EAA BMP Master Research Permit: Role of Aquatic Vegetation on Water Quality and Sediments

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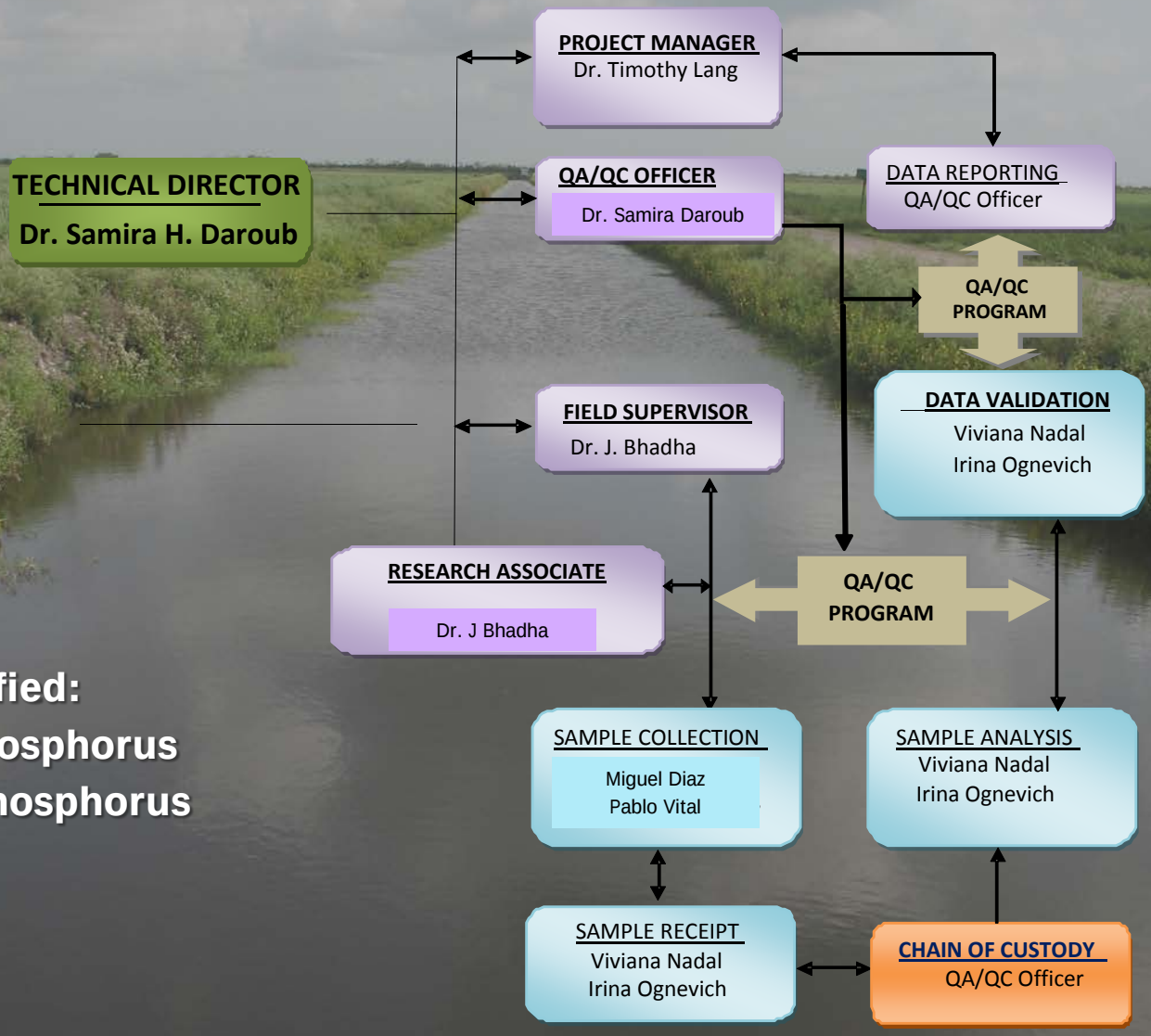
Presentation Outline

- Personnel and NELAC
- Update: Floating Aquatic Vegetation (FAV) Impact on Water Quality and Sediments
  - Rationale
  - Methods
  - Results
    - Farm Treatment Selection
    - Farm drainage water
    - Ambient farm canal water
    - FAV biomass
    - Farm canal sediments
- BMP Training Overview
- 2014 Preview

PERSONNEL

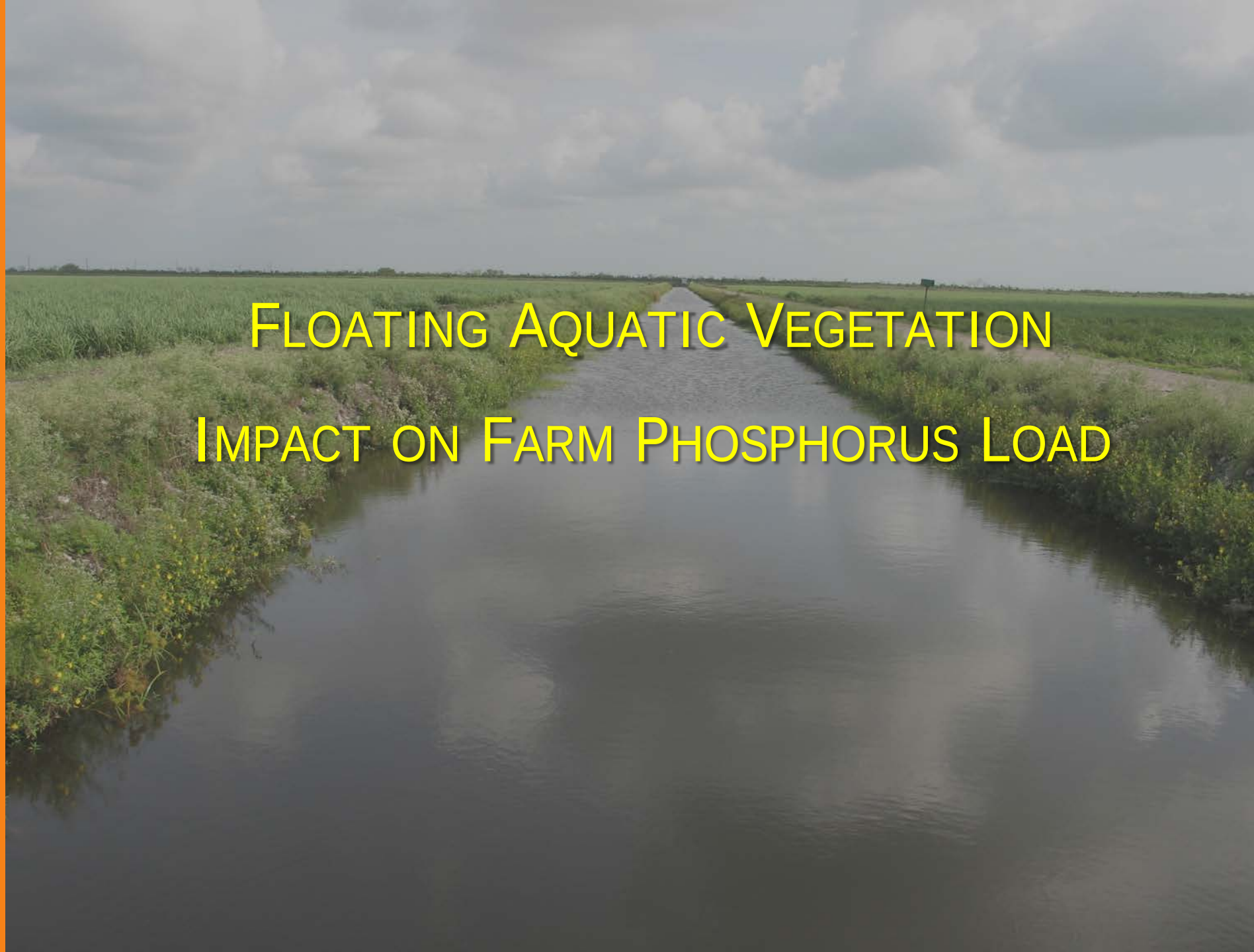
Samira Daroub, PhD	Principal Investigator
Timothy Lang, PhD	Project Manager
Jehangir Bhadha, PhD	Lead Scientist
Vivianna Nadal, MS	Head Chemist
Irina Ognevich, BS	Chemist
Odiney Alvarez, BS	Grad Student
Miguel Diaz, AA	Field Technician
Pablo Vital, AA	Field Technician

NELAC



NELAC Certified:

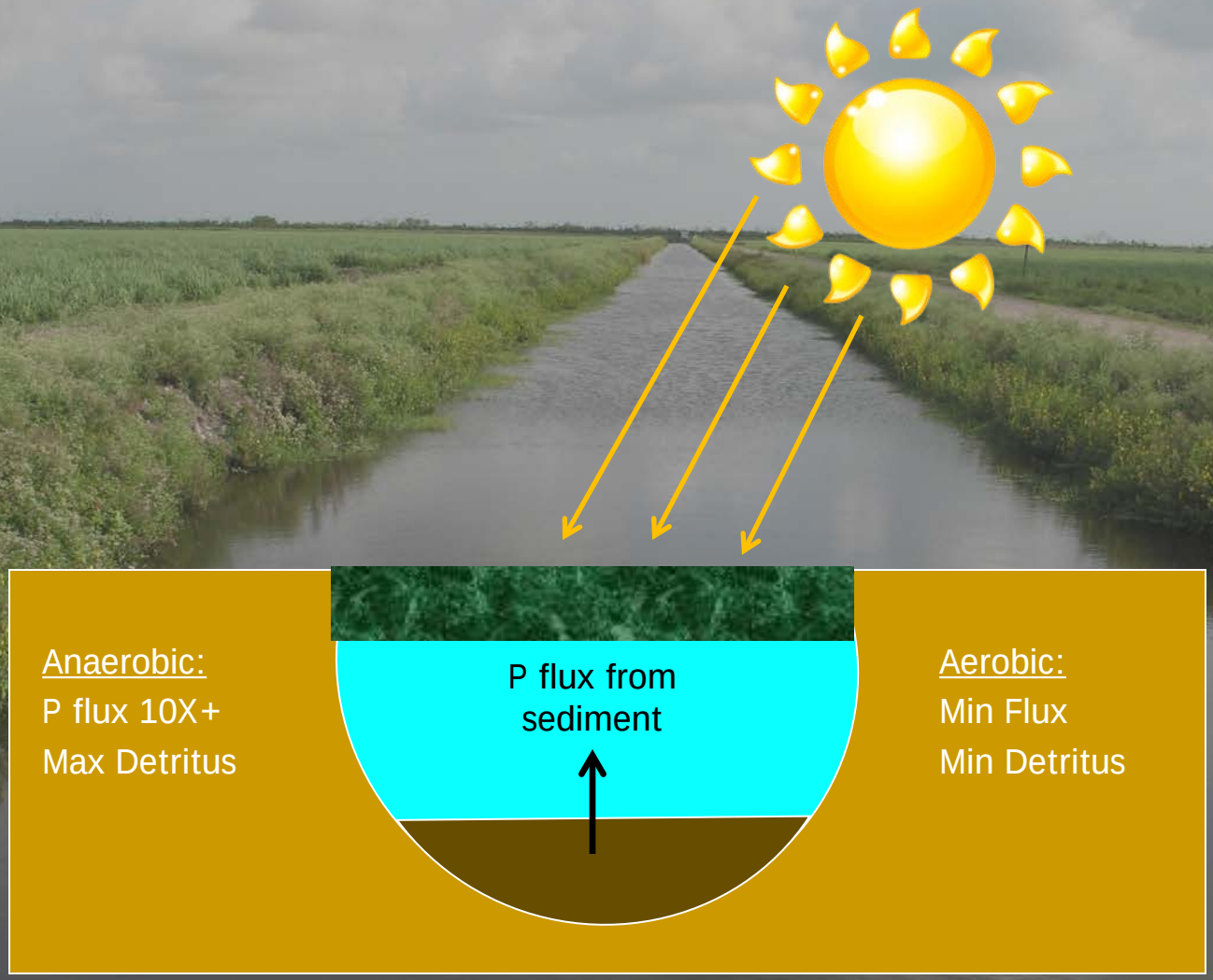
- **Total Phosphorus**
- **Ortho Phosphorus**



Floating Aquatic Vegetation

Impact on Farm Phosphorus Load

PROJECT RATIONALE



Floating aquatic vegetation (FAV)
EAA farm canals

GOAL

To transform sediments produced in farm canals by managing them to control floating aquatic vegetation and thereby limiting the buildup of light, labile, organic sediments in the farm canals and favoring the co-precipitation of Ca-P mineral sediments

OBJECTIVES

- Evaluate FAV management practices in the EAA farm canals for impact on:

  a) farm drainage water phosphorus (P) load

  b) P speciation of farm drainage water

  c) canal sediment properties

- *The goal is to provide growers an additional tool by managing FAV in farm canals in their efforts to reduce off-farm P loading by in the Everglades Agricultural Area.*

METHODS

Paired farms study (4 pairs)

- Two pairs each in S-5A and S-6 sub basins
- 2-yr calibration and 3-yr treatment periods
- Calculate changes after initiation of practices
- Improved vs. typical FAV control practices

Farm Descriptions and Locations

S-5A Sub-basin

Farm 0401: 908 acres- cane w/corn

Farm 2501: 823 acres- cane w/corn

Farm 1813: 594 acres- cane w/corn

Farm 6117: 800 acres- cane

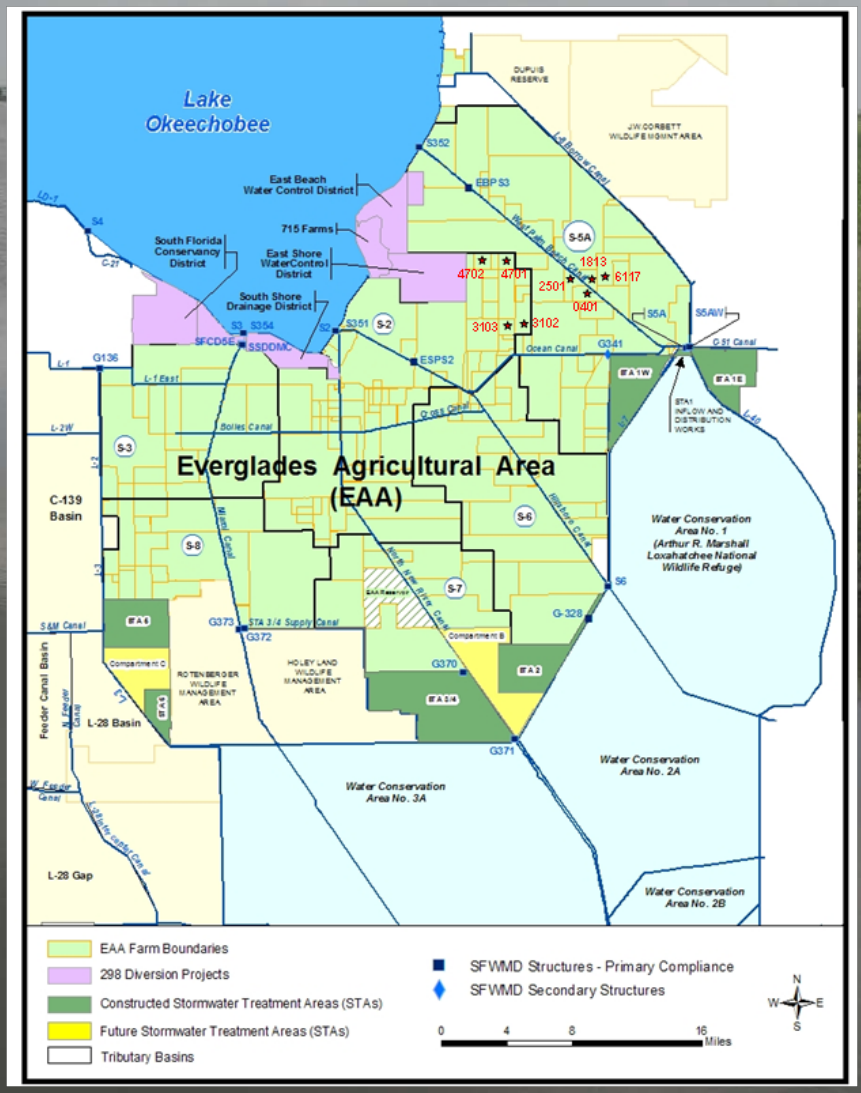
S-6 Sub-basin

Farm 3102: 1608 acres- cane w/corn

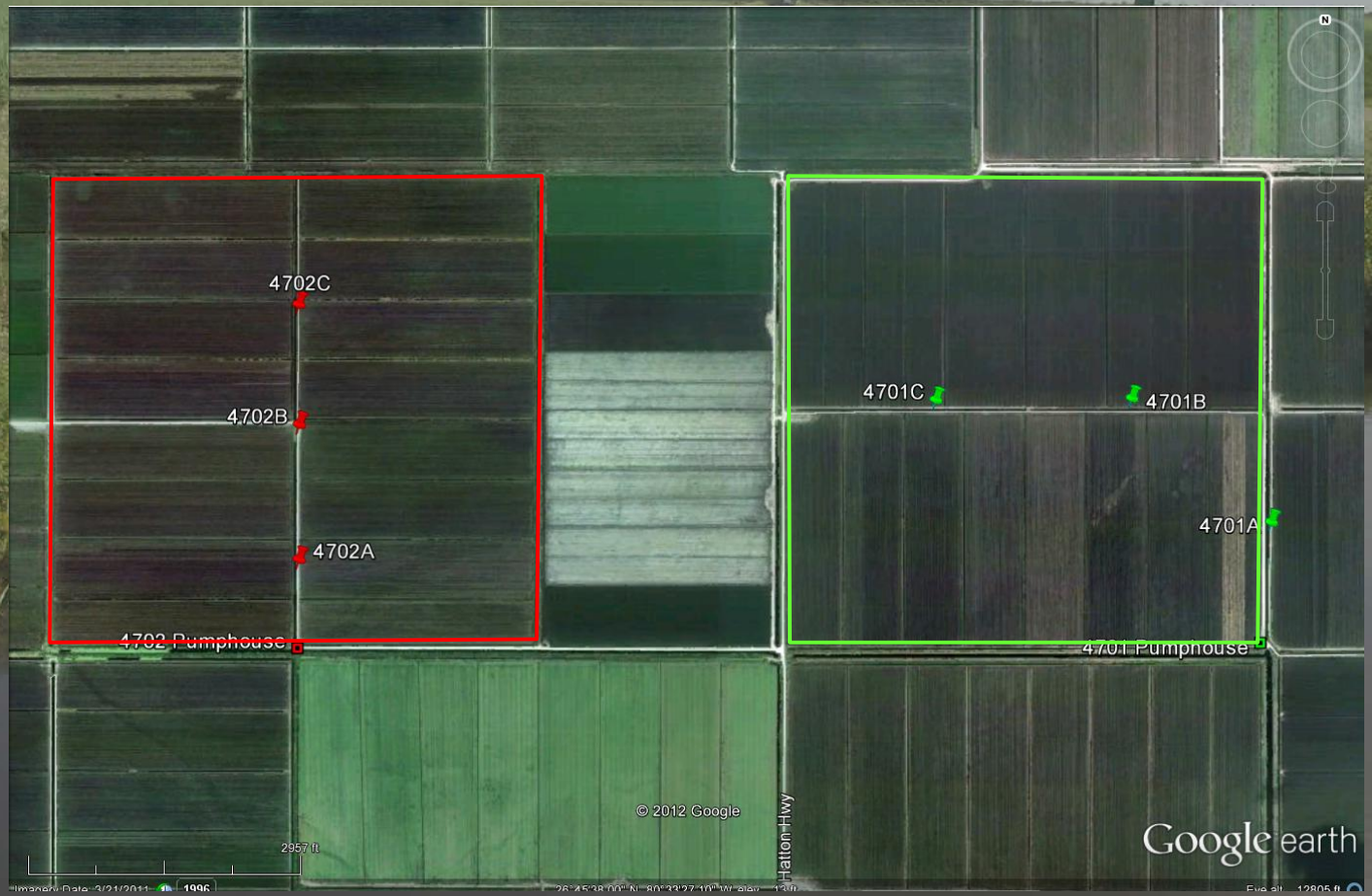
Farm 3103: 602 acres- cane+veg w/corn

Farm 4701: 630 acres- cane

Farm 4702: 640 acres- cane w/rice



Example: Farm Pair Aerial View



Data Collection

Drainage Water:

Flow volume, velocity

TP/TDP/SRP (PP/DOP), Ca, DOC, pH, TSS

Ambient Canal Water:

TP/TDP/SRP (PP/DOP), Ca, DOC, pH, TSS

Hydrolab *in situ:* Temp, DO, ORP, SpCond

Canal Sediments:

TP, Wet Density, Dry Density, OM (LOI), ash content

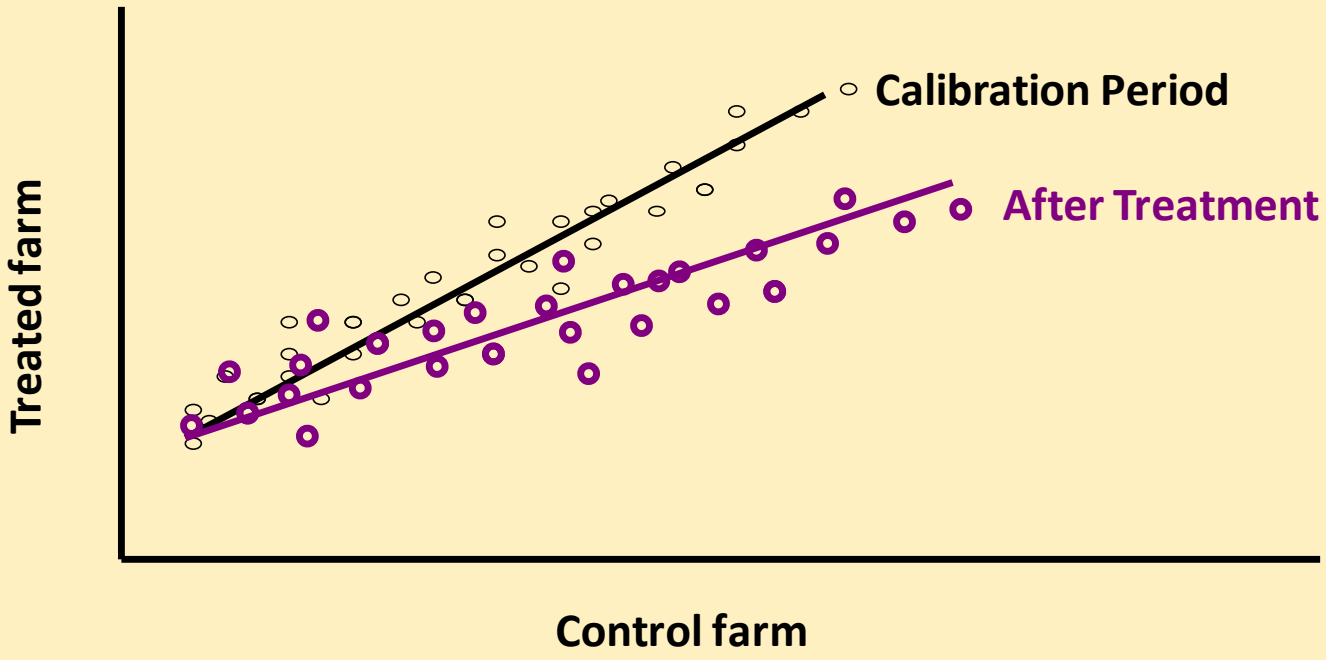
Sediment depth surveys

FAV Biomass:

Species composition, Aerial Coverage, P Content, Biomass

Comparative Regression Analysis For P Load

$$Treated_i = b_0 + b_1 (Control_i) + e$$



Calibration Period

- Calibration: Nov 2010 through April 30, 2013.
- Collected two full water year drainage data:
  - May 1, 2011 – April 30, 2013
- Conducted regression analysis on P loads between farm pairs to determine if the relationship is significant

Calibration Period Regression Equations

Weekly P Load 6117 vs 1813:

P Load1813 = -6.464 + 0.430 P Load6117 + 6.02 Rain6117

Observations = 44, Adj R^2= 0.955, RMSE = 8.52

Weekly P Load 3102 vs 3103:

P Load3102 =-68.85 + 1.45 P Load3103 + 68.2 Rain3102

Observations= 41, Adj R^2= 0.838, RMSE = 81.52

Daily P Load 0401 vs 2501:

P Load0401 = 0.1821 + 1.42 P Load 2501 + 2.00 Rain2501

Observations= 110, Adj R^2 = 0.877, RMSE = 4.44

Weekly P Load 4701 vs 4702:

P Load4701 = 3.072 + 0.432 P Load4702

Observations = 19, Adj R^2= 0.488, RMSE = 5.59

Calibration Period FAV Coverage

Percent FAV Coverage								
Month-Year	Farm 3102	Farm 3103	Farm 2501	Farm 0401	Farm 4701	Farm 4702	Farm 6117	Farm 1813
Jan-11	10	3	NC	40	3	7	20	NC
Mar-11	5	2	15	15	5	2	25	NC
May-11	40	10	50	70	30	5	30	NC
Jun-11	40	40	5	40	1	5	40	NC
Aug-11	40	40	40	60	10	15	10	NC
Oct-11	30	10	15	40	10	15	10	NC
Jan-12	30	40	15	20	15	10	30	NC
Apr-12	30	30	70	50	30	NC	75	NC
Jun-12	30	45	30	2	30	20	38	NC
Aug-12	60	40	30	20	15	30	45	NC
Oct-12	10	20	10	85	10	15	5	NC
Dec-12	30	30	10	70	10	30	10	NC
Feb-13	25	15	20	20	5	35	10	NC
Apr-13	20	10	5	70	5	15	10	NC
Max	60	45	70	85	30	35	75	0
Min	5	2	0	2	1	0	5	0
MEAN	28.6	23.9	24.2	43.0	12.8	15.7	25.6	0.0
STD	14	16	19	25	10	11	19	0

Sediment – farm canals

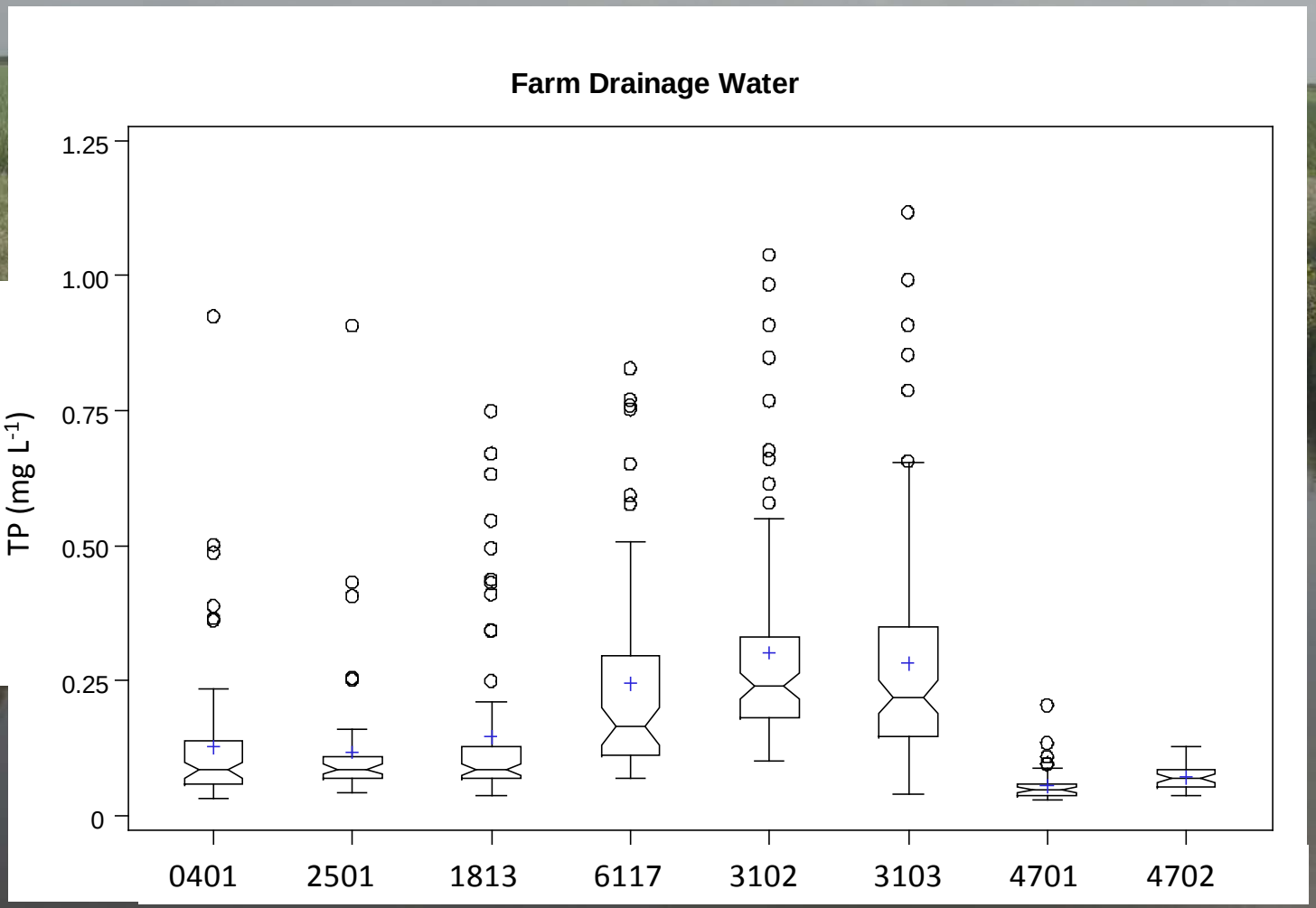
		Sediment Thickness (ft)							
		3102	3103	2501	0401	4701	4702	6117	1813
Feb-11	A	3.02	2.40	4.83	6.52	5.82	2.97	6.25	4.33
Feb-11	B	3.43	3.57	1.43	2.92	4.18	3.73	1.60	4.88
Feb-11	C	4.42	3.07	2.90	2.78	3.80	3.83	9.40	3.67
Nov-11	A	2.59	2.41	4.28	6.01	5.03	3.01	6.41	4.85
Nov-11	B	3.01	3.92	1.42	2.49	4.33	3.66	1.75	5.08
Nov-11	C	4.67	3.00	2.84	2.83	4.00	3.59	8.44	3.83
May-12	A	2.42	2.42	4.50	6.25	4.59	1.84	6.50	4.50
May-12	B	3.33	3.67	1.67	0.67	4.17	2.25	1.50	5.34
May-12	C	4.50	2.84	2.09	3.17	3.42	3.92	10.83	4.25
Nov-12	A	2.50	2.50	4.25	6.59	5.08	2.33	6.33	4.50
Nov-12	B	2.92	1.08	1.34	1.75	5.17	2.75	1.59	5.00
Nov-12	C	4.42	2.92	2.75	3.17	4.09	4.33	11.59	4.00
Apr-13	A	2.42	2.75	4.75	7.91	5.00	2.00	7.00	4.50
Apr-13	B	2.92	3.83	1.17	2.75	4.33	2.50	1.59	5.00
Apr-13	C	4.41	3.58	2.50	3.00	4.25	4.25	11.50	4.00
MEAN		3.44	2.82	2.86	3.76	4.47	3.19	6.02	4.52
STD		0.8	0.8	1.3	2.0	0.7	0.8	3.7	0.5

Project Status

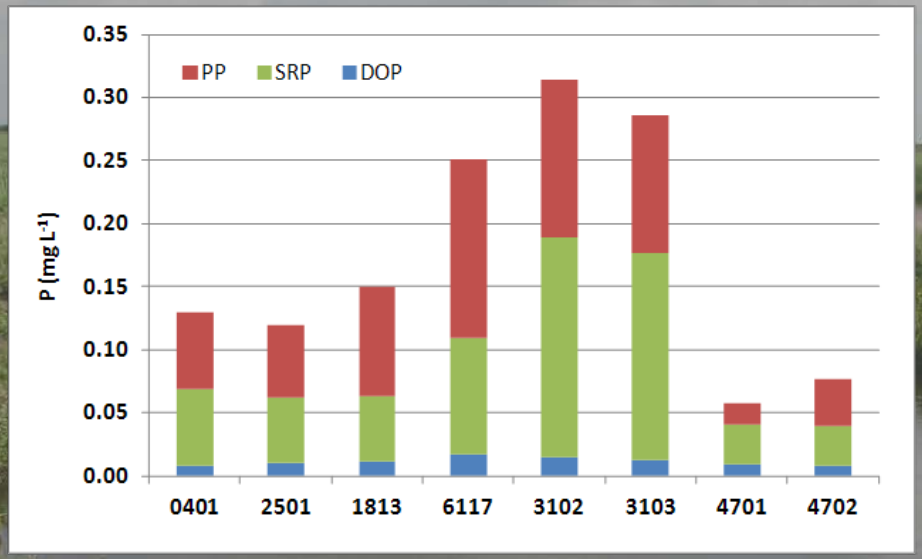
- Treatment Farms: 3103 0401 6117
- Control Farms: 3102 2501 1813
- Continued Baseline Monitoring (one yr):

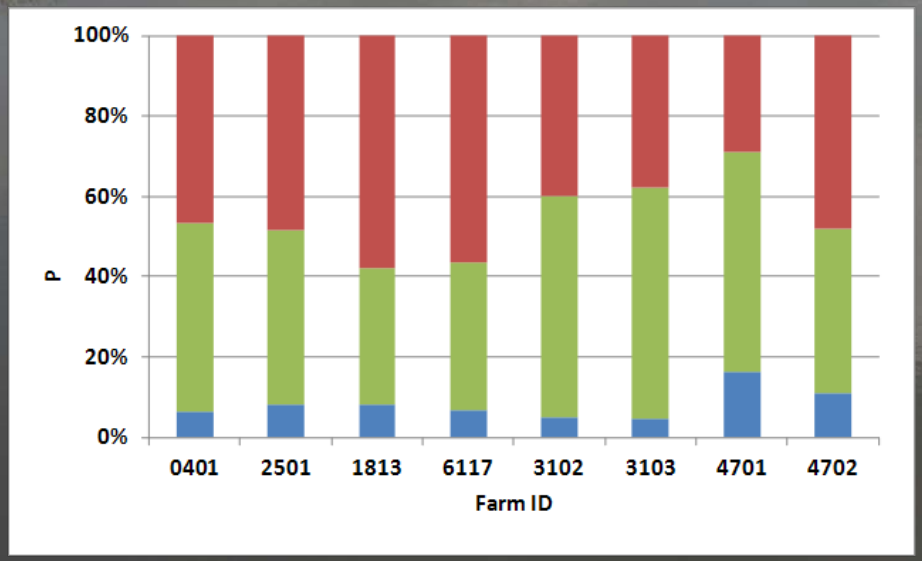
  4701 and 4702
- Treatment Initiation: May 1, 2013 for 3 farm pairs
  - Monitoring of FAV growth
  - Spot spraying with approved Aquatic herbicide
- Treatment Initiation: May 1, 2014 for farm pair 4

Farm drainage water



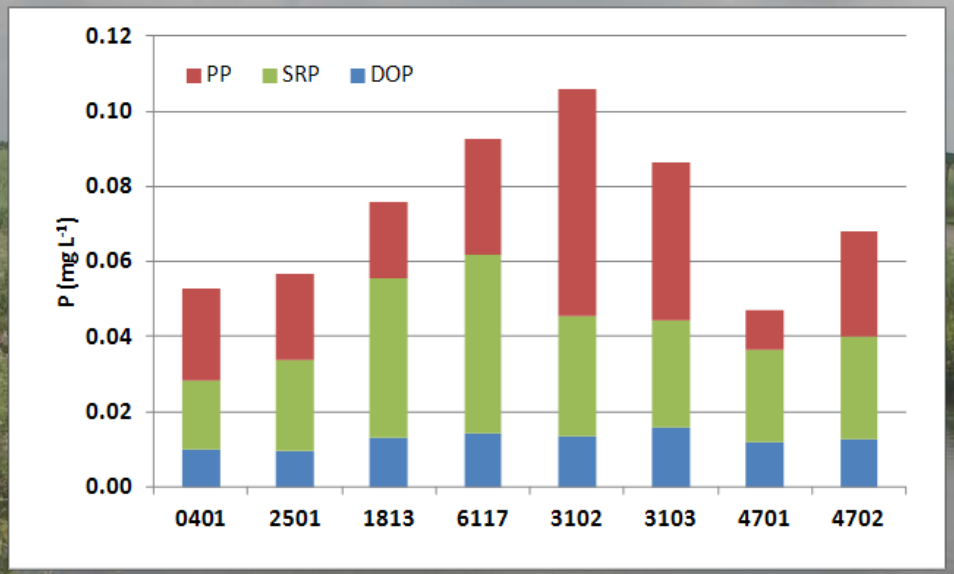
Farm Drainage Water

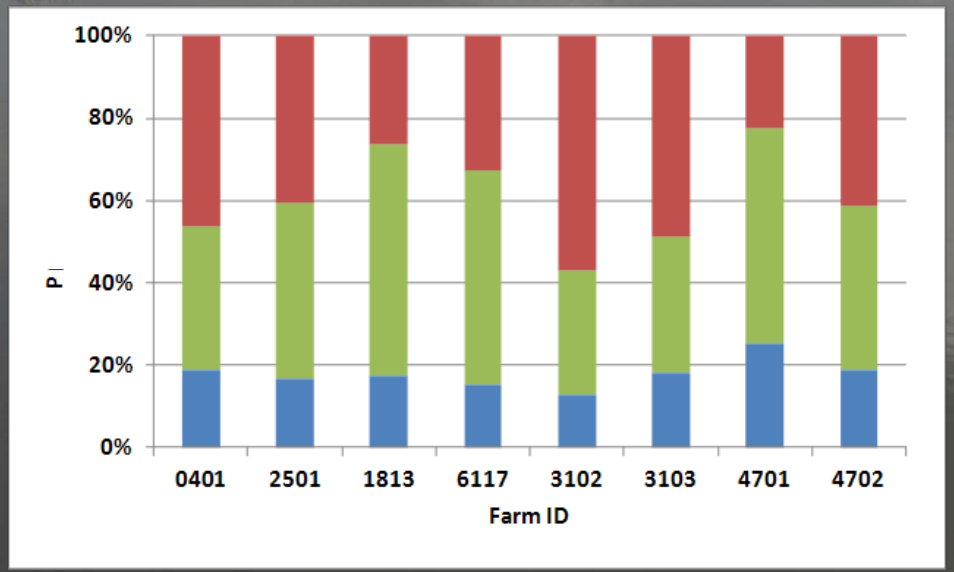




Drainage water samples from Feb 2011 thru Apr 2013

Ambient Canal Water





Ambient canal water samples from Nov 2010 thru Apr 2013

In-situ Water Quality
(Mean values- October 2011- April 2013)

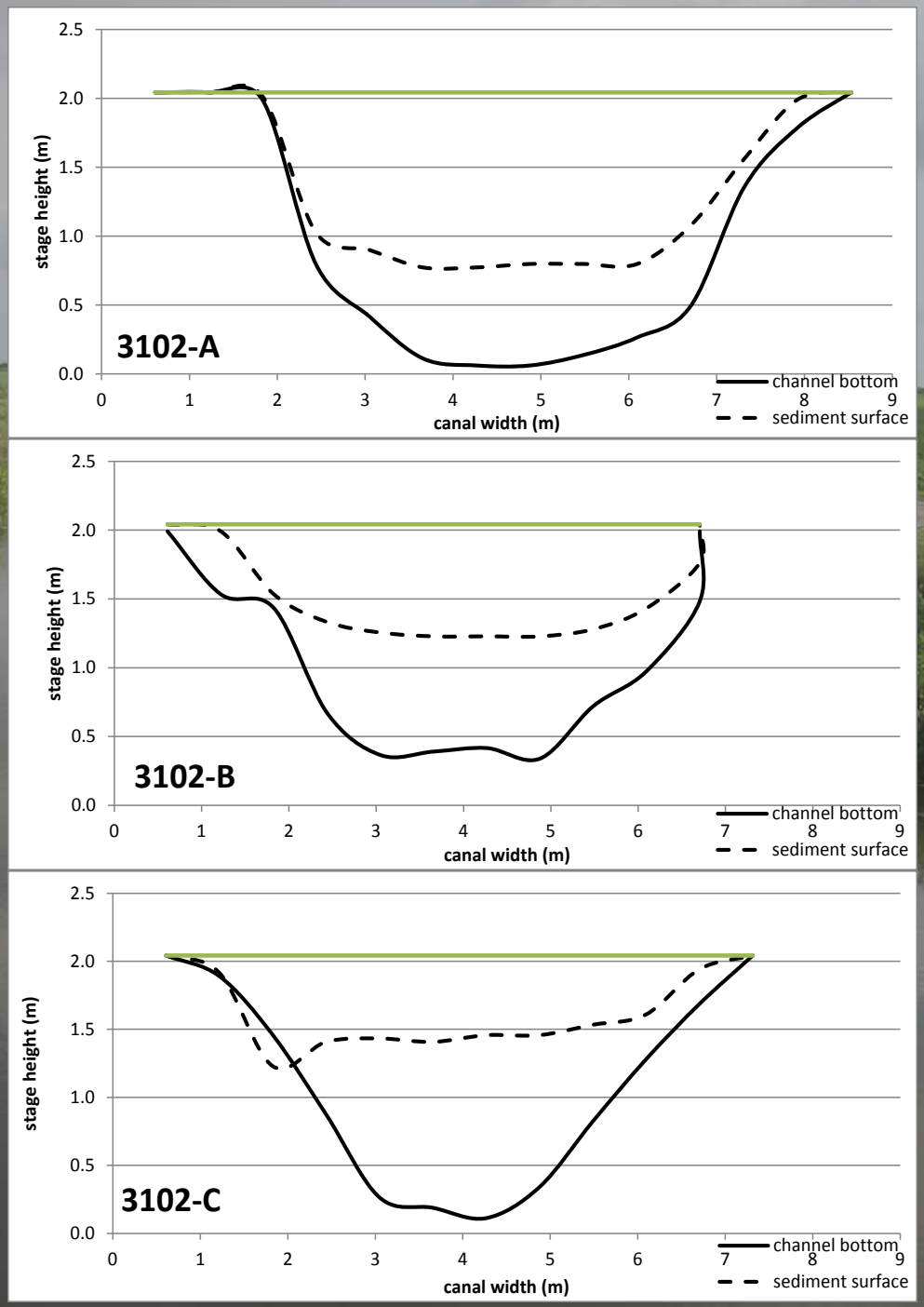
Farm	ORP	Sp. Conductivity
	mv	µS/cm
0401	452	1029
2501	525	885
1813	452	962
6117	452	645
3102	398	1257
3103	416	1391
4701	429	1033
4702	436	1245

Sediment properties – April 2013

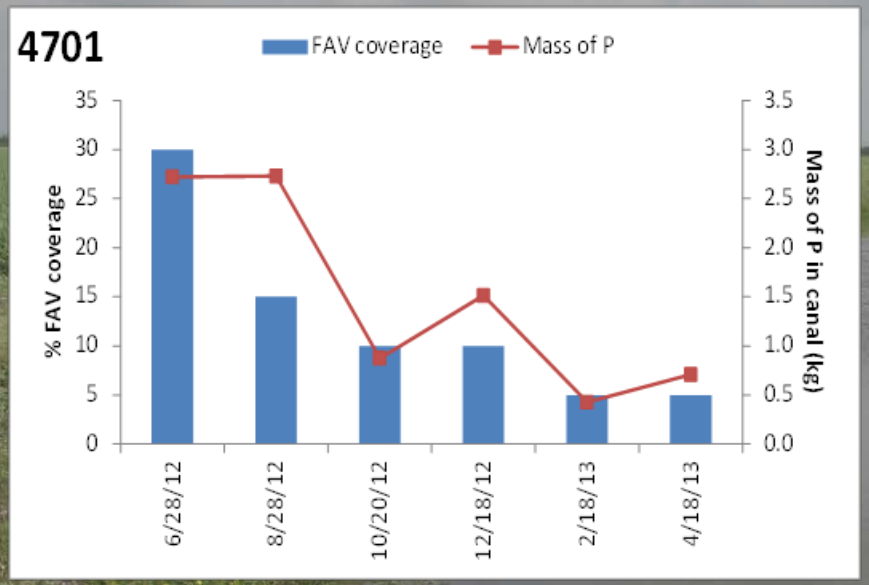
Farm	Depth (cm)	OM (%)	DDb (g cm^{-3})	TP (mg kg^{-1})
0401	0-2.5	30.8	0.28	996
	2.5-5	36.6	0.32	833
2501	0-2.5	38.4	0.20	1106
	2.5-5	43.9	0.22	1014
1813	0-2.5	43.9	0.09	1228
	2.5-5	42.1	0.14	1208
6117	0-2.5	42.8	0.11	1191
	2.5-5	40.8	0.16	1162
3102	0-2.5	43.4	0.12	1152
	2.5-5	42.4	0.16	1063
3103	0-2.5	41.5	0.16	1123
	2.5-5	40.8	0.18	1022
4701	0-2.5	43.3	0.16	1211
	2.5-5	43.9	0.17	1086
4702	0-2.5	39.7	0.21	1112
	2.5-5	34.5	0.31	1060

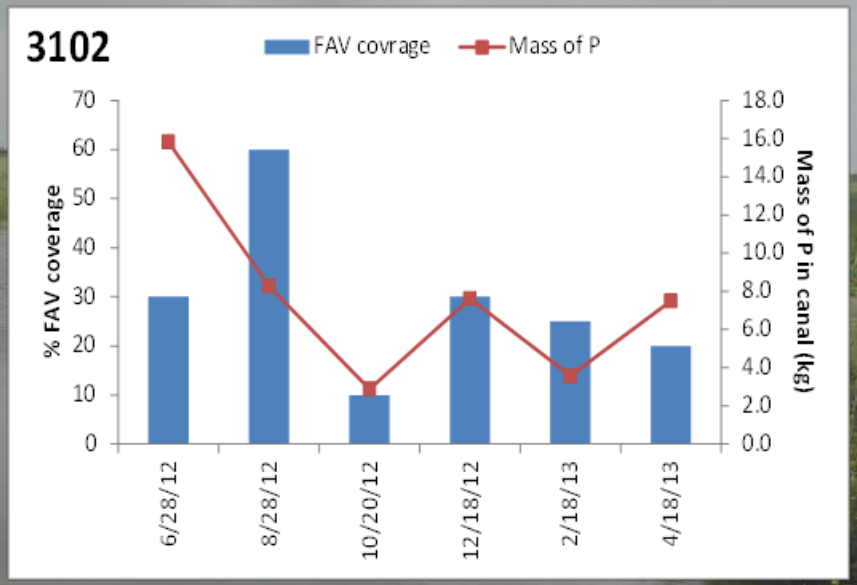
Sediment profile of main canal of farm 3102 at three transects, A, B, and C, surveyed in April 2013. Green line corresponds to height of water.

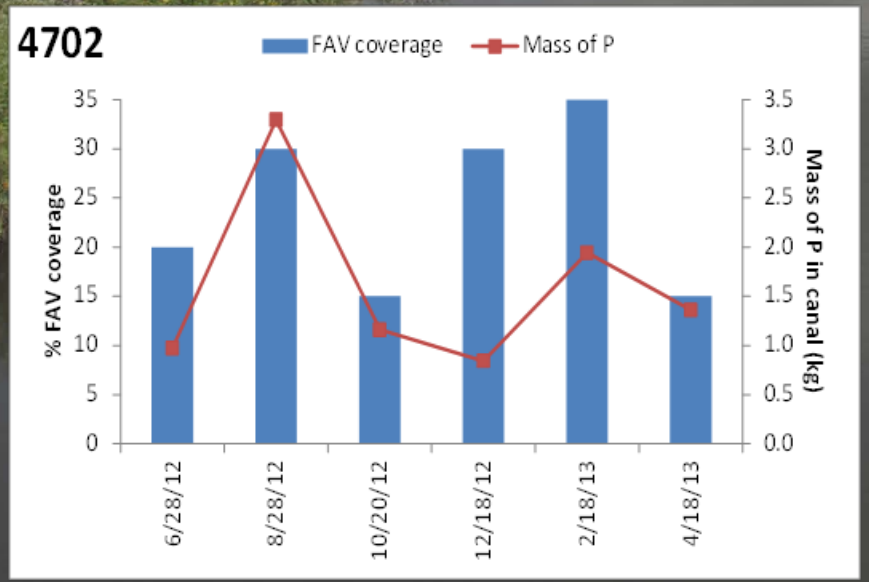
Note: 1 m = 3.12 ft

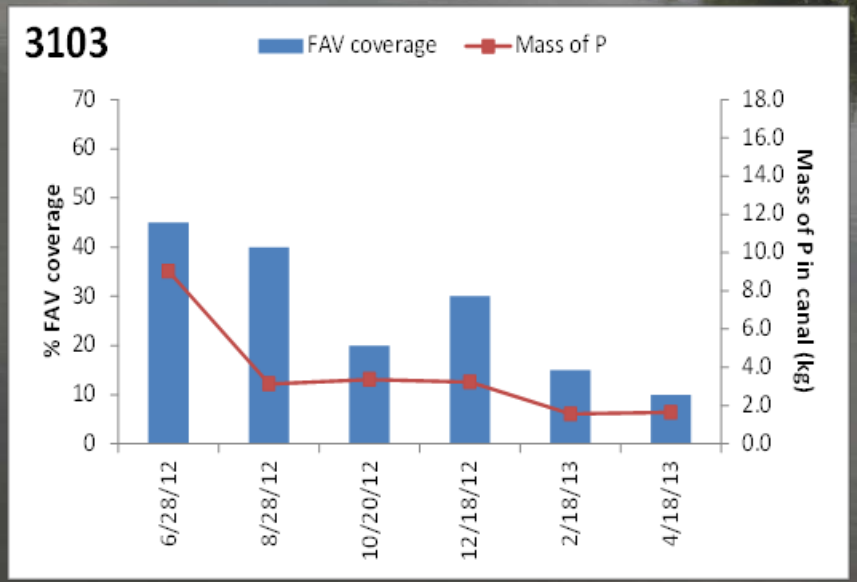


FAV COVERAGE AND P MASS





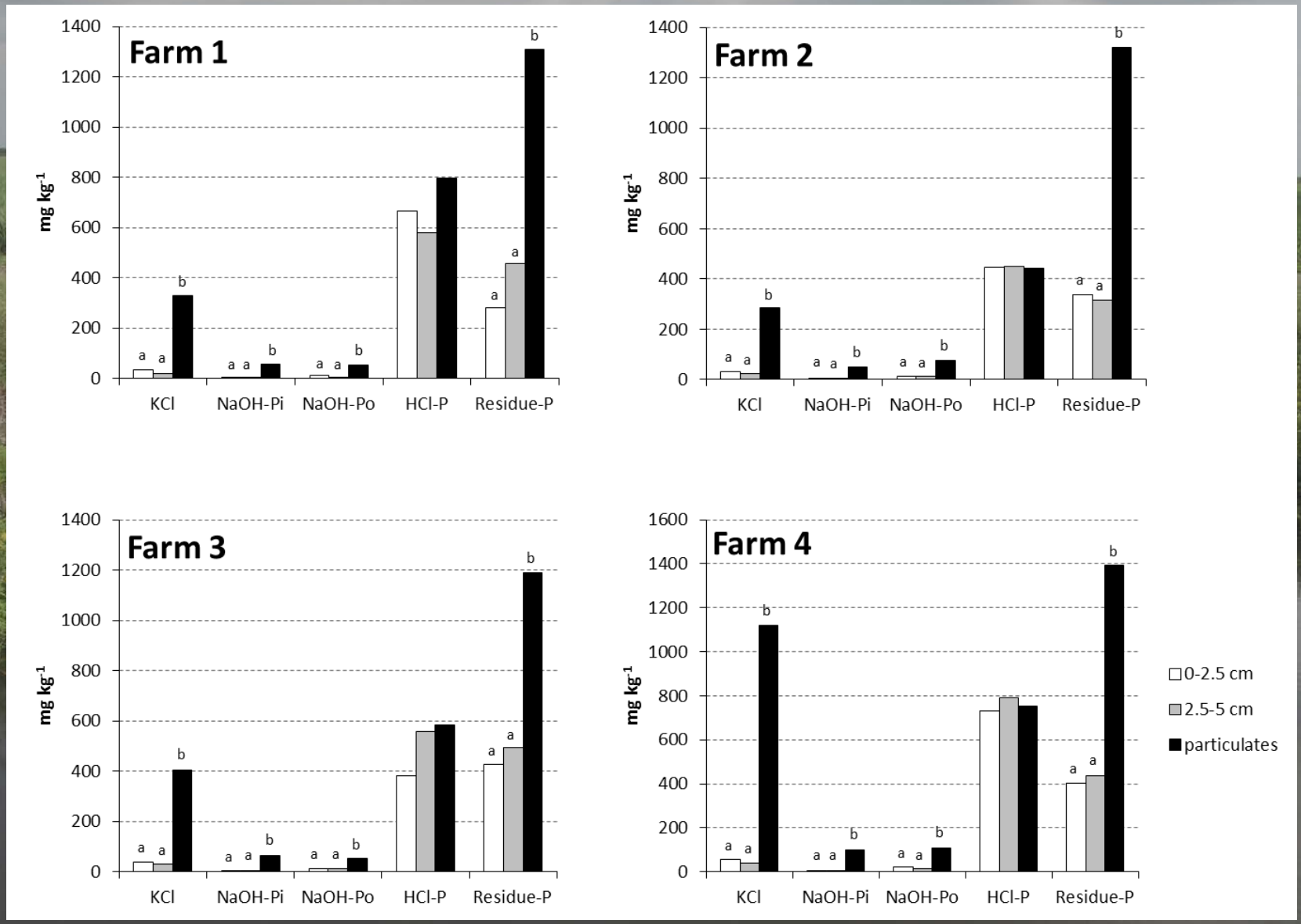




Drainage water particulates Vs. Sediments characterization

- DW particulates exiting EAA farms varies from 30-60% of the P load exiting farms
- DW collected during pumping events; particulates isolated via settling tanks
- P-fractionation was conducted on the particulates and farm canal sediments

P FRACTIONS IN SEDIMENTS VS DRAINAGE WATER PARTICULATES



BMP Training
Twice Yearly Sessions

September 27, 2012 -117 Participants
April 11, 2013 -115 Participants

Training evaluation feedback:

- modify and/or add BMP topics
- modify content of training modules

BMP Training

Twice Yearly Sessions

Speaker	Presentation Title
Samira Daroub, PhD	Everglades Program Chapter 40E-63, F.A.C.
Timothy Lang, PhD	BMP Research Update
Paul Grose, MS	Grower's Experience with BMPs
Jehangir Bhadha, PhD	Nutrient Cycling in South Florida
Les Baucum, MS	Wise Use of Atrazine and Ametryn
Doug Pescatore, MS	EAA Basin Phosphorus Loads
Bill Donovan, PhD	BMP Verification Methodology
Lyn Gettys, PhD	Managing Aquatic Weeds in Farm Canals
Tom MacVicar, MS	What's Going On With Lake Okeechobee?
Barry Glaz, MS	Sugarcane Production and BMPs
Mike Jerauld, MS	Stormwater Treatment Areas Research
Kim O'Dell, PhD	Alternative Treatment Technologies
Mark Howell, BS	Pumping/Discharge Methods

Summary points

- The BMP program in the EAA has been an unqualified success: Basin P load reductions have nearly averaged 50% compared to baseline period
- Targeting Floating Aquatic Vegetation management for further reductions in P loads: FAV plays an important role as being a sink/source of P
- GOAL: Change the characteristics of farm canal sediments from easily transportable organic sediments to heavier mineral sediments.

Preview 2014

Planned Activities

Monitor farm drainage waters: flow volume and WQ

Conduct sediment analyses and surveys: spring and fall 2014

Monitor ambient canal waters: biweekly

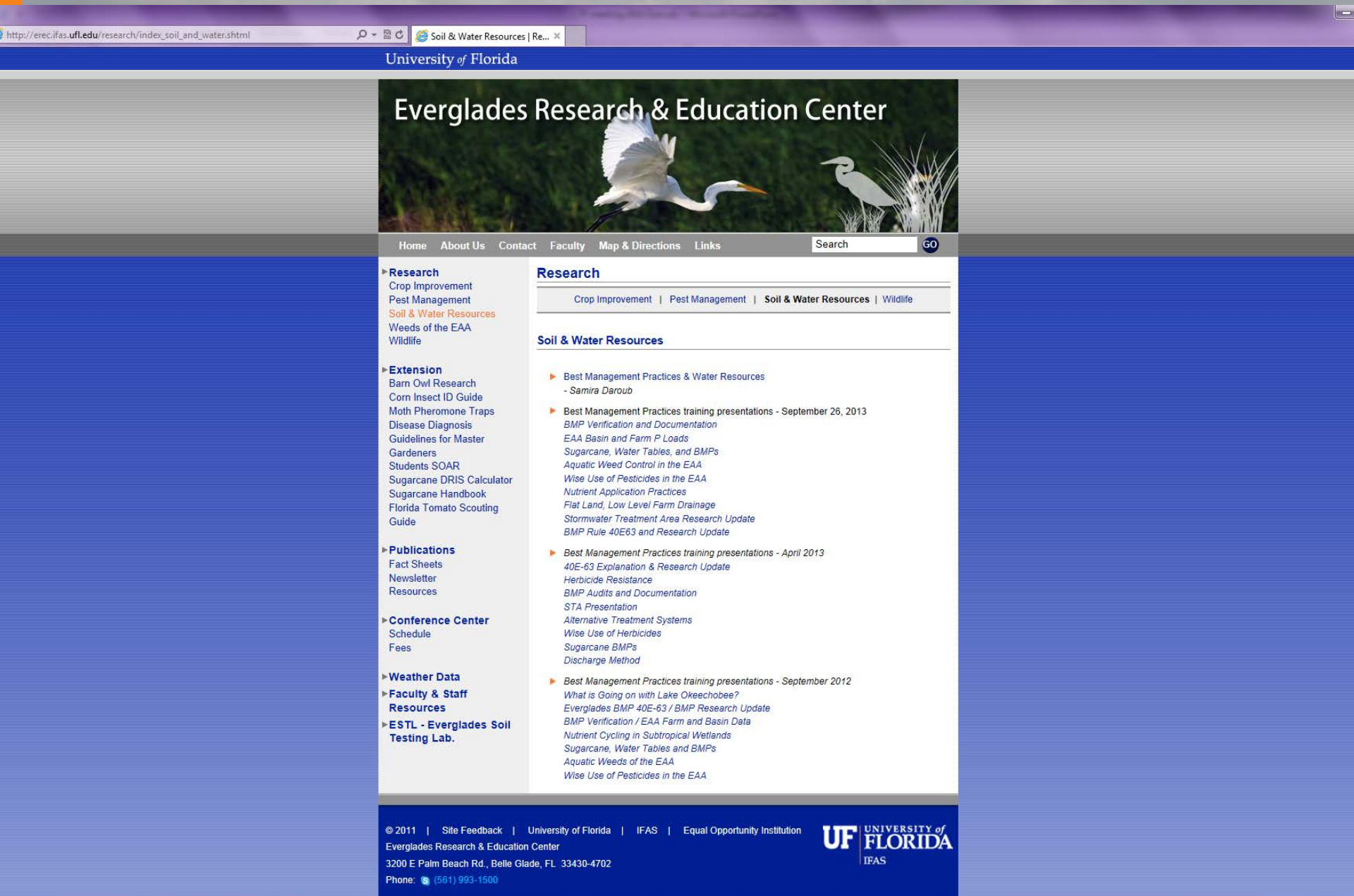
FAV biomass survey/composition analysis: bimonthly

Survey and spot spray FAV on TMT farms: bimonthly

BMP training workshops: Apr 17th, and Sept. 2014

Annual report to SFWMD and EPD: July 2014

HTTP://EREC.IFAS.UFL.EDU

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