EFFECTS OF AERIAL HERBICIDE TREATMENT OF MELALEUCA ON NATIVE HABITAT RECOVERY IN THE NORTHERN EVERGLADES

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2. Arthur R. Marshall Loxahatchee National Wildlife Refuge, Boynton Beach, FL, USA
3. Fairchild Tropical Botanic Garden, Coral Gables, FL, USA
Melaleuca quinquenervia

- Highly aggressive
  - Reproductive in one year
  - 100 million seeds/tree

- Has invaded over 200,000 ha in south Florida
A.R.M. Loxahatchee N.W.R.

- High levels of invasion
- Aggressive management
Selective Treatment Options

Hand Treatment
- Labor intensive
- Time
- Money
- Disturbance

Biological Control
- Variable efficacy
- Generally non-lethal
- Spatio-temporal dependency

sfiwww.er.usgs.gov/sfrsf/rooms/species/biocontrol/melaleuca.html
Non-Selective Treatment

Broadcast Aerial Herbicide
  o Fast
  o Cheap
  o Effective
  o **Non target impacts?**
Objectives

- Assess impact of aerial spraying on non-target vegetation community
- Quantify vegetation community composition and recovery of treated stands
Sawgrass Biomass Removal Experiment (S\textsubscript{a}BRE)

- Thirty 2m x 2m plots
- Control (n=10)
- Clipped (n=10)
- Herbicide (n=10)
Control Plots
Clipped Plots
Herbicide Plots
# Mean Percent Change in Species Richness

<table>
<thead>
<tr>
<th>Week</th>
<th>Clip</th>
<th>Herb</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>-41</td>
<td>-7</td>
<td>+9</td>
</tr>
<tr>
<td>7</td>
<td>-3</td>
<td>-20</td>
<td>+8</td>
</tr>
<tr>
<td>15</td>
<td>+24</td>
<td>-7</td>
<td>+22</td>
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<td>21</td>
<td>+44</td>
<td>-3</td>
<td>+25</td>
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<tr>
<td>36</td>
<td>+43</td>
<td>-11</td>
<td>+31</td>
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</table>

Herbicide decreases species richness
Mean Percent Change in Live Vegetation Cover

<table>
<thead>
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<th>Week</th>
<th>Clip</th>
<th>Herb</th>
<th>Control</th>
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<tbody>
<tr>
<td>3</td>
<td>-84</td>
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<td>21</td>
<td>-51</td>
<td>-82</td>
<td>+21</td>
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<tr>
<td>36</td>
<td>+10(^B)</td>
<td>-74(^A)</td>
<td>+28(^C)</td>
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</table>

Herbicide reduces total live cover
Weeks

BC Dissimilarity

0 0.2 0.4 0.6 0.8 1.0

0 1 2 3 4

Control
Herbicide
Clip

Community Recovery Trajectory

Changes are long-lasting!
Objectives

- Assess impact of aerial spraying on non-target vegetation community
- Quantify vegetation community composition and recovery of treated stands
Community Surveys

- 10 historically treated sites (6-7 years)
- Vegetation transects
Structural Influence

• Stand density may influence herbicide interception
• Greater herbicide impact to understory in sparse stands
• Trees occupy space long after treatment
• Increased habitat complexity
Transects

Dense
Sparse
Marsh
Melaleuca Adjusted % Native Live Cover

% Cover

<table>
<thead>
<tr>
<th>Zone</th>
<th>Dense</th>
<th>Sparse</th>
<th>Marsh</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

A

A

A
Community Diversity

Shannon-Wiener Diversity

Zone

Dense
Sparse
Marsh

C
B
A

0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
Invasive Cover

![Graph showing invasive cover]

- **Dense**:
  - Melaleuca: 10%
  - Lygodium: 6%

- **Sparse**:
  - Melaleuca: 1%
  - Lygodium: 2%

![Image of invasive plants]

Legend:
- Blue: Melaleuca
- Green: Lygodium
Shift in Community Composition

![Graph showing community composition with NMS axes and species labels: Chara, Utricularia, Biomass, Cladium. Points indicated as Dense, Sparse, and Marsh categories.]
Results: Vegetation Patterns

- Stand density-dependent effectiveness of aerial spraying

- Greater impact but lower reinvansion in sparse stands

- Community shifts long-lasting
Objectives

- Assess impact of aerial spraying on non-target vegetation community
- Quantify vegetation community composition and recovery of treated stands
Monitored Treatments

- **19** Melaleuca-invaded sites received aerial herbicide application
- sawgrass marsh (n=5 south, 5 north), slough/wet prairie (n=4), and pocosin (n=5) and were found in the northern and southern parts of the refuge
Methods

• Vegetation composition, canopy density, and water depth within each site were assessed prior to and following herbicide treatment.
• First surveyed in November 2013.
• Treated with a glyphosate-based herbicide in January 2014.
• Resurveyed in March 2015 (14 mos).
Treated islands
Results

Pre- and Post-treatment Plant Communities

ANOSIM results
Global $R = 0.373$
Significance level $= 0.1\%$
Conclusions

• Non-target communities have extended recovery trajectories or shifts to novel communities
• Stand density-dependent effectiveness of aerial spraying
• Greater impact but lower reinvasion in sparse stands
Management Implications

- Stand density/area minimum threshold for aerial spraying
- Adaptive management strategies
- Risk of habitat alteration must be weighed against benefits of spraying
Acknowledgments

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• Committee: Dr. Brian Benscoter, Dr. Nathan Dorn, Dr. Rebekah Gibble, and Dr. Scott Markwith
Questions?