

Capped Artesian Wells on Fire Island

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Introduction

In October 2012, NPS biologists re-surveyed vegetation in five of the six artesian well sites along Fire Island. The primary focus of the survey was to determine if vegetation communities changed since they were last surveyed in 2003. The vegetation survey design from (Hanley 2004) was replicated and results from both surveys (2003 and 2012) were compared to one another. Overall differences between the two surveys (almost a decade apart) were not significant.

Study Sites

Six artesian wells on FIIS were included in the original vegetation-monitoring program (Figure 9). The vegetation in each of the six wells was sampled in 2001 and wells were capped in 2002. The vegetation was re-sampled in 2003, followed by FIIS's survey in 2012.

Three of the wells are located in the island's federally-designated wilderness area, two near Bellport Beach -- Bellport North and Bellport South and one at Smith Point. These three sites are similar in water regime and vegetation type. The other three wells are found in the proximity of Lighthouse Tract, Sailors Haven, and Talisman (Hanley 2004).

Methods

In 2012, NPS biologists re-located the capped well sites by following GPS points found in Hanley (2004). Locating the sites proved difficult due to lack of markers indicating vegetation plots. Some plots were marked with wooden stakes while others were marked with rebar, or both. GPS points and compass directions were originally used to select vegetation plots and those directions were used again by biologists in 2012 (Fig.2-7).

As done in 2003, data was collected based on the NPS protocol for salt marsh vegetation monitoring (Roman et al., 2001). The point intercept method was utilized to enable estimation of percent cover by area for each plant species (Poissonet et. al, 1972). At each plot location a 1 x 1 meter sample grid was constructed using a meter stick and five 1-m long metal poles. Each of the orange grid poles was marked in 10-cm increments with green tape (Figure 8).

On October 12th, 16th, and 24th, five well sites were re-sampled with the method outlined above to evaluate vegetation change. A digital camera was used to photographically record each well site in 2012.

The only well not re-sampled was the Sailors Haven. Due to the nature of the low-lying wetland, only one marker (a wooden post) was located after much effort. Finding one marker alone was not sufficient to properly locate the original vegetation plots and therefore was unable to be resampled. In the future when time allows, it is suggested biologists search the area for any submerged rebar with a metal detector in hopes of finding the original locations.

Plant species identification follows nomenclature using (Gleason and Cronquist, 1991). All statistical analysis for this report was done using JMP 9.0 from SAS.

Results

In 2012, the most dominate species found within the plots at the Lighthouse Tract were: *Myrica pensylvanica* (Bayberry), *Carex scoparia* (broom sedge), *Juniperus virginiana* (Eastern Red-cedar), *Juncus greenei* (Greene's rush), and *Toxicodendron radicans* (Poison Ivy). The percent cover for each species was: $33.5 \pm 14.7\%$, $18.1 \pm 11.8\%$, $9.7 \pm 6.6\%$, $4.5 \pm 4.5\%$, $3.7 \pm 1.8\%$, respectively. Bare ground/litter showed a high percentage of $24.8 \pm 16.75\%$.

The most dominate species found within the plots at the Talisman were: *Myrica pensylvanica* (Bayberry), *Prunus serotina* (Black Cherry), *Juncus greenei* (Greene's rush), and *Achillea millefolium* (Yarrow). The percent cover for each species was: $45.0 \pm 13.6\%$, $9.4 \pm 9.4\%$, $4.7 \pm 4.7\%$, $4.1 \pm 4.1\%$ respectively. Bare ground/litter showed a high percentage of $17.9 \pm 13.2\%$.

The most dominate species found within the plots at the Bellport south site were: *Myrica pensylvanica* (Bayberry), *Phragmites australis* (common reed), *Rubus sp.* (dewberry), *Toxicodendron radicans* (Poison Ivy), and *Smilax rotundifolia* (greenbrier). The percent cover for each species was: $33.2 \pm 5.1\%$, $20.7 \pm 6.2\%$, $11.8 \pm 5.2\%$, $10.5 \pm 3.8\%$, $9.8 \pm 4.5\%$, respectively.

The most dominate species found within the plots at the Bellport north site were: *Myrica pensylvanica* (Bayberry), *Smilax rotundifolia* (greenbrier), *Rubus sp.* (dewberry), *Prunus maritima* (beach plum), and *Euthamia tenuifolia* (slender fragrant goldenrod). The percent cover for each species was: $30.5 \pm 6.4\%$, $16.4 \pm 2.8\%$, $8.9 \pm 3.3\%$, $7.0 \pm 4.8\%$, $6.9 \pm 3.3\%$, respectively. Bare ground/litter showed a high percentage of $18.6 \pm 5.3\%$.

The most dominate species found within the plots at Smith Point were: *Myrica pensylvanica* (Bayberry), *Rubus sp.* (dewberry), *Toxicodendron radicans* (poison ivy), *Prunus maritima* (beach plum), *Rosa sp.* (Dewberry), *Euthamia tenuifolia* (slender fragrant goldenrod), and *Celastrus orbiculatus* (oriental bittersweet). The percent cover for each species was: $17.3 \pm 5.1\%$, $13.5 \pm 2.1\%$, $11.5 \pm 3.7\%$, $9.5 \pm 5.0\%$, $8.4 \pm 3.1\%$, $7.8 \pm 5.3\%$, 5.2 ± 2.4 respectively. Bare ground/litter showed a high percentage of $17.2 \pm 7.9\%$.

Tables (1-5) shows all data at each site, comparing 2003 percent cover with 2012.

Discussion

Hanley 2004 indicated that the greatest amount of change, since they were capped, appeared to be at the Lighthouse Tract. The next three sites that underwent moderate changes in vegetation type were all in the wilderness area of Fire Island (Bellport north, Bellport south, and Smith Point). Talisman and Sailors Haven underwent the least amount of change. Hanley 2004 noted that the Talisman and Sailors Haven sites were not fully capped, which is a possible explanation for the minimal change.

There seems to be no significant changes in vegetation at all the sites on Fire Island when comparing the results from 2003 to 2012. *Toxicodendron radicans* seemed to be the only species with the most change; this change only occurred in two sites (Bellport south and Smith Point). Paired t-test showed that this species had a statistically significant decline; Bellport south fell from $33.0 \pm 7.3\%$ (2003) to $10.5 \pm 3.8\%$ (2012) and Smith Point fell from $28.6 \pm 4.1\%$ (2003) to $11.5 \pm 3.7\%$ (2012).

The data also seems to indicate that some plots experienced an increase in non-native invasive species (i.e. *Phragmites australis* and *Celastrus orbiculatus*). Again, there was no significance to these fluctuations but it is worth noting because these species have the potential to spread rapidly.

Overall the analysis done in 2012 indicates that the sites experienced little to no change over the last decade. While the data shows that some species fluctuated, the overall species composition was still the same and a change in the vegetation community could not be supported statistically. More plots would have helped in the analysis but we could only work with the survey design established in 2001. The lack of replication also accounts for the large standard errors in the percent cover for the species (Tables 1-5).

After the 2012 vegetation surveys the Lighthouse tract and Smith Point well sites were completely covered by sand from Super Storm Sandy. It would be interesting to survey these areas in the future to see how they will change over time.

References Cited

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Tables and Figures

Table 1. Lighthouse Tract site. Comparison of percent species covers in 2003 and 2012

Species	2003 Percent Cover	2012 Percent Cover
<i>Toxicodendron radicans</i>	9.1±6.3	3.7±1.8
<i>Myrica pensylvanica</i>	24.8±14.7	33.5±14.7
<i>Rosa spp</i>	0	0.9±0.9
<i>Prunus maritima</i>	0	1.2±1.2
<i>Juncus greenei</i>	3.9±3.2	4.5±4.5
<i>Euthamia tenuifolia</i>	8.4±6.1	0
<i>Achillea millefolium</i>	4.3±4.3	1.1±1.1
<i>Parthenocissus quinquefolia</i>	0	1.1±1.1
<i>Juniperus virginiana</i>	4.3±3.2	9.7±6.6
<i>Lechea maritima</i>	9.1±9.1	0
<i>Carex scoparia</i>	2.4±2.4	18.1±11.8
<i>Anaphalis margaritacea</i>	2.8±2.8	0
<i>Deschampsia flexuosa</i>	6.5±6.5	0
<i>Bromus tectorum</i>	5.0±3.9	0
Bare Ground/Litter	17.9±8.2	24.8±16.7
TOTAL	81.9±8.1	75.3±16.8

Table 2. Talisman site. Comparison of percent species covers in 2003 and 2012

Species	2003 Percent Cover	2012 Percent Cover
<i>Myrica pensylvanica</i>	57.1±10.5	45.0±13.6
<i>Rubus sp.</i>	1.1±0.4	2.9±1.7
<i>Prunus maritima</i>	0.4±0.4	2.7±2.7
<i>Juncus greenei</i>	0	4.7±4.7
<i>Achillea millefolium</i>	0	4.1±4.1
<i>Prunus serotina</i>	14.2±6.4	9.4±9.4
<i>Juniperus virginiana</i>	0.6±0.6	0
<i>Amelanchier canadensis</i>	0.6±0.6	0
<i>Baccharis halimifolia</i>	5.9±4.8	0
<i>Polygonum scandens</i>	0.3±0.3	0
<i>Lonicera spp</i>	0.6±0.6	0
<i>Carex spp</i>	1.8±1.8	0
<i>Sassafras albidum</i>	0	0.7±0.7
Mud/Water	4.1±4.1	3.1±2.3
Bare Ground/Litter	12.5±7.3	17.9±13.2
TOTAL	88.0±7.5	82.1±13.2

Table 3. Bellport south site. Comparison of percent species covers in 2003 and 2012. (*↓) statistically significant decline using paired t-test.

Species	2003 Percent Cover	2012 Percent Cover
<i>Toxicodendron radicans</i>	33.0±7.3	10.5±3.8(*↓)
<i>Phragmites australis</i>	17.1±4.6	20.7±6.2
<i>Myrica pensylvanica</i>	26.7±3.9	33.2±5.1
<i>Rubus sp.</i>	1.8±1.8	11.8±5.2
<i>Rosa spp</i>	3.3±3.3	0
<i>Smilax rotundifolia</i>	0.6±0.6	9.8±4.5
<i>Parthenocissus quinquefolia</i>	4.9±1.3	3.9±3.2
<i>Amelanchier canadensis</i>	3.7±2.1	2.0±1.6
<i>Lycopus spp</i>	3.6±1.2	0(*↓)
<i>Polygonum scandens</i>	2.1±1.2	0
<i>Myrica gale</i>	0	0.8±0.8
Bare Ground/Litter	1.8±0.8	7.6±4.4
TOTAL	98.2±0.8	92.4±4.4

Table 3. Bellport north site. Comparison of percent species covers in 2003 and 2012.

Species	2003 Percent Cover	2012 Percent Cover
<i>Toxicodendron radicans</i>	12.7±10.4	1.9±1.0
<i>Myrica pensylvanica</i>	18.5±5.3	30.5±6.4
<i>Rubus sp.</i>	15.8±7.3	8.9±3.3
<i>Rosa spp</i>	4.8±3.2	1.0±0.6
<i>Prunus maritima</i>	0.8±0.8	7.0±4.8
<i>Celastrus orbiculatus</i>	7.5±4.7	0.7±0.7
<i>Teucrium canadense</i>	0	0.4±0.4
<i>Euthamia tenuifolia</i>	3.7±3.7	6.9±3.3
<i>Smilax rotundifolia</i>	16.2±4.5	16.4±2.8
<i>Parthenocissus quinquefolia</i>	13.6±5.0	2.6±0.7
<i>Rumex sp.</i>	0.3±0.3	0.4±0.4
<i>Smilax glauca</i>	0	2.7±1.4
<i>Juniperus virginiana</i>	0	0.3±0.3
<i>Amelanchier canadensis</i>	2.0±1.5	0
<i>Baccharis halimifolia</i>	0	1.6±1.6
Bare Ground/Litter	4.2±2.8	18.6±5.3
TOTAL	95.9±2.7	81.5±5.3

Table 5. Smith Pint site. Comparison of percent species covers in 2003 and 2012. (*↓) statistically significant decline using paired t-test.

Species	2003 Percent Cover	2012 Percent Cover
<i>Toxicodendron radicans</i>	28.6±4.1	11.5±3.7(*↓)
<i>Phragmites australis</i>	26.7±9.5	3.1±1.8
<i>Erechtites hieracifolia</i>	0.4±0.4	0
<i>Onoclea sensibilis</i>	1.6±1.6	0
<i>Myrica pensylvanica</i>	4.2±1.9	17.3±5.1
<i>Rubus sp.</i>	9.8±5.4	13.5±2.1
<i>Rosa spp</i>	1.0±1.0	8.4±3.1
<i>Prunus maritima</i>	10.7±10.3	9.5±5.0
<i>Celastrus orbiculatus</i>	0	5.2±2.4
<i>Teucrium canadense</i>	2.4±2.4	0
<i>Juncus greenei</i>	0.4±0.4	0
<i>Euthamia tenuifolia</i>	1.1±1.1	7.8±5.3
<i>Achillea millefolium</i>	0	0.9±0.9
<i>Smilax rotundifolia</i>	0	2.9±2.9
<i>Prunus serotina</i>	0	1.6±1.6
<i>Solidago sempervirens</i>	0	0.8±0.8
Bare Ground/Litter	13.3±5.1	17.2±7.9
TOTAL	86.7±5.1	82.8±7.9



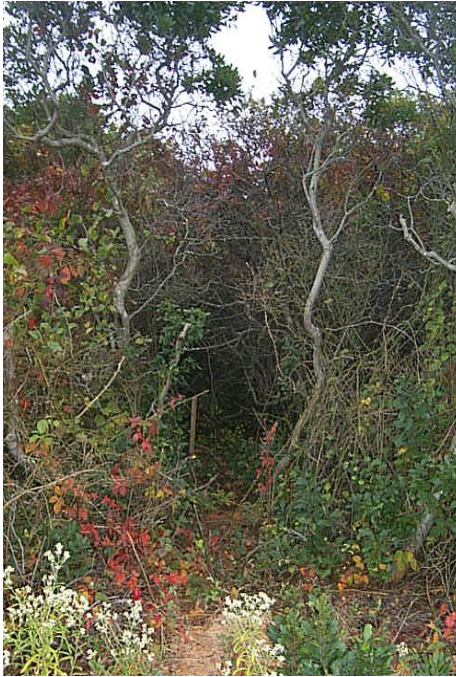
Hanley, 2003



FIIS NRM, 2011

Compass Bearing	Meter Location	Plot ID Name	UTM Easting (m)	UTM Northing (m)
31 degrees	3m	SP 31-1	0679741	4511090
31 degrees	6m	SP 31-2	0679743	4511053
151 degrees	3m	SP 151-1	0679750	4511088
151 degrees	6m	SP 151-2	0679747	4511086

Figure 2. Smith Point - November 2011 FIIS NRM staff found Smith Point West Well with 1m wooden posts designating veg plots just east of western boardwalk that runs from ocean to bay.



Hanley, 2003



FIIS NRM, 2011

Compass Bearing	Meter Location	Plot ID Name	UTM Easting (m)	UTM Northing (m)
39 degrees	3m	BN 39-1	0674922	4509019
39 degrees	6m	BN 39-2	0674928	4509020
200 degrees	3m	BN 200-1	0674928	4509011
200 degrees	6m	BN 200-2	0674931	4509009

Figure 3. Bellport North- November 2011, NRM staff found 3 wooden posts and a few rebar designating the veg plots. Unclear where well is but some cement fragments may be the location.



Hanley, 2003



FIIS NRM, 2011

Compass Bearing	Meter Location	Plot ID Name	UTM Easting (m)	UTM Northing (m)
302 degrees	3m	BS 302-1	0674940	4508883
302 degrees	6m	BS 302-2	0674941	4508878
340 degrees	3m	BS 340-1	0674936	4508887
340 degrees	6m	BS 340-2	0674946	4508894

Figure 4. Bellport South- November 2011, NRM staff found wooden stakes and a metal pipe filled with cement at the well site.



Hanley, 2003



FIIS NRM, 2011

Compass Bearing	Meter Location	Plot ID Name	UTM Easting (m)	UTM Northing (m)
7 degrees	3m	TA 007-1	0665445	4504163
7 degrees	6m	TA 007-2	0665425	4504157
322 degrees	3m	TA 322-1	0665418	4504150
322 degrees	6m	TA 322-2	0665422	4504152

Figure 5. Talisman- November 2011, FIIS NRM staff found a mound of cement that seemed like the well. Next time need to look for rebar and wooden stakes more.



Hanley, 2003

Compass Bearing			UTM Easting (m)	UTM Northing (m)
	Meter Location	Plot ID Name		
79 degrees	3m	SH 79-1	0660343	4502399
79 degrees	19m	SH 79-2	0660385	4502414
79 degrees	35m	SH 79-3	0660408	4502414
103 degrees	3m	SH 103-1	0660400	4502396
103 degrees	6m	SH 103-2	0660391	4502421

Figure 6. Sailor's Haven- NRM staff could not definitively find this well. GPS marks it northwest of ranger housing and maintenance shop. Personal conversations (e.g. Paul Czachor) and others say well was northeast of maintenance shop, east of the cut going to the marina.



Hanley, 2003



FIIS NRM, 2011

Compass Bearing	Meter Location	Plot ID Name	UTM Easting (m)	UTM Northing (m)
215 degrees	3m	LT 215-1	0651259	4499481
215 degrees	6m	LT 215-2	0651260	4499479
308 degrees	3m	LT 308-1	0651262	4499487
308 degrees	6m	LT 308-2	0651258	4499490

Figure 7. Lighthouse Tract- NRM found rebar and cement remnants near GPS locations.



Figure 8. Park Biologist implementing the point-intercept method.



Figure 9. Map of FIIS showing well site locations.

Appendix A. FIIS well site monitoring program datasheet

Plot ID _____

Comments _____

Point-- record species, first row is for points 1-25, second row is for points 26-50.

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