

**Quarterly Report**

**4 December 2013 – 28 February 2014**

**Faculty of  
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11 March 2014

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Please see below for an executive summary, then detail, of major accomplishments, actions, and progress associated with the vegetation and salinity monitoring within the Savannah National Wildlife Refuge. This work is done under Cooperative Agreement Number W912HZ-14-2-0002 under the terms of the Piedmont South Atlantic Coast (PSAC) Cooperative Ecosystems Studies Unit (CESU). The Cooperative Agreement Title is "Identifying and Evaluating Impacts to Wetlands from the Savannah River Estuary".

Respectfully,

Jamie Duberstein  
Clemson University

**Executive Summary:**

A major site reconnaissance was conducted in January, and the 12 marsh monitoring sites were chosen. Seven of these areas were monitored previously by Dr. Kitchens at the Florida Coop Unit. The five new marsh sites were agreed mutually agreed upon by Duberstein and Bailey, under the agreement that three forested areas also be monitored, locations to be determined in the summer, with annual tree/shrub vegetation surveys. The water sensor vendor was quite amenable financially, allowing us the ability to monitor all 15 sites for aboveground and belowground salinity, and water level. Enough water sensors are in-hand for 11 of the 15 areas, with the remaining expected soon. Wells for the sensors are under construction. Sensors will be deployed immediately before, or during, the April marsh vegetation sampling. The processes for purchasing a truck and boat are underway, and we will soon hire our temporary technician. A map of the 12 marsh areas is provided as Figure 1 in the addendum (reconnaissance report). Specific sample locations are provided in Table 1 at the end of this report.

December:

- Official start date is 04 December 2013, according to the US Army Corp of Engineers, Savannah District (USACE).
- Funds were received in December, and an account had been created at Clemson University by 18 December 2013.
- Little was able to be done between the 19 December and the new year.

January:

- Obtained quotes for a boat/motor/trailer package from vendors in Georgia and South Carolina.
- Began processing of the paperwork and ordering of water sensors.
- Got a position approved with Clemson Human Resources, and advertised for the temporary technician to be hired under this grant.
- Field reconnaissance was done in January, and the field reconnaissance report is included as an addendum after the February summary.

February:

- Finalized the order for the water level sensors, and received enough sensors to fully outfit 11 of the 15 monitoring areas. The remaining sensors are expected late March.
- Purchased flat PVC that will be used as the base for mounting wells for underground and aboveground water sampling. Construction of the wells is currently underway.
- Obtained 3 bids for a boat/motor/trailer, all with the same specifications, and submitted them to Clemson Purchasing. A sealed bid process will be used to determine the specific vendor, at which point the equipment can be ordered. I anticipate that I will have to rent a boat for the water sensor deployment and April vegetation sampling; this is readily available.

- Submitted a purchase request to the state contract vendor for a Chevrolet 1500 4x4 truck able to utilize the launching facilities at the refuge, which are often muddy due to tidal action and relatively little use. Vinyl seats were requested, in lieu of cloth. Delivery is expected May or April 2014.
- Received 29 applicants for the Research Technician (term) position that is associated with this project. A short list of 4 applicants was selected for interview in March. Interviews are currently underway.
- Coordinated with Tommy Jordan the site locations and my anticipated data format and storage needs.
- Set a date for the April sample (3<sup>rd</sup> – 12<sup>th</sup>), the 1<sup>st</sup> of the 4 vegetation samples. Two Independent Contractors, outlined in the proposal, are assisting.
- I attended a Motorboat Operator Certification Course and obtained my MOCC certification. I can now be authorized to operate DOI boats, including those of the Savannah Refuge.

## **Addendum: Reconnaissance Report**

### Summary:

Twelve tidal marsh and three tidal forest monitoring sites were chosen, all located within the Savannah National Wildlife Refuge. Seven marsh sites are identical to those historically monitored by Dr. Wiley Kitchens (US Geological Survey Florida Coop Unit). Five marsh sites are new, and locations of monitoring sites have been agreed upon by both the Investigators and the US Army Corp of Engineers. Files associated with this report are provided to the USACE Savannah District via the Google Drive link that was provided. These files include: this report, which includes a map of site locations and a table with site coordinates, a Google Earth \*.KMZ file with marsh sites, an Excel spreadsheet containing the coordinates for all marsh sample sites, and four pictures from each marsh sample site. Pictures of marsh sample sites were taken during the January 2014 reconnaissance trip. Locations of the three forest monitoring stations will be determined following leaf-out (i.e., when leaves are on the trees).

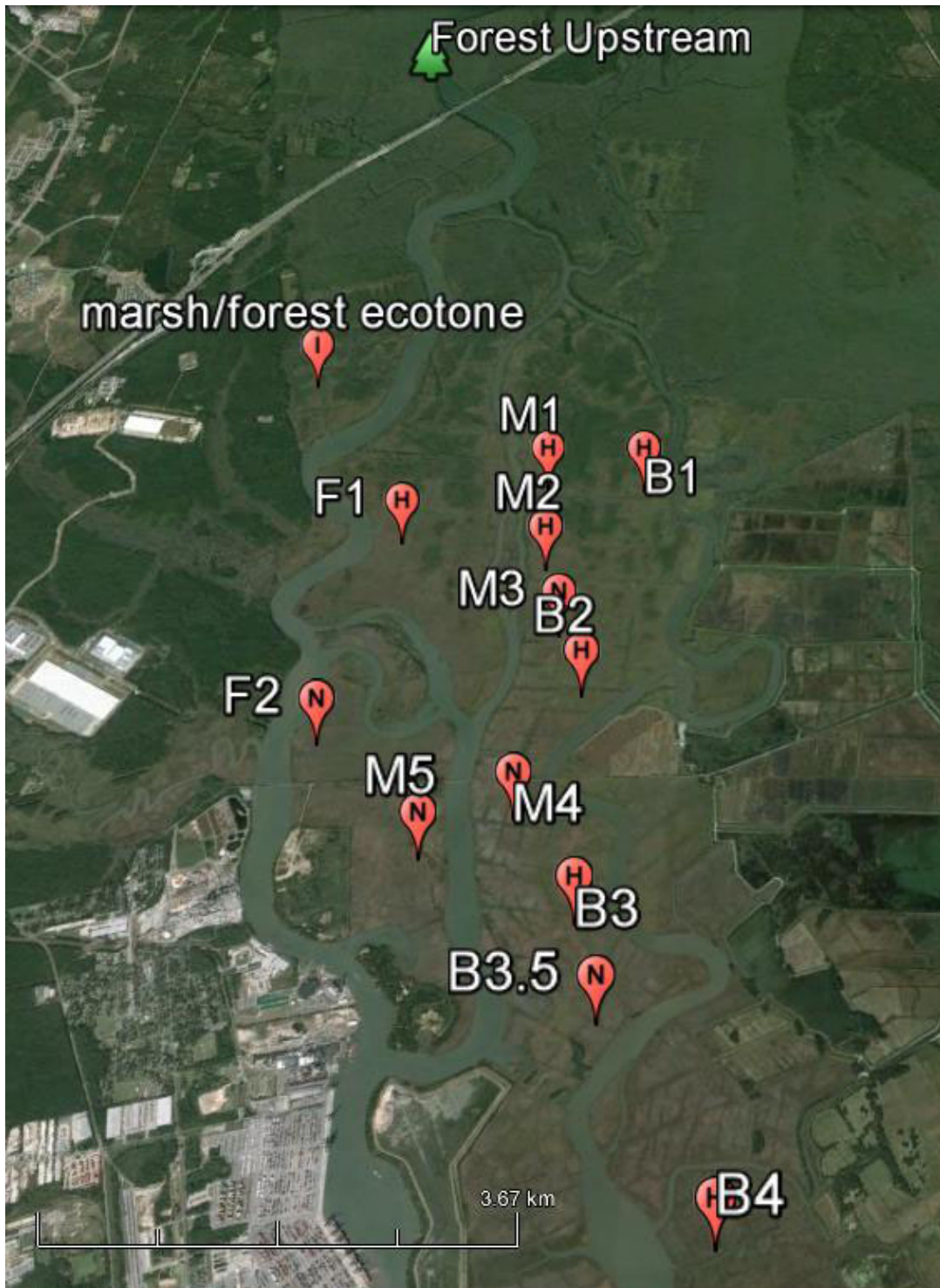


Figure 1: Locations of the twelve marsh monitoring areas. Icons: H depicts historic sites, N depicts new sites, I marks the ecotone between tidal marsh and tidal forest (a mix of both).

## Sample site locations

Nomenclature: Marsh sample site names are a combination of river branch, transect, and plot. For example: Back 1 2A

- **Back** = Back River (versus Middle or Front)
- **1** = area number 1 of the Back River areas; numbering is intra-specific to river branches and begins with 1 as the most upstream area
- **2** = transect number; there are three transects per area, but note that some historic study areas have transects #ed 4, 5, and 6
- **A** = plot along the transect. There are 3 plots located 20, 70, and 120 meters from the bank of the nearby tidal creek

Historic marsh sample sites: Dr. Wiley Kitchens (USGS Florida Coop Unit) monitored seven marsh areas during the years 1985-2006. We will continue to monitor all seven historically monitored areas (Figure 1). However, while Kitchens maintained six transects per area (there were/are seven areas), our study design calls for three transects per area, with the establishment of five new study areas. The choice of which transects to retain for this new monitoring effort was made based on how well transects represent the predominant vegetation of the area, making sure they will all be experiencing the same (or as similar as reasonably possible within field sites) hydrology as the on-site water level (and salinity) recorder. Historic sample sites were reestablished at the same location, made easier by the already existing site markers (i.e., pvc poles); locations were also confirmed by finding the historic salinity well at each marker, and by comparing coordinates (loaded into a GPS) provided in Tidal Wetland Resource Utilization Studies (Kitchens et al. 2003). Some sample site coordinates were unacceptably different than the coordinates we read from our instrumentation during our January 2014 field reconnaissance trip. This was limited to three sample sites, and differences were on the order of 15-20 ft. Specific sites were Back 1 5B; Back 3 3C; and Back 3 4C. Because of the increased accuracy afforded by more advanced GPS technology, coordinates given in Table 1 reflect our adjustments to these three sample sites. Although historic transects were chosen (from the 6 available) in a manner to best represent the hydrology of the river section it is named after (i.e., Back, Middle, Front), some sample sites are

currently occupied by vegetation communities that are outside of the target assemblages. Back 2 transects 2 and 3 are up on the berm (a microtopographical high area typically associated with creek edges) and are dominated by berm species such as cutgrass and wild rice. Back 1 transect 4 pole C is overtaken by a shrubby hazel alder (*alnus serrulata*) tree, but there are nearby patches of marsh. A large portion of this Back 1 site abuts the ecotone between open marsh and dense shrubs, which later transitions to freshwater tidal forest.

New marsh sample sites: Five new marsh study areas were identified during the reconnaissance trip. After doing an on-site visit to the Savannah National Wildlife Refuge, we met with Mackie McIntosh and Bill Bailey (USACE Savannah District) and adjusted our efforts according to locations mutually agreed upon at this 20 January 2014 meeting. My field crew and I then established the five new study areas by putting out site markers (A, B, and C samples sites) along each of the three transects. Pictures of the vegetation were also taken at each sample site. One new Back River area was established between the historic Back 3 and Back 4; it is called Back 3.5. One new Front River area was established downstream of Front 1; it is called Front 2 (Figure 1). Three Middle River areas were established, all downstream of the historic Middle 2; they are named Middle 3, Middle 4, and Middle 5.

Forested sites (all new): Three forested areas will be monitored, and each area will have two (20 x 25 m) sample sites. Vegetative surveys will be conducted yearly, and include identification of all tree species, and a measurement of their diameter at breast height (DBH). All forest areas will be located nearest the Front River (versus Middle or Back), with the site farthest upstream (presumed to be lowest in salinity, if a gradient is identified) already established (Fig. 1), and currently being monitored as part of a separate 10+ year study. Two additional forest areas will be identified after leaf-out (i.e., when leaves are present on the trees), with placement roughly between the established upstream area and the marsh/forest ecotone (Fig. 1).



**Pictures:** Four pictures were taken at each of the marsh sample sites during the reconnaissance trip. These are helpful for visualizing not only the predominant vegetation during this reconnaissance trip, but also for identifying those sample sites that are directly on an ecotone between two communities. It is likely that vegetative sampling will capture both communities at the ecotone, so we will need to be cognizant of this information during our interpretation of analysis results.

Site pictures have been uploaded in \*.jpg format to the folder "Jamie – Marsh Monitoring", available via the Google Drive link that was provided by Ms. McIntosh on 24 January 2014. Sites are identifiable by their file names, following the nomenclature outlined above.

**Water Sensor Locations:** Water level and salinity sensors will be deployed to the same sample sites as the YSI sondes were during previous marsh monitoring (i.e., Dr. Kitchens). Locations of the monitoring wells for marsh sites (new and historic) are indicated in the 'Recorders' column of Table 1, and are displayed as unique icons in the Google Earth \*.kmz file. Monitoring wells in the forested areas will be placed between the two (20 x 25 m) sites. `

Table 1. Locations of marsh monitoring sample sites along the Savannah River. Coordinates are in the UTM system with datum WGS84.

<b>Site</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>	<b>Status</b>	<b>Water Level Recorder?</b>
BACK 1 2A	17S	488298	3561718	Historic	
BACK 1 2B	17S	488296	3561760	Historic	
BACK 1 2C	17S	488289	3561806	Historic	
BACK 1 4A	17S	488134	3561729	Historic	
BACK 1 4B	17S	488132	3561772	Historic	Yes
BACK 1 4C	17S	488122	3561813	Historic	
BACK 1 5A	17S	487982	3561717	Historic	
BACK 1 5B	17S	487981	3561760	Historic	
BACK 1 5C	17S	487977	3561811	Historic	
BACK 2 2A	17S	488024	3559680	Historic	
BACK 2 2B	17S	488020	3559641	Historic	
BACK 2 2C	17S	488020	3559610	Historic	
BACK 2 3A	17S	487893	3559684	Historic	
BACK 2 3B	17S	487892	3559650	Historic	Yes
BACK 2 3C	17S	487892	3559602	Historic	
BACK 2 4A	17S	487766	3559697	Historic	
BACK 2 4B	17S	487771	3559645	Historic	
BACK 2 4C	17S	487771	3559606	Historic	
BACK 3 2A	17S	488326	3557543	Historic	
BACK 3 2B	17S	488348	3557498	Historic	
BACK 3 2C	17S	488366	3557452	Historic	
BACK 3 3A	17S	488130	3557560	Historic	
BACK 3 3B	17S	488123	3557522	Historic	Yes
BACK 3 3C	17S	488122	3557477	Historic	
BACK 3 4A	17S	488063	3557575	Historic	
BACK 3 4B	17S	488062	3557536	Historic	
BACK 3 4C	17S	488057	3557488	Historic	
BACK 3.5 1A	17S	488523	3556592	New	
BACK 3.5 1B	17S	488502	3556547	New	Yes
BACK 3.5 1C	17S	488480	3556501	New	
BACK 3.5 2A	17S	488365	3556684	New	
BACK 3.5 2B	17S	488336	3556642	New	
BACK 3.5 2C	17S	488307	3556600	New	
BACK 3.5 3A	17S	488537	3556647	New	
BACK 3.5 3B	17S	488560	3556691	New	
BACK 3.5 3C	17S	488584	3556736	New	
BACK 4 2A	17S	489479	3554694	Historic	
BACK 4 2B	17S	489496	3554657	Historic	
BACK 4 2C	17S	489510	3554618	Historic	

<b>Site</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>	<b>Status</b>	<b>Recorder?</b>
BACK 4 5A	17S	489561	3554771	Historic	
BACK 4 5B	17S	489542	3554819	Historic	
BACK 4 5C	17S	489529	3554860	Historic	
BACK 4 6A	17S	489722	3554881	Historic	
BACK 4 6B	17S	489731	3554924	Historic	Yes
BACK 4 6C	17S	489739	3554969	Historic	
FRONT 1 1A	17S	486093	3561232	Historic	
FRONT 1 1B	17S	486084	3561197	Historic	Yes
FRONT 1 1C	17S	486068	3561156	Historic	
FRONT 1 2A	17S	486049	3561239	Historic	
FRONT 1 2B	17S	486033	3561210	Historic	
FRONT 1 2C	17S	486019	3561169	Historic	
FRONT 1 3A	17S	485992	3561241	Historic	
FRONT 1 3B	17S	485979	3561217	Historic	
FRONT 1 3C	17S	485959	3561175	Historic	
FRONT 2 1A	17S	485576	3559120	New	
FRONT 2 1B	17S	485576	3559171	New	
FRONT 2 1C	17S	485576	3559221	New	
FRONT 2 2A	17S	485640	3559116	New	
FRONT 2 2B	17S	485643	3559166	New	Yes
FRONT 2 2C	17S	485646	3559216	New	
FRONT 2 3A	17S	485705	3559111	New	
FRONT 2 3B	17S	485709	3559161	New	
FRONT 2 3C	17S	485713	3559210	New	
MIDDLE 1 2A	17S	487286	3561722	Historic	
MIDDLE 1 2B	17S	487282	3561761	Historic	Yes
MIDDLE 1 2C	17S	487276	3561801	Historic	
MIDDLE 1 5A	17S	487425	3561715	Historic	
MIDDLE 1 5B	17S	487437	3561746	Historic	
MIDDLE 1 5C	17S	487445	3561794	Historic	
MIDDLE 1 6A	17S	487503	3561705	Historic	
MIDDLE 1 6B	17S	487501	3561742	Historic	
MIDDLE 1 6C	17S	487501	3561774	Historic	
MIDDLE 2 3A	17S	487395	3560878	Historic	
MIDDLE 2 3B	17S	487393	3560922	Historic	
MIDDLE 2 3C	17S	487388	3560969	Historic	
MIDDLE 2 4A	17S	487467	3560883	Historic	
MIDDLE 2 4B	17S	487468	3560926	Historic	Yes
MIDDLE 2 4C	17S	487467	3560971	Historic	
MIDDLE 2 5A	17S	487546	3560883	Historic	
MIDDLE 2 5B	17S	487536	3560929	Historic	
MIDDLE 2 5C	17S	487525	3560972	Historic	

<b>Site</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>	<b>Status</b>	<b>Recorder?</b>
MIDDLE 3 1A	17S	487418	3560198	New	
MIDDLE 3 1B	17S	487418	3560249	New	
MIDDLE 3 1C	17S	487419	3560299	New	
MIDDLE 3 2A	17S	487581	3560192	New	
MIDDLE 3 2B	17S	487585	3560242	New	Yes
MIDDLE 3 2C	17S	487590	3560291	New	
MIDDLE 3 3A	17S	487741	3560186	New	
MIDDLE 3 3B	17S	487744	3560236	New	
MIDDLE 3 3C	17S	487747	3560287	New	
MIDDLE 4 1A	17S	487312	3558402	New	
MIDDLE 4 1B	17S	487306	3558352	New	Yes
MIDDLE 4 1C	17S	487299	3558303	New	
MIDDLE 4 2A	17S	487522	3558367	New	
MIDDLE 4 2B	17S	487515	3558317	New	
MIDDLE 4 2C	17S	487508	3558267	New	
MIDDLE 4 3A	17S	487326	3558468	New	
MIDDLE 4 3B	17S	487331	3558507	New	
MIDDLE 4 3C	17S	487338	3558556	New	
MIDDLE 5 1A	17S	486833	3558093	New	
MIDDLE 5 1B	17S	486800	3558056	New	
MIDDLE 5 1C	17S	486768	3558017	New	
MIDDLE 5 2A	17S	486776	3558131	New	
MIDDLE 5 2B	17S	486743	3558093	New	Yes
MIDDLE 5 2C	17S	486711	3558054	New	
MIDDLE 5 3A	17S	486708	3558180	New	
MIDDLE 5 3B	17S	486677	3558141	New	
MIDDLE 5 3C	17S	486647	3558102	New	