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

Meadowlands Research & Restoration Institute (Fall 2024)

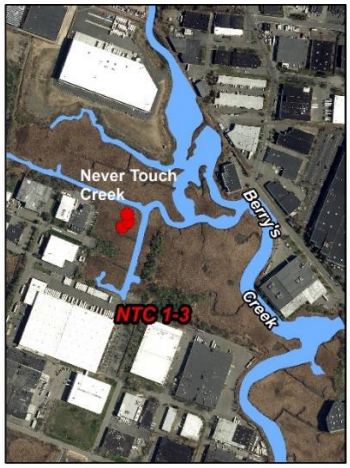
Introduction

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 2024.

Figure 1: Images: Location of each SET site

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

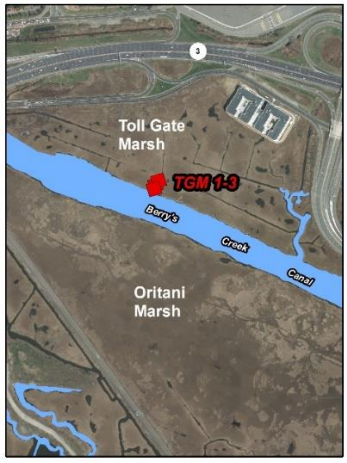
Never Touch Creek
40°50' 7.5"N 74°4' 43"W



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.

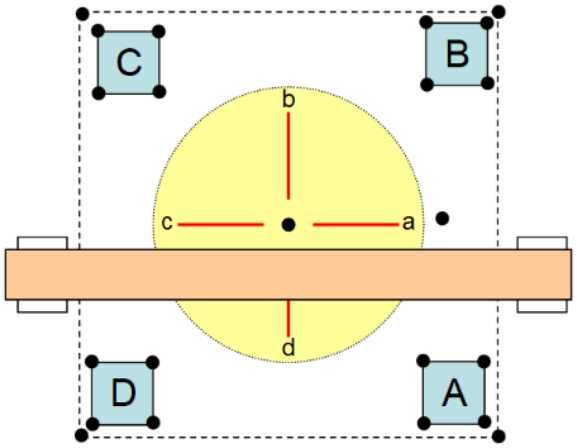


Table 1: Time Elapsed Between SET installation and the latest sampling

Location	Initial Date	Last sampling date	Days since installation	Years since installation
Eight Day Swamp (EDS)	4/30/2009	12/10/2024	5703	15.62
Walden Swamp (WS)	4/30/2009	12/9/2024	5702	15.62
Tollgate Marsh (TM)	11/30/2018	12/4/2024	2196	6.02
Never Touch Creek (NTC)	6/23/2021	11/20/2024	1246	3.41
Ackerman Creek (ACK)	5/20/2021	11/13/2024	1273	3.48

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 2024.

Eight Day Swamp (EDS)		Walden Swamp (WS)		Tollgate Marsh (TM)		Never Touch Creek (NTC)		Ackerman Marsh (ACK)	
All Plots (mm)	112.1	All Plots (mm)	166.7	All Plots (mm)	48.4	All Plots (mm)	29.4	All Plots (mm)	41.6
Std Error	8.9	Std Error	23.1	Std Error	9.6	Std Error	1.3	Std Error	9.4
EDS 1 (mm)	125.6	WS 1 (mm)	155.0	TM 1 (mm)	36.6	NTC 1 (mm)	29.7	ACK 1 (mm)	26.0
SE	14.7	SE	6.8	Std Error	7.1	Std Error	3.6	Std Error	7.8
EDS 2 (mm)	95.4	WS 2 (mm)	211.2	TM 2 (mm)	41.3	NTC 2 (mm)	27.1	ACK 2 (mm)	40.3
SE	7.2	SE	3.2	Std Error	5.9	Std Error	5.4	Std Error	5.7
EDS 3 (mm)	115.4	WS 3 (mm)	133.8	TM 3 (mm)	67.4	NTC 3 (mm)	31.4	ACK 3 (mm)	58.5
SE	9.2	SE	4.5	Std Error	5.2	Std Error	2.0	Std Error	6.4

Table 2a: Summary of Elevation change and marsh type.

Berry's Creek Sites	Marsh Type	Dominant Vegetation	Rate of Elevation Change (mm/yr)
Eight Day Swamp (EDS)	High Marsh	*Phragmites australis*	7.2
Walden Swamp (WS)	High Marsh	*Phragmites australis*	10.7
Tollgate Marsh (TM)	High Marsh	*Phragmites australis*	8.1
Never Touch Creek (NTC)	High Marsh	*Phragmites australis*	8.6
Ackerman Marsh (ACK)	Low Marsh	*Phragmites australis*	11.9

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. Table 1 provides the dates for each reading and the time elapsed in days and years.

Table 3: Average Accretion Tables (mm) - Fall 2024 sampling.

Eight Day Swamp (EDS)		Walden Swamp (WS)		Tollgate Marsh Accretion (TM)		Never Touch Creek Accretion (NTC)		Ackerman Marsh Accretion (ACK)	
All Plots (mm)	86.11	All Plots (mm)	87.44	All Plots (mm)	50.00	All Plots (mm)	32.28	All Plots (mm)	27.22
Std Error	6.83	Std Error	2.79	Std Error	2.89	Std Error	1.04	Std Error	2.42
EDS-1 (mm)	73.33	WS-1 (mm)	87.33	TM-1 (mm)	45.00	NTC-1 (mm)	31.00	ACK-1 (mm)	31.67
Std Error	1.67	Std Error	2.50	Std Error	-	Std Error	1.00	Std Error	-
EDS-2 (mm)	88.33	WS-2 (mm)	92.33	TM-2 (mm)	55.00	NTC-2 (mm)	34.33	ACK-2 (mm)	26.67
Std Error	6.67	Std Error	1.45	Std Error	-	Std Error	0.67	Std Error	1.67
EDS-3 (mm)	96.67	WS-3 (mm)	82.67	TM-3 (mm)	50.00	NTC-3 (mm)	31.50	ACK-3 (mm)	23.33
Std Error	1.67	Std Error	1.00	Std Error	-	Std Error	1.50	Std Error	2.50

Table 3a: Average Accretion Rate - Fall 2024 sampling

Site	Accretion Rate (mm/yr)
Eight Day Swamp (EDS)	5.5
Walden Swamp (WS)	5.6
Tollgate Marsh (TM)	8.3
Never Touch Creek (NTC)	9.5
Ackerman Marsh (ACK)	7.8

Table 4: Summary of Elevation and Accretion rate up to the Fall of 2024.
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	5334	5703
Sample Date	4/30/2009	5/13/2010	5/6/2011	12/12/2012	4/23/2014	4/27/2015	11/9/2017	12/14/2018	10/22/2019	12/17/2020	11/23/2021	11/17/2022	12/7/2023	12/10/2024
Elevation Rate mm/yr	0	19.07	18.67	14.40	11.64	8.99	7.30	7.33	8.16	7.09	8.08	7.87	7.67	7.17
Accretion Rate mm/yr	0	5.92	5.68	5.74	6.05	7.23	3.93	5.45	6.45	5.11	6.23	5.41	5.70	5.51

Walden Swamp														
Days	0	378	736	1310	1824	2198	3120	3501	3807	4247	4589	4963	5332	5702
Sample Date	4/30/2009	5/13/2010	5/6/2011	11/30/2012	4/28/2014	5/7/2015	11/14/2017	11/30/2018	10/2/2019	12/15/2020	11/22/2021	12/1/2022	12/5/2023	12/9/2024
Elevation Rate mm/yr	0	40.27	32.82	22.40	18.37	12.93	10.19	12.35	11.75	10.59	11.27	11.30	11.34	10.67
Accretion Rate mm/yr	0	3.77	8.40	9.38	7.92	8.16	5.91	5.93	5.45	-	7.72	5.27	5.82	5.60

Tollgate Marsh							
Days	0	305	740	1088	1462	1830	2196
Sample Date	11/30/2018	10/1/2019	12/9/2020	11/22/2021	12/1/2022	12/4/2023	12/4/2024
Elevation Rate mm/yr	0.00	-8.63	0.60	6.22	7.11	5.66	8.05
Accretion Rate mm/yr	0.00	1.99	13.70	10.06	11.65	9.97	8.31

Never Touch Creek Marsh					
Days	0	175	530	880	1246
Sample Date	6/23/2021	12/15/2021	12/5/2022	11/20/2023	11/20/2024
Rate mm/yr	0.0	35.1	19.0	11.9	8.6
Accretion mm/yr	0.0	0.0	21.8	12.4	9.5

Ackerman Marsh (ACK)					
Days	0	193	538	907	1273
Sample Date	5/20/2021	11/29/2021	11/9/2022	11/13/2023	11/13/2024
Rate mm/yr	0.0	66.1	20.2	16.7	14.1
Accretion mm/yr	0.0	0.0	14.5	10.3	7.8

Conclusion

In the Fall of 2024, Eight Day Swamp showed an annual elevation change of 7.2 mm/yr and an accretion rate of 5.5 mm/yr. Walden Swamp showed an annual elevation change of 10.7 mm/yr and an accretion rate of 5.6 mm/yr. Tollgate Marsh showed an annual elevation change of 8.1 mm/yr and an accretion rate of 8.3 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 8.6 mm/yr and an accretion rate of 9.5 mm/yr. Ackerman Marsh showed an annual elevation change of 14.1 mm/yr and an accretion rate of 7.8 mm/yr.

References

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