

Reducing Labile Phosphorus in Agricultural Drainage Canal Sediments by Suppressing Floating Aquatic Vegetation In The Everglades Agricultural Area

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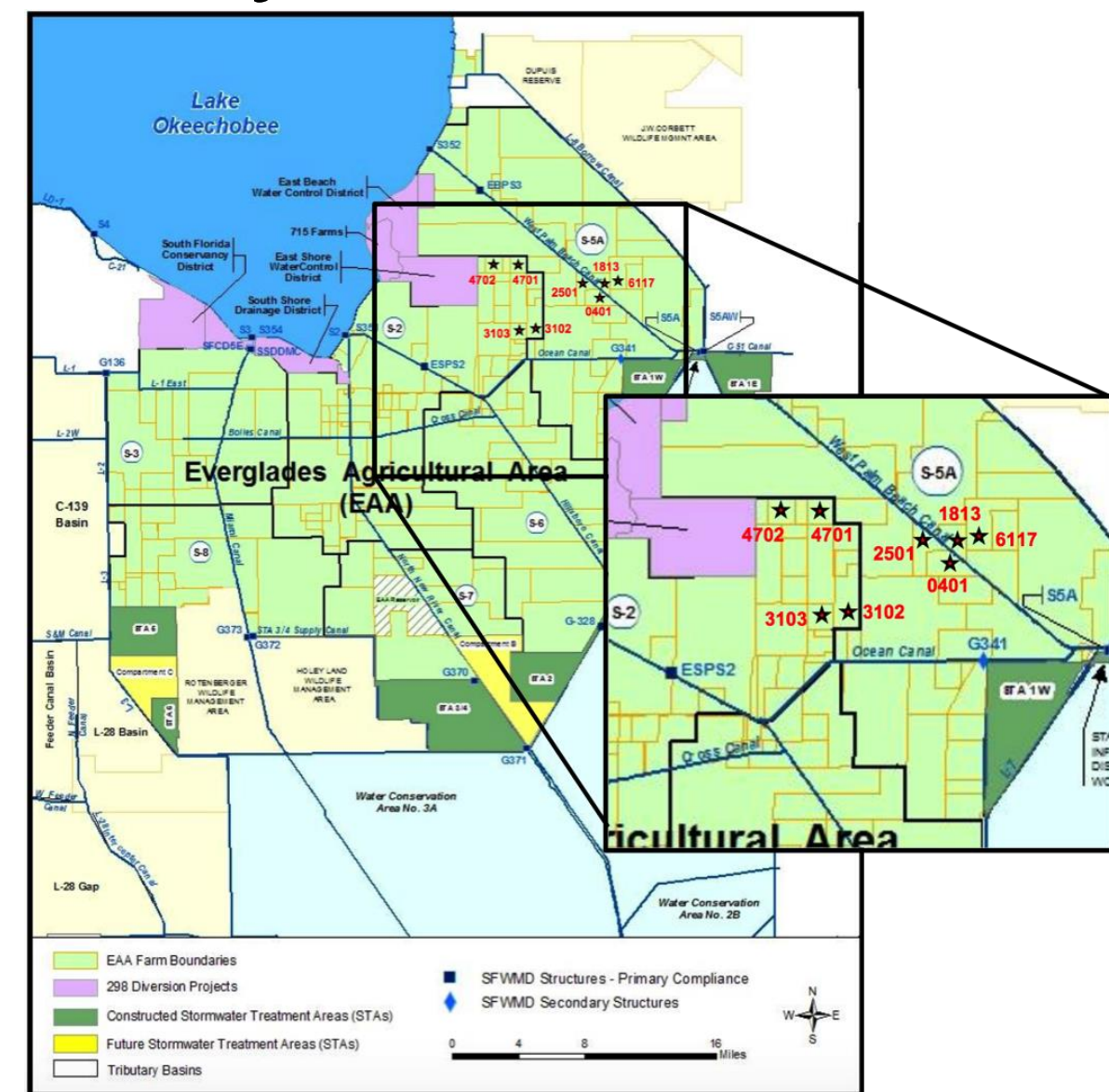
Introduction

We hypothesize that floating aquatic vegetation (FAV) has a significant impact on the ability of agricultural canal sediment to retain and release phosphorus (P) in the Everglades Agricultural Area (EAA) in South Florida.

Expected results of FAV removal:

- Increase in recalcitrant Ca-Mg and Fe-Al bound P;
- Decrease in labile P discharged from farm canals;
- Increased co-precipitation of P with calcium and magnesium (Ca-Mg) into less labile minerals possibly due to increased light penetration into the water column; and
- Increased P sorption with iron and aluminum (Fe-Al) due to increased redox potential from higher dissolved oxygen content.

Study Site



Left: Experimental farm locations within the EAA, depicted with stars and Farm ID; top right: clean canal; bottom right: FAV infestation.

Farm Descriptions

Table 1: Table identifying farm pairs (1, 2, 3, and 4), treatment (T) and control (C) assignment, farm size (acres), and percent land cover by crop type (SC= Sugarcane) for 2012, 2013, and 2014.

Farm ID	Farm Pair	Size (acres)	Crop type (%)	Farm ID	Farm Pair	Size (acres)	Crop type (%)
3102 (T)	1	1387	2012: 50% SC; 50% fallow 2013: 100% SC 2014: 70-89% SC; 11-30% leafy vegetables	6117 (T)	3	781	2012: 90% SC; 10% corn 2013: 80% SC; 20% corn 2014: 100% SC
3103 (C)				1813 (C)			
0401 (T)	2	908	2012: 84% SC; 16% corn 2013: 100% SC 2014: 77% SC; 23% corn	4701 (T)	4	630	2012: 50% SC; 50% fallow 2013: 100% SC 2014: 50% SC; 50% rice
2501 (C)				4702 (C)			

Methods

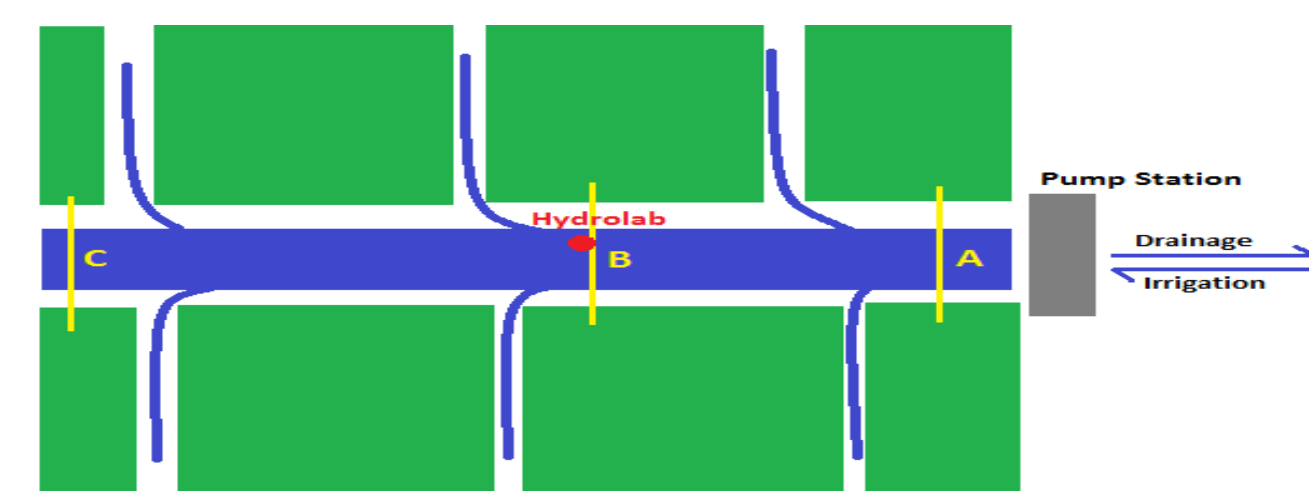
Research is being conducted on eight farms in the EAA, with four treatment-control pairs from 2011-2016. Treatment farms use spot-spraying of herbicide to prevent infestation of FAV, while control farms practice under normal canal management. Normal management can include reducing spray events to lower costs but allowing infestation.

Objective:

- Determine impact of controlling FAV on sediment properties, including P-fractions and water quality

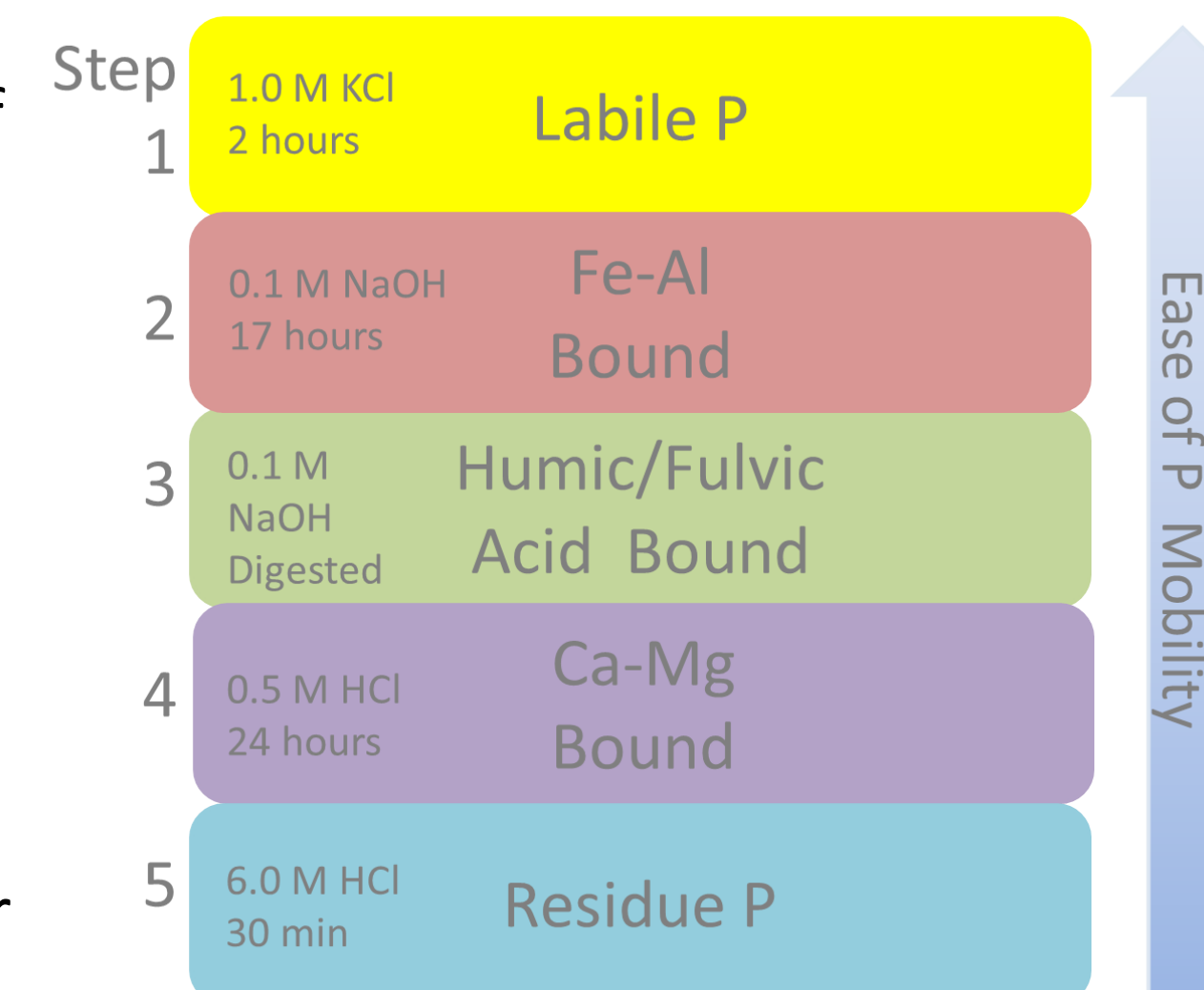
Sediment Sampling

Each farm has three transects, A, B, and C (figure below). Core samples are collected from each transect twice per year (figure right) and sectioned for analysis. Dataloggers collect water quality data at daily, 15-minute intervals year-round at transect B.

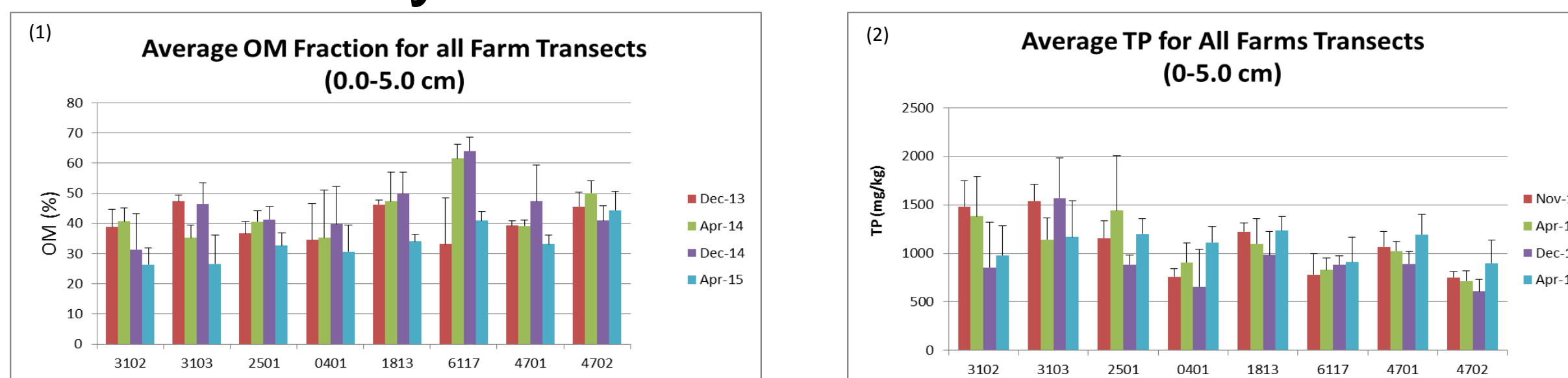


Sequential P-Fractionation

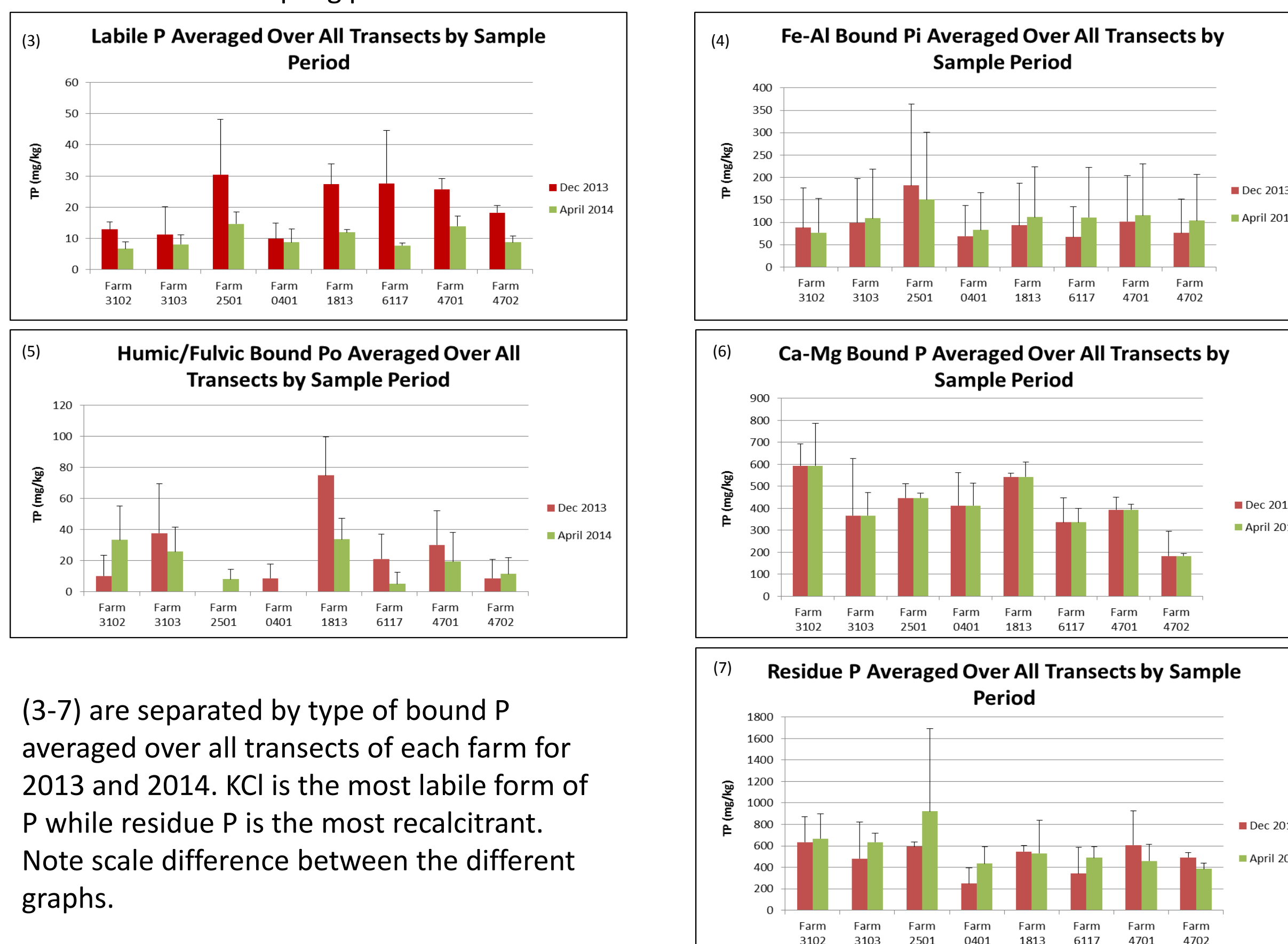
- Phosphorus with varying rates of bioavailability are present in sediments (Reddy et al., 1998);
- Fractionation measures the concentration of labile and recalcitrant P forms in sediment; and
- Chemically treated farms are expected to show differing P fractions from control farms over time.



Preliminary Results



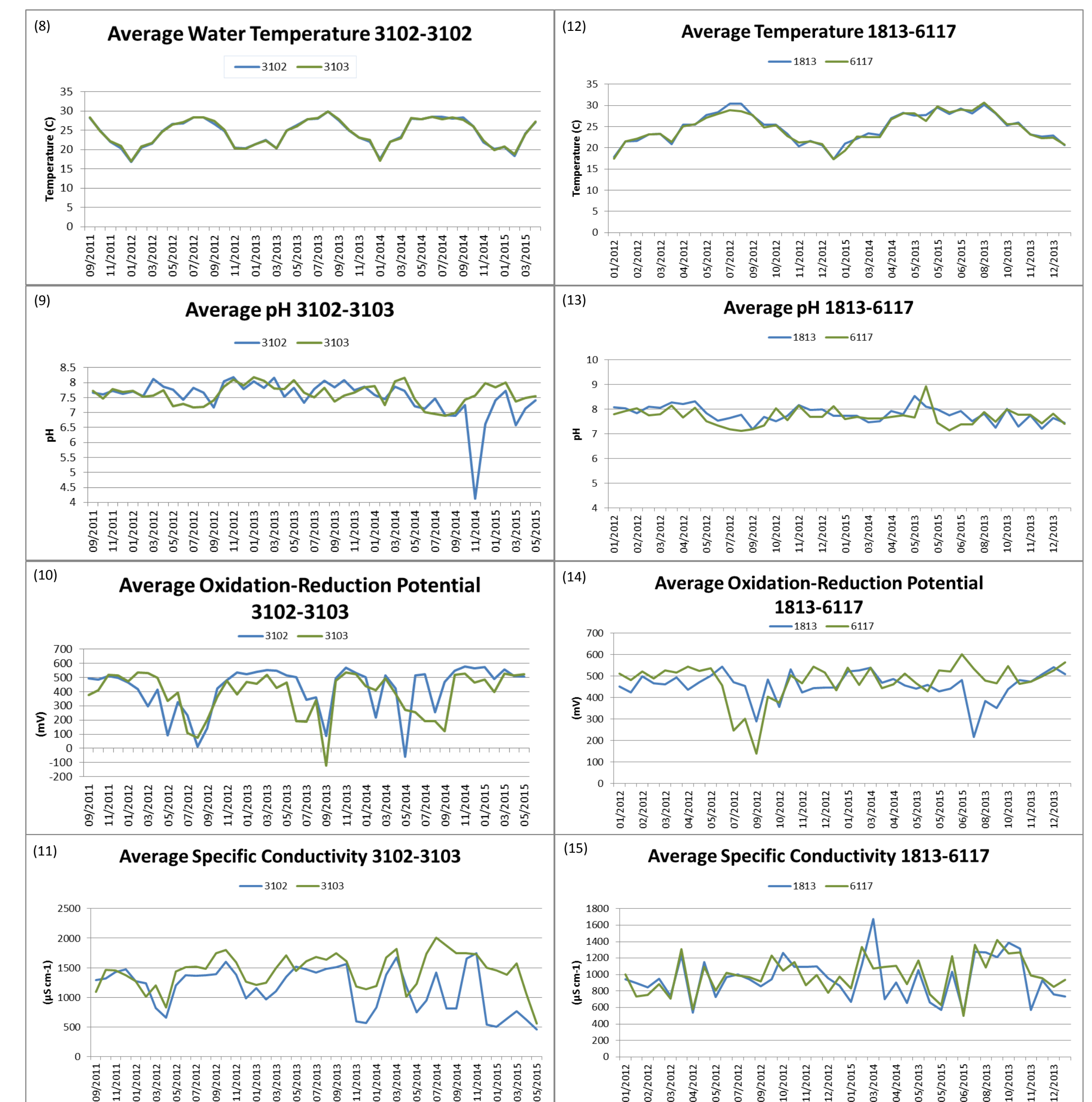
(1) Percent Organic Matter (OM) content averaged for each farm over 2013-2015 sampling periods ranged from 25-65%; (2) Total phosphorus (TP) averaged over all transects for each farm over 2013-2015 sampling periods.



(3-7) are separated by type of bound P averaged over all transects of each farm for 2013 and 2014. KCl is the most labile form of P while residue P is the most recalcitrant. Note scale difference between the different graphs.

Preliminary Water Quality Results

Preliminary water quality data is derived from dataloggers stationed year-round in each canal. Water temperature, pH, oxidation-reduction potential, and specific conductivity data are collected at 15-minute intervals and are averaged by month.



Discussion

Floating aquatic vegetation removal is expected to produce denser, more recalcitrant inorganic P forms that will reduce P transport out of farm canals. Suppression of FAV can potentially serve as an additional management practice in reducing P loads. No significant changes have been detected yet. Sediment fractionation results will be assessed with x-ray diffraction analysis results of dominant sediment minerals.

Future Work

In the future, discharge waters from drainage canals will be collected and suspended sediments settled out. The discharge sediments will undergo p-fractionation analysis to assess nature of P carried out during pumping. Fe-Al content of the canal sediment will be analyzed, as well as equilibrium phosphorus content (EPC), to assess the canal sediment's capacity to retain phosphorus.

Acknowledgements

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