Evaluation of an Oak Woodland Restoration at Deer Grove Forest Preserve

Pete Jackson
February 7, 2009
THE PALATINE AREA
SHOWING
PREHISTORIC FEATURES
EXISTING IN 1804

--- INDIAN TRAILS
○ INDIAN MOUNDS
△ INDIAN VILLAGES
♀ SIGNAL STATIONS

FROM ALBERT SCHARF

Courtesy of the Chicago Historical Society
Entrance to Deer Grove at Quentin Road – Route 68
Spring 2008
Objective: determine whether restoration is meeting management goals.

- Reduce competition from invasive spp.
- Restore community structure
- Restore diversity in ground layer
- Increase oak regeneration
Research Hypotheses:

- Reduce invasive competition $\rightarrow$ Reduction in # of invasive shrub stems
- Restore community structure $\rightarrow$ Decrease in vegetative shading levels
- Restore ground-layer diversity $\rightarrow$ Increase in native species richness
- Increase oak regeneration $\rightarrow$ Increase in oak seedlings, saplings, and small trees
Restoration Site Description

- Dry-mesic oak woodland, ~ 9 acres
- Overgrown with shade-tolerant, invasive species
- Residual populations of native plant species
- Restoration began in 1995
Study Comparisons

- No baseline data

- Spatial: adjacent, unmanaged woodland, 2008

- Temporal: compare managed site:
  - 2002/03
  - 2008
Sampling Design

• Plot selection:
  – Randomized transects
  – Systematic placement of plots
  – Permanent plots

• Sample size:
  – trees: 18 10 x 10 m plots (1800 m²)
  – shrub layer: 18 2 x 10 plots (360 m²)
  – ground layer: 35 ¼ m² plots
Sampling Methods

- Trees: Trees $\geq 5$ cm identified, measured
- Shrubs: Shrubs/saplings $< 5$ cm - stem counts
- Ground layer: Species % cover in $\frac{1}{4}$ m$^2$ quadrat
- Vegetative shading – ocular tube
## Results: Tree Survey, 2008

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Red Oak Raw Counts, Managed Site 2003

1. 5 - 10
2. 10.1 - 20
3. 20.1 - 30
4. 30.1 - 40
5. 40.1 - 50
6. 50.1 - 60

# Stems

Red Oak Raw Counts, Managed Site 2008

1. 5 - 10
2. 10.1 - 20
3. 20.1 - 30
4. 30.1 - 40
5. 40.1 - 50
6. 50.1 - 60

# Stems

White Oak Raw Counts, Managed Site 2003

1. 5 - 10
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5. 40.1 - 50
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# Stems

White Oak Raw Counts, Managed Site 2008

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4. 30.1 - 40
5. 40.1 - 50
6. 50.1 - 60

# Stems
Results: Shrub Layer, 2008

- Managed site, significantly fewer:
  - total stems
    (Z=-3.437; df=34; p=0.000)
  - saplings
    (Z=-2.404; df=34; p=0.016)
  - shrub stems
    (Z=-3.221; df=34; p=0.001)
  - invasive shrub stems
    (Z=-3.125; df=34; p=0.001)
- Both sites: ratio of invasive to total shrubs was very high (97.2% mgd, 94.6% unmgd)
- Both sites: few oak saplings (3/61 mgd, 4/122 unmgd)
Results: Shrub Layer, Managed Site

- Total stems increased  
  \(Z=-0.701; \ df=17; \ p=0.483\)

- Breaking it down:
  - Saplings decreased  
    \(Z=-1.984; \ df=17; \ p=0.047\)
  - Shrubs increased  
    \(Z=-1.433; \ df=17; \ p=0.152\)
  - Invasive shrubs increased  
    \(Z=-1.730; \ df=17; \ p=0.084\)
Results – Vegetative Shading Levels, 2008

• Managed:
  – 77.1% shading

• Unmanaged:
  – 88.6% shading

• Chi-Square Test Results:
  – Chi-Sq. = 22.58;
  – d.f. = 1
  – p < 0.0001
Results – Vegetative Shading Levels, Managed Site 2003 vs. 2008

• 2003:
  – 86.3% shading

• 2008:
  – 77.1% shading

• Chi-Square Test Results:
  – Chi-Sq. = 12.36;
  – d.f. = 1
  – p = 0.0004
Results – Native Species Richness in Ground Layer, 2008

- Managed:
  - 57 native species
  - 7.5 native species/plot

- Unmanaged:
  - 46 native species
  - 5.3 native species/plot

- T-test results:
  - Significant
  - $T=-3.172$; df=68; $p=0.002$
Results – Native Floristic Quality in Ground Layer, 2008

- Managed:
  - FQI: 27.0
  - Mean plot C: 3.7

- Unmanaged:
  - FQI: 23.3
  - Mean plot C: 3.8

- T-test results:
  - Not significant
  - T=0.796; df=68; p=0.429
Results – Native Species Richness in Ground Layer, Managed Site

- **2002:**
  - 49 native species
  - 6.5 native species/plot
- **2008:**
  - 57 native species
  - 7.5 native species/plot
- **T-test results:**
  - Nonsignificant
  - $T = -1.697; \ \text{df}=34; \ \text{p}=0.099$
Results – Native Floristic Quality in Ground Layer, Managed Site

• 2002:
  – FQI: 25.9
  – Mean plot C: 3.0

• 2008
  – FQI: 27.0
  – Mean plot C: 3.7

• T-test results:
  – Significant
  – T= -4.043; df=34; p=0.000
Results – Oak Regeneration, 2008 Managed vs. Unmanaged Sites

• Managed Site Oaks:
  – 4 of 37 seedlings
  – 3 of 61 saplings

• Unmanaged Site Oaks:
  – 0 of 44 seedlings
  – 4 of 122 saplings
Results – Oak Regeneration, Managed Site
2002 vs. 2008

• 2002 Oaks:
  – 0 of 29 seedlings
  – 2 of 82 saplings

• 2008 Oaks:
  – 4 of 37 seedlings
  – 3 of 61 saplings
Conclusions: Tree Community

- Both sites are oak-hickory dominated, but are transitioning to more shade-tolerant species such as sugar maple, black cherry, basswood, and ironwood, and the invasive buckthorn.
- Little evidence of oak regeneration
Conclusions: Shrub Layer

• Managed site had significantly fewer total stems, saplings, and shrub stems than unmanaged site.
• Invasive shrub stems are up dramatically on managed site; limited abundance of native shrubs is also a concern.
• Again, very little evidence of oak reproduction.
Conclusions: Ground Layer

• Native species richness - higher on managed site where it has increased from 49 to 57 species since 2002.

• Mean native plot richness of the managed site (7.5 +/- s.e.m. 0.5 ) compared favorably with 13 Chicago region high-quality reference sites sampled by Bowles et al. (1998): (6.8 +/- s.e.m. 0.5).

• FQI slightly higher on managed site than unmanaged site, also up slightly from 2002.
Conclusions: Vegetative Shading

- Managed site:
  - significantly lower vegetative shading than unmanaged site (77.1% versus 88.6%)
  - significantly lower than managed site 5 years prior (77.1 vs. 86.3%)

- Ground layer vegetation may be responding to the higher light levels
Conclusions: Oak Regeneration

• Very limited oak regeneration on either site

• Reassess:
  – Try some things on small scale
  – Look at areas where oak reproduction does appear to be occurring
Thank You!