

**Monthly Report: December 2016**

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**To:**

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12 January 2016

**By:**

Jamie Duberstein

USACE Savannah District:

Please see the bulleted list below for the major actions and accomplishments associated with Cooperative Agreement Number W912HZ-14-2-0002 (Modification Number P00002) for the month of December 2016.

Please let me know if you would like me to elaborate on the details of any items I've listed below, or if there are any status updates you'd like on unlisted topics.

Thank you,

Jamie

### Marsh Vegetation

- There are no updates to report.

### Water Data

- Data from all water sensors were downloaded on 17 and 18 December.
- An updated salinity table is provided (Table 1).
  - The summary includes both measurements timestamped as 06 Nov 6 2016 02:00 (daylight savings time). These two measurements were actually taken an hour apart.
- There were no new salinity data losses since October 2016 (Table 2).
- A "spot check" of belowground salinity conditions were measured using a YSI Pro30 handheld salinity meter during the December sensor download.
  - Salinity values were compared to those measured via Aquatrolls (Table 3).

### Forest monitoring

- Monthly measurements of baldcypress tree growth were last taken on 17 and 18 December at the swamp monitoring areas.
- Average basal area increase since last measurement:
  - Swamp 1: 0.3 cm<sup>2</sup> (17 November – 18 December)
  - Swamp 2: 0.1 cm<sup>2</sup> (18 November – 17 December)
  - Swamp 3: 0.3 cm<sup>2</sup> (18 November – 18 December)
- Annual calendar year 2016 tree growth was calculated for the three forest monitoring areas. Results are presented in Table 4.

Table 1. Fiscal Year 2017 average, maximum, and minimum salinity (psu: practical salinity units) measured via sensors at above- and below-ground locations at (12) marsh monitoring areas and (3) tidal forest areas. Summaries are based on hourly measurements starting 01 October 2016 through 17 December 2016 for all monitoring areas unless noted by superscript; details of data losses are provided in Table 2. Measurements taken during dry well conditions were removed from calculations of summary statistics.

Area	Month	<u>Aboveground Salinity (psu)</u>			<u>Belowground Salinity (psu)</u>		
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max
Back 1	October 2016	0.03 (0.01)	0.00	0.24	0.22 (0.00)	0.12	0.30
	November 2016	0.07 (0.01)	0.00	0.55	0.32 (0.00)	0.26	0.39
	December 2016	0.04 (0.01)	0.00	0.12	0.28 (0.00)	0.22	0.33
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.06 (0.01)	0.00	0.55	0.27 (0.00)	0.12
Back 2	October 2016	0.16 (0.01)	0.00	1.58	0.31 (0.00)	0.19	0.53
	November 2016	0.35 (0.03)	0.00	2.61	0.63 (0.01)	0.28	1.30
	December 2016	0.08 (0.01)	0.00	0.85	0.31 (0.01)	0.18	0.72
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.21 (0.01)	0.00	2.61	0.43 (0.01)	0.18

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max
Back 3	October 2016	0.24 (0.03)	0.00	2.63	1.19 (0.02)	0.41	1.96
	November 2016	0.52 (0.06)	0.00	4.05	1.35 (0.02)	0.38	3.50
	December 2016	0.11 (0.02)	0.00	2.39	0.95 (0.02)	0.30	2.29
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.32 (0.03)	0.00	4.05	1.20 (0.01)	0.30
Back 3.5	October 2016	0.44 (0.04)	0.00	10.27	2.14 (0.01)	1.75	2.44
	November 2016	0.87 (0.07)	0.00	5.37	2.28 (0.00)	2.09	2.73
	December 2016	0.23 (0.03)	0.00	2.74	2.31 (0.00)	2.17	2.37
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.53 (0.03)	0.00	10.27	2.23 (0.00)	1.75

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)			
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max	
Back 4	October 2016	1.01 (0.06)	0.00	8.96	3.68 (0.02)	3.01	4.50	
	November 2016	1.38 (0.11)	0.00	8.80	3.76 (0.02)	3.15	4.18	
	December 2016	0.77 (0.08)	0.00	5.72	4.07 (0.01)	3.80	4.20	
	January 2017							
	February 2017							
	March 2017							
	April 2017							
	May 2017							
	June 2017							
	July 2017							
	August 2017							
	September 2017							
	<b>FY17</b>		1.10 (0.05)	0.00	8.96	3.80 (0.01)	3.01	4.50
	Front 1	October 2016	0.18 (0.02)	0.00	1.23	0.25 (0.00)	0.09	0.60
November 2016		0.42 (0.03)	0.00	1.86	0.56 (0.01)	0.30	0.94	
December 2016		0.09 (0.01)	0.00	0.66	0.49 (0.01)	0.28	0.63	
January 2017								
February 2017								
March 2017								
April 2017								
May 2017								
June 2017								
July 2017								
August 2017								
September 2017								
<b>FY17</b>			0.26 (0.02)	0.00	1.86	0.42 (0.00)	0.09	0.94

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max
Front 2	October 2016	0.52 (0.07)	0.00	12.29	1.43 (0.02)	0.48	6.07
	November 2016	0.83 (0.08)	0.00	6.53	1.84 (0.01)	1.15	2.26
	December 2016	0.20 (0.03)	0.00	5.73	1.72 (0.01)	1.31	2.20
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.56 (0.04)	0.00	12.29	1.65 (0.01)	0.48
Middle 1	October 2016	0.29 (0.02) <sup>a</sup>	0.08 <sup>a</sup>	0.35 <sup>a</sup>	0.55 (0.02)	0.24	9.62
	November 2016	1.11 (0.09)	0.00	3.46	0.88 (0.02)	0.37	1.68
	December 2016	0.40 (0.02)	0.00	0.79	0.88 (0.00)	0.78	0.95
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.77 (0.06) <sup>a</sup>	0.00 <sup>a</sup>	3.46 <sup>a</sup>	0.75 (0.01)	0.24

<sup>a</sup> Incomplete data record. See Table 2 for details.

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)			
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max	
Middle 2	October 2016	0.84 (0.36)	0.00	11.67	0.75 (0.04)	0.19	11.17	
	November 2016	0.34 (0.12)	0.00	6.20	1.44 (0.03)	0.48	5.50	
	December 2016	0.16 (0.03)	0.00	0.94	1.23 (0.03)	0.42	2.00	
	January 2017							
	February 2017							
	March 2017							
	April 2017							
	May 2017							
	June 2017							
	July 2017							
	August 2017							
	September 2017							
	<b>FY17</b>		0.39 (0.10)	0.00	11.67	1.12 (0.02)	0.19	11.17
	Middle 3	October 2016	0.26 (0.26)	0.00	5.92	1.02 (0.04)	0.32	9.64
November 2016		N/A <sup>b</sup>	N/A <sup>b</sup>	N/A <sup>b</sup>	2.01 (0.04)	0.80	5.28	
December 2016		0.43 (0.08)	0.00	1.29	1.57 (0.04)	0.54	2.64	
January 2017								
February 2017								
March 2017								
April 2017								
May 2017								
June 2017								
July 2017								
August 2017								
September 2017								
<b>FY17</b>			0.35 (0.12)	0.00	5.92	1.52 (0.02)	0.32	9.64

<sup>b</sup> There wasn't any aboveground flooding for this reporting period.

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max
Middle 4	October 2016	0.55 (0.09)	0.00	16.89	3.23 (0.07) <sup>a</sup>	1.02 <sup>a</sup>	11.16 <sup>a</sup>
	November 2016	0.81 (0.09)	0.00	7.41	3.74 (0.02)	2.60	4.90
	December 2016	0.16 (0.04)	0.00	6.34	3.80 (0.03)	2.75	5.90
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.55 (0.05)	0.00	16.89	3.60 (0.03) <sup>a</sup>	1.02 <sup>a</sup>
Middle 5	October 2016	0.63 (0.05)	0.00	10.82	1.51 (0.01)	0.92	2.42
	November 2016	0.84 (0.06)	0.00	5.57	1.54 (0.01)	1.17	1.78
	December 2016	0.28 (0.03)	0.00	3.63	1.72 (0.00)	1.70	1.75
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.65 (0.03)	0.00	10.82	1.56 (0.01)	0.92

<sup>a</sup> Incomplete data record. See Table 2 for details.



Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)			
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max	
Swamp 1	October 2016	0.07 (0.00)	0.00	0.43	0.07 (0.00)	0.06	0.08	
	November 2016	0.07 (0.00)	0.00	0.08	0.07 (0.00)	0.06	0.09	
	December 2016	0.05 (0.00)	0.00	0.07	0.08 (0.00)	0.07	0.09	
	January 2017							
	February 2017							
	March 2017							
	April 2017							
	May 2017							
	June 2017							
	July 2017							
	August 2017							
	September 2017							
	<b>FY17</b>		0.06 (0.00)	0.00	0.43	0.07 (0.00)	0.06	0.09
	Swamp 2	October 2016	0.46 (0.09)	0.00	10.95	0.25 (0.00)	0.14	0.37
November 2016		0.43 (0.04)	0.00	1.80	0.33 (0.00)	0.31	0.37	
December 2016		0.24 (0.01)	0.07	0.36	0.29 (0.00)	0.28	0.32	
January 2017								
February 2017								
March 2017								
April 2017								
May 2017								
June 2017								
July 2017								
August 2017								
September 2017								
<b>FY17</b>			0.42 (0.05)	0.00	10.95	0.29 (0.00)	0.14	0.37

Table 1 (cont'd). Fiscal Year 2017 average, maximum, and minimum salinity at above- and below-ground locations in marsh and tidal freshwater forest monitoring areas.

Area	Month	Aboveground Salinity (psu)			Belowground Salinity (psu)		
		Avg. (std. err.)	Min	Max	Avg. (std. err.)	Min	Max
Swamp 3	October 2016	0.25 (0.04)	0.00	5.72	0.32 (0.00)	0.20	0.57
	November 2016	0.38 (0.04)	0.00	3.04	0.39 (0.01)	0.19	0.66
	December 2016	0.17 (0.01)	0.02	0.68	0.36 (0.00)	0.32	0.41
	January 2017						
	February 2017						
	March 2017						
	April 2017						
	May 2017						
	June 2017						
	July 2017						
	August 2017						
	September 2017						
	<b>FY17</b>		0.29 (0.02)	0.00	5.72	0.36 (0.00)	0.19

Table 2. Summary of FY17 salinity data losses from Aquatroll sensors deployed at SHEP monitoring areas between the dates of 01 October - 17 December 2016. Data loss periods and number of days may include periods within FY16. Minor data losses were incurred when data were downloaded near pre-programmed sensor measurements. Water level data losses may be beyond dates listed below.

Area	Position	Data loss period			Reason
		Beginning	End	# Days	
Middle 1	Aboveground	09/28/2016 03:00	10/20/2016 12:00	22.38	Circuit board failure
Middle 4	Belowground	10/09/2016 07:00	10/20/2016 15:00	11.33	Circuit board failure

Table 3. Comparison of belowground salinity measurements taken December 2016 via autonomous sensors (In-Situ Aquatrolls) versus a "spot check" measured via handheld YSI salinity meter (units: parts per thousand = ppt). Reports typically provide summaries of hourly Aquatroll measurements of salinity as practical salinity units (psu) though measurements of total dissolved solids as parts per thousand (ppt) are also collected. Here we report both Aquatroll measurements to facilitate comparisons with handheld YSI measurements. Accuracy of the handheld YSI meter is 0.1 (ppt), while accuracy of the Aquatrolls is 0.001 (psu, ppt); Aquatroll values were rounded to the nearest 0.1 to facilitate comparisons.

Site	Aquatroll Total		YSI "spot check" (ppt)	YSI Measurement Time	Aquatroll Measurement Time
	Aquatroll Salinity (psu)	Dissolved Solids (ppt)			
Back 1	0.2	0.3	0.2	12/17/2016 13:04	12/17/2016 13:00
Back 2	0.2	0.3	0.2	12/17/2016 13:34	12/17/2016 13:00
Back 3	0.7	0.9	0.8	12/17/2016 14:04	12/17/2016 14:00
Back 3.5	2.2	2.7	2.2	12/17/2016 14:30	12/17/2016 14:00
Back 4	3.8	4.5	3.8	12/17/2016 14:50	12/17/2016 14:00
Front 1	0.3	0.4	0.3	12/17/2016 09:33	12/17/2016 09:00
Front 2	1.4	1.8	1.4	12/18/2016 08:52	12/18/2016 08:00
Middle 1	0.8	1.0	0.8	12/17/2016 11:05	12/17/2016 11:00
Middle 2	0.5	0.7	0.9	12/17/2016 10:35	12/17/2016 10:00
Middle 3	0.9	1.2	1.3	12/17/2016 10:02	12/17/2016 10:00
Middle 4	3.3	3.9	3.2	12/17/2016 08:38	12/17/2016 08:00
Middle 5	1.7	2.1	1.7	12/17/2016 08:15	12/17/2016 08:00
Swamp 1	0.1	0.1	0.1	12/18/2016 11:43	12/18/2016 11:00
Swamp 2	0.3	0.4	0.3	12/17/2016 12:17	12/17/2016 12:00
Swamp 3	0.3	0.4	0.3	12/18/2016 10:43	12/18/2016 10:00

Table 4. Calendar year 2016 average tree growth in terms of basal area increment. Averages calculated from dendrometer band measurements from co-dominant baldcypress trees in SHEP monitoring areas.

Area	Sample Size	Basal Area Increment	Standard Error
	(n)	(in <sup>2</sup> per tree)	
Swamp 1	20	1.3	0.1
Swamp 2	20	1.4	0.1
Swamp 3	20	0.8	0.1