

Elevation Change in Berry's Creek Marshes Using Surface Elevation Tables (SETs) and Marker Horizons

Meadowlands Research & Restoration Institute (Fall 2022)

Introduction

Sediment Elevation Tables (SET) provide a constant plane in space from which the change in marsh surface elevation can be measured (USGS 2010). Benchmark rods and marker horizons of feldspar have been established at five sites. The five sites being monitored are Eight Day Swamp (EDS) and Walden Swamp (WS) established in the spring of 2009, Tollgate Marsh (TM) established in the Fall of 2018, and Ackerman Marsh (ACK) and Never Touch Creek (NTC) added in 2021. Each site is measured annually. This report is a summary of the marsh elevation change up to the Fall of 2022.

Figure 1: Images: Location of each SET site

Eight Day Swamp
40°49' 46.4"N 74°4' 35"W



Never Touch Creek
40°50' 7.5"N 74°4' 43"W



Ackerman Creek
40°49' 35"N 74°5' 12"W



Walden Swamp
40°49' 8.1"N 74°5' 9.4"W



Toll Gate Marsh
40°48' 27"N 74°5' 10.4"W



Methods:

Three replicate plots are installed at each of the five sites. At each plot within a site, a total of 36 measurements are made covering the four cardinal directions, which gives a total of 108 measurements per site. Every year, measurements in each site are compared to the previous year and this constitutes a data point. To obtain the rate of elevation change, the last data point value is divided by the number of years elapsed between the establishment of the site. Time elapsed between readings is summarized in this report (Table 1).

Figure 1: Diagram of the SET benchmark plot:

The four outside corners, A, B, C, and D represent feldspar horizon markers. The yellow circle inside with a, b, c, and d are the four cardinal directions in which the pin measurements are taken.

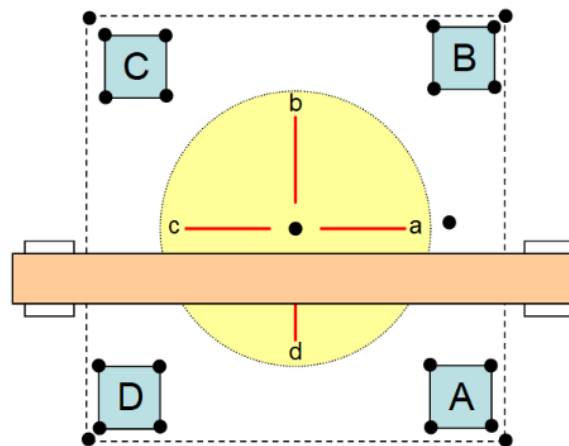


Table 1: Time Elapsed Between SET installation and the latest sampling

Location	Initial Date	Last sampling date	Days since installation	Years since installation
Eight Day Swamp (EDS)	4/30/2009	11/17/2022	4949	13.6
Walden Swamp (WS)	4/30/2009	12/1/2022	4963	13.6
Tollgate Marsh (TM)	11/30/2018	12/1/2022	1462	4.01
Never Touch Creek (NTC)	6/23/2021	12/5/2022	530	1.45
Ackerman Creek (ACK)	5/20/2021	11/9/2022	538	1.47

Table 2: Averages of elevation changes obtained at each of the five sites. The average of all the plots is then divided by the time elapsed since the initial date (Table 1) to derive the rate of elevation change in mm/yr (Table 2a).

Table 2: Average Elevation Change (mm) up to Fall of 2022.

Eight Day Swamp (EDS)		Walden Swamp (WS)		Tollgate Marsh Accretion (TM)		Never Touch Creek Accretion (NTC)		Ackerman Marsh Accretion (ACK)	
All Plots (mm)	106.8	All Plots (mm)	153.7	All Plots (mm)	28.5	All Plots (mm)	27.7	All Plots (mm)	29.8
Std Error	7.7	Std Error	24.4	Std Error	7.3	Std Error	2.1	Std Error	6.6
Plot 1 (mm)	116.0	Plot 1 (mm)	151.0	SM-1 (mm)	14.4	SM-1 (mm)	25.3	SM-1 (mm)	20.0
Std Error	20.0	Std Error	8.0	Std Error	11.0	Std Error	2.7	Std Error	8.0
Plot 2 (mm)	91.4	Plot 2 (mm)	197.2	SM-2 (mm)	32.1	SM-2 (mm)	25.9	SM-2 (mm)	27.2
Std Error	5.2	Std Error	3.1	Std Error	7.1	Std Error	2.7	Std Error	7.1
Plot 3 (mm)	112.8	Plot 3 (mm)	112.8	SM-3 (mm)	38.9	SM-3 (mm)	31.8	SM-3 (mm)	42.3
Std Error	3.3	Std Error	4.4	Std Error	4.3	Std Error	1.9	Std Error	9.5
Elevation rate mm/yr		Elevation rate mm/yr		Elevation rate mm/yr		Elevation rate mm/yr		Elevation rate mm/yr	
7.9		11.3		7.1		19.1		20.3	

Table 2a: Summary of Elevation change and marsh type

Site	Marsh Type	Dominant Vegetation	Rate of Elevation Change (mm/yr)
Eight Day Swamp	High	Phragmites	7.9
Walden Swamp	High	Phragmites	11.3
Tollgate Marsh	High	Phragmites	7.1
Never Touch Creek	High	Phragmites	19.1
Ackerman Marsh	Low	Phragmites	20.3

Feldspar horizons were placed inside three corners of each plot. The sediment between the white feldspar marker and the horizon is measured. One reading is taken at each of the three corners resulting in a total of nine values per site. The average of all readings is shown in Table 3a. All recoverable values are included in the calculation for accretion rate. To obtain a yearly rate, total accretion is divided by the number of years that have elapsed between establishment of the benchmark and the latest reading. Thirteen years elapsed between the readings summarized in this report. Table 1 provides the dates for each reading and the time elapsed in days and years.

Table 3: Average Accretion Tables (mm) - Fall 2022 sampling

Eight Day Swamp (EDS)		Walden Swamp (WS)		Tollgate Marsh Accretion (TM)		Never Touch Creek Accretion (NTC)		Ackerman Marsh Accretion (ACK)	
All Plots (mm)	73.3	All Plots (mm)	71.7	All Plots (mm)	46.7	All Plots (mm)	31.7	All Plots (mm)	21.4
Std Error	4.4	Std Error	1.7	Std Error	1.7	Std Error	1.7	Std Error	3.6
SM-1 (mm)	80.0	WS-1 (mm)	70.0	TM-1 (mm)	50.0	SM-1 (mm)	30.0	SM-1 (mm)	15.0
Std Error	-	Std Error	-	Std Error	-	Std Error	-	Std Error	-
SM-2 (mm)	65.0	WS-2 (mm)	70.0	TM-2 (mm)	45.0	SM-2 (mm)	30.0	SM-2 (mm)	21.7
Std Error	-	Std Error	-	Std Error	-	Std Error	-	Std Error	3.3
SM-3 (mm)	75.0	WS-3 (mm)	75.0	TM-3 (mm)	45.0	SM-3 (mm)	35.0	SM-3 (mm)	27.5
Std Error	-	Std Error	-	Std Error	-	Std Error	-	Std Error	2.5

Table 3a: Average Accretion Rate - Fall 2022 sampling

Site	Accretion Rate (mm/yr)
Eight Day Swamp (EDS)	5.4
FWalden Swamp (WS)	5.3
Tollgate Marsh Accretion (TM)	11.6
Never Touch Creek Accretion (NTC)	21.8
Ackerman Marsh Accretion (ACK)	14.5

**Table 4: Summary of Elevation and Accretion rate up to the Fall of 2022.
Eight Day Swamp, Walden Swamp, Tollgate Marsh, Never Touch Creek Marsh and Ackerman Marsh**

Eight Day Swamp												
Days	0	378	736	1322	1819	2188	3115	3515	3827	4249	4590	4949
Sample Date	4/30/09	5/13/10	5/6/11	12/12/12	4/23/14	4/27/15	11/9/17	12/14/18	10/22/19	12/17/20	11/23/21	11/17/22
Elevation Rate mm/yr	0	19.1	18.7	14.4	11.6	9.0	7.3	7.3	8.2	7.1	8.1	7.9
Accretion Rate mm/yr	0	5.9	5.7	5.7	6.1	7.2	3.9	5.5	6.5	5.1	6.2	5.4

Walden Swamp												
Days	0	378	736	1310	1824	2198	3120	3501	3807	4247	4589	4963
Sample Date	4/30/09	5/13/10	5/6/11	11/30/12	4/28/14	5/7/15	11/14/17	11/30/18	10/2/19	12/15/20	11/22/21	12/1/22
Elevation Rate mm/yr	0	40.3	32.8	22.4	18.4	12.9	10.2	12.4	11.8	10.6	11.3	11.3
Accretion Rate mm/yr	0	3.8	8.4	9.4	7.9	8.2	5.9	5.9	5.5	-	7.7	5.3

Tollgate Marsh					
Days	0.00	305.00	740.00	1088.00	1462.00
Sample Date	11/30/18	10/1/19	12/9/20	11/22/21	12/1/22
Elevation Rate mm/yr	0.0	-8.6	0.6	6.2	7.1
Accretion Rate mm/yr	0.0	2.0	13.7	10.1	11.6

Never Touch Creek Marsh			
Days	0	175	530
Sample Date	6/23/21	12/15/21	12/5/22
Elevation Rate mm/yr	0.0	35.1	19.0
Accretion Rate mm/yr	0.0	0.0	21.8

Ackerman Marsh (ACK)			
Days	0	193	538
Sample Date	5/20/21	11/29/21	11/9/22
Elevation Rate mm/yr	0.0	66.1	20.2
Accretion Rate mm/yr	0.0	0.0	14.5

Conclusion

In the Fall of 2022, Eight Day Swamp showed an annual elevation change of 7.9 mm/yr and an accretion rate of 5.4 mm/yr. Walden Swamp showed an annual elevation change of 11.3 mm/yr and an accretion rate of 5.3 mm/yr. Tollgate Marsh showed an annual elevation change of 7.1 mm/yr and an accretion rate of 11.7 mm/yr. Ackerman and Never Touch Creek SET plots were installed in the Spring of 2021. Never Touch Creek Marsh showed an annual elevation change of 19.0 mm/yr and an accretion rate of 21.8 mm/yr. Ackerman Marsh showed an annual elevation change of 20.2 mm/yr and an accretion rate of 14.5 mm/yr.

References

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