Wetland vegetative assessment in Highland, Sullivan County, NY, summer and fall 2007

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BACKGROUND (Upper Susquehanna Coalition 2007a).

The Millennium Pipeline Co, LLC plans to retrofit 181 miles of natural gas transmission pipeline and right-of-way (ROW) across 8 counties in the southern tier of New York State within the next two years. Upon construction/retrofit, scheduled to begin in July 2008, various degrees of habitat destruction are expected to occur. In 1952, a portion of the existing pipeline was installed off of Kieferle Road in the town of Highland, NY and degradation of emergent sedge tussock wetland habitat was noted. In anticipation of permanent impacts associated with the Millennium Pipeline Project, the Upper Susquehanna Coalition (USC) has developed a Wetland Mitigation Plan to assess damage, compensate for the losses, and help restore the wetland. Approximately 1.02 acres of palustrine forested wetland is expected to be impacted in this specific area. In cooperation with the USC, the SUNY Oneonta Biological Field Station will work throughout the duration of the project to assess the vegetative components of the wetland in Highland and ultimately assist in restoration efforts.

INTRODUCTION

Increasing rates of wetland degradation and the subsequent recognition of their values have encouraged restoration of wetland systems (Mitsch and Gosselink 2000). Restoration efforts entail returning a wetland back to its original state by re-establishing natural hydrology and vegetative communities. Artificial restoration may be necessary after a disturbance because many aquatic emergent plants do not readily re-establish themselves naturally due to isolation and limited dispersal modes (Galatowitsch & van der Valk 1996). As a result, environmental organizations have become a key part in restoring disturbed wetlands to their previous state.

The Upper Susquehanna Coalition is a network of county natural resource professionals who develop strategies, partnerships, and projects to protect the headwaters of the Susquehanna River and Chesapeake Bay watershed (USC 2007a). The USC was contracted to develop a Wetland Mitigation Plan to address anticipated impacts associated with the Millennium Pipeline Project in wetland areas within the Susquehanna and Delaware River watersheds. This plan describes efforts required to replace the lost functions of local wetland communities. Vegetative restoration after disturbances serves to benefit both the environment and human community. Wetlands have hydrological, biogeochemical, and food web functions (Folke 1991). They provide habitat for a plethora of plant and animal species, many of which are threatened or endangered (Mitsch and Gosselink 2000). Economically and recreationally, humans value wetlands for timber, vegetation, and as a refuge for many game species (Mitsch and Gosselink 2000). Wetlands mitigate floods by intercepting storm runoff, and improve water quality by filtering nutrients and toxic contaminants out of groundwater (Mitsch and Gosselink 2000).

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In collaboration with the USC, the SUNY Oneonta Biological Field Station will assist the implementation of the Wetland Mitigation Plan in Highland, NY (within the Delaware River watershed). Restoration efforts in Highland will include replacing existing plant diversity and abundances over a span of two years (USC 2007a). An inventory of the plant species in the community, their density, biomass, and frequency of occurrence will take place prior to disturbance in the summer and fall of 2007. The transects established during the inventory will also be used to assess species composition, diversity, abundance, and mortality post-construction (USC 2007a).

Aside from the inventory, the plan also includes removal and temporary storage of sedge-dominated tussocks in the pipeline ROW (USC 2007a). They will be stored nearby until the 2008 growing season when they will be re-planted on the ROW. As a result, values and functions of the affected wetland will be determined. The Wetland Mitigation Plan ultimately aims to restore the hollow and hummock microtypography of the site after the pipeline project is completed.

In order to most appropriately analyze the wetland community at Highland, modified point-centered quarter (PCQ) sampling will be used. This method was originally developed by Cottam and Curtis (1956) and used to describe frequency and density of forests (Penfound 1963). Subsequently, Dix (1961) and Penfound (1963) took advantage of this technique in the analysis of grasslands (Penfound 1963). The PCQ method will assist in documenting both the pre- and post-construction vegetative characteristics of the Highland wetland (USC 2007a).

METHODS (Penfound 1963)

Species composition and percent cover were assessed using modified point-centered quarter sampling from Penfound (1963). Five vegetative transects were established in and adjacent to the gas pipeline right-of-way (ROW) (Figure 1). Transects A, B, C, and E were 30.48 m in length and transect D was 15.24 m. Transects A and D were established parallel along the ROW, while transects B, C, and D were established adjacent to the ROW at 90° (Figure 1). Using a measuring tape, 3.05 m intervals were marked with flags along each transect. A PCQ sampling unit was placed one meter out from the transect line at every flag. A coin was flipped to determine whether the PCQ was placed to the right or left of the line. The distance and taxa of the nearest plant in each quarter from the point was measured and recorded. Quarters were labeled according to their orientation (N, E, S, or W). Subsequently, each plant was cut where it emerged from the *Sphagnum* mat and placed in a paper bag. Plants were identified to genus level, species level when possible. Plants that could not be positively identified by defining characteristics or reproductive parts were recorded as 'unknown' species. The plants were dried in the lab using an industrial plant oven at 105°C and weighed to the nearest hundredth of a gram. In addition to the plant stem samples, a 10cm by 10cm sample of living *Sphagnum* was taken, dried, and weighed in order to estimate the biomass associated with the *Sphagnum* mat.

Relative frequency values (Equation 1) were calculated for all taxa, compiled for each transect and each sampling event. Stem density (Equation 2) and biomass (Equation 3) were calculated for each transect and across all transects. Calculations were performed according to Penfound (1963). The total numbers of taxonomic groups sampled in each transect are reported. Species richness is calculated to describe how many taxa one found on each transect.

Equation 1. Calculation of relative frequency.

Relative frequency = (# quadrats present in transect/total # quadrats sampled) x 100

Equation 2. Calculation of stem density. (derived from Penfound 1963)

Stem density = $(1000/\text{mean distance to center point})^2$

Equation 3. Calculation of biomass (derived from Penfound 1963)

Biomass = stem density x mean stem weight

RESULTS

A total of 20 taxonomic groups were identified over the three sampling events on five established transects (Table 1). Plants were found growing on sedge-dominated tussocks. Tussocks occurred at an estimated density of 2.3 tussocks/m^2. *Sphagnum* moss formed 100% cover in all transects and served as the substrate for plant growth. Although the depth of *Sphagnum* varied considerably over the wetland, the depth of living moss was remarkably homogeneous. Other vegetation on the tussocks was primarily comprised of two sedge species, and is described in further detail below.

Transects B and E recorded the greatest number of taxa over the three sampling events, 11, while transect D was recorded as having the least number, five taxa. The greatest number of taxa present was 19, during the August sampling event. Thirteen taxa were recorded on taxa within the bounds of the ROW (A and D), while 20 taxa were recorded in transects outside of the ROW (B,C, and E) (Table 1). *Carex stricta* was sampled in the greatest number of quadrats, representing greater than 50% of all stems sampled in the three-month assessment (Figure 2), and was the only taxon to be sampled in every transect during all three sampling events.

Table 1. Number of taxonomic groups found, organized by sampling event, transect, and totals over each. A+D indicates transects within the ROW, B+C+E indicates transects outside of the ROW.

Transect	July	August	October	totals
A	10	8	8	12
B	6	11	9	13
C	9	8	7	12
D	6	7	5	11
E	8	11	11	16
A+D	10	11	9	13
B+C+E	13	17	13	20
overall	13	19	14	20

Thelypteris palustris was the second-most frequently occurring taxon in July and August and *Carex lurida* in October, comprising 13.1, 11.4, and 12.4% of the stems sampled, respectively. Outside of the ROW, *Rubus* sp. occurs in greater than 12% of quadrats, while it occurs in less than 2% of quadrats within the bounds of the ROW (Figure 3).

The frequency at which each of these taxonomic groups occurred varied between the five transects. The maximum occurrence of *C. stricta* was recorded at 72.7% of stems in transect B during the October sampling event, while its lowest frequency, 31.8%, was recorded in August for transect E. Nine of the taxa sampled never occurred at a frequency greater than 5%, while only three taxa occurred in greater than 20% of the quadrats for at least one transect (Figure 2).

On average, stem density was greatest during the August sampling event, although the highest individual density estimation was 365 stems/m^2, for the October sampling of transect E (Table 2, Figure 4). July density estimates range from a low of 50 stems/m^2 in transect A to 291 stems/m^2 in transect E. August densities range from 65 to 343 stems/m^2, while October estimates were higher, ranging from 152 to 365 stems/m^2.

Biomass estimates show patterns similar to those seen for density, as density is used to calculate biomass (Table 2). Among the three sampling events, the greatest biomass was estimated for August, with transect B recording the maximum of 265 g/m^2.

Table 2. Stem density (stems/sq m) and biomass (g/sq m) for each transect, as determined for July, August, and October sampling events.

	Stem Density (stems/sq m)			Biomass (g/sq m)		
Transect	July	August	October	July	August	October
A	50	65	167	14.22	64.09	79.87
B	275	319	165	35.22	264.77	49.79
C	54	343	152	21.56	131.43	40.96
D	165	157	365	53.76	89.13	240.22
E	291	278	197	190.37	87.84	111.99
overall	108	182	183	39.08	112.39	79.42

The five transects showed wide range of changing patterns over the course of the growing season for both stem density and biomass (Table 2, Figures 4 and 5). Transect A increased in both stem density and biomass steadily from July to October. Transect B peaked in density and biomass in August, with both estimates declining to the October sampling event. Transect C showed the greatest change in density from July to August, increasing by 289 stems/m^2, but was second to transect B for increases in biomass for the same period. Transect D showed the greatest increase in density from August to October, and also the greatest increase in biomass in the same time period. As can be seen from the data presented, transects vary greatly from month to month in terms of density and biomass, but overall, stem densities in August and October were consistent with one another. Conversely, August and October biomass are drastically different from one another, showing seasonal changes in productivity within the system.

Taxa-specific estimates of stem density and biomass are not presented here, as they were not the main objective of this assessment method, and would not be representative of actual conditions for all taxonomic groups. Living *Sphagnum* is estimated to have a biomass of 1400

g/m^2 based on the dry weight of a $100cm^2$ sample, and 100% cover. In many areas large amounts of dead and decomposing *Sphagnum* dominate the organic substrate.

DISCUSSION

Tussocks are an important component of this particular wetland ecosystem and care should be given to the restoration of tussock structures following any destructive activities in the wetland. Therefore, the density of tussocks ($2.3/m^2$) should be restored after disturbance. Destruction of tussock structures would drastically affect the vegetative community of the wetland; plant species currently present would have no growth medium, and water levels would inundate other available substrates. Data indicate that at the present time there is less species richness (13 species) on the ROW (disturbed in 1952) than outside the ROW (20 species) on what are apparently undisturbed sites. These numbers should be considered as targets for mitigation.

A drawback of most sampling methods is that they do not provide assurance that all of the species present in a given system will be recorded. Such errors are inherent in the point quarter method employed in this assessment; there is a chance that the species list compiled here is not inclusive of all species present in the wetland. Only the stem closest to the center point in each quadrat is recorded; therefore, rare taxa may not be reported.

Community composition changes over the course of the growing season. Assessment of the diversity and conditions in the wetland following any work on the pipeline should be done throughout the growing season. Fewer species were sampled in transect D – it should be noted that this transect was only 15.24 m in length, half as long as the other others. This shorter distance may contribute to the low number of species sampled. However, this transect experiences a greater degree of shading from surrounding forested areas, and was impacted by the pipeline installation in 1952, which may also contribute to the presence of fewer taxa.

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List of Taxonomic Groups Present (Gleason and Cronquist 1991)

Division: Magnoliophyta (flowering plants)
Class: Liliopsida (monocotyledons)
Subclass: Commenlinidae
Order: Glumiflorae
Family: Gramineae (grasses)
Cyperaceae (sedges)
Genus/Species: *Carex stricta*
Carex lurida
Class: Magnoliopsida (dicotyledons)
Subclass: Asteridae
Order: Asterales
Family: Asteraceae (asters)
Genus/Species: *Solidago* sp. (goldenrod)
Order: Lamiales
Family: Lamiaceae (mint)
Genus/Species: *Lycopus* sp.
Order: Rubiales
Family: Rubiaceae (madder)
Genus/Species: *Galium* sp. (bedstraw)

Subclass: Caryophyllidae
Order: Polygonales (buckwheat)
Family: Polygonaceae (knotweed)
Genus/Species: *Polygonum sagittatum* (arrowleaf tearthumb)

Subclass: Dilleniidae
Order: Ericales
Family: Ericaceae (heath)
Genus/Species: *Vaccinium* sp. (blueberry)
Order: Violales
Family: Violaceae
Genus/Species: *Viola* sp. (violets)

Subclass: Rosidae
Order: Apiales
Family: Apiaceae (carrot)
Genus/Species: *Hydrocotyle americana* (American marshpennywort)
Order: Fabales
Family: Fabaceae (pea)
Genus/Species: *Trifolium* sp. (clover)
Order: Geraniales
Family: Balsaminaceae (touch-me-not)
Genus/Species: *Impatiens capensis* (jewelweed)

Order: Rosales
Family: Rosaceae (rose)
Genus/Species: *Fragaria* sp. (strawberry)
Rubus sp. (blackberry)
Spiraea alba (meadowsweet)
Order: Sapindales
Family: Aceraceae (maple)
Genus/Species: *Acer rubrum* (red maple)

Division: Pteridophyta (Vascular Cryptogams)
Class: Filicopsida (ferns and fern allies)
Order: Polypodiales
Family: Dryopteridaceae (wood ferns)
Genus/ species: *Dryopteris cristata* (crested wood fern)
Onolcea sensibilis (sensitive fern)
Family: Thelypteridaceae (marsh ferns)
Genus/ species: *Thelypteris palustris* (eastern marsh fern)

Sullivan County Public Health Services has confirmed that a Resorts World Catskills employee tested positive for COVID-19. There is currently no indication that the employee contracted the virus at the casino or impacted anyone else. Public Health Services has determined that this individual was working in the resortâ€™s casino, located at 888 Resorts World Drive in Monticello, during the following dates and times: ...Continue Reading. Wurtsboro, NY â€“ Sullivan County Public Health Services has confirmed that an employee at the Wurtsboro Diner & CafÃ© tested positive for COVID-19. A BJâ€™s Wholesale Club and 800-car parking lot is planned on 28 acres of wetlands on Staten Islandâ€™s northern shore. The plan would protect 11 acres of the woods and swamps.Credit...Amr Alfiky/The New York Times. By Anne Barnard. Oct. 28, 2020. It is an unlikely centerpiece for a save-the-wetlands campaign: a patch of woods and swamps surrounded by strip malls and service roads on the densely populated, industrial northern shore of Staten Island. To nearby residents fighting to preserve it, the parcel is a bulwark against disaster. The 28 acres are part of a network of wetlands that in 2012 hel Wetland vegetative assessment in Highland, Sullivan County, NY, summer and fall 2007. Article. Holly Waterfield.Â Water quality monitoring of five major tributaries in the Otsego Lake watershed, summer 2009 results update. Article. Holly Waterfield. Matt Albright. View. REPORTS: Monitoring the effectiveness of the Cooperstown wastewater treatment wetland 1. Article. M F Albright.