Assessment of Vegetation Along Peconic River Post Remediation

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ABSTRACT

The Peconic River running through the property of Brookhaven National Laboratory is the focus of a remediation process to eliminate contaminated sediments inadvertently created by the laboratories past practices. An assessment of planted vegetation from April 2002 is being conducted to monitor how reintroduced vegetation has thrived. The methods used to assess the vegetation's progress includes 1) identifying native and invasive plant species, 2) mapping various plant species with a Thales Navigational Mobile Mapper GPS unit and 3) comparing present results with the original revegetation planted in April 2002. The data collected was used to determine how different species adjust after the remediation process has occurred.

INTRODUCTION

The Peconic River running through the property of Brookhaven National Laboratory (BNL) is the focus of a remediation process to eliminate contaminated sediments created by the Laboratories past practices. Brookhaven National Laboratory supported by the Department of Energy in March 2002 to begin the remediation process. The Brookhaven National Laboratory's Sewage Treatment Plant became a route for contaminated sediments to inadvertently pollute the river from waste disposal practices. Sediments such as Polychlorinated biphenyls, pesticides, radionuclides and elevated concentrations of metals were found in the section of the river that spanned between the Sewage Treatment Plant and various offsite depositional areas.

Pilot studies were performed on site to evaluate the success of remediation in the wetland habitat. One section of the Peconic River used as a pilot study was Area D, which runs along the eastern boundary of the laboratory crossing into residential properties, as seen in figure 3 (area of study shown in red). Area D was chosen for the study due to the areas' accessibility for equipment from North St., the public could easily view it, and the site is on the Laboratories' property.

Both native and invasive species inhabited the area. One invasive species of special concern was the Reed Canary Grass (Phalaris arundinacea). A dense population of the invasive Reed Canary Grass inhabited a major portion of Area D. Reed Canary Grass is an invasive species, introduced from Europe and Asia. Reed Canary Grass is an aggressive species that reproduces by seed or creeping rhizomes. The grass can grow on dry soils in upland habitats but does best fertile, moist organic soils in full sun. The species prefers disturbed areas such as ditching of wetlands, stream channelization and sedimentation. Once established, reed canary grass dominates an area by building up a tremendous seed bank that will erupt, germinate and recolonize treated sites. Reed Canary Grass has a history of establishing a wetland area and reducing biodiversity in a twelve-year time period.

In March 2002, 740 cubic yards of contaminated sediments were excavated from the area of study. After the completion of sediment removal, native vegetation species were planted to complement the wetlands habitat. The studies main purpose was to assess if the Reed Canary Grass had re-established in the area.

METHODS AND MATERIALS

A Thales Navigation Mobile Mapper GPS unit with Wide Area Augmentation System and post processing capabilities was used delineate polygons and points in the restored area (see figure 2). Large abundances of plants were mapped as polygons. Single plants were entered as separate points in the GPS. An initial river boundary was logged into the system under the line option to get the parameters for mapping. The river boundary is a representation of where the forest and high marsh merge. The most abundant species in the area of study were mapped first in the polygon setting proceeding down to single plants with no similar species adjacent to them, which were mapped as points. Mapping was performed when ideal satellite and PDOP numbers were available. The goal of successful mapping was to have the highest number of satellites combined with the lowest number for the PDOP. The minimum number of satellites that could enable accurate mapping was five. The highest number PDOP allowable for mapping was eight.

At the end of each survey, vegetation data was uploaded into the computer and exported into the GIS software program where it would begin to form a body within the initial river border. Once entered in the GIS software the data was post-processed to further enhance accuracy. The GPS/GIS had a 2-3 meter error margin that must be accounted for when interpreting the resulting data.

Other materials used to help compare the present vegetation status with the previously planted vegetation were a digital camera (see photographs 1 and 2) and planting maps. Flagging tape was used to help identify the boundaries of each polygon. The digital camera also helped with the identification of unknown species. A field guide was constructed to easily identify species in the wetland. A two way radio and cellular phone were used for communication and emergencies.

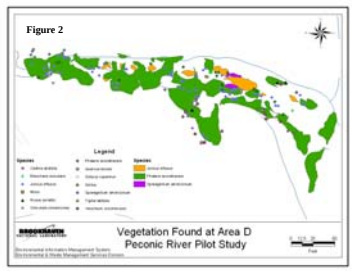
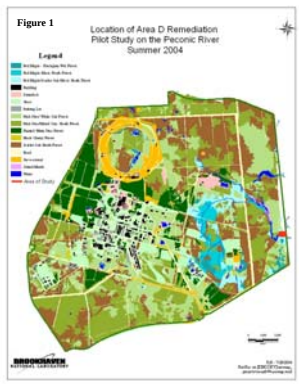


Photo 1 taken April 2002

Photo 2 taken August 2004



RESULTS

Table 1 presents a significant percentage difference between *Phalaris arundinacea* (Reed Canary Grass) and all other vegetation species present in the area surveyed. The total area of vegetation covered was 11,231 square feet. Of the 11,231 feet squared, 79.8 percent was Reed Canary Grass. The second largest vegetation population in the area was *Juncus effusus*(soft rush) which was 13.7 percent. The species percentages began to drop dramatically to 3.0 for the *Sparganium americanum* (American burreed). The ten other species identified in the area of study were found to be less than one percent each.

Table 1

Species	Area of Points in Feet ^{2}	Area of polygons in Feet ^{2}	Total Maximum Area in Feet ^{2}	Pecentage of Vegetation by area
Clethra alnifolia	43.06		43.06	0.383
Eleocharis acicularis	53.82		53.82	0.479
Juncus effusus	656.60	887.11	1543.71	13.744
Moss	10.76		10.76	0.096
Nyssa sylvatica	32.29		32.29	0.288
Osmunda cinnamonea	32.29		32.29	0.288
Phalaris arundinacea	161.46	8805.31	8966.76	79.834
Quercus bicolor	10.76		10.76	0.096
Scirpus cyperinus	32.29		32.29	0.288
Smilax	43.06		43.06	0.383
Sparaganium americanum	226.04	118.57	344.61	3.068
Typha latifolia	32.29		32.29	0.288
Vaccinium corymbosum	86.11		86.11	0.767
Total area of vegetation covered = 11231.82 feet ^{2}				

DISCUSSION AND CONCLUSION

The restoration project objective was to obtain 80-85 percent survivability among planted vegetation species [4]. Six months later, in October of 2002 the success of the wetland restoration was determined by having achieved a 98 percent survival rate of planted wetland species [2]. Based on the current calculations, survivability for planted species is 21 percent. Many of these plants looked stressed and stifled due to the invasive grass that inhabits the area. There were no preliminary percentages noted for each species planted in the area, which makes it difficult to compare with the data presented in Table 1. It is assumed that once restored, the project area had no Reed Canary Grass present (see photo 1). As seen in Figure 1, the Reed Canary Grass dominates the area of excavation by 79 percent (see photo 2). It is unclear how this invasive species was introduced into the wetland habitat, but it requires more management than initially anticipated.

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