Can we control Southern Cattail (*Typha domingensis*) in a Midwest Wetland System?
A Cryptic Invasion

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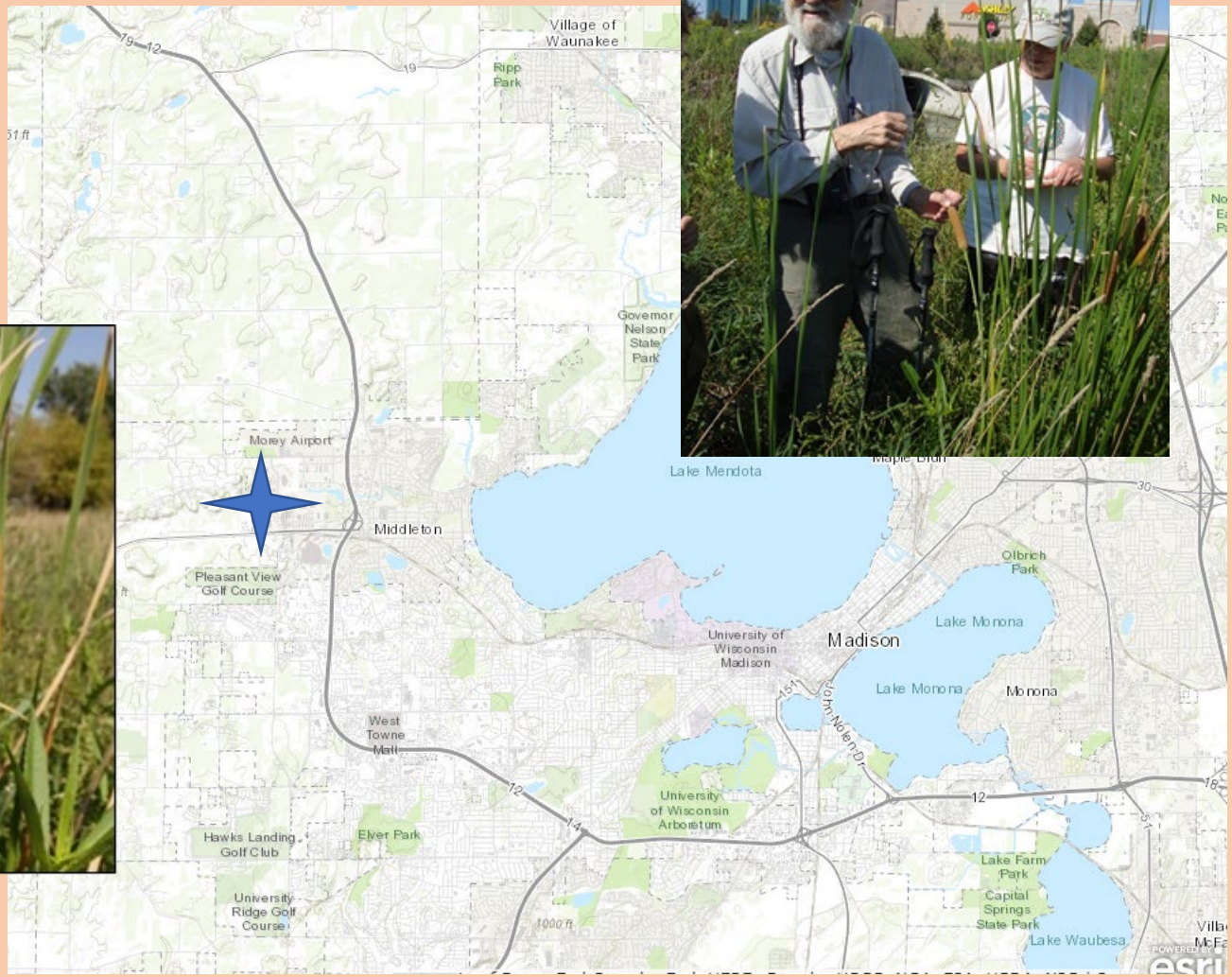
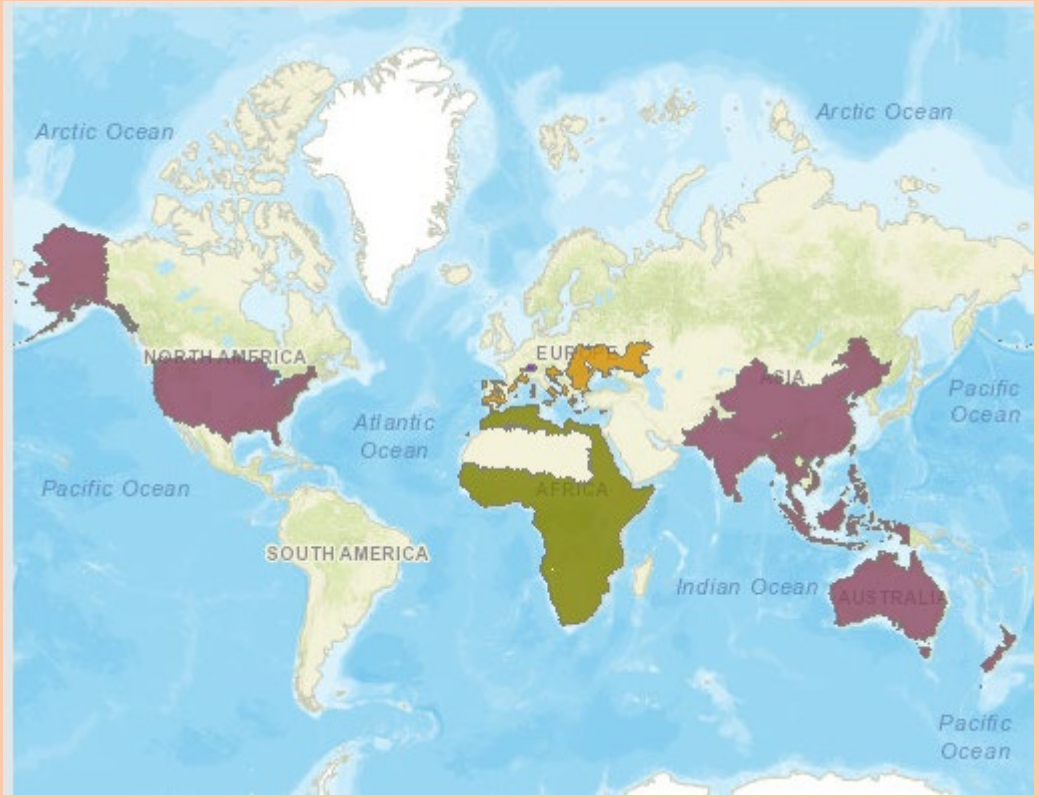
Southern Cattail in WI

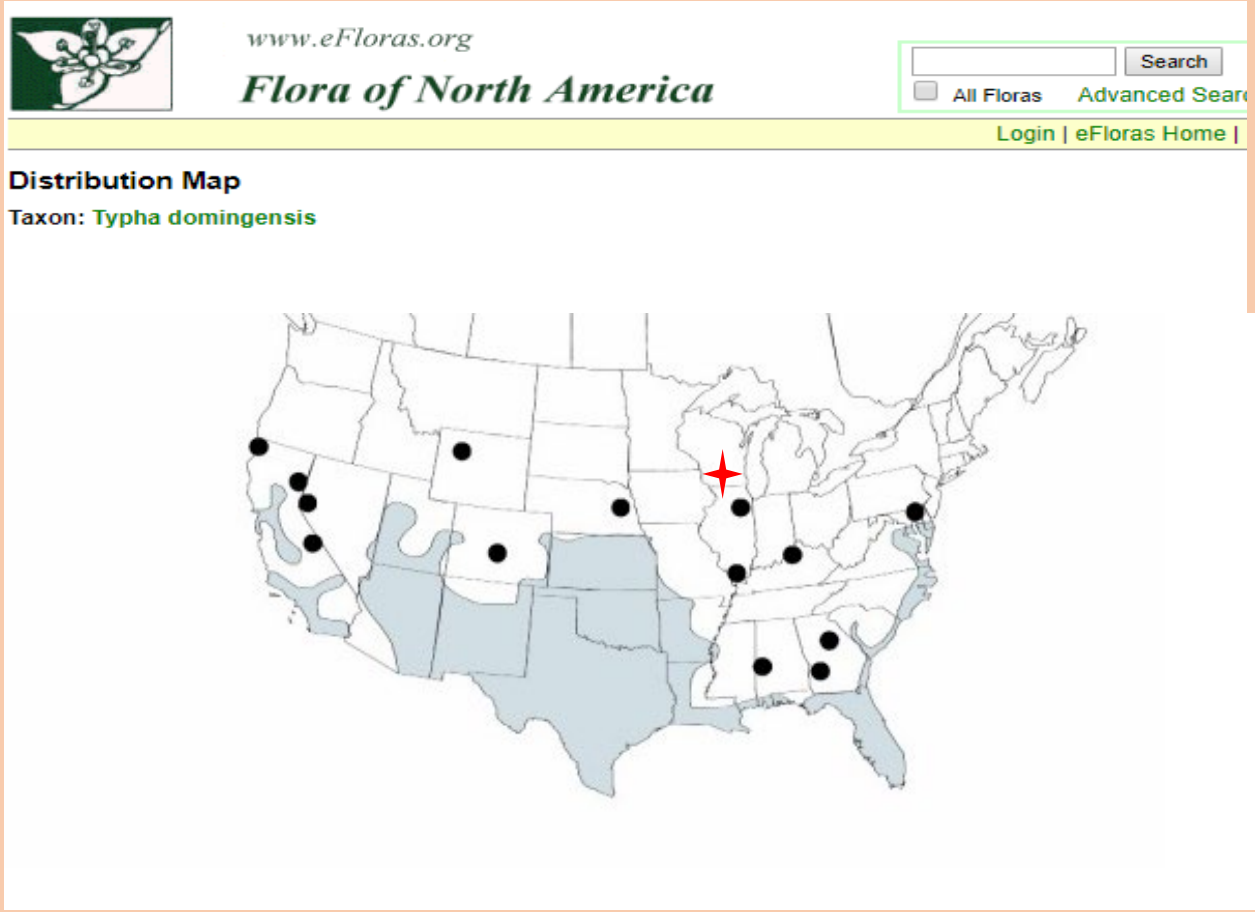
August, 2011 the late Dr. Galen Smith Emeritus Professor UW-Whitewater found Southern Cattail as he drove through Middleton. Smith authored *Typha*, Flora of North America.



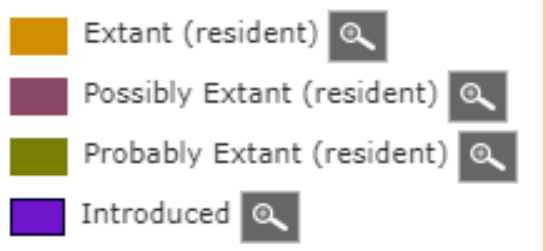
Known Distribution

Closest population 150 miles south at a cooling plant in Illinois





International Union for Conservation of Nature



Typha domingensis Morphological Field Traits

Cinnamon colored spike, lime green leaves

Spotted mucilage coloration extends across inner leaf sheaf

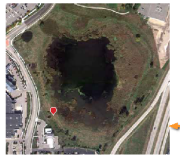
2012- Dr. Smith reports finding at Wisconsin Wetlands Association Conference

1. We get Early Detection Grant AIS funding from WDNR
2. We meet Dr. Pamela Geddes Northeastern IL University at WWA- studying cattail genetics with microsatellite primers
3. We find multiple stands of Southern cattail and begin control efforts

Typha domingensis (Southern cattail) new to Wisconsin

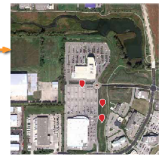
S. Galen Smith[1], Mary Linton, Alice Thompson
[1]Professor Emeritus, University of Wisconsin-Whitewater, Honorary Fellow, Botany Department, University of Wisconsin-Madison

The genus *Typha*, in North America called cattails, with about 15–17 species, occurs in temperate and tropical regions worldwide. The center of diversity is in eastern Asia, especially China where 12 species are recognized. The only species that are definitely native to North America are *T. latifolia* (Broad-leaved cattail) and *T. domingensis* (in North America called Southern cattail). *Typha angustifolia* is probably introduced from Europe.



Esser Pond surrounded by degraded marsh-prairie complex showing location of *T. domingensis* colony next to parking lot

Air photo of area where *T. domingensis* was found



North of Hwy. 14 showing the location of 3 colonies next to parking lots in highly developed area

In August 2011 I found a small colony of *T. domingensis*, probably a single clone, near Esser Pond in Middleton, Wisconsin, and Mary Linton found many other colonies near the Costco store a short distance to the north along tributaries to Pheasant Branch Creek. The habitats are marshes near parking lots and streets and are greatly disturbed by humans. They are partly fed by storm water runoff but probably also by groundwater.

Storm-water outlet near T. domingensis colony near Esser Pond

This is the first Wisconsin record of *T. domingensis* and is about 150 miles north of the nearest known locality at a power plant cooling pond about 50 miles ssw. of Chicago.

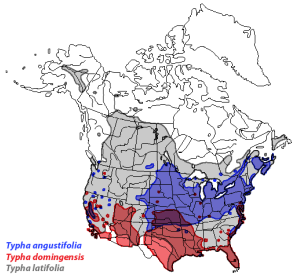
The *T. domingensis* plants were easily distinguished from the abundant *T. latifolia* and *T. angustifolia* plants nearby by their lighter green leaves and especially by their lighter, cinnamon-colored fruiting spikes that became paler in the autumn as most of the stigmas wore off. *Typha domingensis* is similar to *T. angustifolia*, from which it may best be distinguished in all seasons by the small brown mucilage-secreting glands on the inner surface of the leaf sheath and about 1–10 cm of the base of the leaf and are visible with the naked eye. To see the glands it is necessary to peel off about an inch of the leaf sheath next to the base of the blade. In *T. angustifolia* and *T. latifolia* the glands are restricted to the leaf sheath, but in *T. latifolia* they are very difficult to see without staining with an artificial dye.

Typha domingensis colony showing the cinnamon-brown pistillate spikes

Inner surface of leaf-sheath transition of *T. domingensis* from Esser Pond showing many small brown mucilage glands extending onto the leaf blade

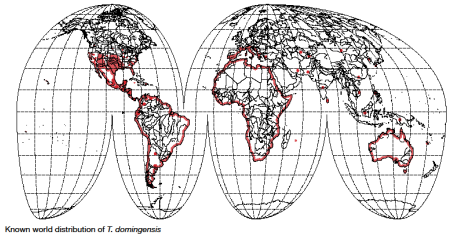
The *T. domingensis*, *T. angustifolia* and *T. latifolia* plants were obviously healthy and producing numerous apparently normal seeds.

Typha domingensis was probably brought to Middleton as seeds by wind, birds or humans, perhaps on construction equipment, and established in 2003–2008 when that region was developed. The building of streets, parking lots and storm-water runoff culverts and ponds in the edges of existing wetlands probably created the bare mud which the tiny cattail seeds need to germinate and the delicate seedlings need for growing until they are well-established.



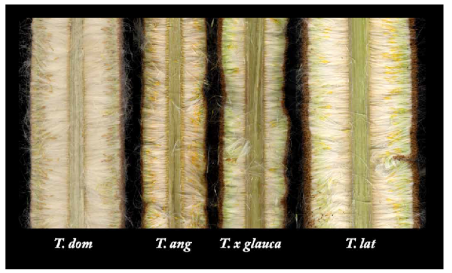
Known north American distribution of *T. latifolia*, *T. angustifolia* and *T. domingensis* showing overlapping ranges where hybridization is possible

Typha domingensis is the most widely-distributed cattail species. It ranges throughout tropical and warm temperate regions of the world commonly to about 40 degrees latitude. In North America it is locally common along the Atlantic Coast from Florida to Maryland and Delaware and in the Gulf Coast states; rare in southern Illinois, Kentucky and Tennessee; and locally common in Arkansas, southwestern Missouri and Kansas west to the Pacific Coast, from Mexico to Nebraska and northern California. The Wisconsin locality is at about 43 degrees N. In 2003 I collected a similar specimen in South Dakota at about the same latitude. The northernmost known North American locality is in central Washington state on the shore of a reservoir at about 47 degrees N, the voucher collection made in 2001.



Known world distribution of *T. domingensis*

Typha domingensis is variable worldwide in the size of the plants and inflorescences, presence of auricles at the leaf sheath summits, and details of the flowers and fruits. Its taxonomy is poorly known, and it is possible that it should be divided into several species. The Wisconsin plants have pistillate bractlet tips that are unusually narrow, only about as wide as the stigmas.



Longitudinal sections of nearly mature pistillate spikes of *T. domingensis* from Esser Pond and *T. latifolia*, *T. angustifolia* and *T. angustifolia X latifolia* hybrid (*T. Xglauca*) from the Madison area showing many young seeds (yellow) except for *T. Xglauca* with few seeds

Typha domingensis sometimes forms mostly fertile *T. angustifolia x domingensis* hybrids and highly sterile *T. domingensis x T. latifolia* hybrids which are very similar to *T. angustifolia x latifolia* hybrids (=*T. Xglauca*).

It seems possible that presence of healthy, seed-bearing colonies of *T. domingensis* in Wisconsin is an indicator of climate warming.

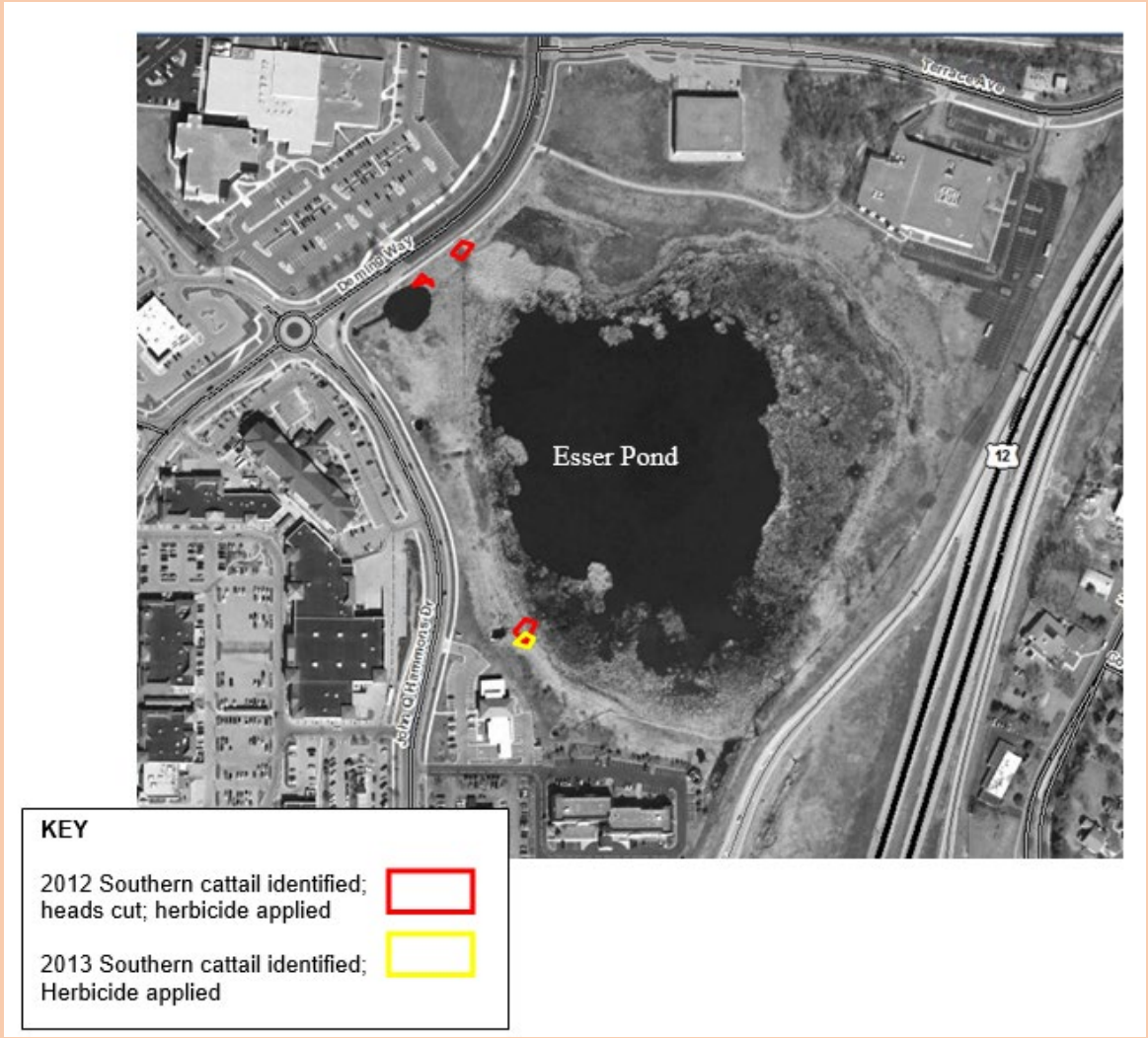
Part of the field trip attendees to Esser Pond in August 2011; Alice Thompson on left, Galen Smith in middle, Mary Linton on right

Southern Cattail Locations ♦

- Stormwater swales
- Outlets of stormwater culverts
- Areas of construction – 2003, 2005, 2008- did it arrive with construction equipment?
- Mixed within “Wisconsin” cattails- narrow leaved, broad leaved and hybrid
- Upstream of large wetland system and Lake Mendota

LAG TIME- 3 + years prior to detection

2012-2017 Control Efforts



Identify cinnamon spikes/ light green leaves
Cut spike- bag and landfill

Apply 2.5 % AquaNeat with 1% Liberate (Surfactant)

Esser Pond Results

Firefighters Park Results

Yearly control;
While a few isolated stands are gone

Formidable southern cattail areas expand

2015- used seed from WI cattails and bur reed to over seed areas

No discernable impact

Barriers to effective control:

- 2-8 year time lag- seed bank
- “leap frog” colonization
- Identification by orange spikes- pollen already released- leaf morphology too time consuming
- Labor intensive removal of cattail spikes
- Southern cattail surviving WI winter
- Possible hybrid zone

Increasing Confusion:

- Are we controlling Southern cattail or a hybrid swarm?
- How much of the stand should we control?

2017- Samples from nine locations sent to Dr. Pamela Geddes, Northeastern Illinois University

- Dr. Geddes is testing microsatellite primers on our samples in comparison with known microsatellite primers of
- *T. angustifolia (4)*
- *T. minima (2)*

Samples:

By Morphology- 56% were *T. domingensis* or a hybrid

- Sent samples from 8 areas of Southern Cattail control work and one from a pond with no known S. cattail
- Each sample was identified by morphology as S. cattail or a suspected hybrid of S cattail and “Wisconsin cattail” (*T. glauca*, *T. angustifolia, T. latifolia*)
- 11 were RED- showed up in 2017

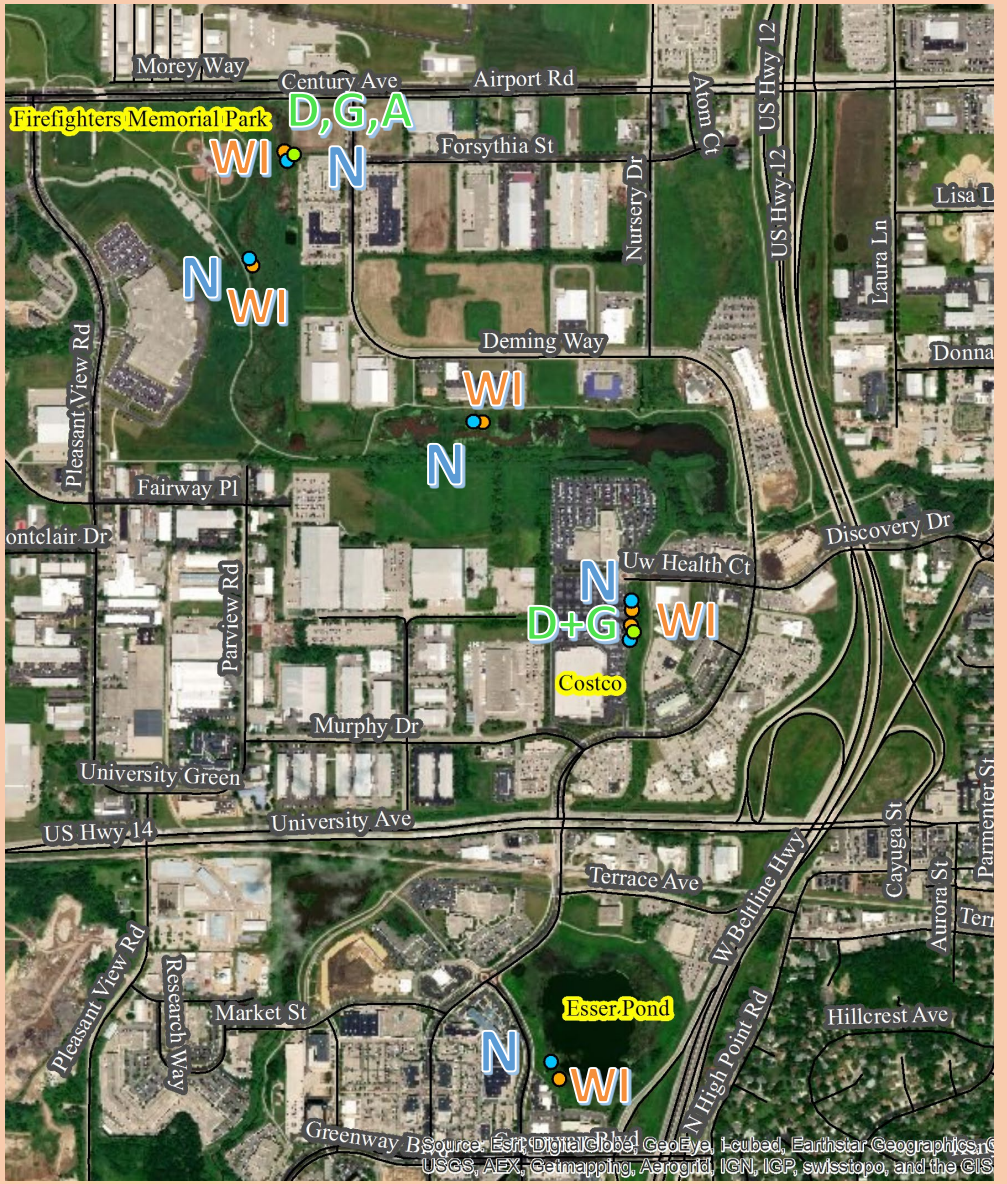
Preliminary Results:

By Morphology- 56% were *T. domingensis* or a suspect hybrid

19% Wisconsin Cattail
26% Weird RED spikes

Out of 45 samples:	**# of individuals**	**%**	
A (angustifolia)	14	33%	52% Wisconsin cattail
L (latifolia)	2	5%	
G (glauca)	6	14%	
New peaks (N)	4	9%	23% New Peaks
G+N	4	9%	
G+A	1	2%	21 % WI mix
L+A	3	7%	
L+G	5	12%	
L+N	2	5%	
D (domingensis)+G	1	2%	4% Florida D peaks
D+G+A	1	2%	
TOTAL	**43**	100%	
No results	2		

Locations of N and D vs WI



The Plot Thickens, It's a Mess!!

Over ½ the plants sent to Dr. Pamela Geddes showed all or part of the morphological traits of *T. domingensis* taught to us by Dr. Galen Smith- *Typha* expert

Only 2 plants showed *T. domingensis* peaks that matched Florida samples- none were "pure"

10 plants had new peaks that are not consistent with *T. domingensis* from Florida or ANY OTHER SAMPLES of *Typha latifolia, T. angustifolia or T. glauca* – **New peaks are in areas of suspected *T. domingensis***

Cattails inscrutable:

- ~ 20% of our samples had morphology of Wisconsin cattails- 73% of samples were A, L, G or mix.
- Did the original cattail introduction- maybe off construction equipment- already contain hybrids? Of what???
- What species is N- New Peaks??
- Do we have the ability to identify Southern cattail by molecular analysis?

What is our target plant?

- How do we control a species if we cannot recognize it in the field?
- How do we measure success?
- How do we control a “Cryptic Invasion”

Need more primers!

“In short, I believe this highlights the need to try multiple primers in multiple species, yet not many primers are published, which hinders the progress of molecular work. Developing our own primers is really costly and time-consuming, so we rely on primers that have already been published. Unfortunately for our case with *T. domingensis*, they do not seem to do a good job at separating *T. domingensis* from the Midwestern species. “

Dr. Pamela Geddes, Northeastern Illinois University

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More ?? Than Answers!

Is it Southern Cattail?

Can we justify herbiciding acres cattail within our possible range?

What We Might Do Differently; In Hindsight

- ❑ GPS locations of potential cattail invader (remove seed heads)
- ❑ Send samples for genetic testing of suspected invader and a potential hybrid zone

If samples positive for invader:

- ❑ Spray all cattail within known location and also spray radius of “hybrid” zone **before** plant flowers
- ❑ Re test samples in genetic lab after several years of control

Can we estimate a hybrid zone?

What would be a reasonable zone of control?

Cattails On the Move

Flood in Middleton- rainfall of 11.63”in 24 hours on August 20-21, 2018

$3 Million in Flood Damage in Middleton

All Suspected Southern Cattail Areas Flood Spreading Cattails to Unknown Locations

Thank you to our partners and collaborators:

Dr. Pamela Geddes & Students, Northeastern Illinois University

Dr. Joy Zedler, UW Madison
Dr. Paul Zedler, UW Madison
Dr. Don Waller, UW Madison

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Penni Kline, Retired from City of Middleton
Dino Hellebrand, City of Middleton

Thompson Associates: Aaron Menke, Carissa Anich, Danielle Tesar, Devon Cupery, Dr. Mary Linton

Oak Hill Corrections Crew

Tracy Hames, Wisconsin Wetlands Association

In Memory of Dr. Galen Smith- whose bright smile and enthusiasm for all things botanical lives on