Integrated Management of Cattails

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Gregg Knutson, Glacial Ridge/Rydell NWR
Local example of spread. Burnham Creek Wildlife Management Area.
Dear Dr. Svedarsky,

I am a new wetland researcher with the Minnesota DNR in Bemidji. **Land managers continually emphasize cattail control as *the* top research priority.** Questions I repeatedly hear from wetland managers are: Will cattail control work for my site? Which control measures should I use (e.g., fire, spraying, harvest, combos)? Why did it work here, but not there?!?

Danelle Larson

12 September 2016
Cattail cover in northwest Minnesota

Total units: 903
Total area: 95,500 A or 38,640 Ha
Open marshes, less blackbirds
less crop depredation
FIG. 1. Design of cover-removal plots. Stippled and clear areas represent cattail and open water, respectively.
The Goal: a hemi-marsh!
The general idea

Harvest

Storage

Pelletizing

Burning pellets
Minnesota Pilot Harvesting
Pilot scale processing at Northwest Research and Outreach Center
End Products

Torrefaction

CATTAIL SHOOTS

CHOPPED

MILLED

PELLETIZED

Pellets

Pucks

Cubes
Issues to address

- Get material out of the marsh.
- Transport costs.
- Produce a fuel usable in existing burners, economically competitive, and with consistent quantity and quality.
- Demonstrate the value as a wetland wildlife management tool.
Parnell Impoundment Cattail Study

Mow area.
Fall of 2014
Harvesting options

Equipment challenges.

Wet year, dry year, average year?
Piston Bully - Baling technology for Phragmites harvesting. Germany.
New York trail groomer
A “Quadbaler” from Washington state swaths and bales in one pass!
Working with Robin Brekken, local farmer/entrepreneur to make pellets. Tory Stulen working on life cycle analysis.
Pellets from grass seed residue in Sweden
Biochar Carbon Sequestration

- Green crops
- Biochar
- Bioenergy
- Bioagrochar™

Ecoera
Biofuel engineering
Industrial/Farm scale

Biomass Stoker Boilers

Residential/Commercial

Pellet stoves
Northwest Manufacturing, maker of Woodmaster stoves. Red Lake Falls, MN
# Comparative cost of energy sources

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Btu/lb</th>
<th>Cost per ton</th>
<th>Cost per MMBtu</th>
</tr>
</thead>
<tbody>
<tr>
<td>UMC Coal (Sub-Bituminous, delivered)</td>
<td>9,500</td>
<td>$71</td>
<td>$3.68</td>
</tr>
<tr>
<td>Wood pellets picked up (Hayward, WI)</td>
<td>8,000 to 9,000</td>
<td>$150</td>
<td>$8.82</td>
</tr>
<tr>
<td>Wood pellets delivered to Red Lake Falls (Ladysmith, WI)</td>
<td>8,000 to 9,000</td>
<td>$175</td>
<td>$10.29</td>
</tr>
<tr>
<td>Cattail pellets</td>
<td>8,551</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Biomass gasification at UMM? Use of whole bales??
Biological effects of cattail management

- Vegetation
- Birds
- Amphibians
Study Area

- Glacial Ridge National Wildlife Refuge
  - One of the largest prairie-wetland restorations to date.
- Refuge encompasses 15,200 ha
  - 1,240 ha of restored wetlands
  - 8,100 ha of restored prairie

<table>
<thead>
<tr>
<th>Number of Wetlands</th>
<th>Treatment Applied in 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Control</td>
</tr>
<tr>
<td>3</td>
<td>Mow</td>
</tr>
<tr>
<td>7</td>
<td>Chemical</td>
</tr>
<tr>
<td>3</td>
<td>Fire</td>
</tr>
<tr>
<td>4</td>
<td>Chemical x Fire</td>
</tr>
<tr>
<td><strong>23</strong></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
## Treatment and Cost

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of Wetlands</th>
<th>Average Wetland Size</th>
<th>Timing</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mow</strong></td>
<td>3</td>
<td>4.78 ha</td>
<td>11/12/14</td>
<td>$5.81 per ha $300 per hr 14.33 ha total mowed</td>
</tr>
<tr>
<td><strong>Chemical</strong></td>
<td>7</td>
<td>5.47 ha</td>
<td>9/12/14</td>
<td>$106.52 per ha 202 ha total sprayed total cost $21,518.53</td>
</tr>
<tr>
<td><strong>Fire</strong></td>
<td>3</td>
<td>1.76 ha</td>
<td>10/08/14</td>
<td>$990.58 per ha 5.27 ha burned $27,000 total along with chemical x fire wetlands</td>
</tr>
<tr>
<td><strong>Chemical x Fire</strong></td>
<td>4</td>
<td>5.35 ha</td>
<td>9/12/14</td>
<td>$1,218.52 per ha 21.41 ha total sprayed and burned</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>6</td>
<td>6.48 ha</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Vegetation Results:

Take home:
- Live cattail ↑ 68% and 54% following fire treatment.
- Live cattail ↓ 73% and 24% following chemical treatment.

✓ Ponzio et al. (2004): *Typha* density at the burned sites doubled.
Take home:
- Dead cattail ↑ 57% and 45% after chemical application.

☑ Linz et al. (1996): Dead vegetation was greater after chemical was applied.
**Take home:**
- Recall we desired an increase in open water!
- No significant impact from treatments on open water.
- Boers and Zedler (2008): Hybrid cattail increased where water levels were unchanged.
- Water level manipulation difficult/unfeasible in shallow wetlands!
Vegetation Results:

Take home:
- Other species (non-cattail spp.)↓ 57% and 39% after chemical x fire application.
- Other treatments had little impact.

✓ Lawrence et al. (2015): Glyphosate reduced *Typha* density AND other native species.

![Graph showing vegetation results](image)
Bird Species Richness:

**Take Home:**
- Overall bird richness not impacted.
- Some spp. benefited while others didn’t.

- Humpert and Hubbard (1995): Waterfowl richness higher in treated areas.
- Linz et al. (1996): Chemical application increased waterfowl densities.
- Our methods not best for assessing waterfowl species.

![Bird Species Richness Chart](chart.png)
Individual Bird Species:

**Take home:**
- Interior wetland species.
- Marsh wren numbers ↓ 56% and 74% after fire treatment.
- Marsh wren numbers ↓ 70% and 56% after chemical treatment.

✓ Linz et al. (1996): Chemical application reduced marsh wren numbers.
Individual Bird Species:

Take home:
- Exterior wetland species.
- Sedge wren numbers ↑ 22% and 96% following fire treatment.

Schramm et al. (1986): Sedge wrens preferred spring-burned areas.

Trt*Year $p$ = 0.0473
Individual Species:

- Generalist wetland/upland species.

- Common yellowthroats ↓ 46% one year after fire then ↑ 36% two years post-treatment.
Individual Species:

**Take home:**
- Generalist/nuisance wetland species.
- Chemicals ↓ red-winged blackbirds by 62% followed by a 5% ↑.
- Red-winged blackbirds ↑ 90% and 157% after chemical x fire treatment.

✓ Linz et al. (1996): Chemical application reduced red-winged blackbird use.

*Trt*Year p = 0.0067
**Take home:**
- Generalist wetland species.
- Swamp sparrows ↑ 177% and 106% after fire treatment.
Amphibian Results:

- 5 total species observed.
- Overall amphibian richness not impacted.
- Initial 53% ↓ after mowing application.
  - Relyea (2005): Round-up eliminated 2 species of tadpoles and nearly exterminated another. Resulting in a 70% decline in species richness.

Take home:
- 5 total species observed.
- Overall amphibian richness not impacted.
- Initial 53% ↓ after mowing application.

- Relyea (2005): Round-up eliminated 2 species of tadpoles and nearly exterminated another. Resulting in a 70% decline in species richness.

\[ Trt \times Year \ p = 0.5814 \]
Amphibian Results:

**Take home:**
- Overall chorus frog abundance not impacted.
- Mowing ↑ boreal chorus frogs by 319% and 296%.

✓ Shulse et al. (2012): Chorus frogs positively associated with vegetation cover.

✓ Mowing = more litter = more cover = good for chorus frogs!
Invertebrate Results:

Take home:
- Overall dragonfly abundance not impacted.
- Dragonflies ↓ 23% and 63% following fire treatment.
- Chemical x fire ↓ dragonflies by 45% and 54%.

- Murkin et al. (1982): Increased invertebrate populations.
- Elo et al. (2015): Time lags of as much as 3 years might exist to see invertebrate responses.
What should the manager do?

• To manage cattail-choked wetlands:
  • Chemicals ↓ live cattail
  • Chemical x Fire ↓ live cattail
  • Short-lived (2 years post-treatment reverted)
  • Caution: Fire (by itself) ↑ live cattail

• Species Specific Responses:
  • Marsh wrens ↓ after fire and chemical
  • Sedge wrens ↑ after fire
  • What is your objective?

• Have management goals in mind, but examine other aspects affected by various management choices.
## Conclusions and Costs

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Live Cattail</th>
<th>Percent Open Water</th>
<th>Avian Species Richness</th>
<th>Amphibian Species Richness</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mow</td>
<td>↑↓</td>
<td>↓</td>
<td>↓</td>
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Future Directions

• Conduct a long-term study to assess treatment and year effects.
  • Other studies explore management implications 5–10 years post-treatment (Lehikoinen et al. 2017).
  • Multi-year treatment applications.
Interdisciplinary Approach

• Guide management to benefit both wildlife and people.

• Extension Publication: “Cattail Management in the Northern Great Plains: Implications for Wetland Wildlife and Bioenergy Harvest”
  • Website: https://www.nwroc.umn.edu/research/wildlife-management-biofuels