Cryptic Cattail Invasions in North American Wetlands: Impacts to Biodiversity

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Once members of mixed species assemblages, many cattail stands now form dense monocultures.
Cattail monocultures as novel ecosystems

- High primary productivity
- High litter accumulation, soil organic matter content, and soluble nutrients (Tuchman et al. 2009)
- Reduced soil surface light and temperature (Larkin et al. 2012)
- Elevated sediment microbial community diversity (Angeloni et al. 2006)
- Reduced insect herbivore abundance (Penko and Pratt 1987)
- Elevated bird abundance (Smith-Cartwright et al. 2011)
Why have cattails become invasive?

- Altered hydrology (e.g., Wilcox et al. 1985)
- Eutrophication (e.g., Woo and Zedler 2002)
- Hybridization (Travis et al. 2010)

*Typha latifolia*  
Broad-leaf cattail

*Typha domingensis*  
Southern cattail

*Typha angustifolia*  
Narrow-leaf cattail

*Typha x glauca*  
Hybrid cattail
Hybrid cattail: *Typha x glauca*
Cattail monocultures dominated by hybrids show the importance of vigorous clonal growth to invasiveness.
Hybridization is attributable to the westward expansion of the narrow-leaf cattail from Galatowitsch et al. 1999.
but does every cattail invasion involve hybrids, and how can we know for certain?

**Table 3.** Distribution frequency of SSR alleles in clones that were identified as either *Typha latifolia* (L) or *Typha angustifolia* (A) using RAPD markers. Shading indicates fragment sizes that were designated as *T. latifolia* (pink, underlined), *T. angustifolia* (blue), or uncertain (no shading); boldface with green shading indicates exceptions for these designations. Collection sites are shown in Tables 1 and 2.

<table>
<thead>
<tr>
<th>TA 3 locus Allele</th>
<th>TA 5 locus Allele</th>
<th>TA 7 locus Allele</th>
<th>TA 8 locus Allele</th>
<th>TA 16 locus Allele</th>
<th>TA 20 locus Allele</th>
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<td>A</td>
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</table>

Total no. of clones: 65 33 56 40 68 42 65 42 49 43 68 42 13 7

Group 1: 52 26 43 33 55 35 52 35 36 36 55 35 0 0

Group 2: 13 7 13 7 13 7 13 7 13 7 13 7

from Snow et al. 2011
Is hybridization between narrow-leaf and broad-leaf cattail occurring on the Atlantic Coast?

- Old Saybrook, CT
- Fire Island NS, NY (3 sites)
- Prime Hook NWR, DE (2 sites)
- Assateague Island NS, MD
- Back Bay NWR, VA (2 sites)
Yes, but pure stands of narrow-leaf cattail are not uncommon.
Is hybridization between narrow-leaf and broad-leaf cattail occurring in the Great Lakes region?
where cattails are a particular nuisance

VOYA: Large Lake Margin
SACN: Small Lake Margin
PIRO: Sweet Gale Swamp
SLBE: Beaver Impoundment
CUVA: Floodplain Fen
INDU: Bog
Yes, but the migrating hybrid front has thus far bypassed the central Great Lakes... or has it?
... and native broad-leaf cattail persists where motorized traffic is limited or restricted.
Is hybridization between narrow-leaf and broad-leaf cattail occurring in California?
Is hybridization between narrow-leaf and southern cattail occurring in Florida?

- T. domingensis
- T. angustifolia
- T. x glauca or other hybrid
Patterns of Cattail Hybridization

- Hybridization between North American cattails is widespread
- Hybrids are fertile, creating the potential for gene introgression
- Hybrids are especially dominant (and aggressive) in the western Great Lakes region
- Portions of the central Great Lakes region have yet to be colonized by hybrids
- Hybridization and introgression are also apparent on the West Coast
- . . . And, tentatively, on the Gulf Coast
Due to the fertility of hybrids, the invasion dynamics of hybrid cattails are complex.
Future Directions

- Develop additional species-diagnostic microsatellite markers for enhanced detection of introgression
- Confirm the reliability of pollen as a low-cost indicator of cattail hybridization

*T. latifolia*  
*T. angustifolia*  
*T. x glauca*
Modeling the spread of non-native cattail by “resistant kernel analysis”

- Sample cattail pollen from the coast of New England, fanning out to encompass the entire western Great Lakes
- Include lightly populated areas and isolated wetlands in addition to urban areas and disturbance wetlands
- Correlate multiple anthropogenic and environmental features with presence/absence of non-native cattail

Figure courtesy of S. Cushman