

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?

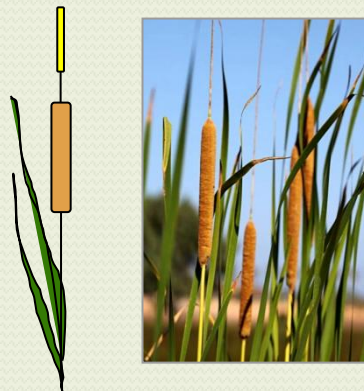
- Altered hydrology (e.g., Wilcox et al. 1985)
- Eutrophication (e.g., Woo and Zedler 2002)
- Hybridization (Travis et al. 2010)

Broad-leaf cattail



Typha latifolia

Southern cattail



Typha domingensis

Narrow-leaf cattail



Typha angustifolia

Hybrid cattail

?

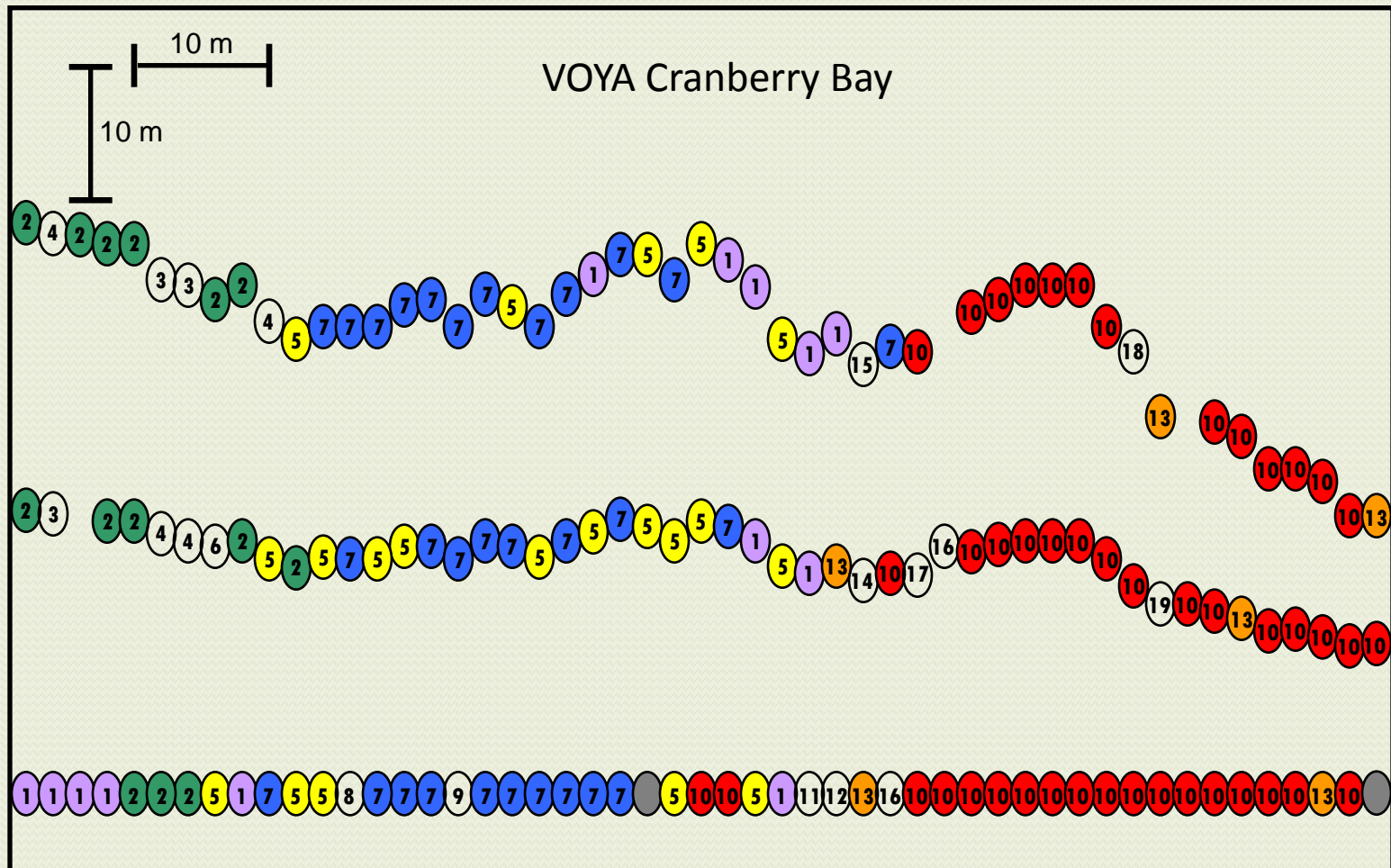


Typha x glauca

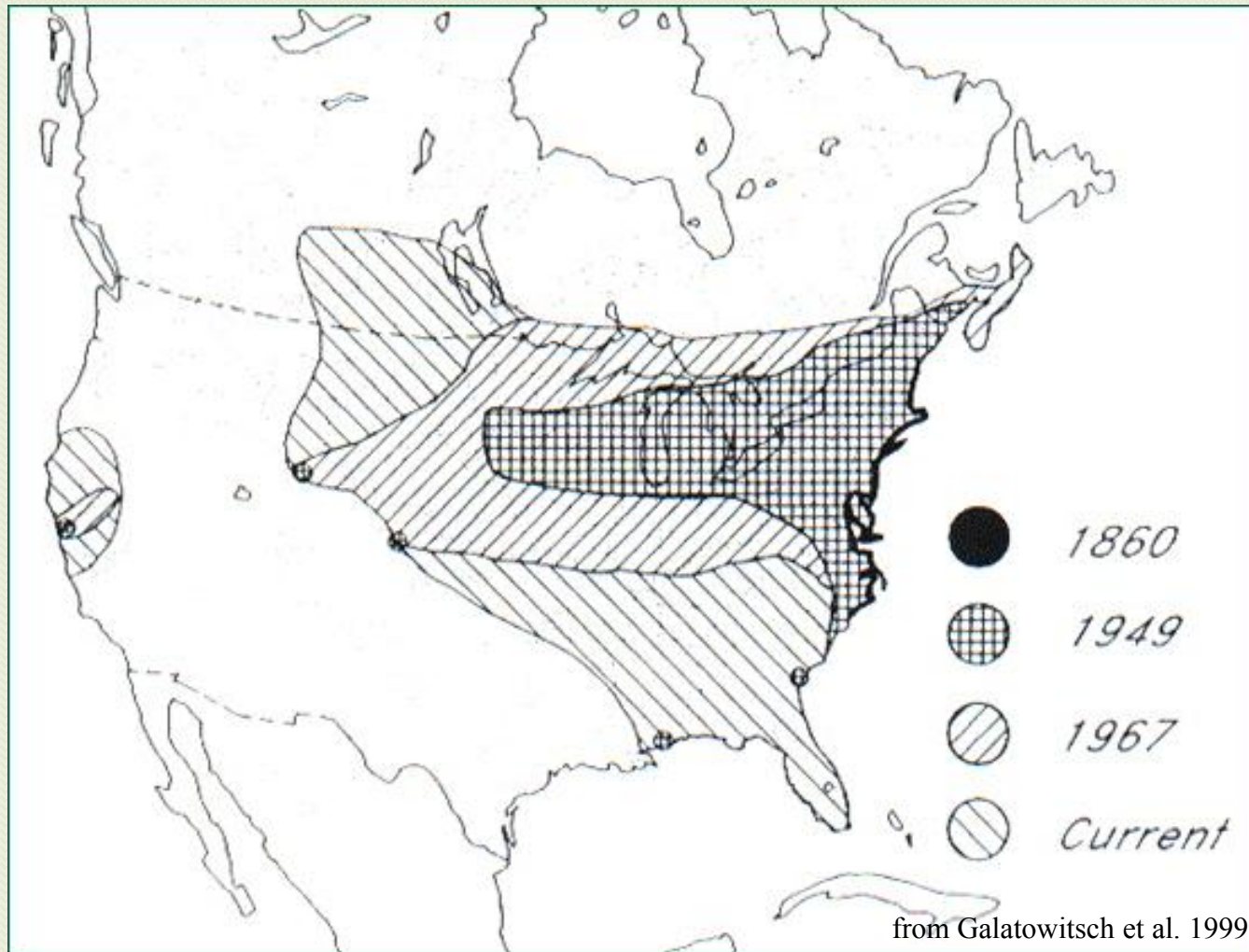
Hybrid cattail: *Typha x glauca*



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

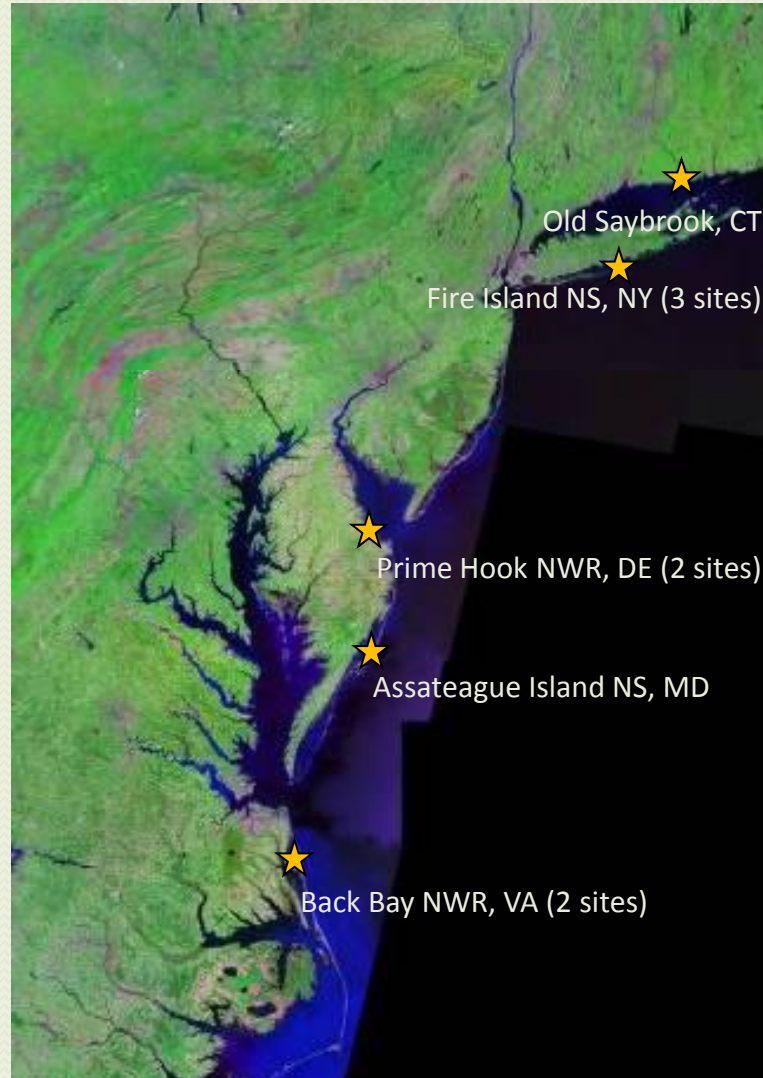


... but does every cattail invasion involve hybrids, and how can we know for certain?

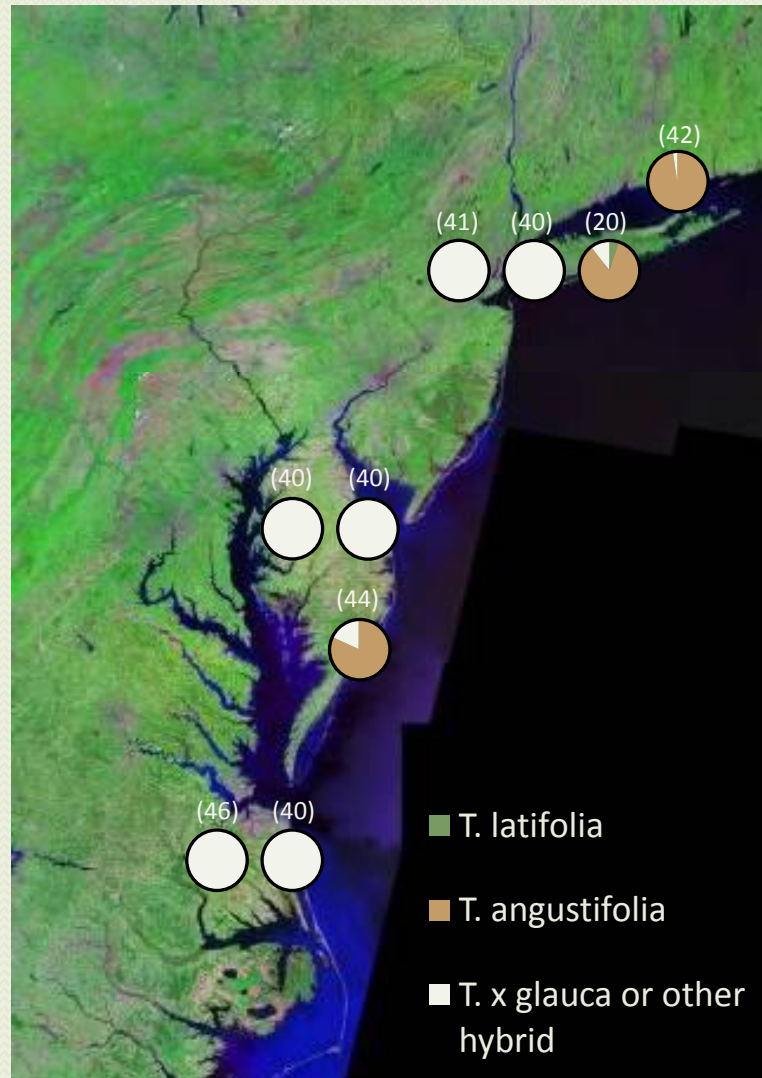
TABLE 3. Distribution frequency of SSR alleles in clones that were identified as either *Typha latifolia* (L) or *Typha angustifolia* (A) using RAPD markers. Shading indicates fragment sizes that were designated as *T. latifolia* (pink, underlined), *T. angustifolia* (blue), or uncertain (no shading);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

	TA 3 locus			TA 5 locus			TA 7 locus			TA 8 locus			TA 16 locus			TA 20 locus			TA 21 locus		
	Allele			Allele			Allele			Allele			Allele			Allele					
	Size (bp)	L	A	Size (bp)	L	A	Size (bp)	L	A	Size (bp)	L	A	Size (bp)	L	A	Size (bp)	L	A	Size (bp)	L	A
	<u>174</u>	40	0	<u>276</u>	4	0	<u>176</u>	5	0	<u>267</u>	18	0	<u>167</u>	15	0	<u>91</u>	84	0	<u>278</u>	26	0
	<u>176</u>	57	0	<u>278</u>	26	0	182	4	2	<u>269</u>	25	0	<u>177</u>	2	0	<u>93</u>	52	2	<u>280</u>	0	14
	<u>178</u>	9	0	<u>280</u>	80	0	186	3	6	<u>271</u>	85	0	<u>179</u>	80	1	<u>99</u>	0	15			
	<u>180</u>	18	1	<u>282</u>	2	0	<u>188</u>	10	0	<u>273</u>	0	2	181	1	5	<u>101</u>	0	65			
	<u>210</u>	6	56	<u>286</u>	0	14	<u>190</u>	108	0	<u>275</u>	2	44	<u>191</u>	0	1	<u>103</u>	0	2			
	<u>216</u>	0	9	<u>288</u>	0	31	<u>192</u>	6	0	<u>287</u>	0	9	<u>193</u>	0	70						
				<u>290</u>	0	8	<u>196</u>	0	68	<u>289</u>	0	19	<u>195</u>	0	9						
				<u>292</u>	0	1	<u>210</u>	0	8	<u>291</u>	0	12									
				<u>294</u>	0	26															
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		13	7

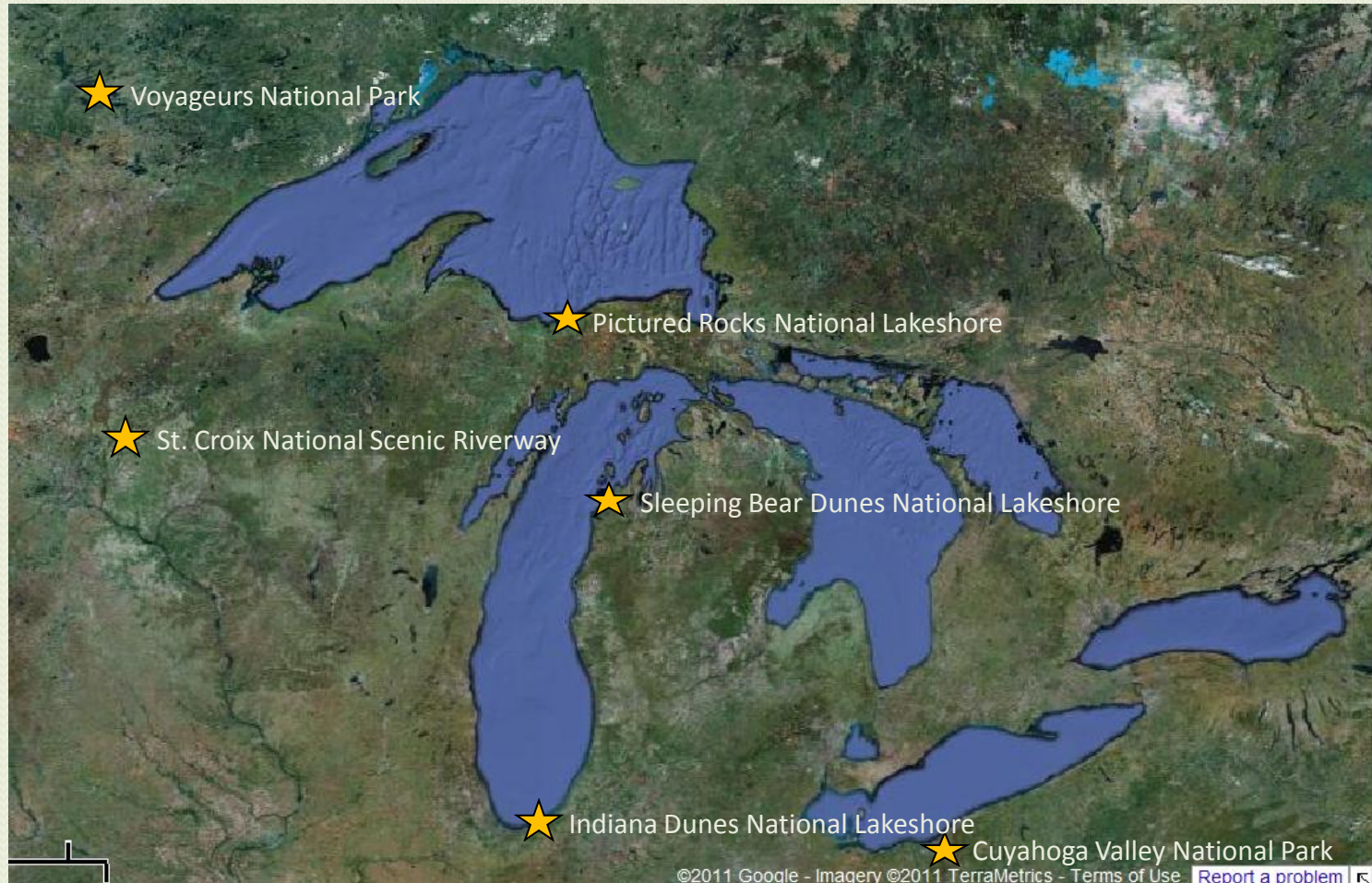
Is hybridization between narrow-leaf and broad-leaf cattail occurring on the Atlantic Coast?



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



INDU: Bog



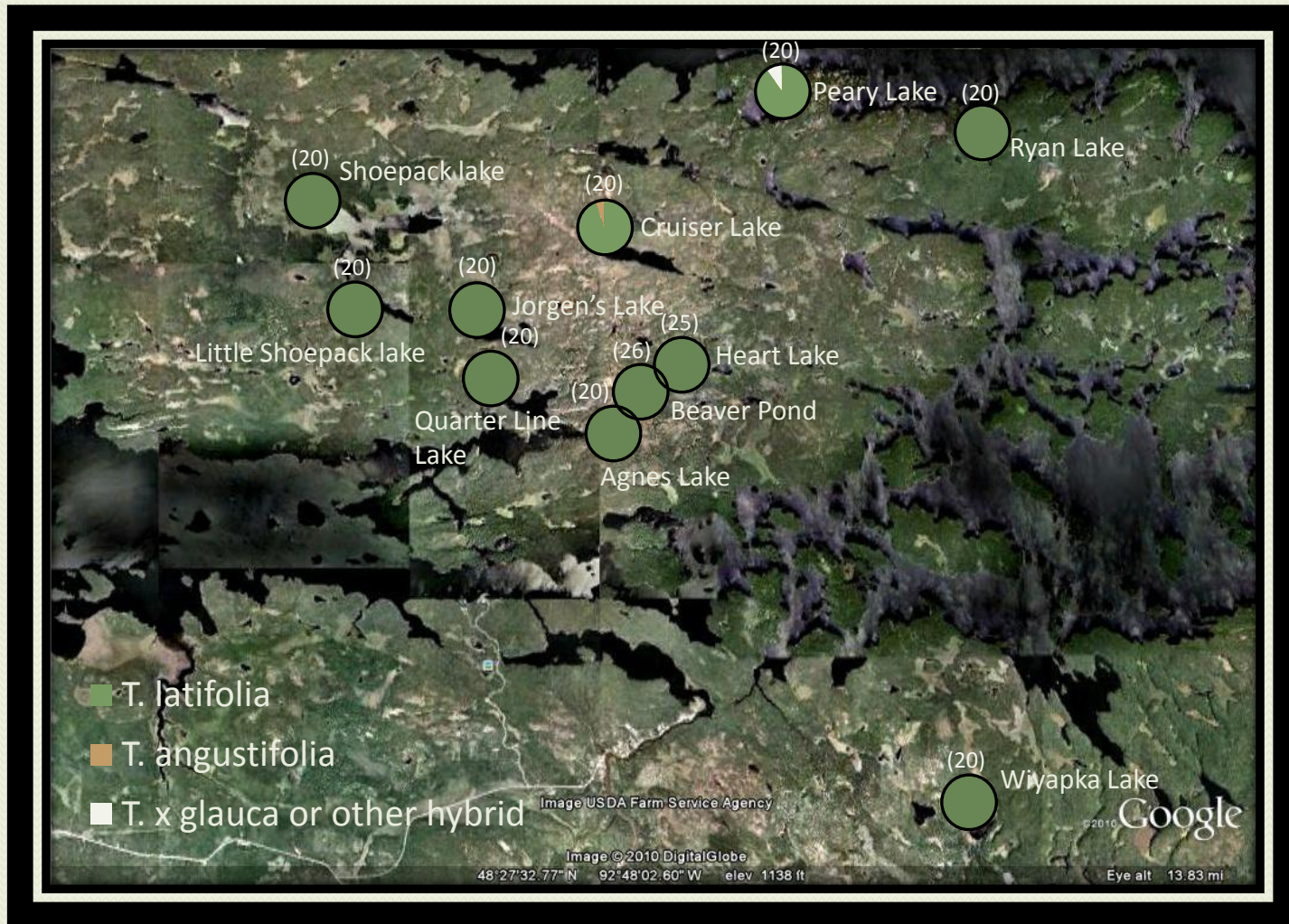
CUVA: Floodplain Fen



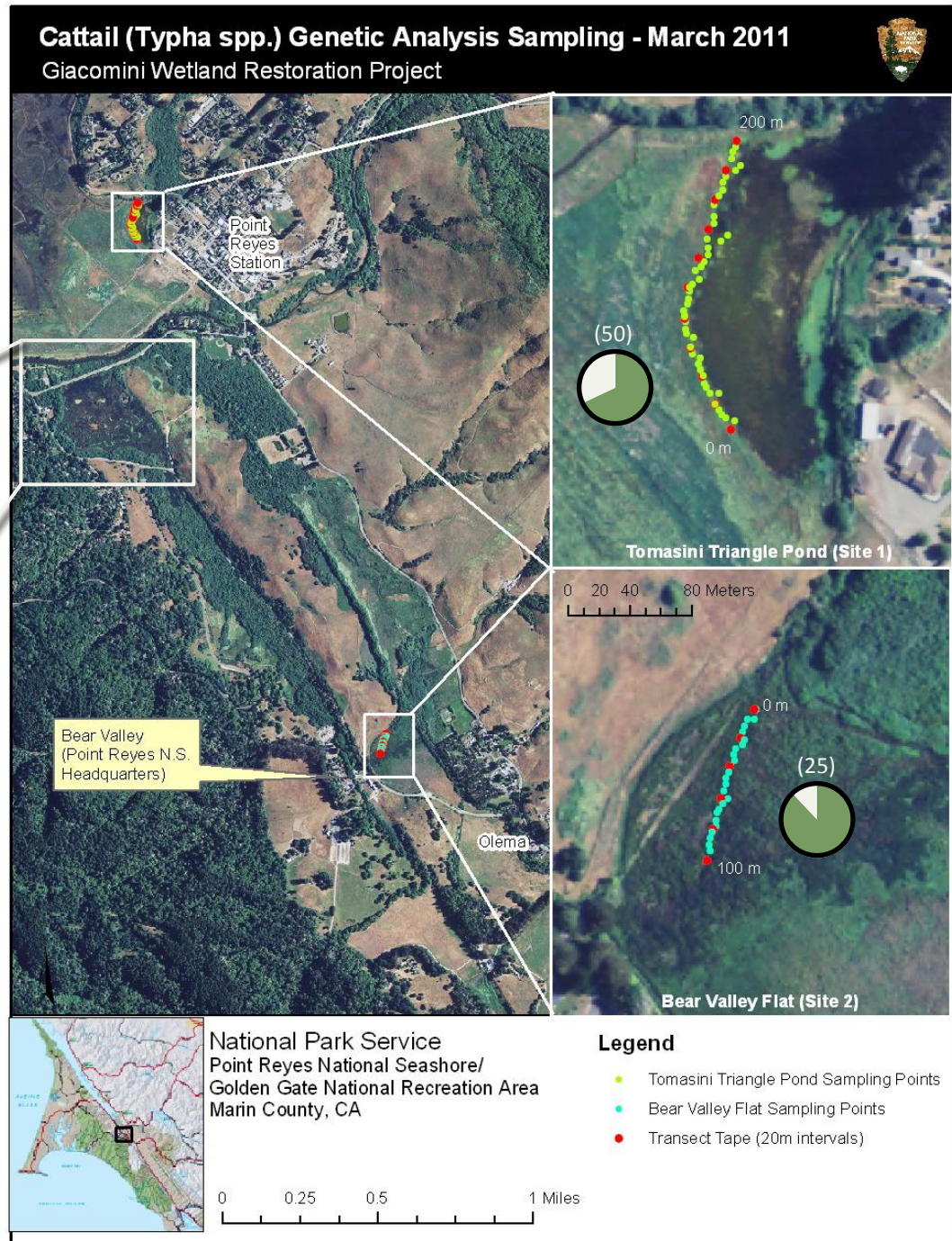
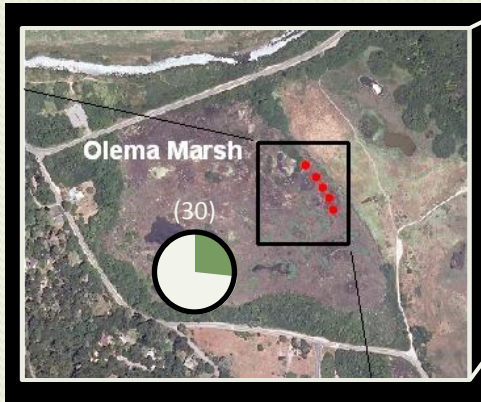
Yes, but the migrating hybrid front has thus far bypassed the central Great Lakes. . . or has it?



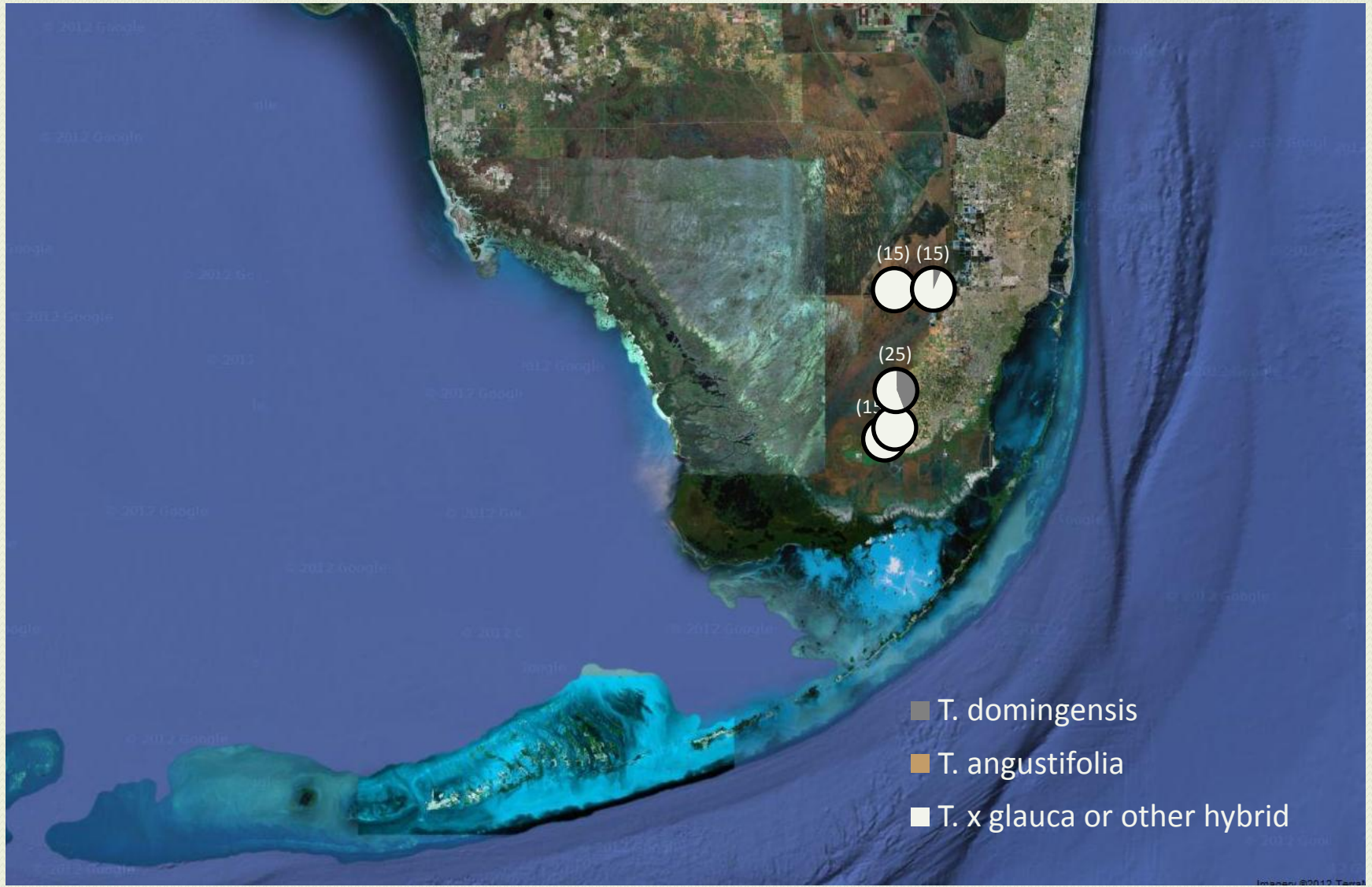
... and native broad-leaf cattail persists where motorized traffic is limited or restricted



Is hybridization between narrow-leaf and broad-leaf cattail occurring in California?



Is hybridization between narrow-leaf and southern cattail occurring in Florida?

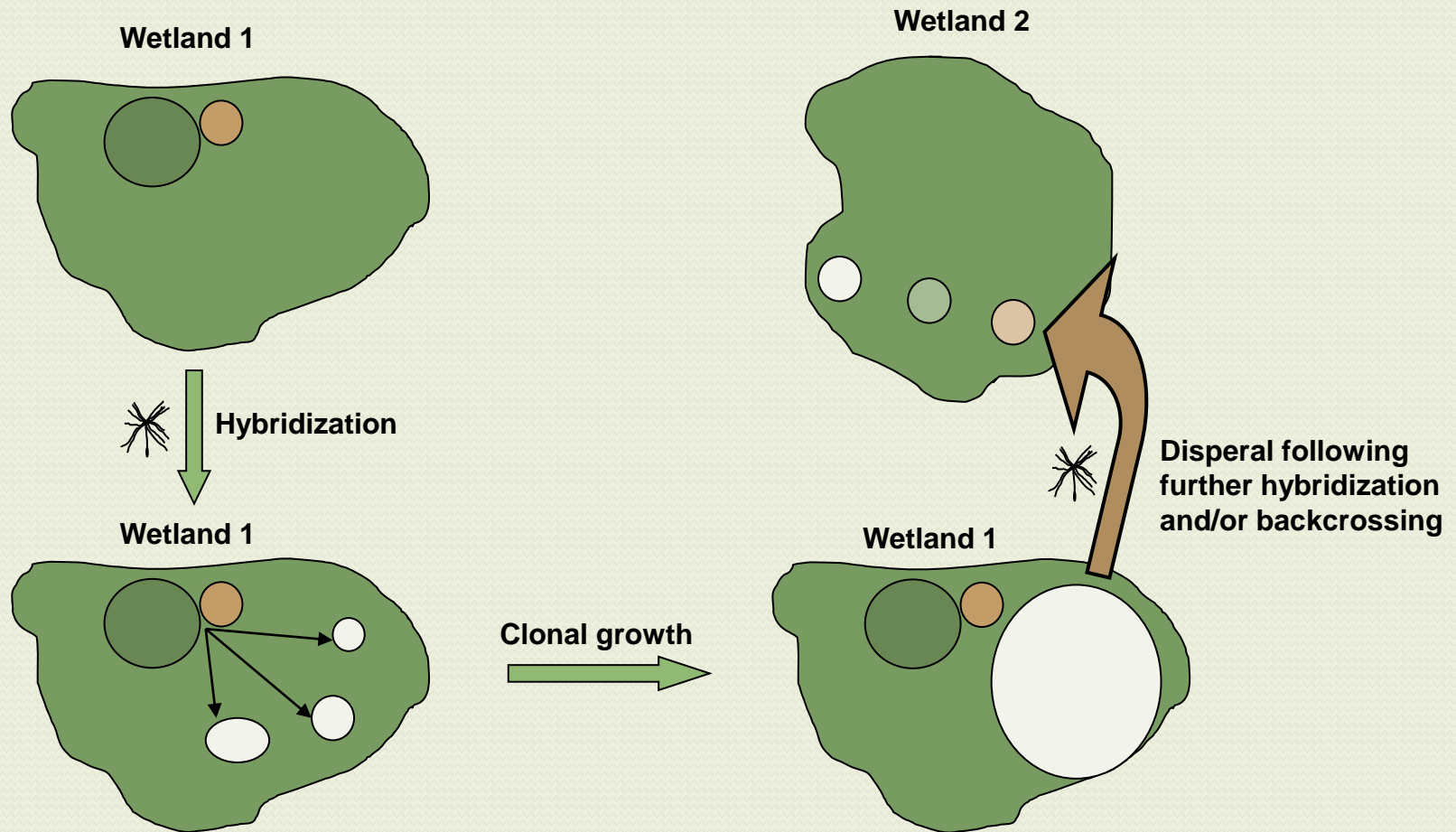


Patterns of Cattail Hybridization



- 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

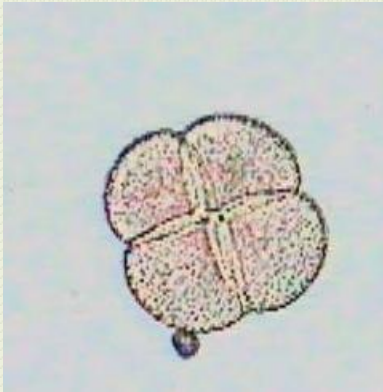
Due to the fertility of hybrids, the invasion dynamics of hybrid cattails are complex



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

