Promoting oak regeneration through prescribed fire and silviculture: Early results

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Abstract: Many oak-dominated, eastern deciduous forests have very little oak understory regeneration, and instead have an understory dominated by shade tolerant, mesic maple and beech species. Oak regeneration failure is a result of changing natural disturbance regimes, including a century of active fire suppression, and is a major driver in these compositional shifts. In 2014, we implemented a large-scale study to investigate the combined, long-term effects of novel silvicultural systems and prescribed fire on oak regeneration, ecosystem resilience, and structural diversity in an oak dominated hardwood forest in southern Indiana.

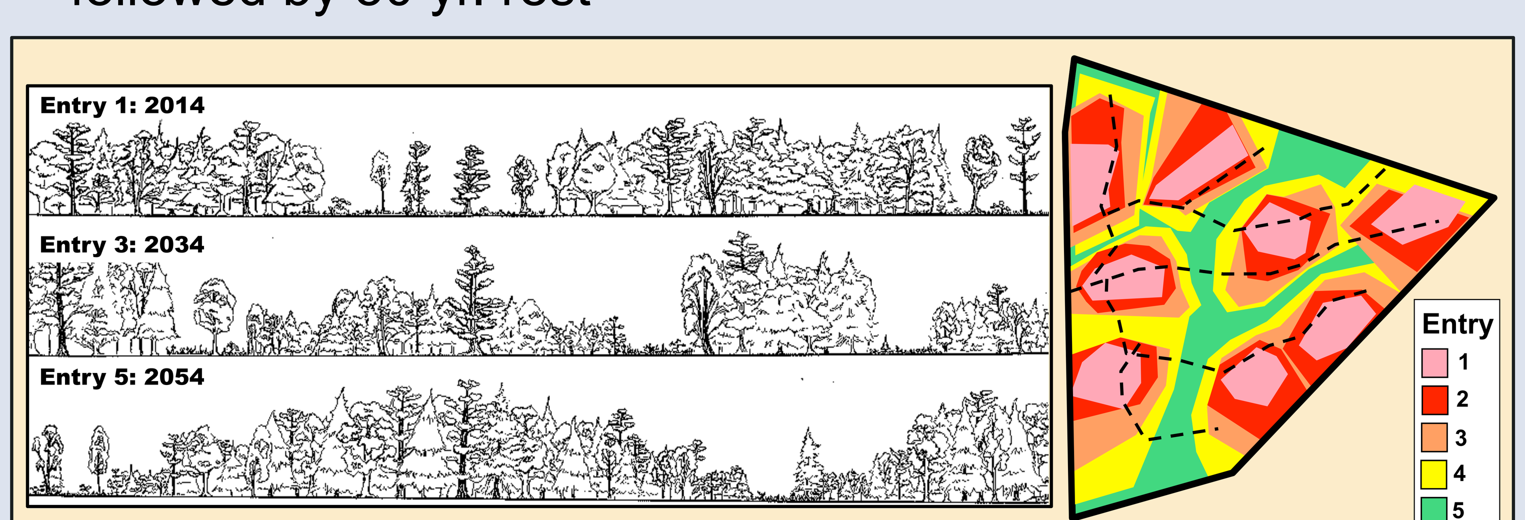
Introduction

- Mesophication of eastern hardwood forests led to widespread oak regeneration failure
- Understory conversion beech and maple
- Likely due to change in disturbance regimes including fire suppression
- Oak is adapted to fire and intermediately shade tolerant
- Prescribed burning coupled with shelterwood harvest may increase regeneration

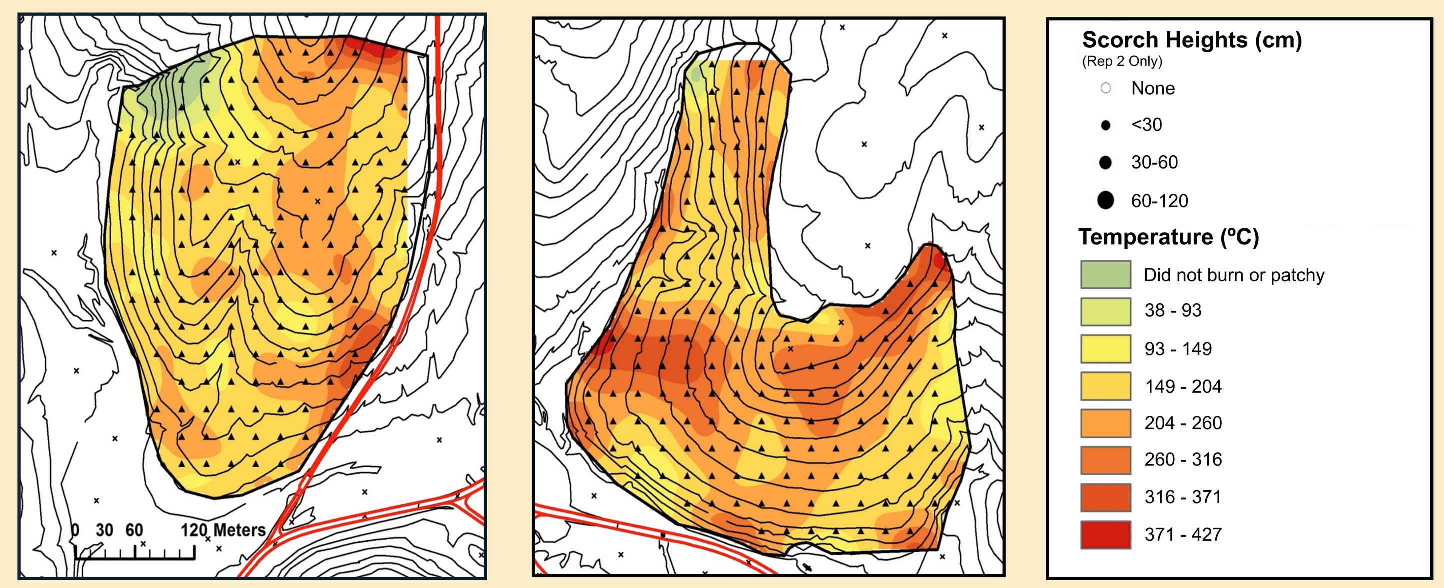
In 2014 we implemented a large-scale study to investigate the combined, long-term effects of prescribed fire and novel silvicultural systems on oak regeneration, ecosystem resilience, and structural diversity.

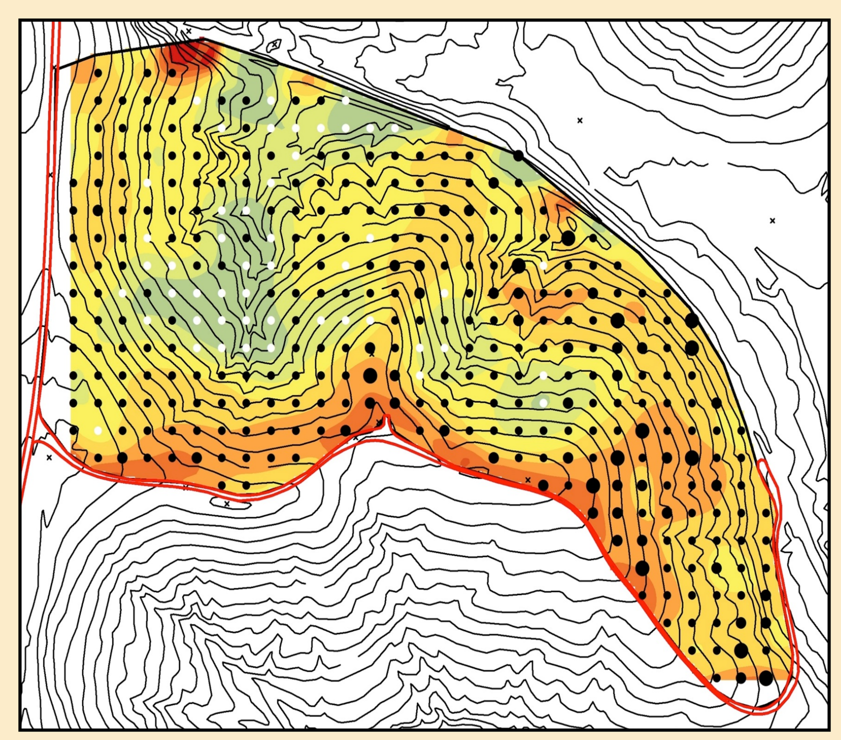
Experimental Design

- Expanding group shelterwood silvicultural system
- Naval Surface Warfare Center Crane, Indiana
- 2 X 2 factorial design + control, 3 replicates
  - 2 stage and 3 stage shelterwood
    - 2 stage: Midstory removal & complete overstory cut
    - 3 stage: Midstory removal; 50% basal area establishment cut; 100% overstory cut
  - Burned (every 5 years) and unburned
- Five 10 yr. cutting cycles, each removing 20% of area, followed by 50 yr. rest



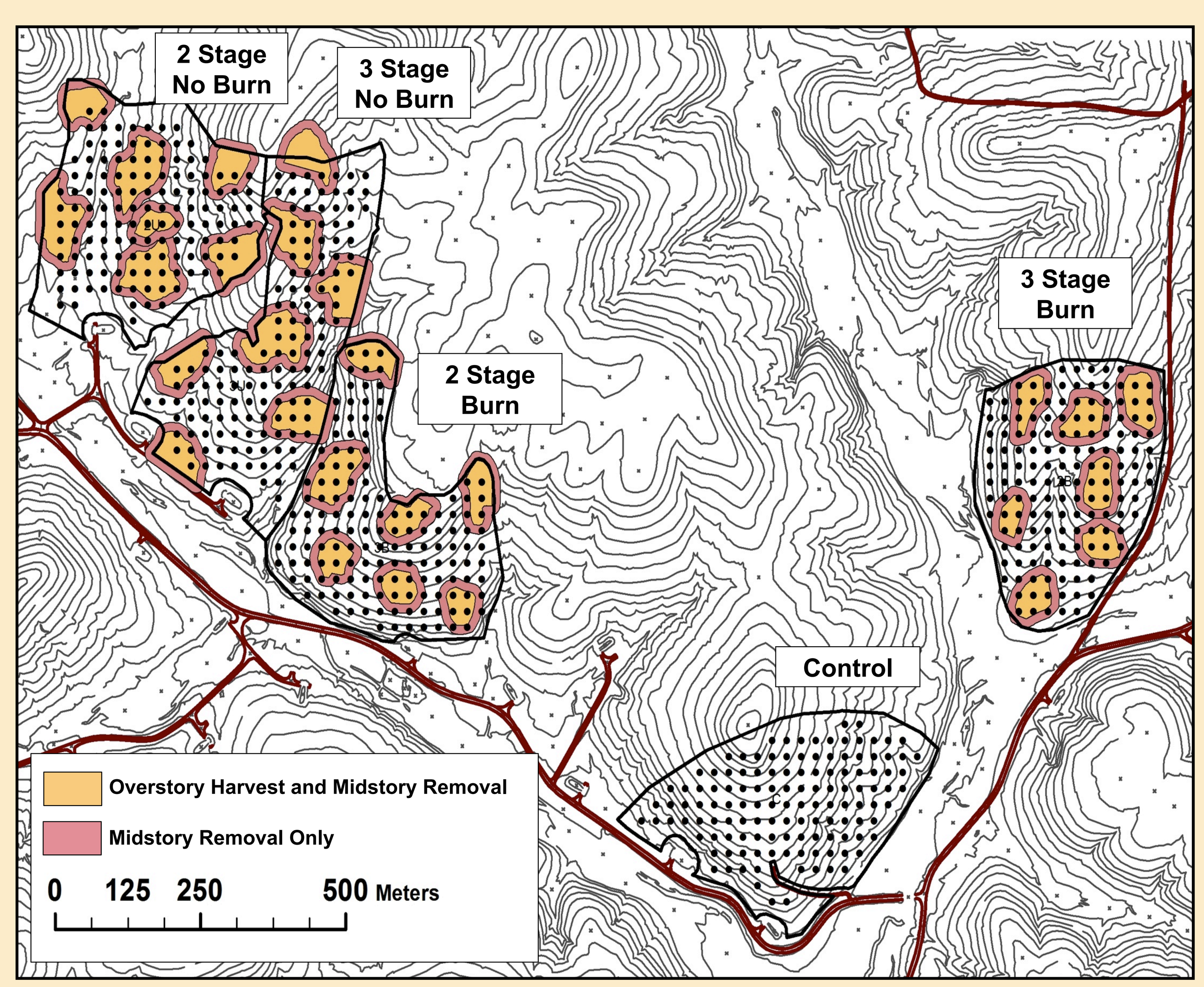
Kernel Estimate Temperature Interpolations





- Created using temperature recorded on a 25 x 25 m grid
- 62.5 m weighted interpolation bandwidth
- Max 13 points used to interpolate each pixel

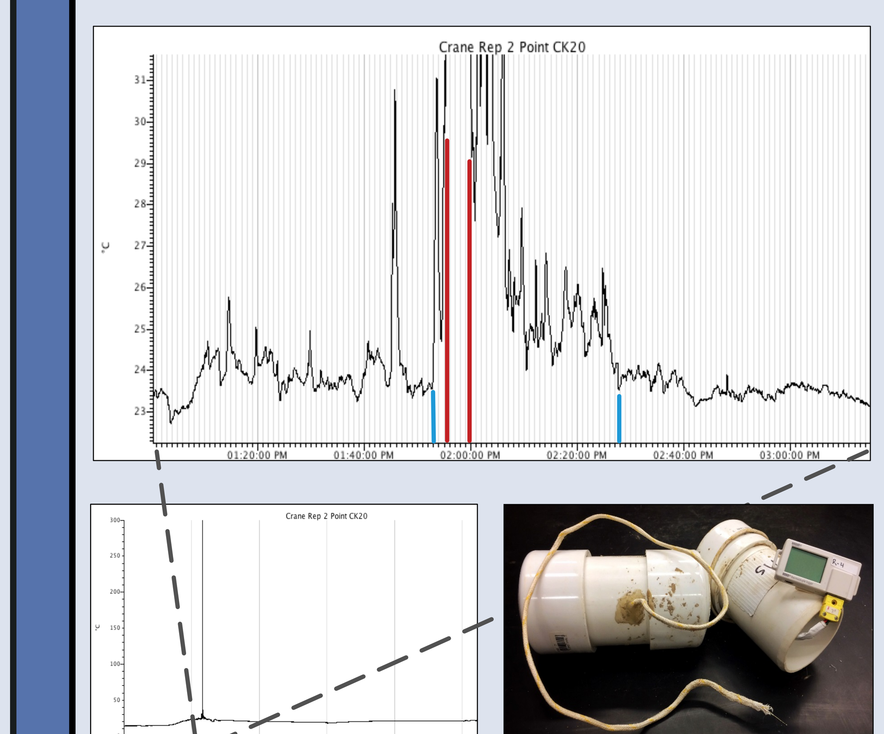
Replicate 1 Map



Pyrometer Paint Tags

- 2 tags per point on a 25 x 25 m grid throughout burn
- 15 cm above ground
- Heat activated Tempilaq paint melts at 79, 121, 162, 204, 317, and 427 ºC

Thermocouples



- 40 single channel sensors, 15 cm above ground
- 10 four channel sensors placed on tree trunks at 30, 60, 120, and 210 cm
- Record every 3 seconds
- HOBO Onset UX100 & UX120 data loggers
- Fuel composition data taken at these points

Current Projects

1. Quantify short-term oak regeneration
2. Improve fire models for Indiana
3. Investigate changes in small mammal caching behavior after prescribed fire
4. Assess acorn mortality after fall burns
5. Quantify changes in timber quality after prescribed fire
6. Implement final replicate summer/fall 2016

References

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