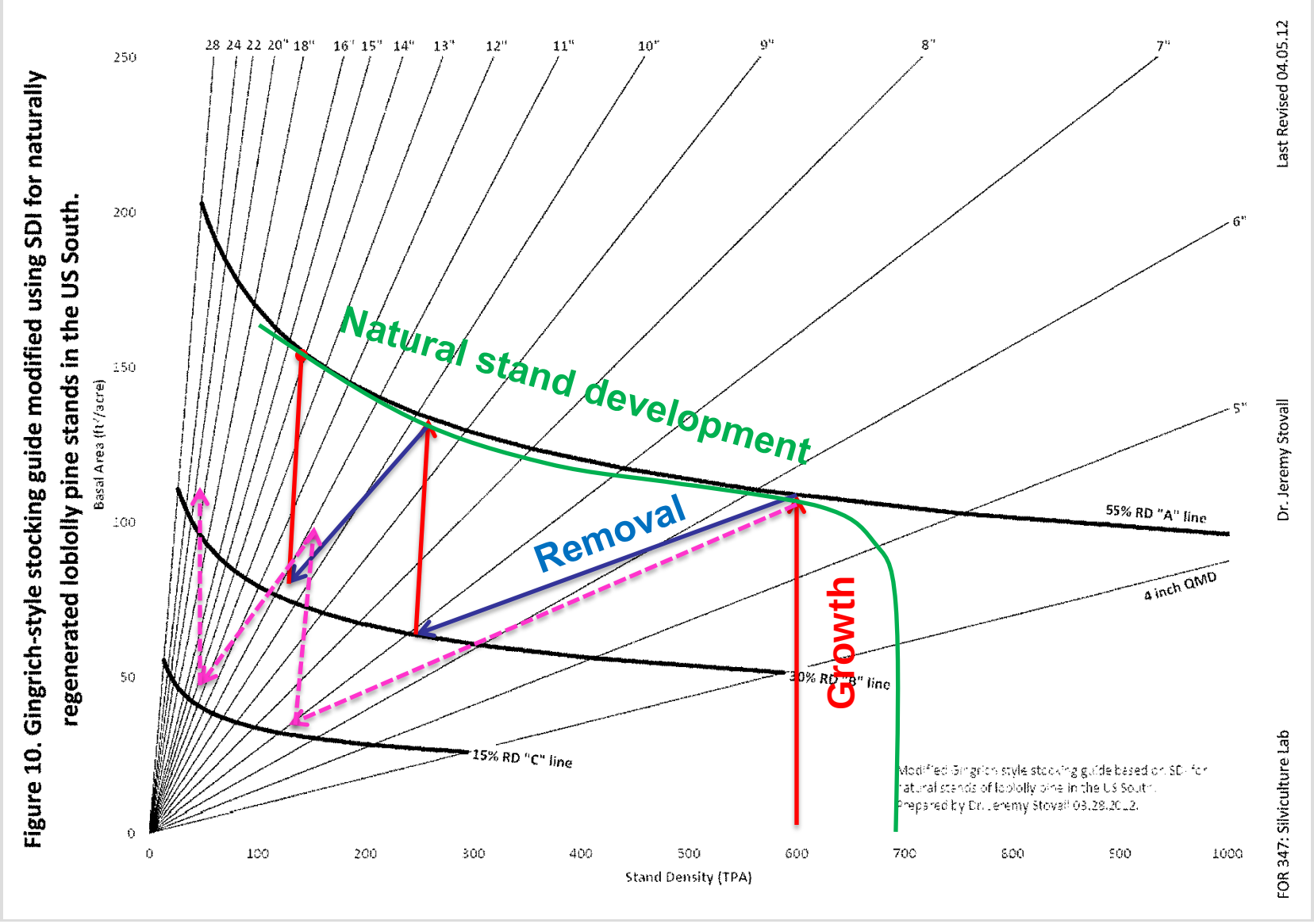
Stocking Guide for Loblolly Pine



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Alternative Stand Development Trajectories

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Low-density management of Eastern white pine

-Seymour 2007

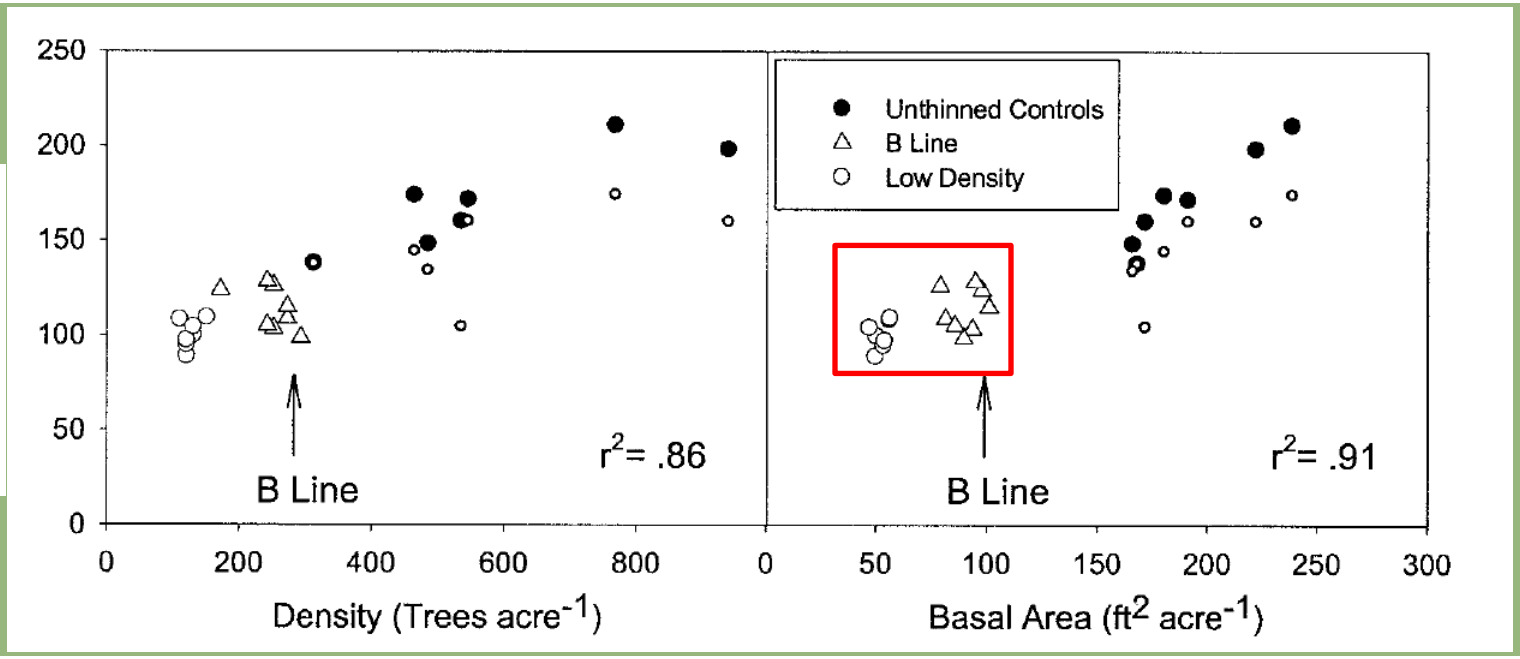

Table 4. Ten-year changes in tree characteristics and stand volume (dominants and codominants only).

Treatment	10-yr Changes in				Stand growth components (ft³/ac per yr)		
	CL (feet)	Live-crown ratio	dbh (in.)	Tree volume (ft³)	Gross	Mortality	Net
Low-density	9.73	0.114	2.31	8.26	100.1	0.6	99.5
B line	7.27	0.080	1.47	5.28	113.6	8.4	105.2
Unthinned control	2.17	−0.015	0.83	3.99	171.2	26.5	144.6
Contrasts (probabilities of no difference)							
B line vs low density	0.04	0.08	<0.001	<0.001	0.13	0.22	0.52
B line vs control	<0.001	<0.001	<0.001	0.008	<0.001	<0.001	<0.001
Low density vs control	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Root mean square error (19 df)	2.16	0.036	0.157	0.845	16.7	11.8	16.8

All crown parameters define the crown base as the lowest whorl with three or more living branches.

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Consider low-density thinning…

- Enhanced habitat values
- Increased revenue generation- marginal jobs possible
- With fire, can remove pulpwood while it still has value*
- Production of high-value sawlogs not necessarily reduced

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Pre-commercial sized stands

Thermal thinning & pruning

Mechanical thinning

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Unit 16- Sixty-one acres of ~10-yo loblolly pine

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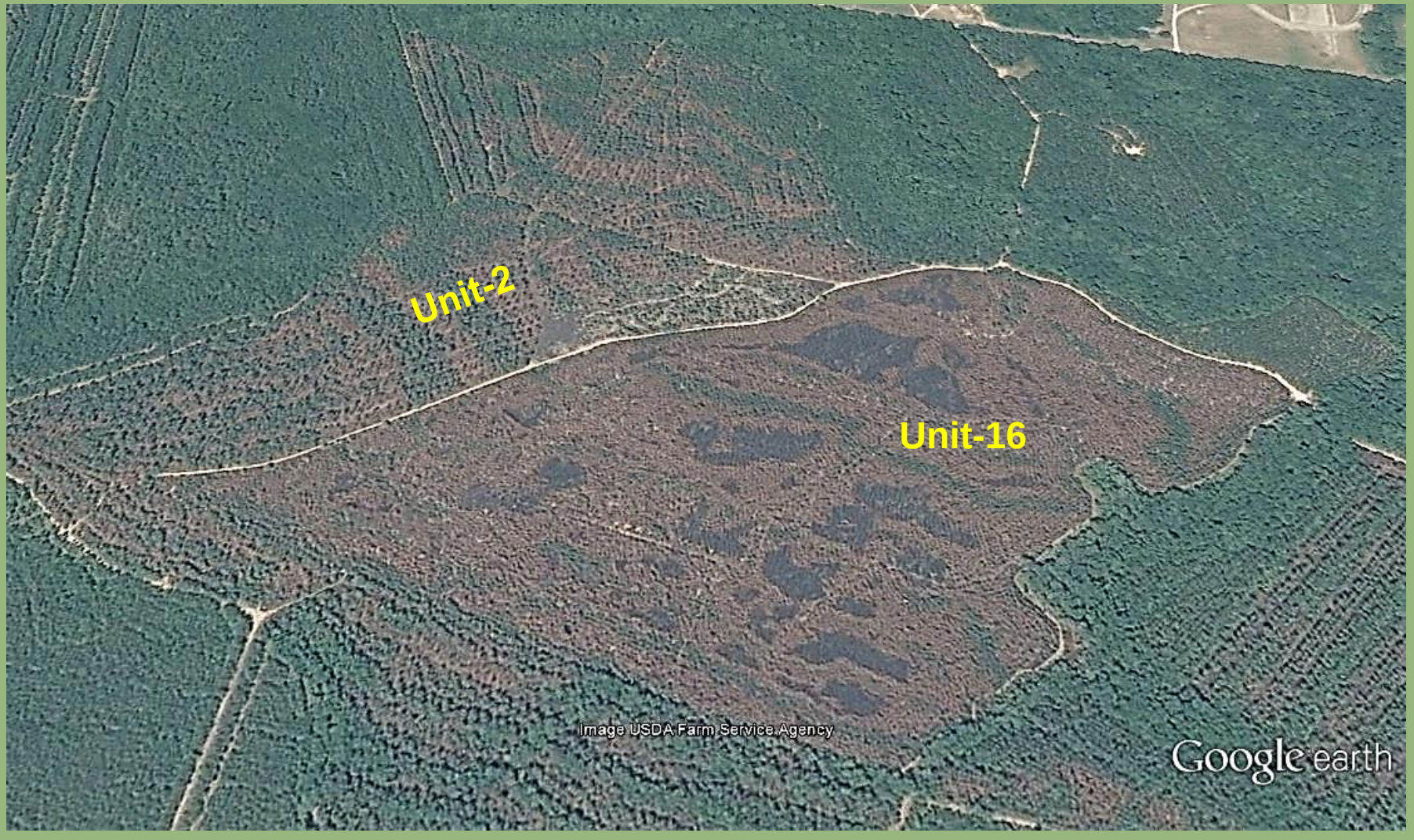
November 2011 Imagery



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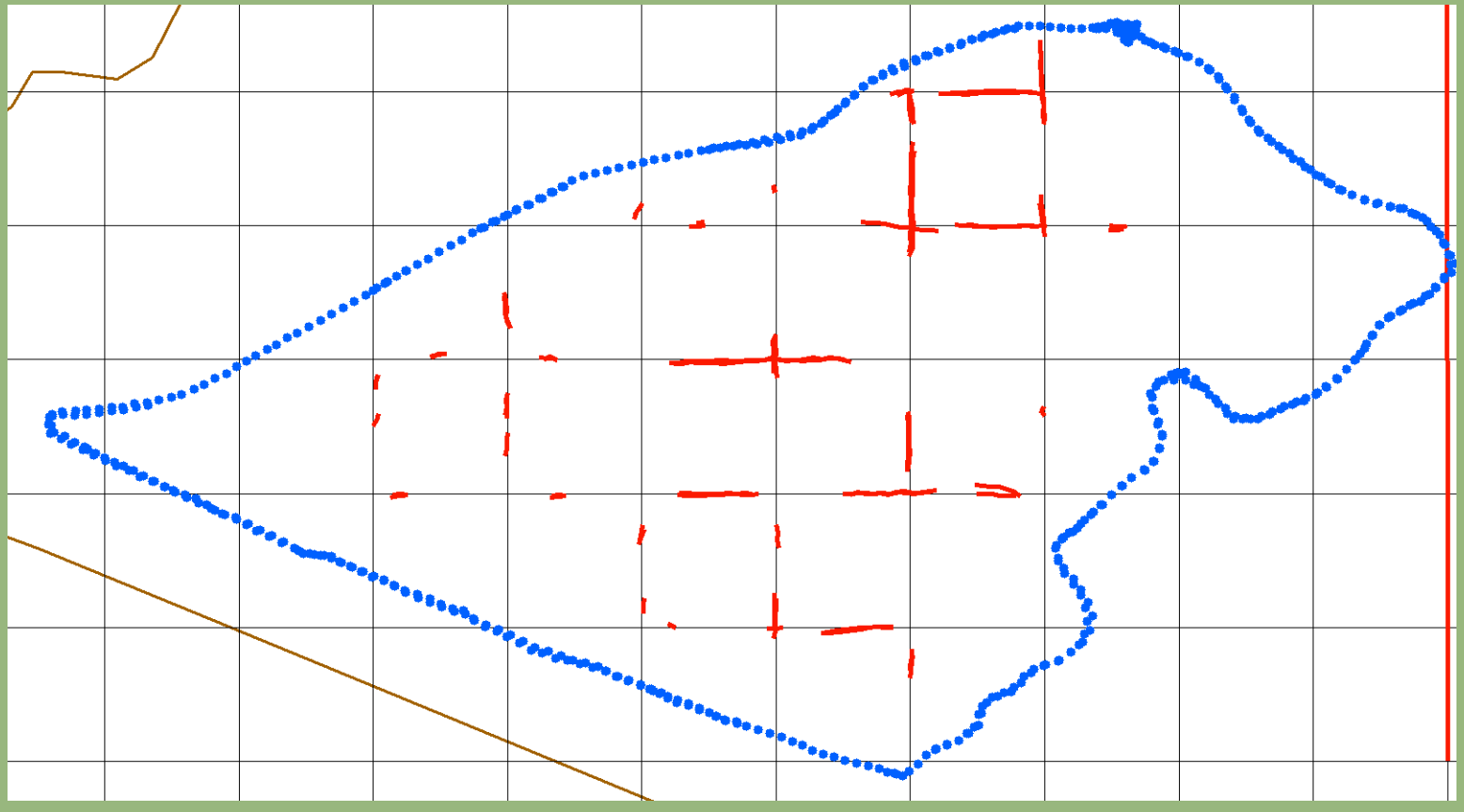

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Mixed-severity fire *n.* A fire that exhibits a wide range of **fire severity** as a result of **underburning** some patches, burning others with **stand-replacing severity** , and thinning the overstory in other patches.

Area	BA (ft^2/ac)	LCR	Dq (in)	Canopy Ht (ft)
Unit 16	104 / 71	77 / 36	4.2 / 4.6	28 (L) / 19 (D)
Unit 5	30 / 5	-	2.1 / 2.7*	16 / 16

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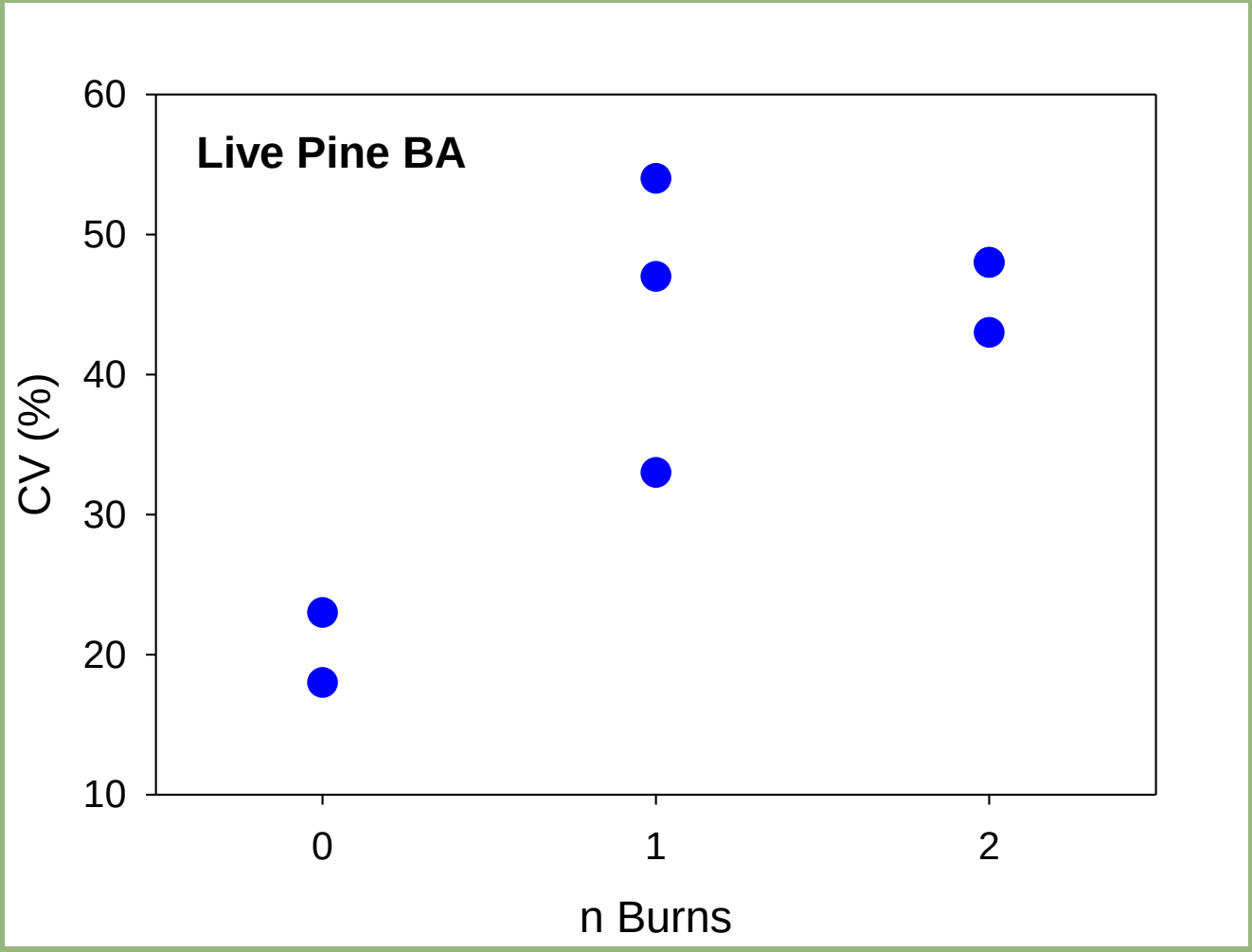
Fire promotes variation….



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Leverage your logging operations…

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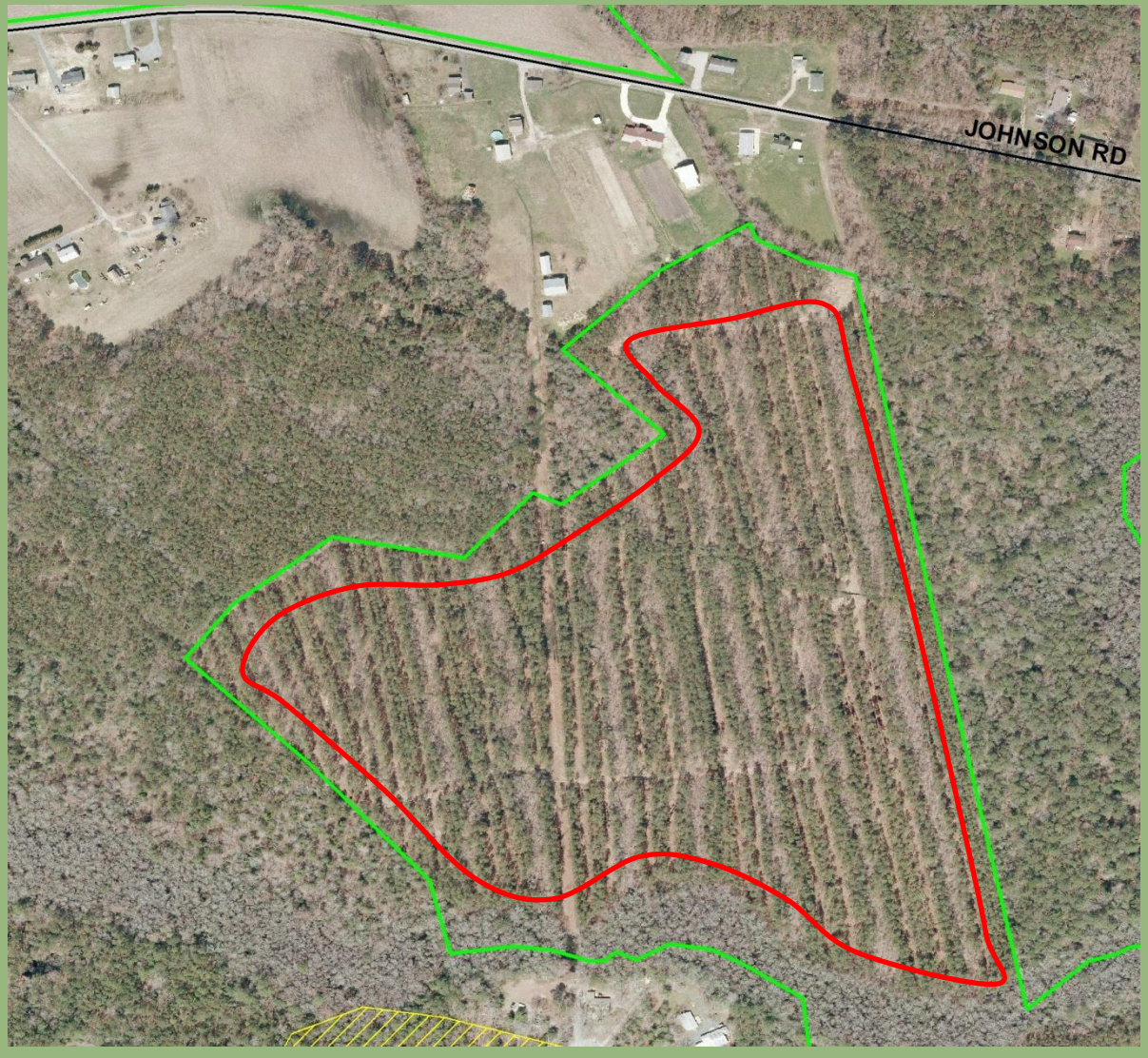
Fire line construction…



- Where they don't already exist, use harvest operation to cut and clear lanes that will serve as fire lines.
- Lay them out (with input from the logger).
- Use as drag trails to expose mineral soil.
- Leave a buffer for safety.

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Logging → slash → fuel

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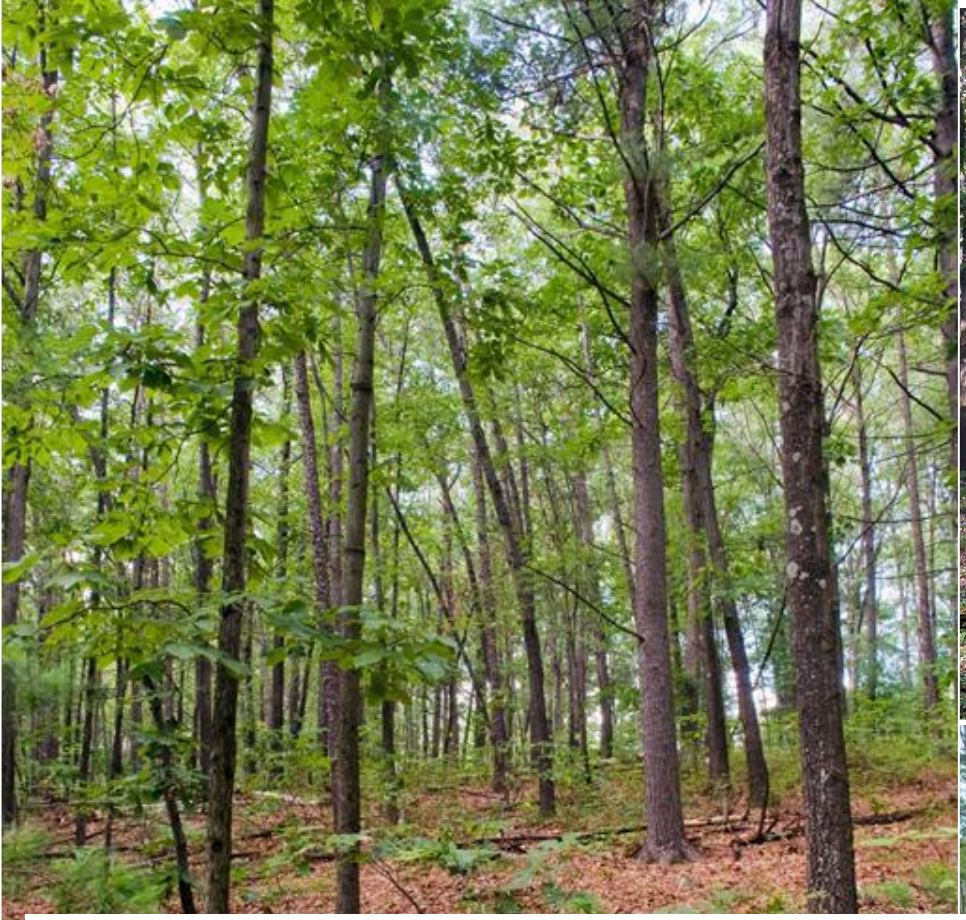
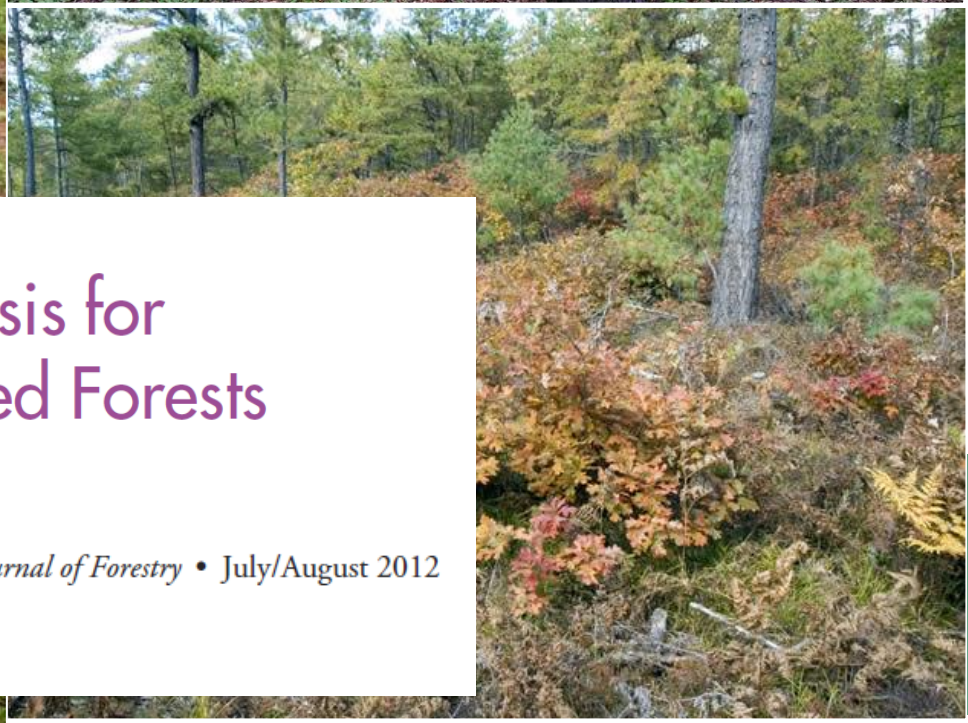
Accomplish restoration projects…





Refining the Oak–Fire Hypothesis for Management of Oak-Dominated Forests of the Eastern United States

Journal of Forestry • July/August 2012

Mary A. Arthur, Heather D. Alexander, Daniel C. Dey, Callie J. Schweitzer, and David L. Loftis

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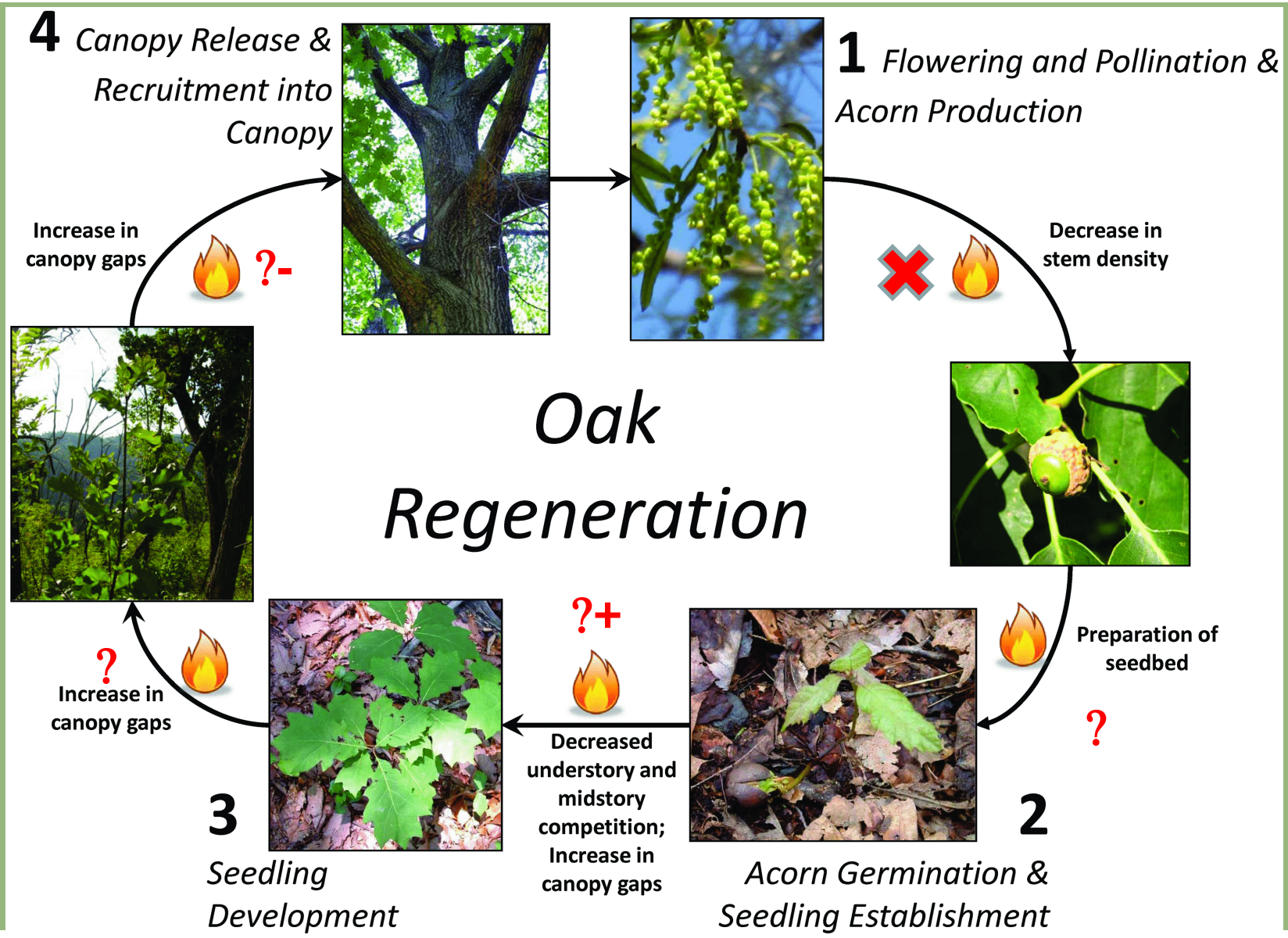
Refining the Oak–Fire Hypothesis for Management of Oak-Dominated Forests of the Eastern United States

-Arthur et al. 2012



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Some take aways from that review…

- Tree ring studies indicate oak recruitment events coincided with lengthy fire-free intervals
  - The problem of focusing on the mean fire return interval
  - Intervals of 10-30 yr may be required
- Low intensity fires can kill modest sized oaks (4-8 in) yet they need to be relatively large to be competitive post disturbance.
- Silviculture is likely to be more effective at managing overstory light levels than fire
  - Residual BA's as low as 20-60 ft2/ac inhibit recruitment
- Knowledge of site productivity and oak species silvics can help guide successful management with fire

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Conclusions / Recommendations

- Rx Fire is generally compatible with timber management objectives, but presents some challenges
- Give ample consideration to where and when these practices are integrated
- Consider thinning stands to lower than conventional densities when fire is part of the equation
- Use logging operations to set yourself up for the successful use of prescribed fire


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