

Invasive Plant Operations Overview

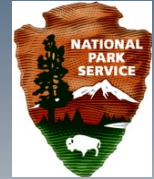
2015 Everglades Invasive Species Summit

LeRoy Rodgers, SFWMD



EVERGLADES CISMA

ECISMA Plant Monitoring: 2015 Update



- **Systematic Reconnaissance Flights**

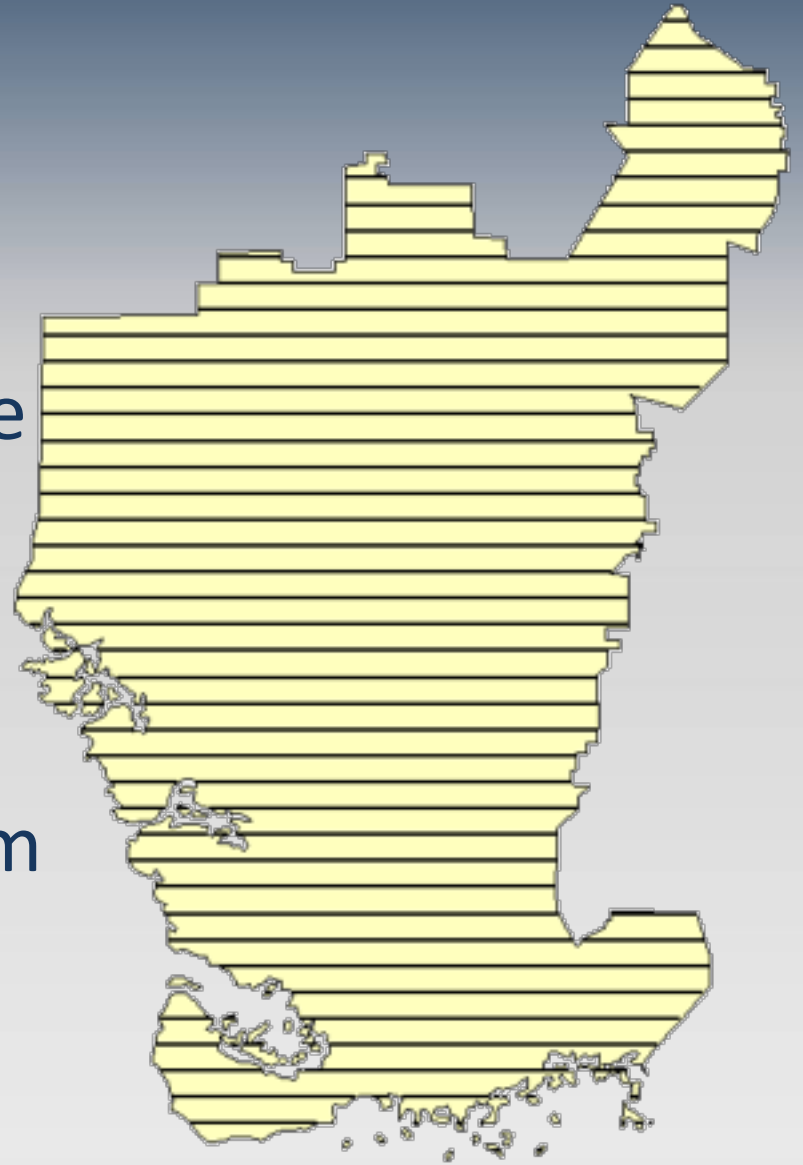
- Completed coast to coast mapping between Lake Okeechobee and Florida Bay
- Currently evaluating 20 year trends

- **Digital Aerial Sketch Mapping**

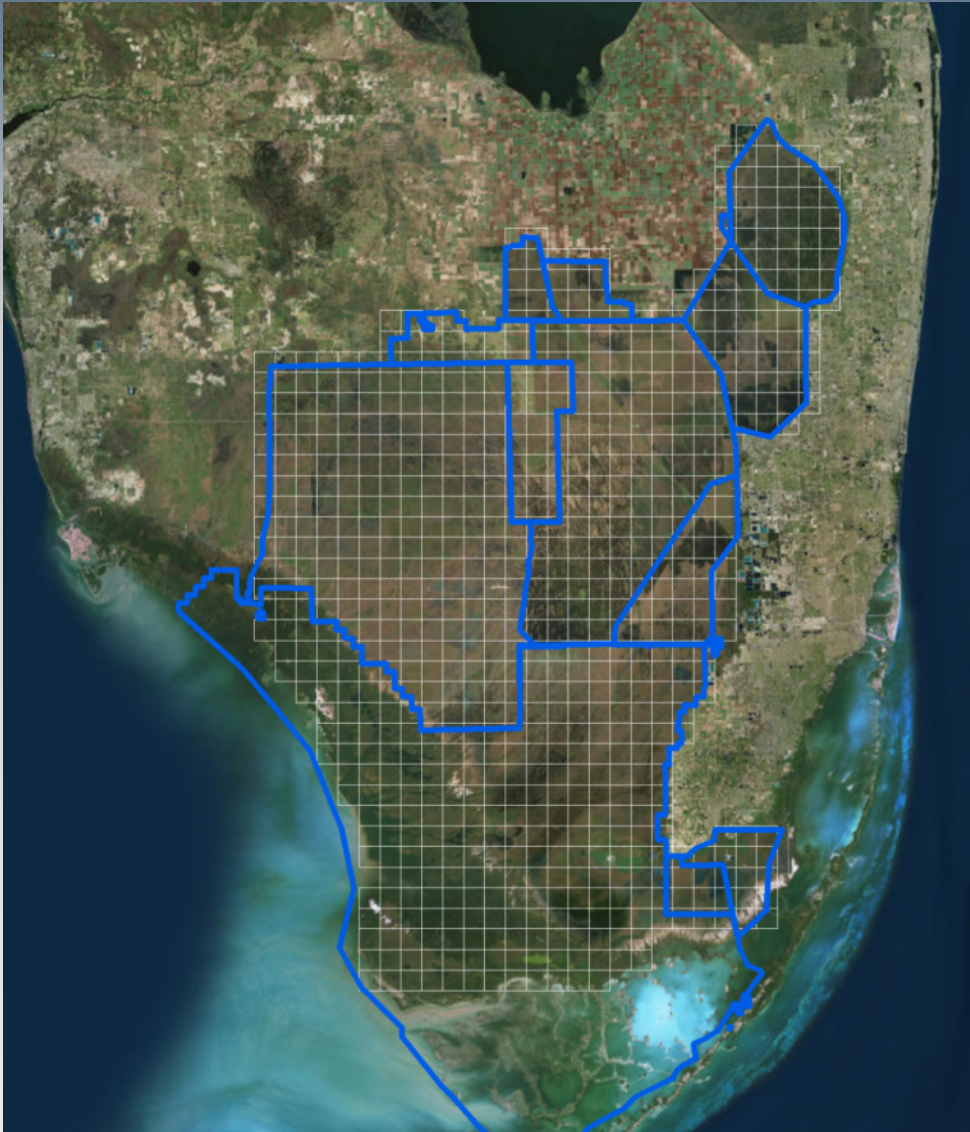
- Detailed mapping in support of planned control efforts
 - Loxahatchee National Wildlife Refuge
 - Big Cypress National Preserve
 - Water Conservation Area 2A

Systematic Reconnaissance Flights

- Aerial regional assessment initiated in 1993
- Objective: assess landscape level distribution and abundance of priority invasive plants
- East-west transects on 4-km intervals



Everglades CISMA








- 4 kilometer grid
- Cell = 4 km x 4 km
 - 3954 acres
- 1995 and 2015 results presented

Grid Cell Abundance Classes

Index Value

Translation

Invasive Species Abundance

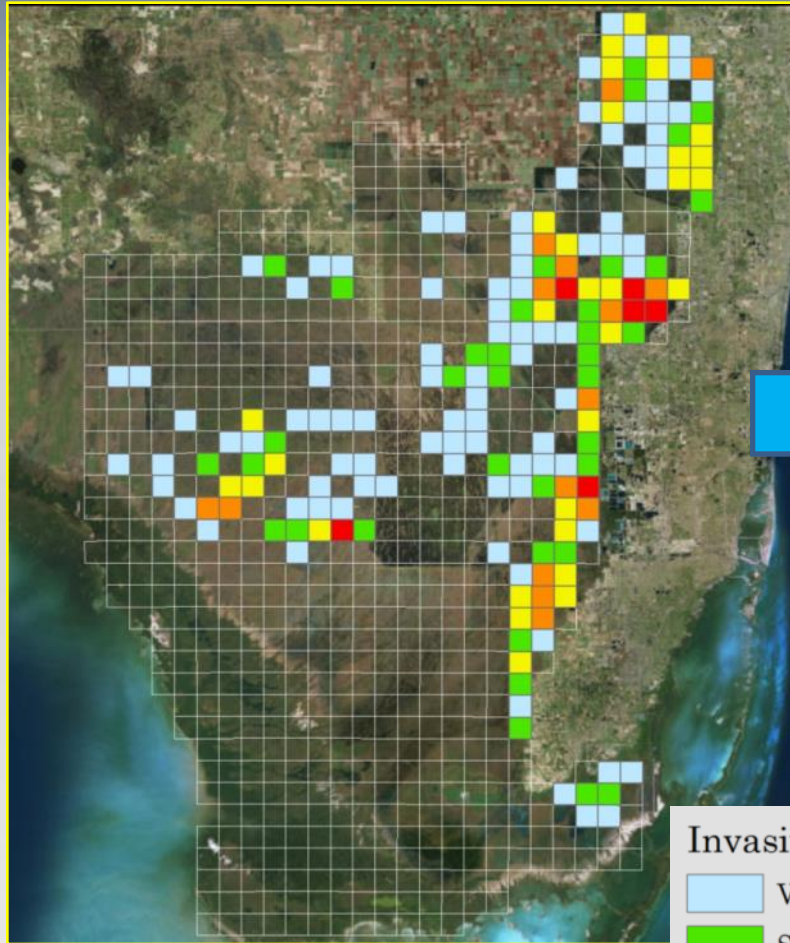
	Very Sparse	(0.1 - 1.0)
	Sparse	(1.1 - 2.0)
	Intermediate	(2.1 - 5.0)
	High	(5.1 - 10.0)
	Very High	(10.1 - 24.0)

Very rare (single tree) to “Maintenance control”

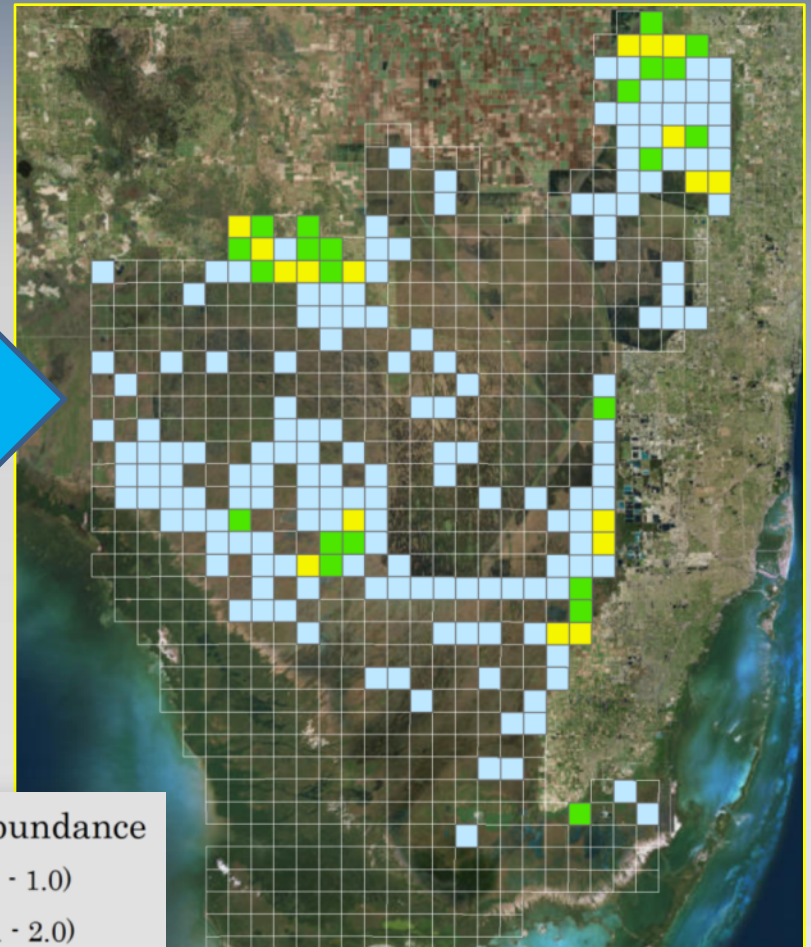
Widely scattered or some dense patches

Many dense infestations or scattered throughout

Melaleuca 1995 - 2015








1995

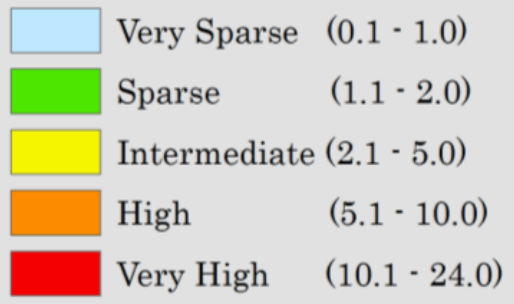
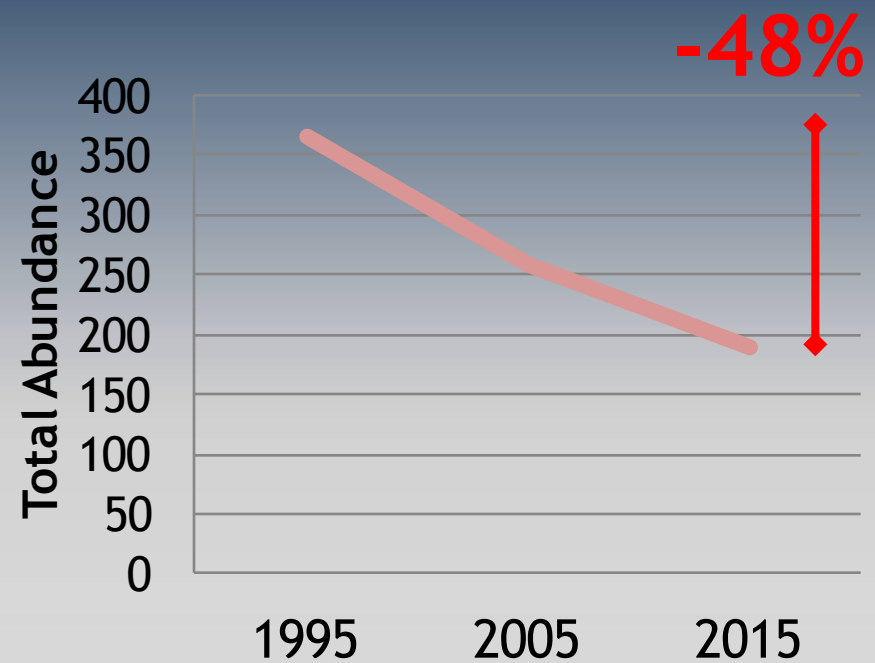
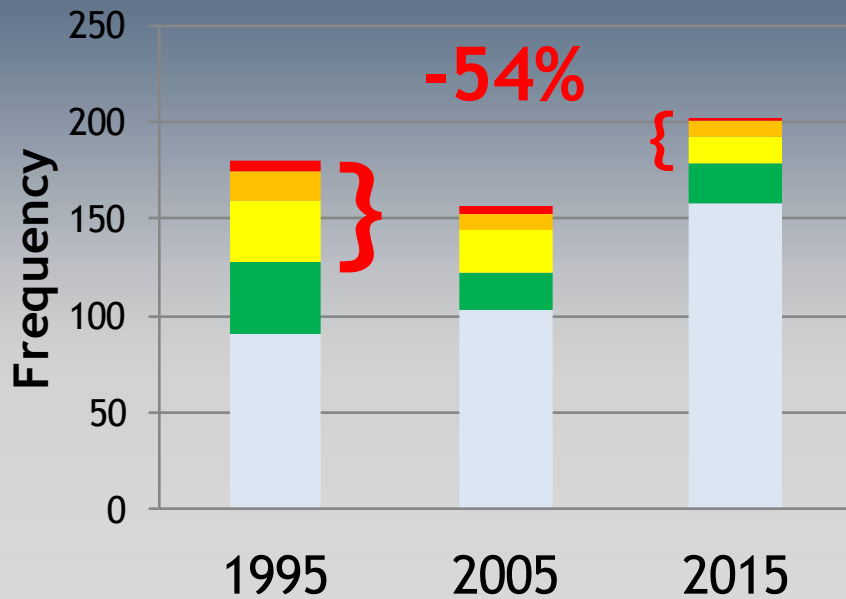


2015

Invasive Species Abundance

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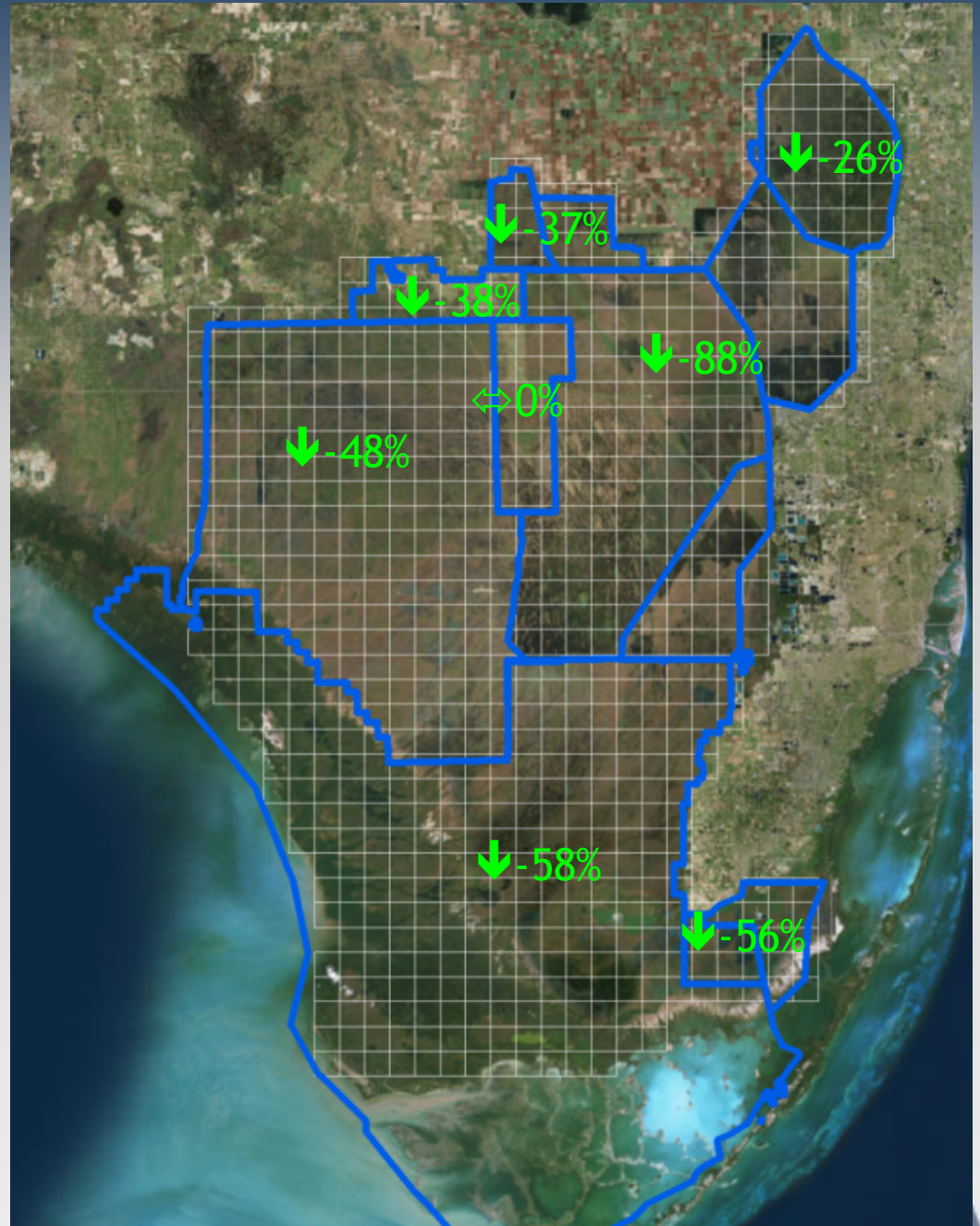
Melaleuca



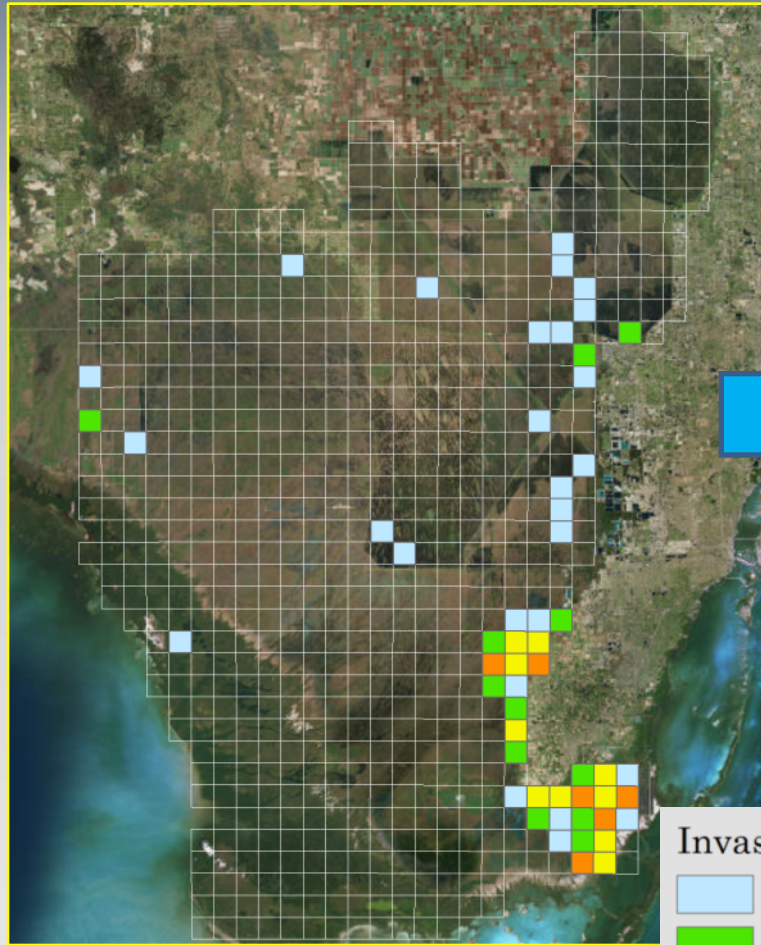
- 6% increase in frequency (occupancy)
- Frequency of cells with \geq intermediate abundance scores down 54%
- Region-wide abundance down 48%

Melaleuca

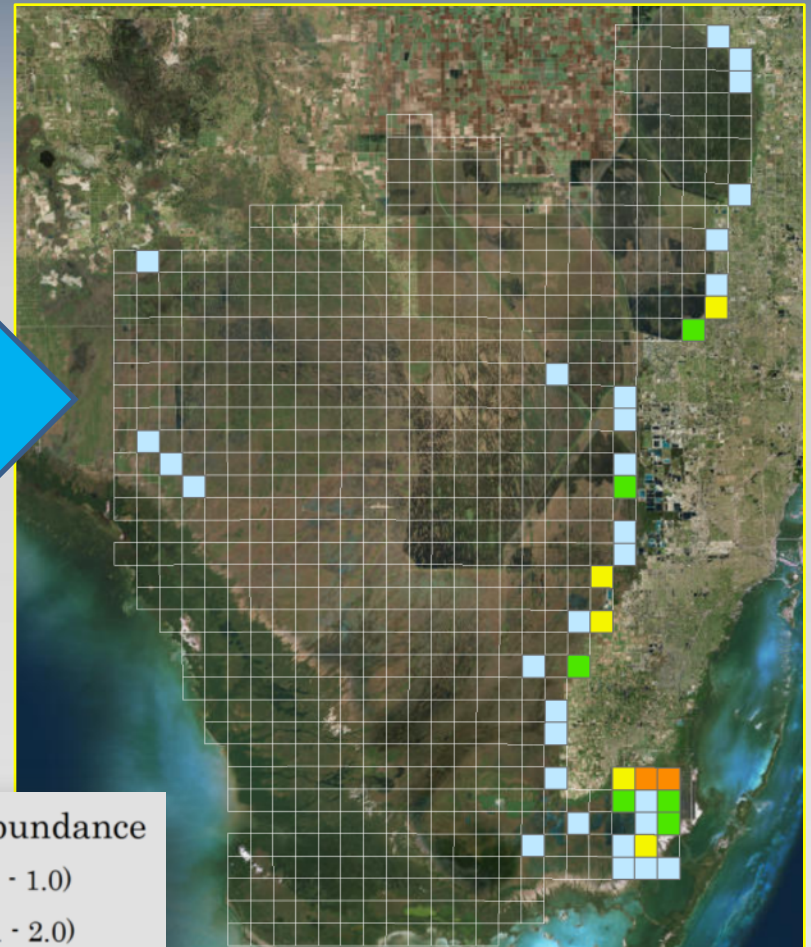
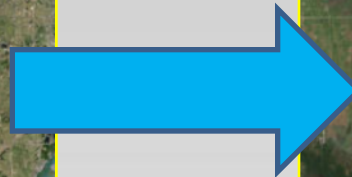
1995-2015 Trend by Management Area



Australian Pine 1995 - 2015








1995



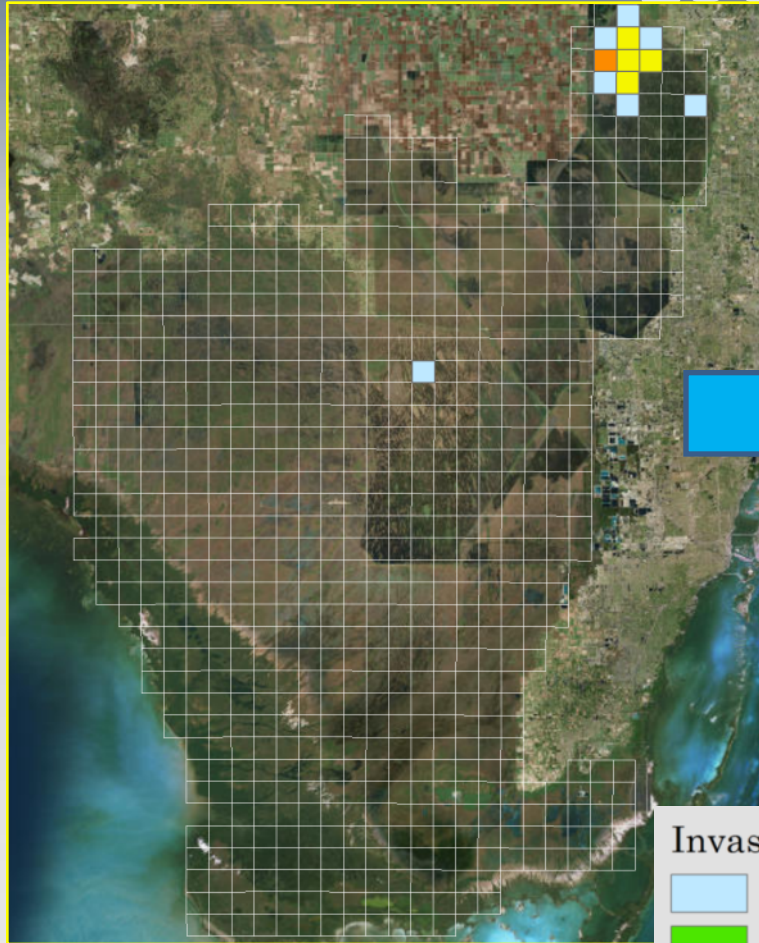
2015

Invasive Species Abundance

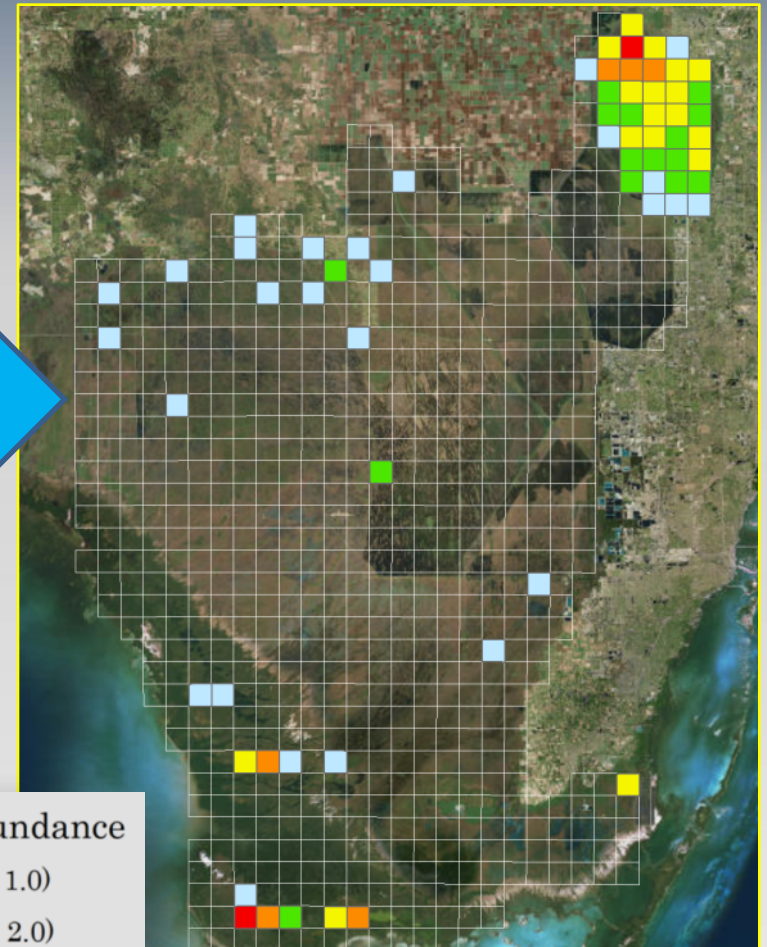
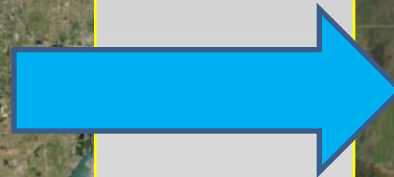
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Old World Climbing Fern

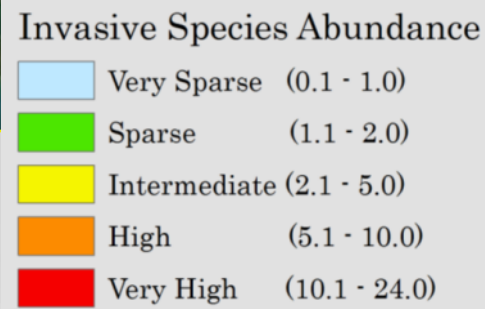
1995 - 2015



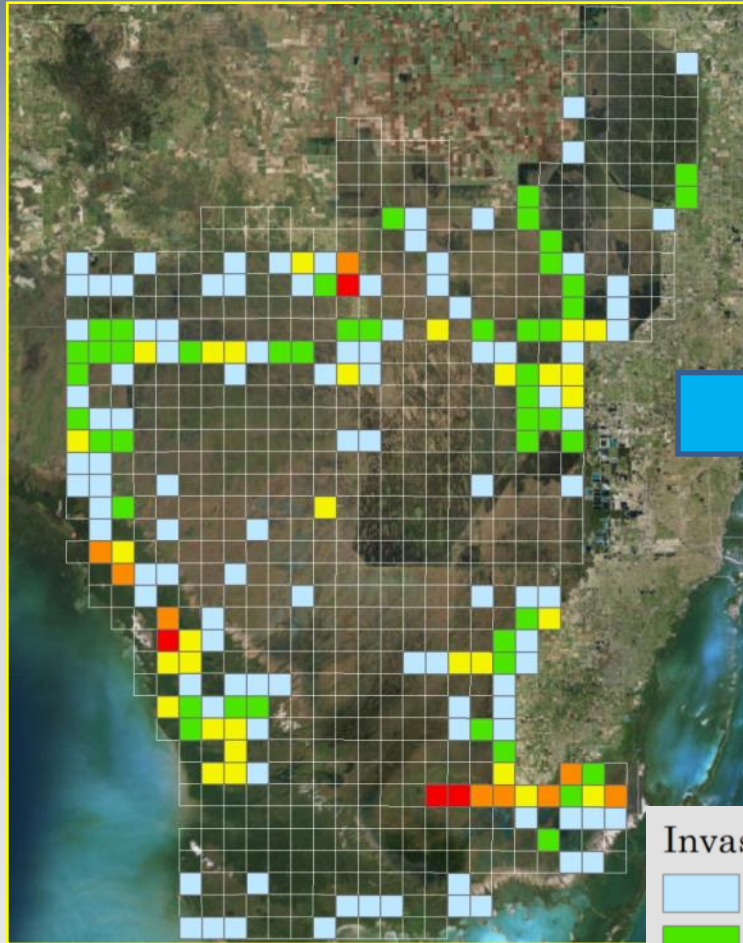
1995



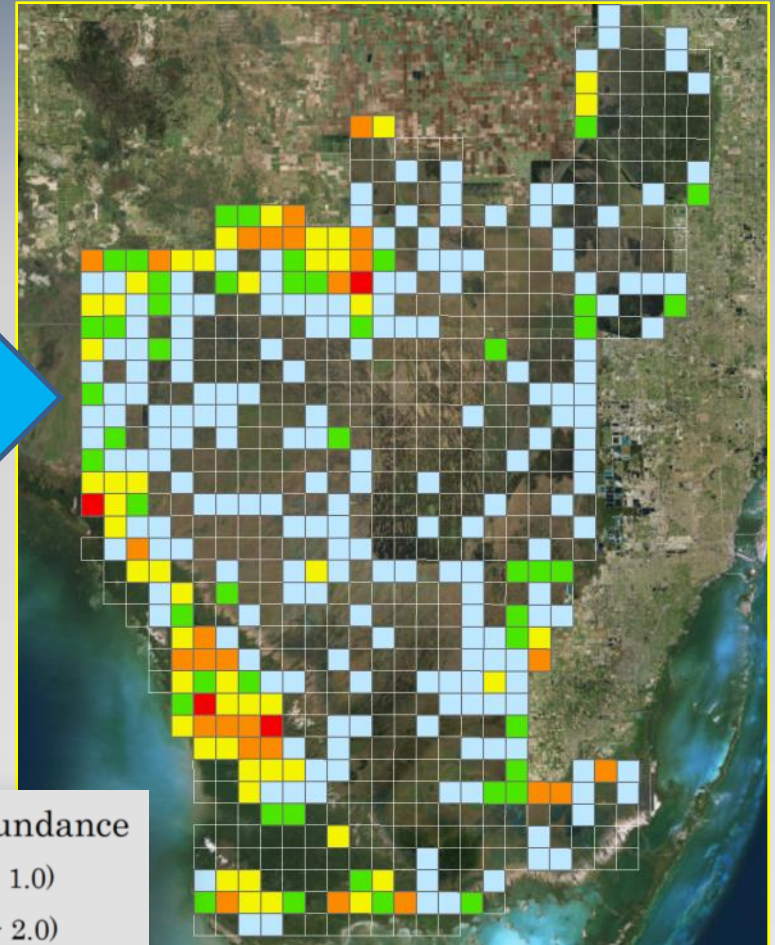
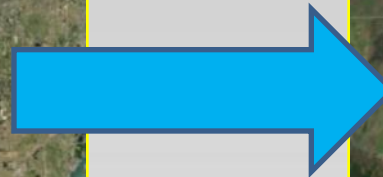
2015



Brazilian Pepper 1995 - 2015



1995

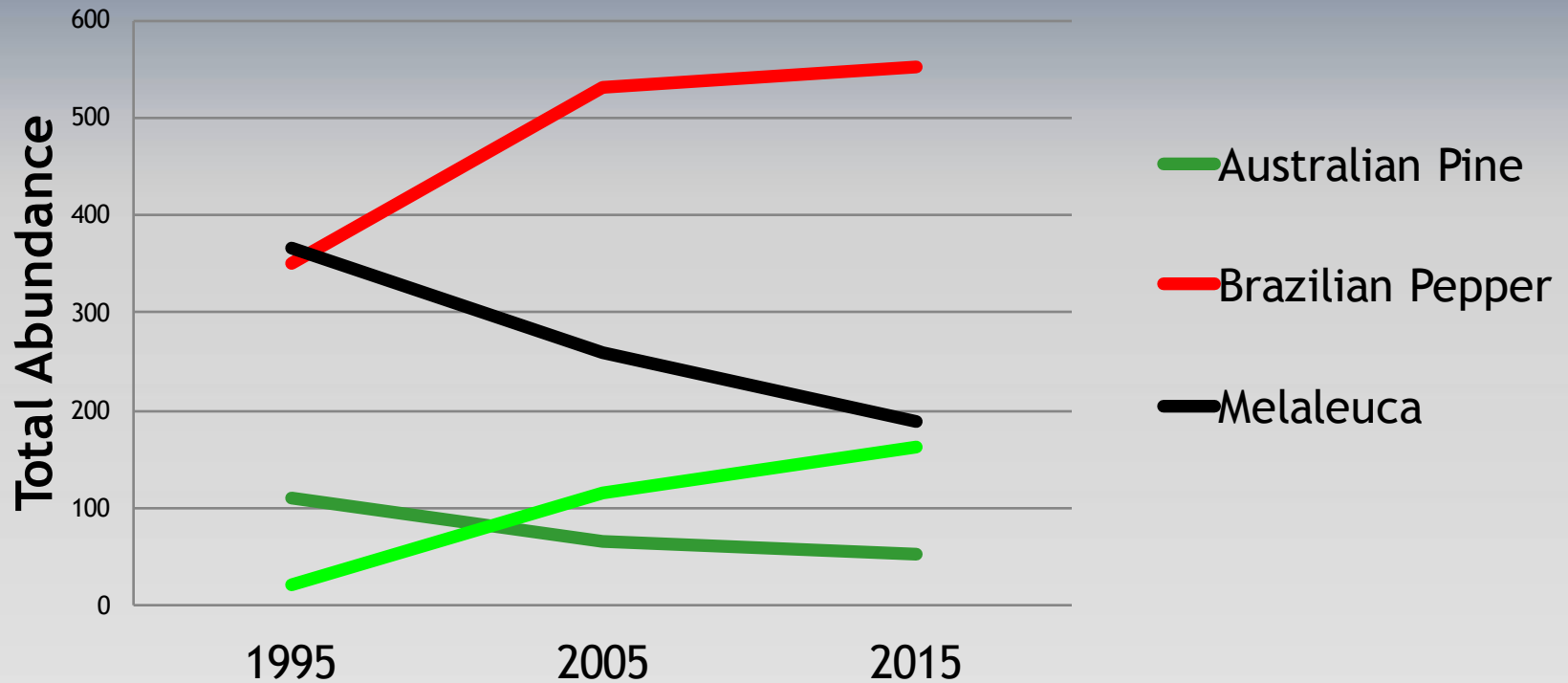


2015

Invasive Species Abundance

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ECISMA Trends



Summary of ECISMA Trends

- **Australian Pine** and **Melaleuca** down roughly 50% within Everglades ECISMA
- **Melaleuca's** distribution range is static
- **Brazilian Pepper** and **Old World Climbing Fern** increased in frequency, range is expanding, and number of high abundance cells increasing.

ECISMA Priority Plant Species

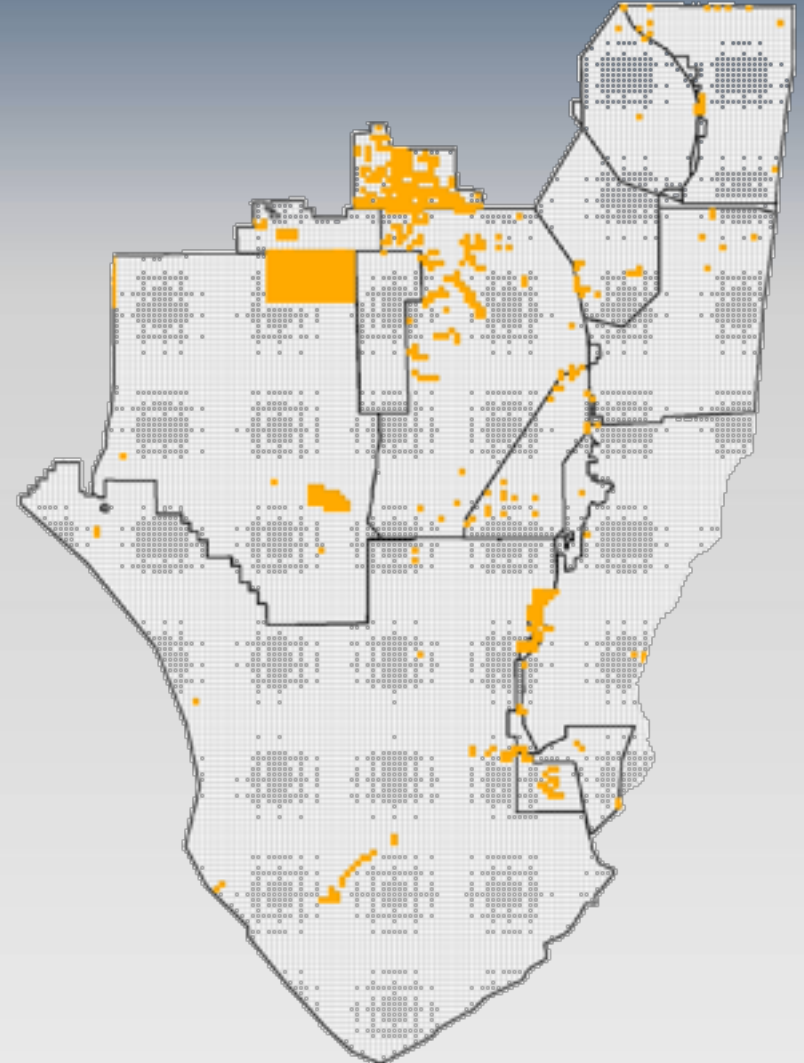
Agency/Tribe	Melaleuca	Lygodium	Brazilian Pepper	Australian Pine	Shoebuttan Ardisia	Lather leaf	Portia Tree	Air Potato	Many Cat.1
Big Cypress NP									
Biscayne Bay NP									
Broward County									
Everglades NP									
FP&L									
FWC									
FWS (Lox Refuge)									
Miami-Dade Co.									
Palm Beach Co.									
Seminole Tribe									
SFWMD									

New Species Observations

Species	Common Name	Mgmt Area	FLEPPC Category
<i>Syngonium podophyllum</i>	Arrowhead vine	WCA 3A South	Cat. I
<i>Pteris vittata</i>	Chinese brake fern	WCA 3A South	Cat. II
<i>Pteris tripartita</i>	Giant brake fern	WCA 3A South	
<i>Phoenix reclinata</i>	Senegal date palm	WCA 3A South	Cat. II
<i>Hyparrhenia hirta</i>	Thatching Grass	Miami Dade	
<i>Lygodium japonicum</i>	Japanese climbing fern	Southern Glades	Cat. I
<i>Miscanthus sinensis</i>	Chinese silver grass	8.5 SMA	
<i>Spathoglottis plicata</i>	Philippine ground orchid	East Coast Buffer	
<i>Eucalyptus deglupta</i>	Rainbow eucalyptus	Biscayne Bay Coastal Wetlands	

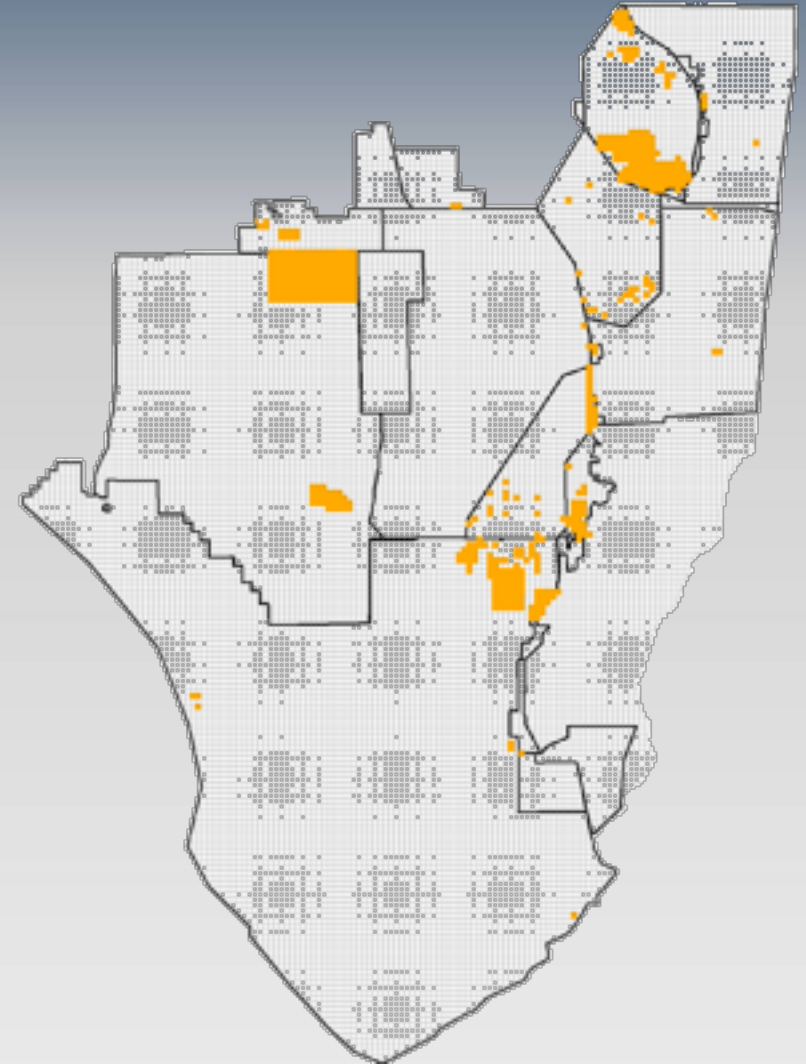
2014/15 Treatments: Brazilian Pepper

- ~83,000 acres swept for Brazilian Pepper
 - Majority of effort in Big Cypress NP, FWC Wildlife Management Areas



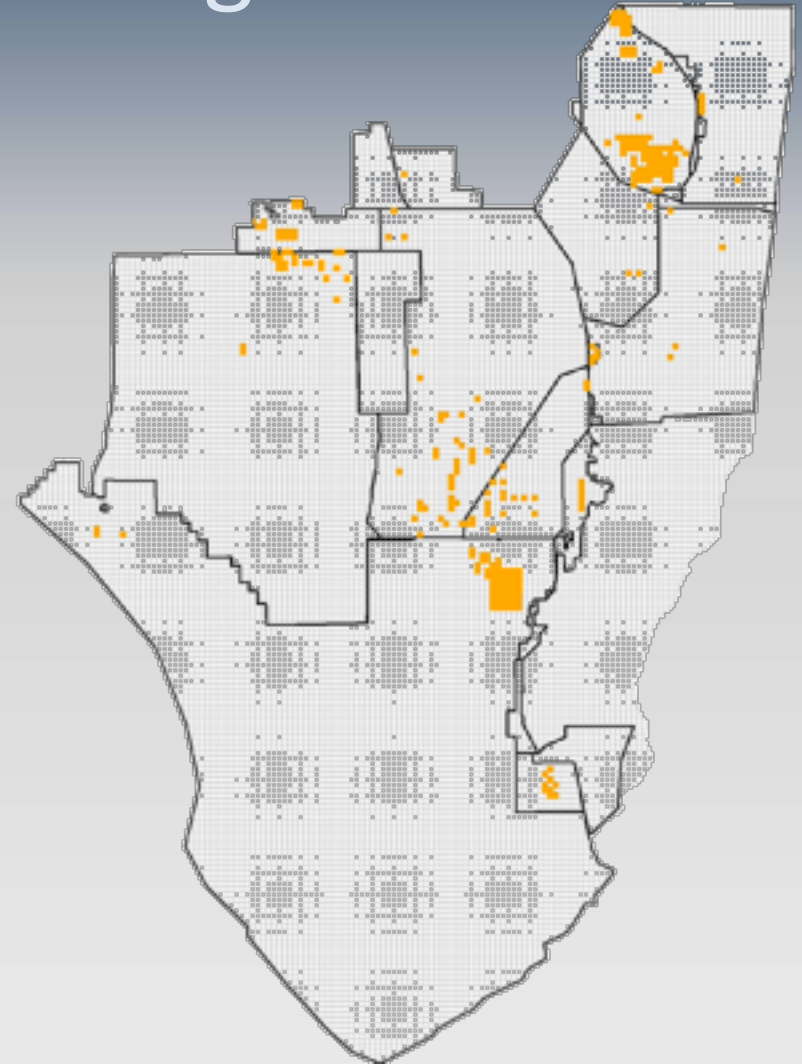
2014/15 Treatments: Melaleuca

- ~ 112,000 acres swept for melaleuca
- Predominantly maintenance control work in nearly all management areas



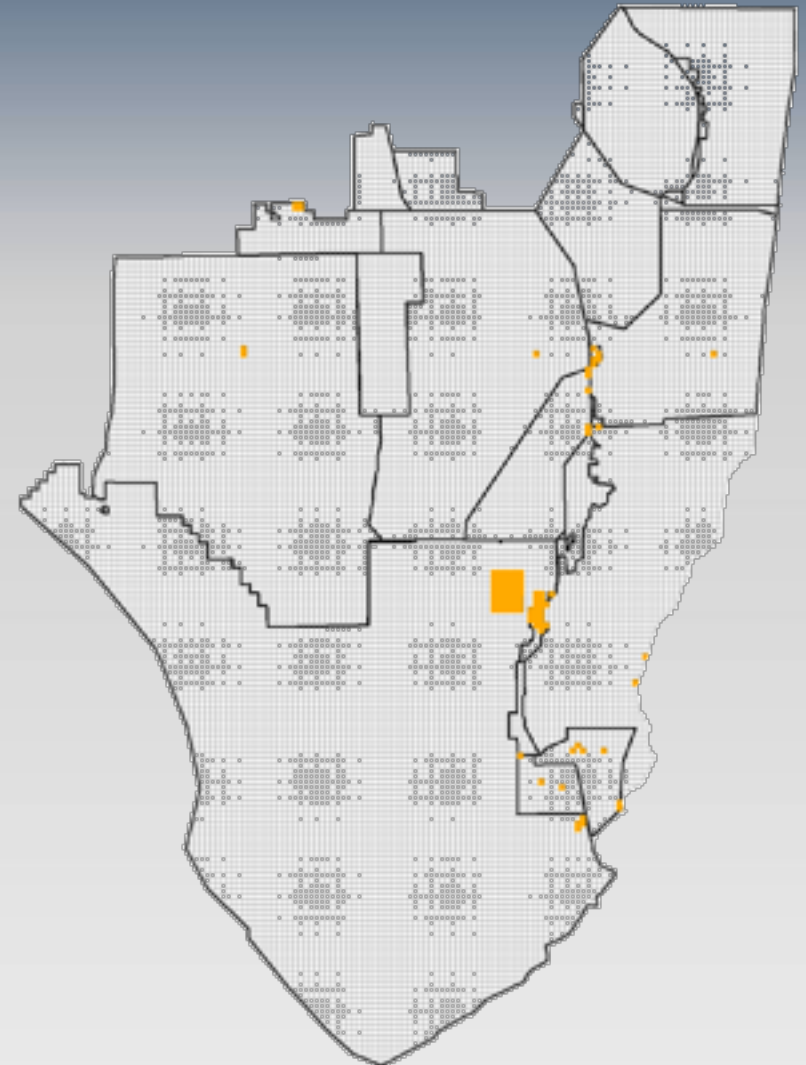
2014/15 Treatments: Old World Climbing Fern

- ~ 54,000 acres swept for OWCF
- Tree islands and other forested wetlands in Southern Glades, Holey Land, and Rotenberger WMA's
- Scattered OWCF in Loxahatchee NWR



2014/15 Treatments: Australian Pine

- ~ 1,270 acres swept for Australian pine
- Most work in eastern ENP and Southern Glades



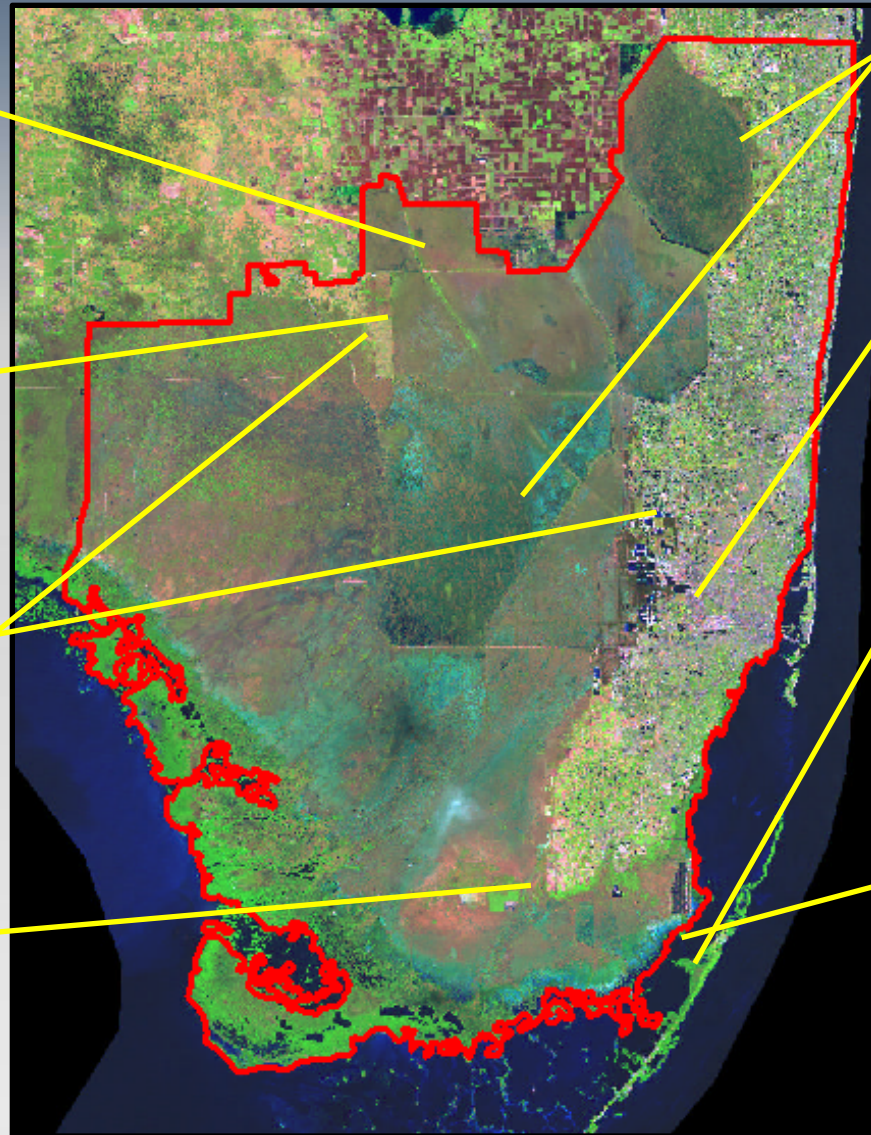
Other Managed Invasive Plant Species

Day Jessamine
(*Cestrum diurnum*)

Arrowhead Vine
(*Syngonium podophyllum*)

Air Potato
(*Dioscorea bulbifera*)

Shoebutt
Ardisia
(*Ardisia elliptica*)



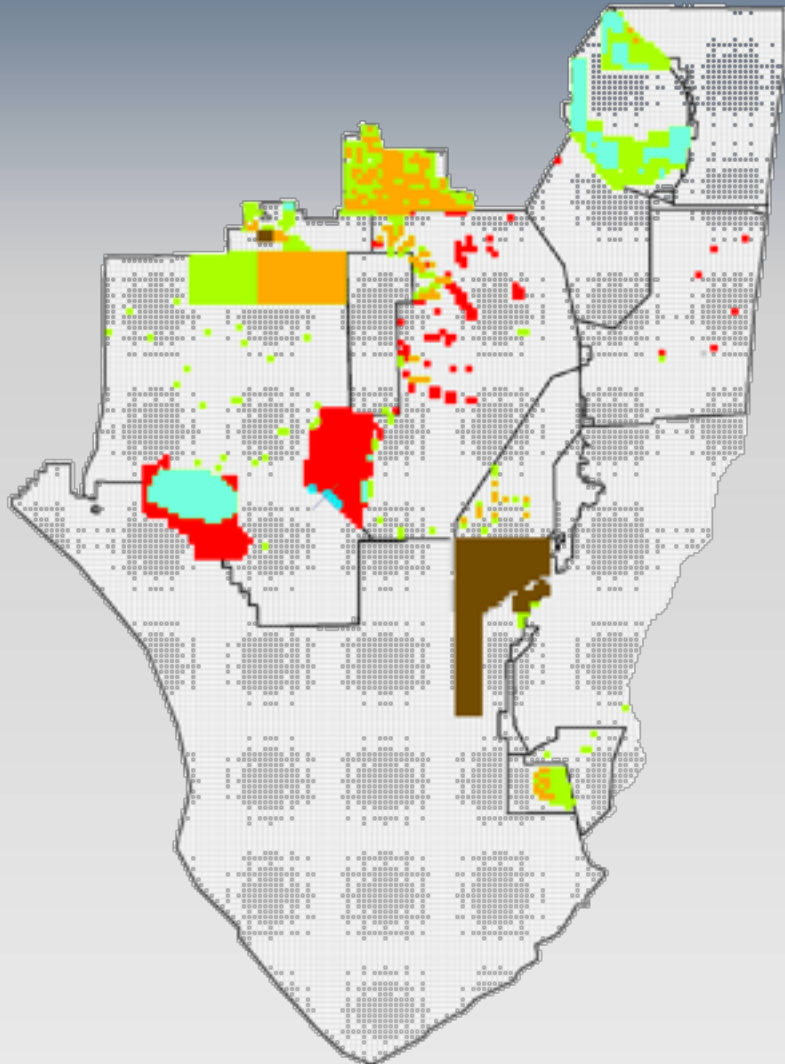
Giant Brake Fern
(*Pteris tripartita*)

Bishopwood
(*Bischofia javanica*)

Latherleaf
(*Colubrina asiatica*)

Portia Tree
(*Thespesia populnea*)

Planned Treatments FY15/16



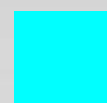
Brazilian Pepper



Old World Climbing Fern



Old World Climbing Fern,
Brazilian Pepper



Old World Climbing Fern,
Melaleuca



Melaleuca, Brazilian Pepper,
Old World Climbing Fern,
Australian Pine

~490,000 acres planned
for treatment coverage

Thanks

- **Presentation support from:**

- **Ellen Allen** (SFWMD)
- **Ryan Brown** (SFWMD)
- **Shea Bruscia** (NPS)
- **Hillary Cooley** (Everglades NP)
- **Jane Dozier** (Miami-Dade Co.)
- **Andrew Eastwick** (USFWS, Loxahatchee NWR)
- **Pat Howell** (Broward Co.)
- **Christen Mason** (SFWMD)
- **Vanessa McDonough** (Biscayne Bay NP)
- **Shelby Moneysmith** (Biscayne Bay NP)
- **Tony Pernas** (NPS)
- **Amy Peters** (SFWMD)
- **Jed Redwine** (NPS)
- **Whitney Sapeinca** (Seminole Tribe of Indians)
- **Billy Snyder** (Big Cypress NP)
- **Marsha Ward** (FWC)

Foliar Aminocyclopyrachlor Trials

Christen Mason
South Florida Water Management District





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8.5 Square Mile

Objectives

Maintain prior work in sawgrass/muhlygrass prairies in the most cost-effective way.

Determine the rate of aminocyclopyr that is most effective across multiple species with the least amount of non-target damage

Streamline – 4 weeks



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Method 240 SL/Trycera – 3 weeks



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Streamline – 5 MAT



5' trees

Streamline – 5 MAT



8' trees



Almost

Method 240 SL/Trycera – 5 MAT



8' trees



5' trees



Method 240 SL/Element 3A – 4 MAT



6' trees



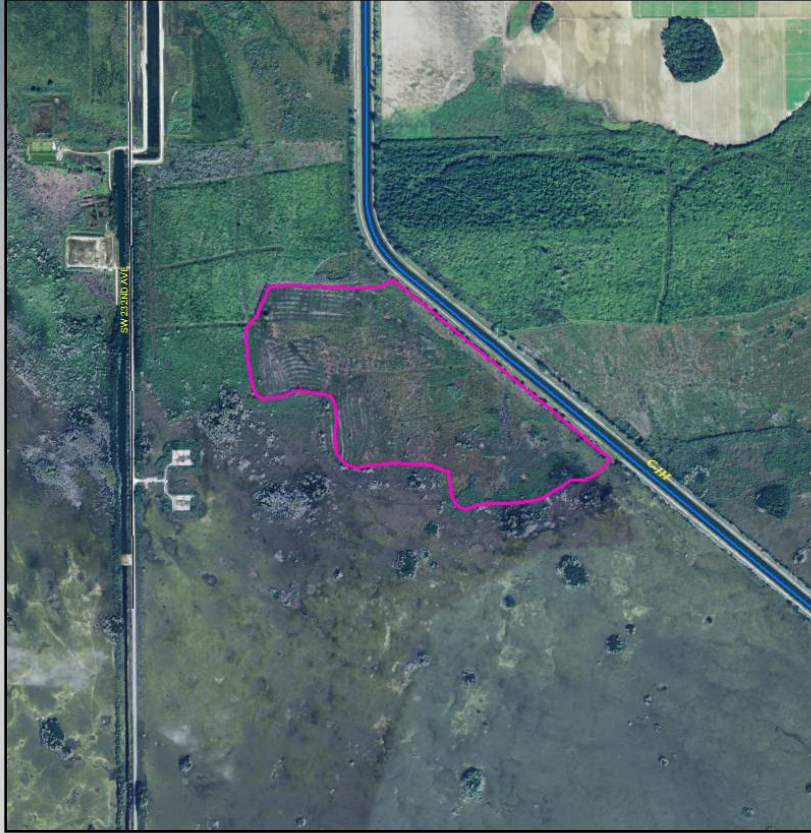
8' trees



Too soon



C-111 Spreader



Objective: Restore an invaded area by treating nuisance and exotic broadleaf vegetation to promote the return of the native, fire-adapted graminoid community.

Foliar Streamline for Ardisia control



11.5 oz/acre

2 MAT

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3 MAT



Initial thoughts

- Aminocyclopyrachlor (ACP) at 9.5 oz/acre as a foliar application on BP and AP is effective.
- ACP is likely effective on melaleuca at 9.5 oz/acre
- Streamline at 11.5oz/acre will likely control small ardisia.
- Sawgrass is sensitive to ACP

Future plans

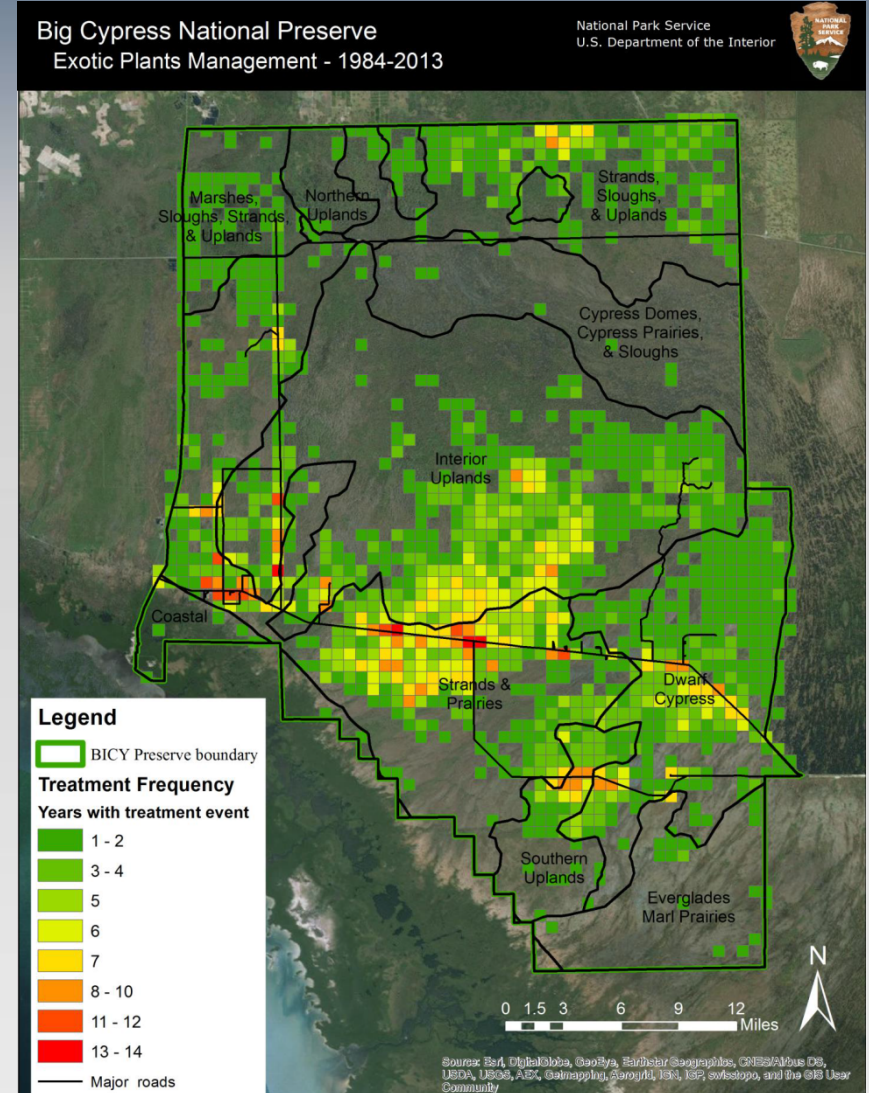
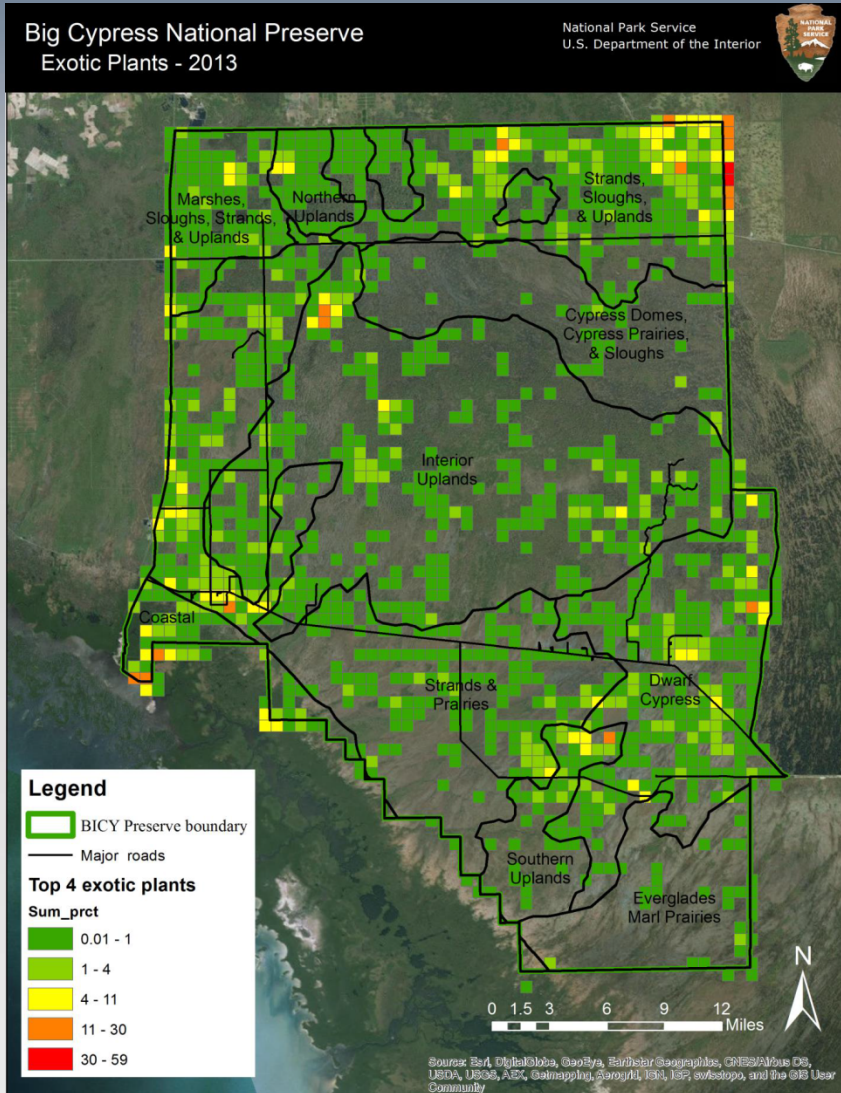
- Lower rates for BP and AP control
- Lower rates for Melaleuca control
- Lower rates for ardisia control
- Other ACP formulations
- Nozzle type, application methods

Big Cypress NP Treatment History Analysis

Jed Redwine
Everglades National Park



Current coverage and historical treatment intensity



Watershed Unit	Proportion of cells treated	mean treatment frequency	Proportion of 1km cells with exotic plants
1. Marshes, Sloughs, Strands, & Uplands	34.5%	1.2	63.4%
2. Northern Uplands	13.8%	1.2	46.9%
3. Strands, Sloughs, & Uplands	39.8%	2.1	58.4%
4. Strands & Prairies	44.7%	3.7	39.4%
5. Interior Uplands	44.8%	3.1	32.8%
6. Cypress Domes, Cypress Prairies, & Sloughs	3.0%	1.2	11.4%
7. Coastal	7.1%	1.9	25.4%
8. Southern Uplands	36.2%	3.1	31.2%
9. Dwarf Cypress	59.9%	2.5	50.0%
10. Everglades Marl Prairies	7.4%	1.2	11.4%
Average	36.7%	2.5	36.7%

Table 4.19. Assessment of exotic plants in the watershed units of BICY.

Watershed Units	Proportion of area infested	Infestation spatially constrained	Management intensity	Overall	Rationale
Region 1 – Marshes, Sloughs, Strands, & Uplands			Low		63% of area infested, mostly Brazilian pepper. Extensive, low intensity management effort has not reduced area infested
Region 2 – Northern Uplands			Low		47% of area infested, mostly Brazilian pepper. Extensive, low intensity management effort has not reduced area infested.
Region 3 – Strands, Sloughs, & Uplands			Medium		58% of area infested, mostly Brazilian pepper. Extensive management effort has not reduced area infested.
Region 4 – Strands & Prairies			High		39% of area infested, aggressive treatment has reduced spatial extent of infestation
Region 5 – Interior Uplands			High		33% of area infested, aggressive treatment has reduced spatial extent of infestation
Region 6 – Cypress Domes, Cypress Prairies, & Sloughs			Low		11% of area infested, low level of treatment activity, lowest level of infestation in BICY
Region 7 – Coastal			Medium		25% of area infested, low level of treatment activity, low level of infestation.
Region 8 – Southern Uplands			High		31% of area infested, aggressive treatment activity has reduced infestation
Region 9 – Dwarf Cypress			Medium		60% of area infested, aggressive treatment activity has reduced infestation
Region 10 – Everglades Marl Prairies			Medium		9% of area infested, treated areas a bit smaller than infested area

Four regions have evidence that exotic plants are spatially constrained.

The average frequency of treatments is 2.5-3.7 in these watershed units

Bottom line

- Reducing and infestation is the most expensive form of exotic management (EDRR is much cheaper).
- Analysis suggests that an average of 3 treatments per km² is threshold for constraining an infestation.
- Land managers are best at identifying where treatments should occur (some areas treated much more frequently than 3 times), but 3-treatment threshold may be a general rule-of-thumb that helps budget forecasting

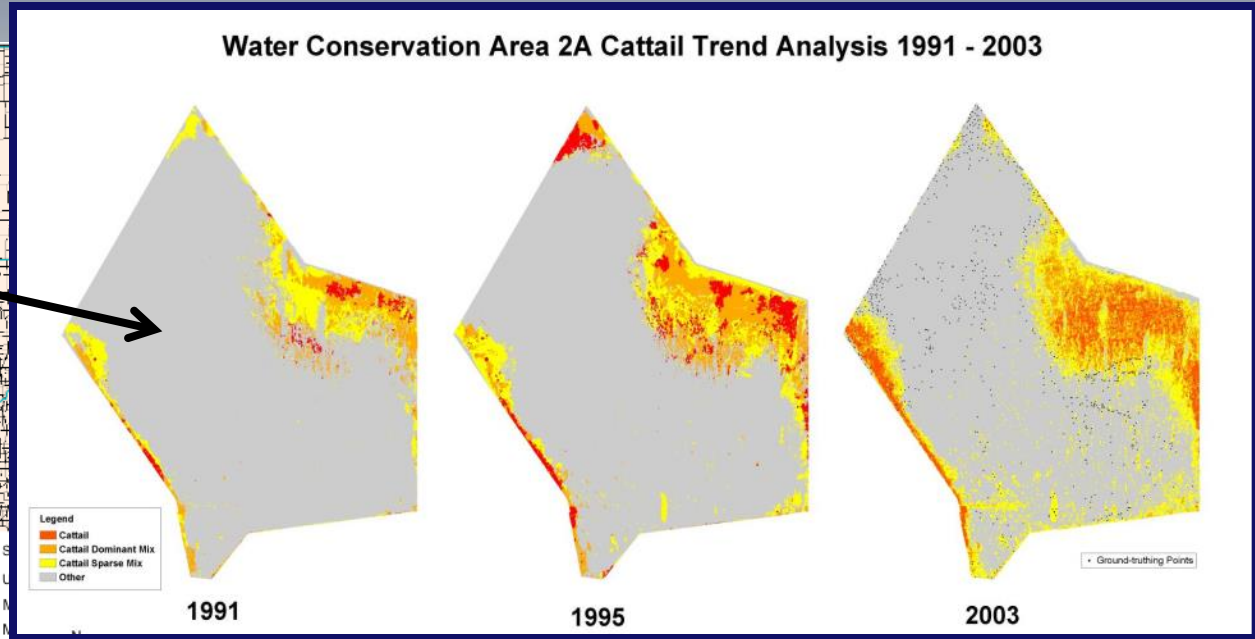
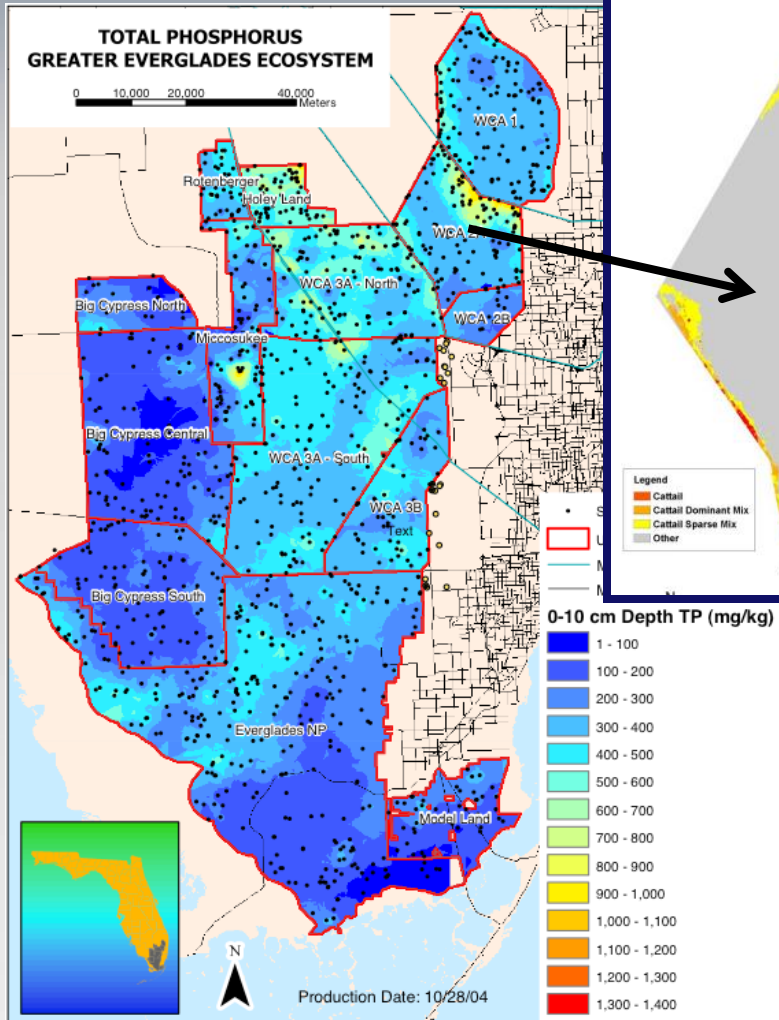
Cattail Management with Imazamox in Nutrient Enriched Everglades Wetlands

LeRoy Rodgers, SFWMD



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The Everglades' Phosphorus Problem



Increased phosphorus leads to cattail dominance

Cattail Encroachment Degrades Habitat

Current Conditions



- Dense cattail stands
- Low species diversity
- Poor wading bird foraging habitat

Desired Conditions



- Mosaic of sawgrass “ridge” and open water sloughs
- Increased habitat complexity
- Increased species diversity
- Increased wildlife habitat

Cattail Habitat Improvement Project

“CHIP”

Creating “open” habitat with herbicides and fire



Timeline

May 2006 - glyphosate (7.5 pts/ac AquaNeat™)

July 2006 - burn

Aug 2006 - glyphosate + imazapyr (7.5 pts/ac AquaNeat™ + 1 qt/ac Habitat™)

Mar 2007 - glyphosate + imazapyr

Nov 2007 - glyphosate + imazapyr

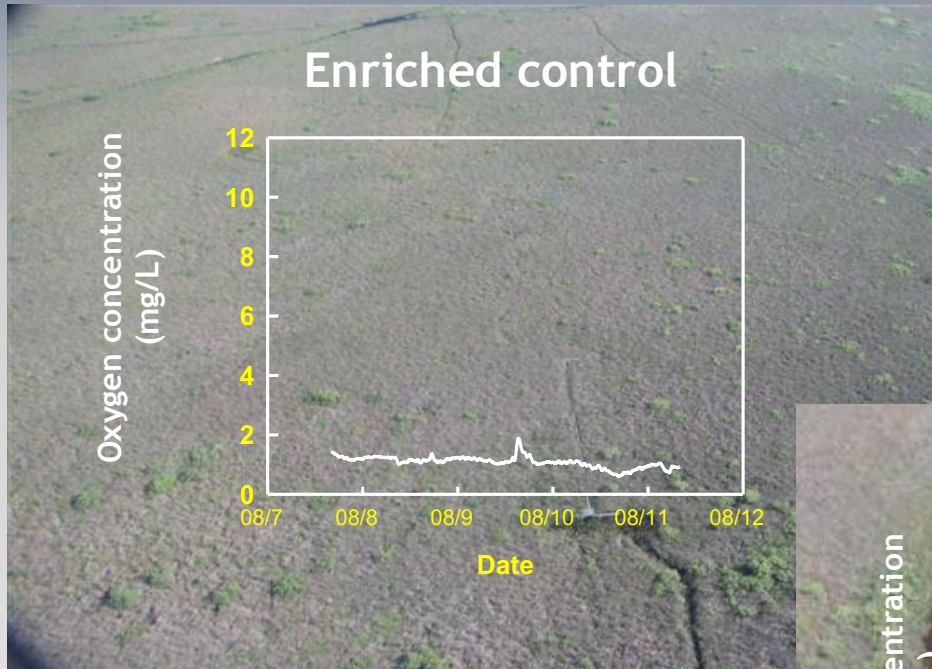
Succession of an Ecosystem



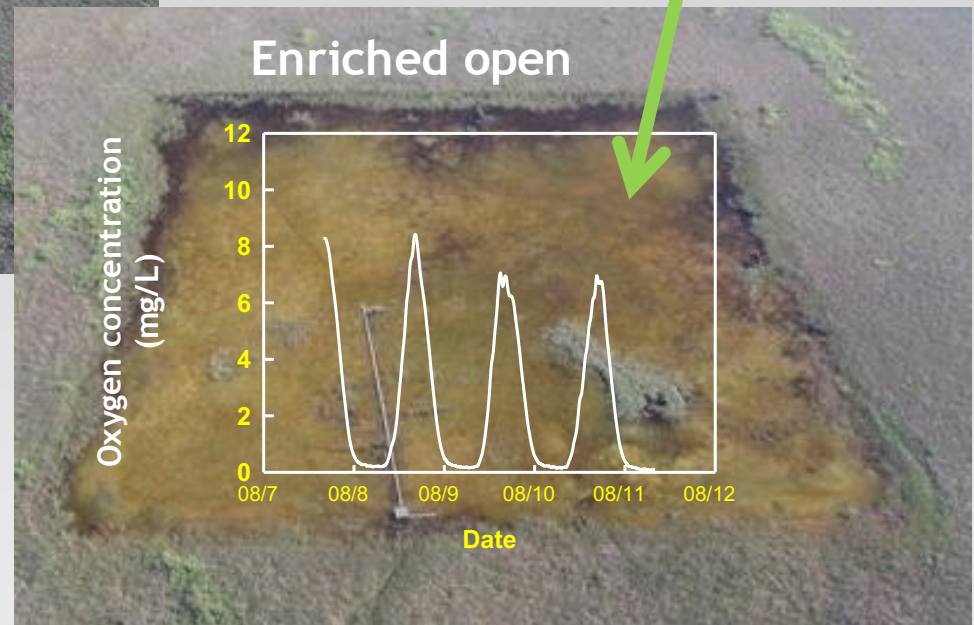
Herbicide + Burn treatments:

- created open water habitat with submerged aquatic vegetation
- increased productivity
- reduced phosphorus levels
- increased wading bird utilization

Increased Dissolved Oxygen



Algae and submerged vegetation



Wading bird usage greater in open versus control plots (WY2010 dry season)

	Enriched Control	Enriched Open
Mean birds per week \pm S.D. (all species pooled)	0.5 \pm 1.4	36 \pm 36
Total # birds	26	2,024
Total # species	4	9
Number of weeks \geq 1 bird observed	6	17



Challenges

- Glyphosate and imazapyr provided good, but non-selective control of cattail and other emergent vegetation.
- Several treatments required
- Did not achieve sawgrass ridge/slough landscape



Imazamox

- EPA registration 2008
- Belongs to the imidazolinone class of pesticides.
 - Includes imazapic, imazapyr, imazaquin
- Mode of action: inhibits acetohydroxyacid synthesis (ALS inhibitor)
- Imidazolinone herbicides generally exhibit very little toxicity to mammals, birds, fish, or insects.
- Approved for aquatic use

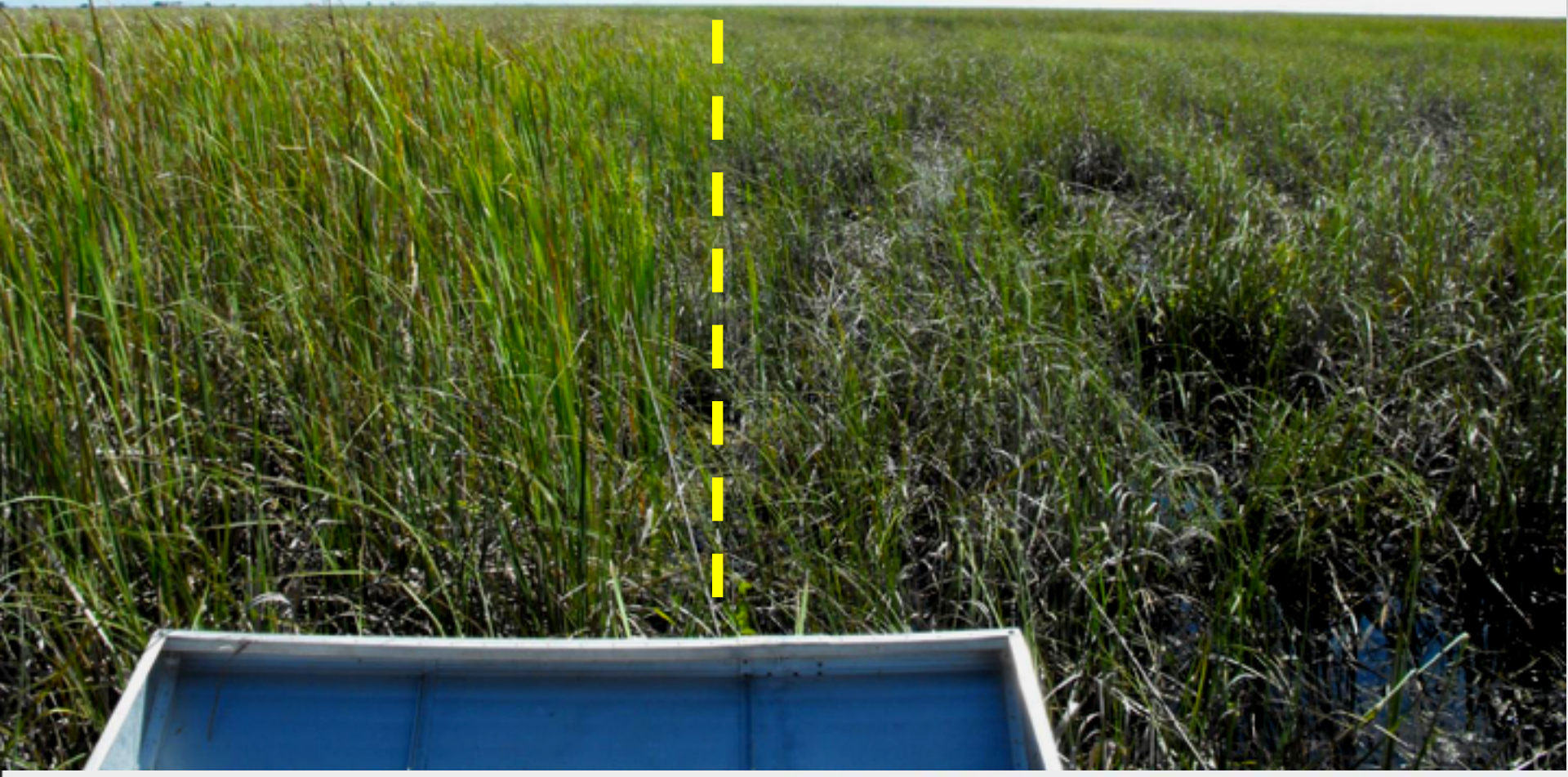
Clearcast for Cattail Control

- Recommended rate for cattail control
 - 32 - 64 oz/acre
- BASF reported excellent control at 32 fl oz/acre
- Recommended rates for some plants closely related to desired non-target Everglades species
 - 64 - 128 oz/acre
 - e.g. smartweeds, floating heart, bulrushes, grasses
- Can imazamox provide selective control of cattail in Everglades marsh?

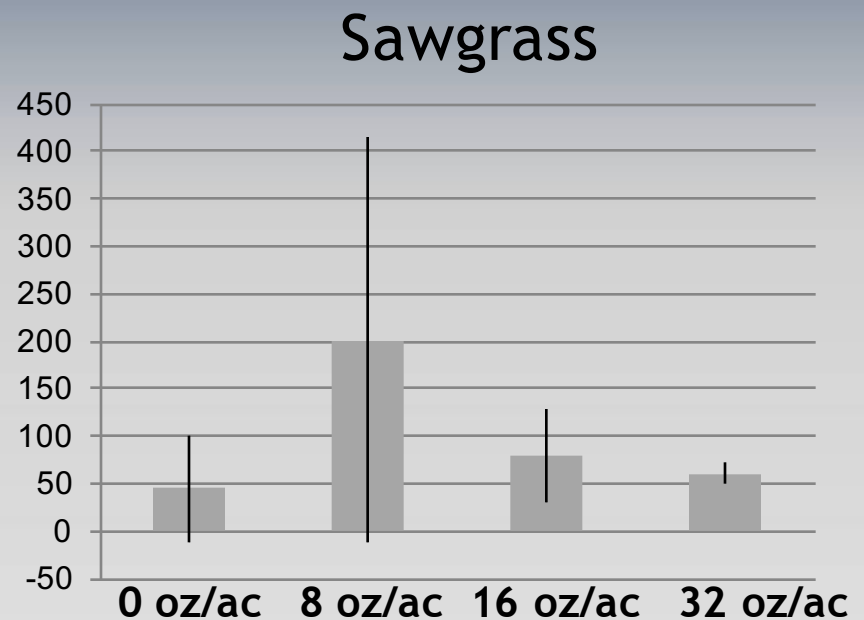
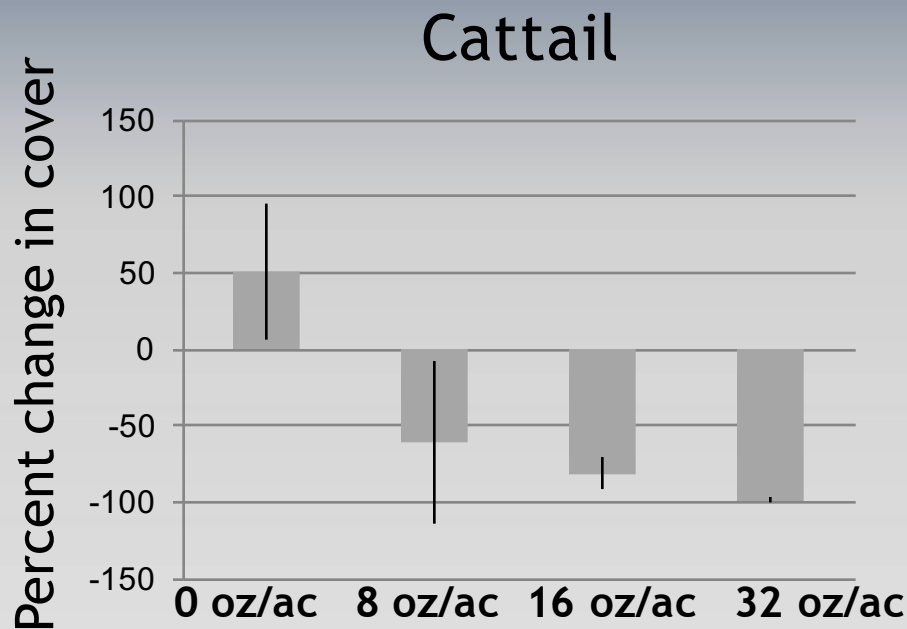
Initial Everglades Trials 2010 - 11

Control

**Clearcast
32 oz/ac
Aerial Application**



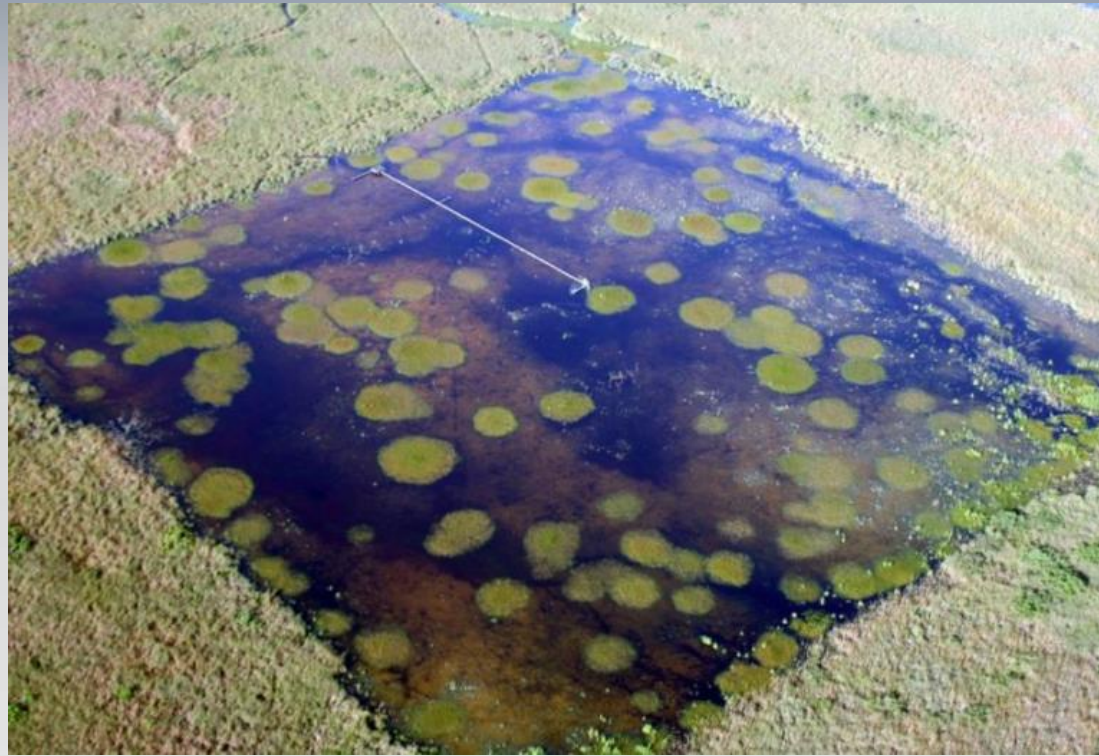
Clearcast Treatments 12 MAT



- Excellent cattail control at 32 oz/ac; moderate control at 16 oz/ac
- Minimal to no damage to sawgrass and other dominant species in all treatments

Back to CHIP

- Switched to imazamox in 2011
- Cattail very well controlled for three years
- Habitat evolving into productive emergent marsh with bulrush and other species.



*Bulrush and other emergent species
now colonizing CHIP plots*

Post-Imazamox Treatment 2015

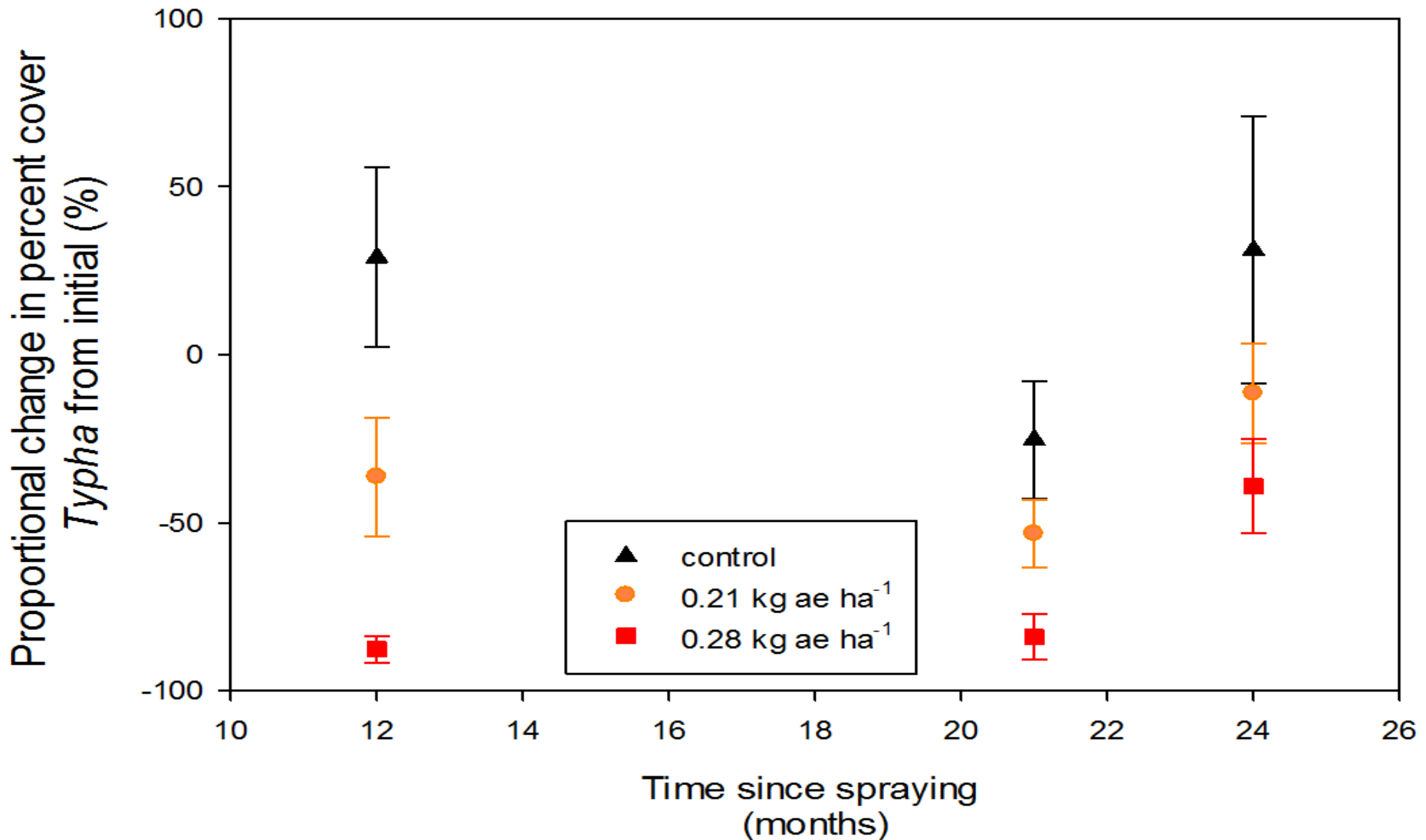


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Active Marsh Improvement Project “AMI”

- New trial in **dense** cattail areas in WCA 2A
- Evaluated 32 oz/ac and 24 oz /ac
- Results suggest that dense cattail requires no less than 32 oz/ac with follow up treatments
 - More biomass to kill, interference from dense thatch probably limits uptake

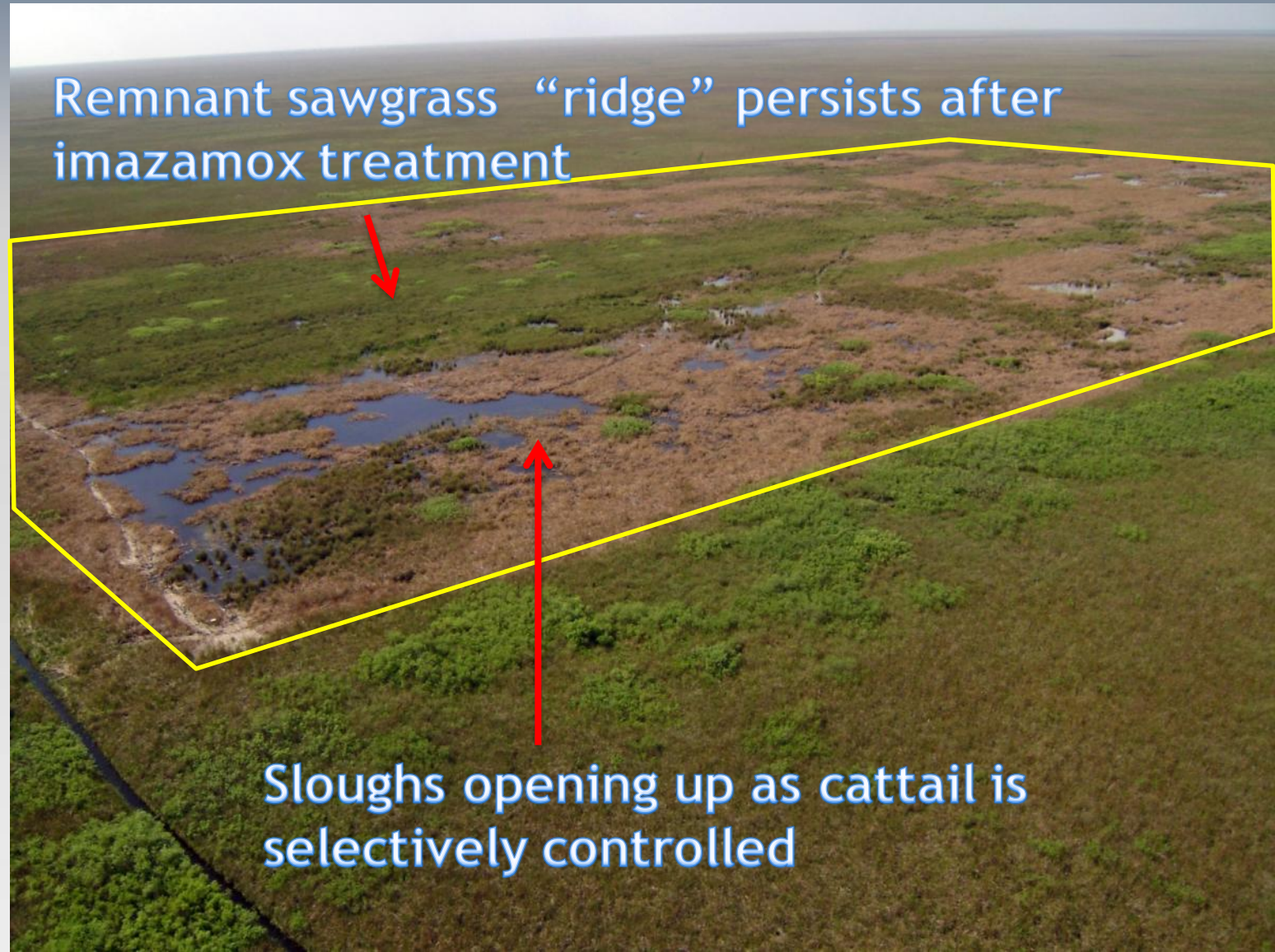
Cattail Control – 12, 21, and 24 MAT



24 MAT Species Results

SPECIES		Alive			Resprout Injury			Dead		
		0 oz	24 oz	32 oz	0 oz	24 oz	32 oz	0 oz	24 oz	32 oz
Chara sp.	Muskgrass	100%	100%	80%						20%
Cladium jamaicense	Sawgrass	100%	100%	93%			7%			
Eleocharis cellulosa	Spikerush	100%	100%	100%						
Nymphaea odorata	Fragrant Water Lily	100%	100%	83%						17%
Typha domingensis	Cattail	100%	31%	13%			13%		69%	73%
Polygonum setaceum	Bog Smartweed	100%	100%	100%						
Utricularia foliosa	Bladderwort	100%	100%	86%						14%
Salix caroliniana	Carolina Willow	100%	100%	100%						
Sagittaria lancifolia	Duck Potato	100%	100%	55%						45%

New Imazamox Trials in WCA 2A



Next Steps

- Assess impact of pre-herbicide burning to remove dense thatch
- Evaluate ground-based cattail treatments using imazamox
- Address **resistance management** concerns

Acknowledgements

- Sue Newman, SFWMD
- Michael Manna , SFWMD
- Mark Cook , SFWMD
- David Black , SFWMD
- Todd Horton, SeaPro Corp.
- Bill Haller, UF/IFAS
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