Dry Sites: An Introduction

Matthew Horvath

Dredge material can be used to physically create dry land for the city, especially along the edges of Cayuga Lake. This process is not a new one; in the past both Stewart Park and Cass Park were constructed using dredge material. First an edge of large stone is constructed in the water, which is then filled with dredge material. The edge acts as a barrier, reducing the risk of diffusion of dredged material back into the lake.

Creating dry land has multiple beneficial effects for the city. First, it reduces the distance that the dredge material has to be freighted, thus reducing the carbon footprint. Additionally, creation of land on the lake has the ability to increase property values while creating additional property for the city. Cayuga Lake is used mostly by residents as a recreational destination, and the city profits from this use. This alternative would certainly strengthen the user interface with Cayuga Lake by giving residents further reason to visit this public commodity, benefitting both residents and the city alike.

Cornell Lake Source Cooling Project: Dryden, New York

Becky Mikulay

KEYNOTES:
(1) Approximately 3,000 cubic yards of sediment.
(2) After 12 years, similar vegetation is found in the dredged sediment as on the adjacent old field soil.
(3) Refer to Dredge Material Section for more information.

Project Description

As has been discussed earlier in this report (in the Dredge Material tests), after the installation of Cornell's Lake Source Cooling project in Cayuga Lake 12 years ago, approximately 3,000 cubic yards of subaqueous soil slurry was spread over the western half of the old agricultural field in nearby Dryden, NY. After the site was left to a zero-order restoration for over a decade, our class surveyed the plant communities on two sides of this field to compare the plant species that had established in the old field soil as compared to those growing in the sediment. While at first glance, plant communities in the two soils appeared the same, upon closer inspection, less species overlap was found than initially expected. However, plants classified as "invasive" did not give overwhelming preference to one soil condition or the other. (See Dredge Material section of this report)

Figure 6.5 a - Sediment spread across field. 10 1999. Courtesy of Patrick McNally, Associate Director - EHS Compliance.

Figure 6.5 b - Restoration Ecology class inventorying the plant community on the Dryden site. 9 2011.

Inlet Application

Applying a layer of dredge sediment to this previously disturbed agricultural site doesn't appear to have negatively impacted plant succession through this primary stage. This suggests that the dredge material taken from the Inlet could be distributed locally with very little flow-up at no real consequence if the site was previously disturbed and not a sensitive habitat or of prime aesthetic concern. However, no net benefit was made through this disposal approach either – no park or habitat intentionally created, no erosive hillside restored, no profit made, no beneficial reuse to speak of. As well, the sheer volume of dredge material that needs to removed from the inlet would be very hard to truck all over the county, even if there were sites that could take it. The cost of trips and carbon footprint would be enormous. If handled correctly, some dredge material from the Inlet could be used in upland sites such as here in Dryden, but a more purposeful use should be considered.

References

"LSC EIS 2.3.5 Lake Sediments." Energy & Sustainability. Cornell University. Web. 17 Nov. 2011. <http://energyandsustainability.fs.cornell.edu/util/cooling/production/lsc/eis/lakesediments.cfm>.

Times Beach: Buffalo, New York

Andrew Miller

KEYNOTES:
(1) 1972-1976, functioned as a 50-acre Confined Disposal Facility (CDF) to accommodate sediment from lake Erie
(2) Since disposal operations ended, wildlife, vegetation, and aquatic species have prospered
    a. 2004 - designated as a nature preserve
(3) Four distinct habitat zones observed: silt flat, marshland, woodlands, and upland.
(4) Seen as helping to improve Buffalo's waterfront and natural recreation attraction.

Project Description

In the early 20th century, the site presently known as Times Beach functioned as a sand beach where locals could go for recreational entertainment. The area was located next to a disenfranchised neighborhood that began to disappear just after World War II. Due to its strategic location, the local newspaper and future basis for the area's name, the Buffalo Times, promoted the site's use as a beach. However, as people began to flock to the site so did industry. Shortly thereafter, the waterways became polluted and recreational bathing was discouraged at Times Beach.

Fast-forward a few decades, and by 1972, much of the city's industry had disappeared. As a result, the Army Corps of Engineers used the site from 1972 to 1976 as a confined disposal facility (CDF). Here, dredged sediments from the Buffalo River and harbor were pumped and stored. The dewatered sediments remain within the site today.

Despite the area being concentrated with many contaminated soils, since 1976 nature has reclaimed Times Beach. Presently, four distinct habitat zones have been identified within the site: a silt flat, marshland, woodland, and upland. The Niagara River and Buffalo shoreline area are part of a flyway for migratory birds and the established zones have become a haven for more than 240 species of birds such as great blue heron, great egret, wild turkey, common goldeneye, lesser yellowlegs, downy woodpecker, Carolina wren, belted kingfisher, and red-tail hawk. Due to the vast array of species, three bird-watching locations have been constructed on-site.

With the success of Times Beach, growth is beginning to reoccur along the Buffalo waterfront, and the site's future is uncertain. At any rate, the preserve is playing a critical role in the natural regeneration of the waterside habitat and could further Buffalo's economy as the city hopes to benefit on waterfront and natural recreation.

Inlet Applications

Similar to Dike 14, although the scale of the Confined Disposal Facility approach would need to be down-sized to fit the smaller area of Cayuga Lake, the basic concept and benefits would remain the same. Thus, the incorporation of a CDF into the Cayuga Lake watershed could be a very real consideration, and, like Dike 14 and Times Beach, may even become a nature preserve after the site's functional use as a CDF.

Figure 6.6a - Times Beach Nature Preserve plan

References

Burney, Jajean (2011). "Times Beach Nature Preserve - A Waterfront Jewel in Downtown Buffalo." Friends of Times Beach Nature Preserve. Available: <http://thegoodneighborhood.com>.

Cuyahoga River & Dike 14: Cleveland, Ohio

Andrew Miller

KEYNOTES:
(1) 200,000-300,000 cubic yards of sediment dredged annually
(2) Prior to Clean Water Act of 1972, dredged sediments were placed in the open lake or along shoreline as fill.
(3) Became a Confined Disposal Facility from 1979 to 1999. One of 45 CDFs in the Great Lake Region.
(4) Today, dike 14 is an 88-acre Cleveland Lakefront Nature Preserve.
(5) Quick Facts:
  a. Perimeter: 5,400 feet
  b. Height: 39 feet
  c. Capacity: 6,130,000 cubic yards

Project Description

Dike 14 is a former Confined Disposal Facility (CDF) located approximately 4.5 miles east of the Cuyahoga River and is adjacent to the northern end of the Cleveland Lakefront State Park. The Cuyahoga River has a natural depth of six feet and so the U.S. Army Corps for Engineers is responsible for dredging the lower 5.5 miles of the river to maintain a necessary navigational depth of 27 feet. This results in between 200,000 to 300,000 cubic yards of annually, dredged sediments from the Cuyahoga River and harbor, combined. Much of the sediments are the result of some upstream erosional process and runoff of the Cuyahoga River watershed (813 square miles in size) and are mostly polluted with various heavy metals, chemicals, organics, and oils. Needing a place to be disposed, from 1979 to 1999, much of these sediments were placed within dike 14. The dike, itself, was originally designed to contain 6,130,000 cubic yards of dredge at a cost of about $29 million. However, in 1994, the structure was raised 7 feet and providing an additional capacity of 880,000 cubic yards to allow for another CDF (Dike 10B) to be constructed along the Cleveland harbor waterfront.

Since disposal operations ceased on the dike in 1999, the site has become a naturalized 88-acre wildlife haven. The city of Cleveland even recently deemed the area a "nature preserve." Over 280 bird species, numerous butterflies, 16 mammal species, 26 plant and 9 tree and shrub species have been identified inhabiting the dike due to its strategic coastal location and access to Lake Erie.

Confined Disposal Facilities (CDFs)

Until the 1960s, many dredged sediments from the Cuyahoga River and Cleveland Harbor were disposed in Lake Erie's open waters. However, after the River and Harbor Act was passed in 1970, engineered structures deemed "Confined Disposal Facilities" were built for contaminated dredge material. In fact, half of the 3-5 million, annually dredged materials from the Great Lakes is determined to be polluted. Since 1968, all government-dredged material in Cleveland has been placed in CDFs named Dike 9, Dike 12, Dike 13, Dike 14, and Dike 10B. Including the ones in Cleveland, there are currently 45 CDFs throughout the Great Lakes - 16 are similar to Dike 14, and another 29 function as in-water or shoreline, underwater facilities. Most of these facilities, Dike 14 included, have no liner. Instead, as sediments are pumped or mechanically placed into the dike, the water percolates or evaporates through the walls and the sediments consolidate thereby creating a predetermined, site-specific landmass.

Figure 6.7 a - Cleveland harbor waterfront with the Cuyahoga River in the right-foreground

Inlet Applications

Although the Confined Disposal Facility approach would need to be down-sized to fit the much smaller size of Cayuga Lake, the basic concept and benefits would remain the same. Due to the great abundance of CDFs in the Great Lake regions (45) and several acting as nature preserves, they have clearly shown to provide benefits beyond their use as a dredge disposal site. Furthermore, since these are "confined" sites the risk of contamination of other ecosystems with heavy metals, chemicals, and organics within the material would be limited. Although, it should be noted that much of our material has been found to be benign in character from the tests we have performed, thus far.

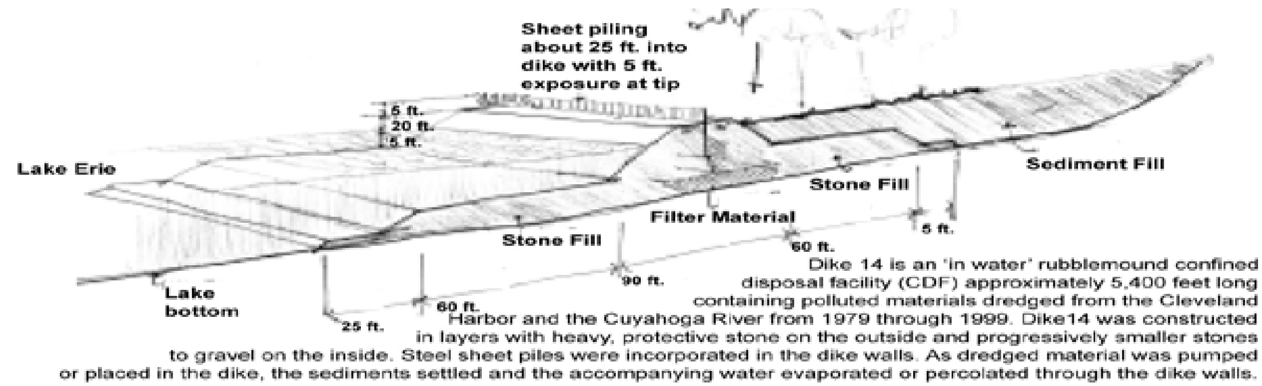

Figure 6.8 f - Cut-away of Dike 14 for basic construction elements


Figure 6.8 b - Dike 14 perimeter construction (1975)


Figure 6.8 d - Dike 14 with mud flats (1984)


Figure 6.8 c - Dike 14 perimeter completed (1983)


Figure 6.8 e - Dike 14 vegetation growth (1986)

References

Cleveland City Planning Commission. (2006) "Dike 14 Master Plan." Nov. 2008. (Online) 16 Nov. 2011. <http://planning.city.cleveland.oh.us/lakefront/dike14.html>.

Dredge Infill Project at Stewart Park: Ithaca, New York

Becky Mikulay

KEYNOTES:

(1) 1894 – Renwick Park created

(2) c.1911 – Land "reclaimed" with fill from Inlet Channel dredgings.

(3) 1921 – Stewart Park became the first municipal park on the lake front (grand opening postponed due to flooding).

(4) 1934 – Comprehensive plan calls for raising grade by 2-4 ft by infilling with dredge material from the Inlet; results in a more abrupt land/water edge condition.

(5) 1960s – 80-100 ft. added to shoreline and planted with willows after Rt. 13 construction.

Project Description

Ithaca's Stewart Park has a long history associated with dredging the Inlet. William Weidorn's 1921 thesis, The Plans for the Development of Stewart Park, spoke of "reclaiming" land within then Renwick Park from Inlet channel dredgings at least as early as 1911. Stewart Park has been accumulating Inlet sediment on an ongoing basis for over a century. In the summer of 1921, Stewart Park became Ithaca's first municipal lakefront park, filling in the wetland habitat in exchange for this ecosystem service was viewed as beneficial to residents at the time. In 1934 a comprehensive master plan was proposed for the park. It called for raising the grade an additional 2-4 feet in various places with more dredge fill from the inlet to finish the job of wetland eradication throughout most of the park. While Wiedorn's 1921 photographs still show aquatic plants reaching out from the Stewart Park shore to the lake, the fulfillment of the 1934 master plan created the much more abrupt land/water edge condition that is seen today. Further extensive fill work was done in the 1960s after the Route 13 construction when an additional 80-100 feet was added to the shoreline, which is now planted with willows.

Figure 6.8 b Dump site in Stewart Park, 1921.
Photo: William Wiedorn

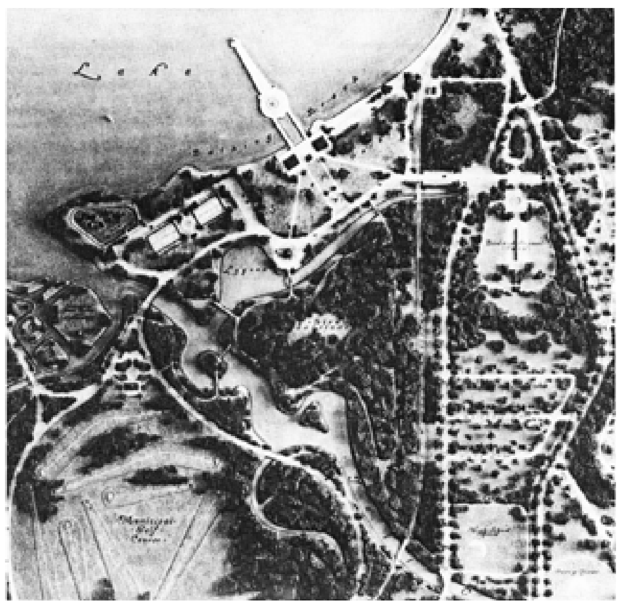

Figure 6.8 a - The 1934 Master Plan for Stewart Park.
Image: History Center in Tompkins County

Figure 6.8 c - Stewart Park after the flood of 1935.
Image: History Center in Tompkins County

Inlet Applications

Stewart Park demonstrates that there is a history of creating dry land from the Inlet dredge material. Currently there are regulations that prohibit this type of land creation. Stewart Park does show however, that without much fuss, this dredge sediment can be easily used to create relatively flat, non-structural fill material that supports standard park vegetation.

References

Armstrong, Victoria. A Cultural History Survey of the Cayuga Waterfront. Rep. Ithaca: Cayuga Waterfront Trail Initiative, 2001.

Trowbridge. Stewart Park: 1987 Preservation Goals and Guidelines. Rep. Ithaca: Dept. of Planning and Development & the Dept. of Public Works, 1987.

Wiedorn, William S. The Plans for the Development of Stewart Park. Thesis. Cornell University, 1921.

"Ithaca, NY - Parks." Official Website of Ithaca, NY. Web. 17 Nov. 2011. <http://www.ci.ithaca.ny.us/parks/index.cfm>.

Various historic photographs of Stewart and Cass Parks. The History Center in Tompkins County, Ithaca.

Figure 6.8 d - Wetlands off the shore of Stewart Park, 1921. Photo: William Wiedorn

Dredge Infill Project at Cass Park: Ithaca, New York

Becky Mikulay

KEYNOTES:
(1) c.1906 – West side of park infilled with dredge material from Barge Canal.
(2) 1930's – WPA project to build airport runway over swampy area filled by Inlet dredge material.
(3) 1966 – Dredge material used to fill southern portion of park.
(4) 1971 – Cass Park developed; southern portion of park filled with soil from Channel project.

Project Description

As with Ithaca's Stewart Park, Cass Park has a long history of association with dredging the Inlet. In 1906, the city began acquiring and infilling land in what is now Cass Park. A failed peach orchard was eclipsed by the rail line and airport that dominated the area. During the Depression, a WPA project was implemented to build an airport runway over a swampy area after, once again, filling the swap with dredge sediment from the Inlet. The 1960's brought the construction of the adjacent and long-awaited flood control channel; the soil generated from this project was used to fill the southern portion of Cass Park in 1971.

Along with Stewart Park, the filling of Cass Park made the ecology of the southern tip of Cayuga Lake unique from sister sites in the Finger Lakes. Although Conesus, Hemlock, Honeoye, Canandaigua, Owasco, Skaneateles and Seneca still maintain some of their natural sediment accretion into wetlands, the only place left for this natural process to happen in Ithaca is within the flood control channel.

Inlet Applications

As with Stewart Park, past dredge material infill projects in Cass Park suggest that it is certainly possible to use the dredged sediment as a viable fill to create relativity flat ground suitable to parkland and similar uses. It is worth noting, however, that in much of the previous work done in Cass Park, sediment was used to fill holes and depressions in the landscape, any proposal to build up from a flat ground plane would require a different design approach to make sure that the earthwork stayed in place rather than melting back into a "minute soil" slurry in the first heavy rainfall. Also with *Hydrilla* being an issue, a silt curtain could be used to keep it contained in the land.

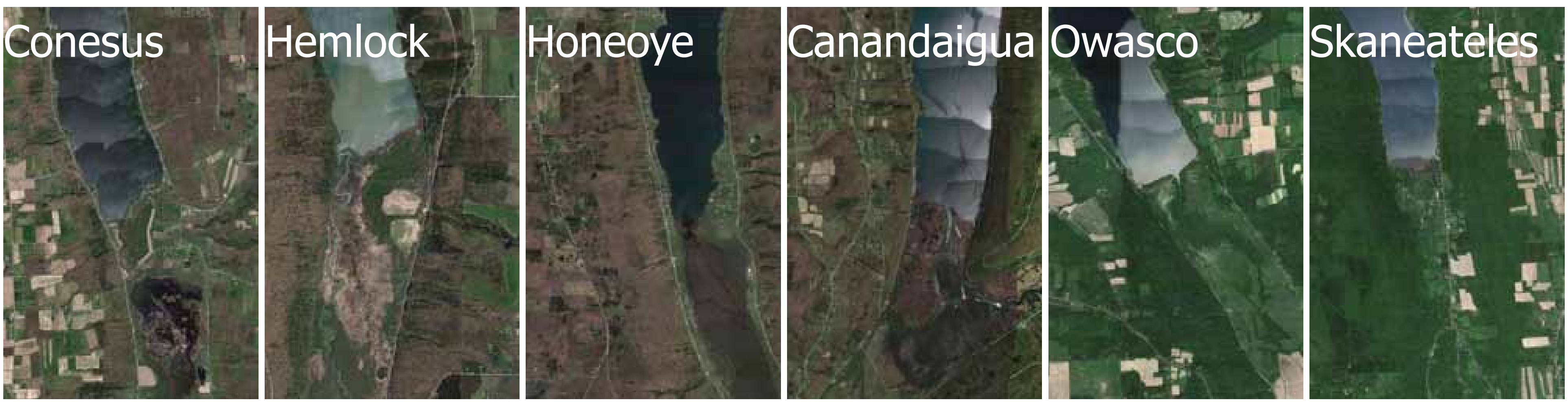

Figure 6.9a - Cayuga's sister lakes maintain some amount of natural wetland at the southern end of the lakes. Images: Google Earth.

Wetland Sites: An Introduction

Gene Fifer

Erosion from upland watersheds has been depositing sediments at the southern end of Cayuga Lake since the end of the glacial period. Marshes were continuously created, altered, and filled in through thousands of years of flooding events. The marshes that existed in Ithaca were drained and isolated from their water sources for residential and commercial development at the expense of native flora and fauna.

This loss of wetland habitats occurred throughout the Finger Lakes region and has been partially remediated through restoration projects like the Montezuma National Wildlife Refuge. The lessons of the following case studies could provide an approach appropriate for the inlet dredge project.

Manning and Cowett Proposal at Stewart & Cass Park

Amy McLean

KEYNOTES:
Cass Park
(1) Reduce erosion and control flooding.
(2) Enable CU and IC to continue to watch crew races.
Stewart Park
(1) Enhance wildlife habitat.
(2) Provide amenities- bird watching, hiking, fish access.
(3) NYDEC states that this would negatively impact fish habitat.

Project Description

In 2008, the city of Ithaca hired Ecologic, an environmental consulting company, to suggest ideal locations and assess environmental implications for those sites receiving dredge material. Evaluated sites include Treman State Marina Park, Cass Park, Newman Golf Course, and Stewart Park. Working from an earlier Cornell University Landscape Architecture studio proposal, designed by Fred Cowett, they suggested an alternative of using dredged material to create wetlands off of Stewart Park and Cass Park.

Inlet Applications

As an alternative use that has already been explored, this project serves to reexamine the feasibility and benefits of creating wetlands from dredged material. A wetland edge along Cass Park will reduce the risk of flooding, especially in the downtown residential areas. A stabilized bank would also enable continual viewing of Cornell University and Ithaca College crew races. In addition, peninsula off to the west end of Stewart Park would be a beneficial reuse of the dredge material by enhancing wildlife habitat and providing amenities such as hiking, bird

Figure 6.10 a - Cass Park: bank loss and erosion. Courtesy of the City of Ithaca.

Figure 6.10 b - Cass Park: bank loss and erosion. Courtesy of the City of Ithaca.

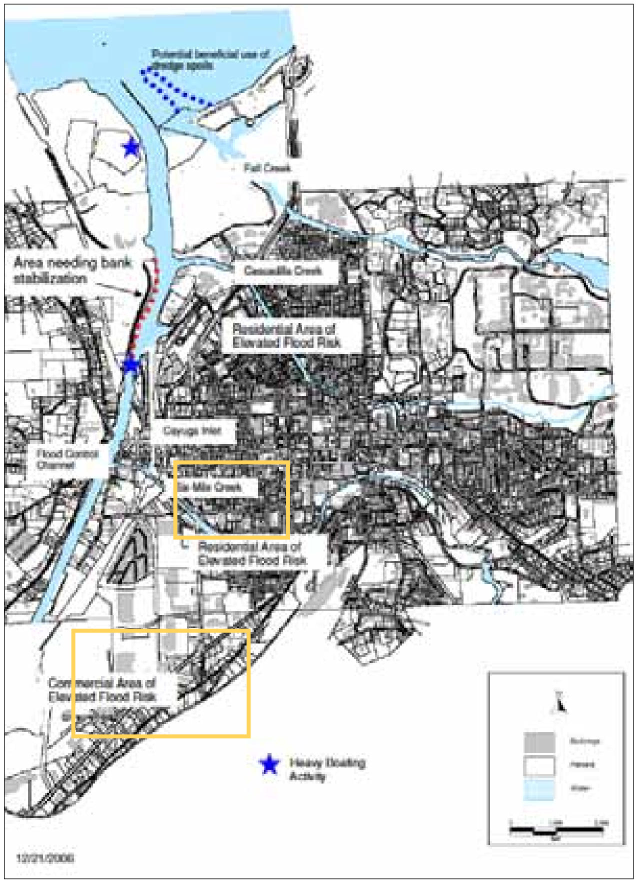

Figure 6.10 c - Context Map

Figure 6.10 d - Stewart Park Conceptual Plan. Designed by Fred Cowett.

Figure 6.10 e - Stewart Park Wetland Phasing. Drawn by Fred Cowett.

watching, and fish access. Sediment from Six-mile Creek, Cascadilla Creek and Fall Creek would be pushed further to the north in Lake Cayuga, away from the Stewart Park shoreline, which could allow for safer swimming conditions. However, it is perceived by NYDEC that this would negatively impact fish habitat. Recreating wetlands reintroduces ecosystem function that has been lost with the draining of wetlands and creates new ecosystem services and potentially contains dredge material that contains Hydrilla to one location, with the use of a in water silt curtain.

References

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Manning, Rick. Stewart Park Rehabilitation Action Plan. Rep. City of Ithaca, Strategic Tourism Planning Board, and Tompkins County Chamber of Commerce Foundation, Dec. 2009. Web. 14 Nov.2011.<http://www. cayugawaterfronttrail.com/file_uploads/SPRAP_Report_12-7-09_LowRes.pdf>.

Poplar Island: Chesapeake Bay, Maryland

Amy McLean

KEYNOTES:
(1) 1847- over 1,000 acres.
(2) 1994- over 4 acres of remnant islands.
(3) 1998- Project begins.
(4) 2029- Last year of dredge shipment.
(5) 2039- Habitat restoration complete process.
Construction Process
(1) Dredge material shipped from Baltimore Harbor.
(2) Built like jigsaw puzzle in manageable size cells.
(3) Crust management.
(4) Planting.
(5) Cells connected.

Project Description

The Maryland Environmental Service and US Army Corps of Engineers were contracted by the Port of Baltimore to rebuild Poplar Island to its 1847 footprint, as it had begun disappearing due to deforestation. Other participating agencies include National Marine Fisheries Service, NOAA, USACE, U.S. Fish & Wildlife Service, Maryland Department of Environment, Maryland Department of Natural Resources. Initiated in 1998, Poplar Island will receive dredge up to 2029 and habitat restoration will be completed by 2039. Poplar Island was first surveyed in 1847 and it comprised of over 1,000 acres, supporting a diverse array of wildlife habitat. When the project was started it had eroded to about 4 acres of remnant islands. The Maryland Environmental Service aspired to recreate the island to improve water quality, restore wildlife habitat, and reduce erosion from the mainland. They formed a complimentary relationship with the Baltimore Harbor- in order for the Harbor to remain navigable and economically viable they need to dredge the shipping channel annually.

The island borders were first reconstructed with armored rock edges and then filled with slurry of dredge material. From there, the island was divided into cells, based on what could be a workable dredge load over a manageable period of time. The first deposited substrate consisted of sand, and is now filled with material from the dredge approach channels leading to the Baltimore Harbor. Dredge material is not used from the Harbor in order to minimize heavy metals or toxic conditions. The material arrives at Poplar Island from November to March and it pumped through 24" pipes at a concentration of 10% sediment to 90% water to its destined cell. Once there, the water is left to drain and dry out. Oxygen, pH, salinity, and turbidity are monitored every hour to ensure proper functioning of the constructed environment. Once the desired conditions are reached, planting occurs. At the end of the construction all cells will be connected.

Figure 6.11 a - Context.

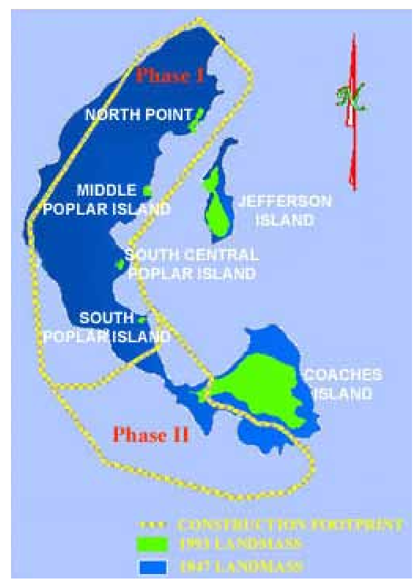

Figure 6.11 b - Phasing.

Figure 6.11 c - Aerial view, 1994.

Figure 6.11 d - 2009 Master Plan.
(all images from USACOE)

Inlet Applications

Poplar Island exemplifies what can be accomplished with multiple agencies working toward a common goal. In addition, this partnership enables the Baltimore Harbor to remain economically viable while enhancing the ecological services and functions by recreating wildlife habitat.

Figure 6.11 e - Reconstructed wetland, November 2011.

Figure 6.11 f - Diamondback Terrapin

Figure 6.11 g - Great Blue Herons

Figure 6.11 h - Snowy Owl (*Nyctea scandiaca*)

Figure 6.11 i - Striped Bass (*Morone saxatilis*) (all fauna images USACOE)

Figure 6.11 j - Reconstructed wetland, November 2011.

References

"Introduction." Baltimore District - U.S. Army Corps of Engineers. Updated 9 Mar. 2011. Web. 15 Nov. 2011. <http://www.nab.usace.army.mil/Projects/PoplarIsland/Intro.htm>.(1994)

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"Project Information." Baltimore District - U.S. Army Corps of Engineers. Updated 9 Mar. 2011. Web. 15 Nov. 2011. <http://www.nab.usace.army.mil/Projects/PoplarIsland/ProjectInfo.htm>.

Living Shorelines: St. Michaels, Maryland

Amy McLean

KEYNOTES:
Living Shorelines effectively:

(1) Absorb wave impact.
(2) Reduce and filter nutrients.
(3) Foster wildlife habitat.

Project Description

Founded in 1972, Environmental Concern is a 501(c)3 public non-profit institution focused on protecting and enhancing wetlands in the Chesapeake Bay Watershed. Restoration methods have been developed and refined over the past 39 years by the founder, Dr. Garbisch and other scientists and engineers. Environmental Concern's main objective is to advocate wetland stewardship and understanding through educational outreach and wetland construction. Educational activities include curriculum development, schoolyard habitat development, publications, and community programs at their Wetland Learning Center.

A major component of Environmental Concern's work is constructing wetlands. Their Living Shoreline refers to a constructed salt marsh, typical to the Chesapeake Bay region. These gently sloping marshes absorb the impact of waves and reduce nutrients such as nitrogen (through denitrification) and phosphorus from the water, thus reducing algae blooms, eutrophication, and dissolved oxygen levels. Prior to construction, the site is first analyzed and state and local permits are obtained. Next the sill is constructed by placing filter cloth and stone at the desired location. The existing bank is then graded and sand is placed as a growing medium. Typically, marsh grasses are installed; *Spartina alterniflora* below the Mean High Water Table and *Spartina patens* above the Mean High Water Table. Exclusion fences are then installed to protect the new plants from geese.


Figure 7.12 a - Typical plan.

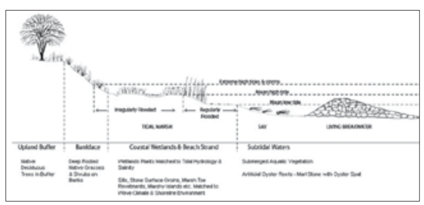


Figure 7.12 b - Typical section.


Figure 7.12 c - Sill construction.


Figure 7.12 e - Marsh grasses installed.


Figure 7.12 d - Existing bank is graded and sand is placed.


Figure 7.12 f - Exclusion fences installed to protect the new plants from geese.

Inlet Applications

Although the living shoreline approach would require slight modifications if applied to creating wetlands within the inlet, the basic concept and benefits to the Chesapeake remain the same to Cayuga Lake.

References

"EC Restoration - Living Shorelines." Environmental Concern - Dedicated to Working with All Aspects of Wetlands; the Most Active and Fascinating Ecosystems in the World. Web. 08 Nov. 2011. <http://www.wetland.org/restoration_livingshorelines_build.htm>.

Montezuma National Wildlife Refuge: Seneca Falls, NY

Gene Fifer

KEYNOTES:
(1) 50,000 acre wetland preserve.
(2) Drained in 1910, restored in 1937.
(3) Tolerates natural seasonal fluctuations of water level.

Project Description

The Montezuma Wetlands Complex (MWC) is a joint project of the US Fish and Wildlife Service, the New York State Department of Environmental Conservation, and Ducks Unlimited to restore wetland wildlife habitat. It covers 50,000 acres at the northern end of Cayuga Lake and includes both state and federal wildlife refuges, as well as property owned by private landowners and conservation organizations.

The widening and extension of the New York State Barge Canal in 1910 drained much of the marshland. A dam was built at the north end of Cayuga Lake and the level of the Seneca River was lowered eight to ten feet with locks to allow barges to continue operating. The remaining river course was straightened and deepened for better navigation and flood surge control. In 1937, the US Fish and Wildlife Service bought almost 6,500 acres of the former marsh and the Civilian Conservation Corps built low dikes around the area to restore wetland habitat.

Figure 6.13 a - Site Map (MNHR)

Figure 6.13 b - Aerial: Montezuma National Wildlife Refuge by Bill Hecht

The wildlife refuge is now designated a National Natural Landmark and is managed for education, recreation, and migratory bird habitat.

References

Montezuma National Wildlife Refuge - USFWS
www.fws.gov/r5mnwr/

Montezuma National Wildlife Refuge
www.fws.gov/refuges/profiles/index.cfm?id=52550

Friends of the Montezuma Wetlands Complex
friendsofmontezuma.org/

Figure 6.13 c - Sandhill Cranes by Doug Racine at Montezuma National Wildlife Refuge

Catharine Creek Area: Watkins Glen, New York

Gene Fifer

KEYNOTES:
(1) A naturally occurring Finger Lakes wetland.
(2) 1,000 acre wetland operated by NYS DEC.
(3) Still dredged for navigation and flood control.

Project Description

Queen Catharine Marsh, between Watkins Glen and Montour Falls at the southern end of Seneca Lake, is the last remaining headwater marsh in the Finger Lakes region. It is approximately 1,000 acres and is administered by the New York State Department of Environmental Conservation. In 2008 it was designated a part of New York State's Bird Conservation Area (BCA) program. The marsh was threatened by the construction of the Chemung Canal in 1833. The canal connected Watkins Glen with Elmira linking the Erie Canal system with Pennsylvania's Susquehanna River watershed. The section of Catharine Creek adjacent to the marsh is still dredged for navigation and flood control by the US Army Corps of Engineers.

Both the Montezuma Wetlands Complex and Catharine Creek Wildlife Management Area are examples of drained or threatened wetlands that have been restored and protected in the Finger Lakes watershed through joint federal, state, and local government actions in partnership with local and national wildlife protection organizations.

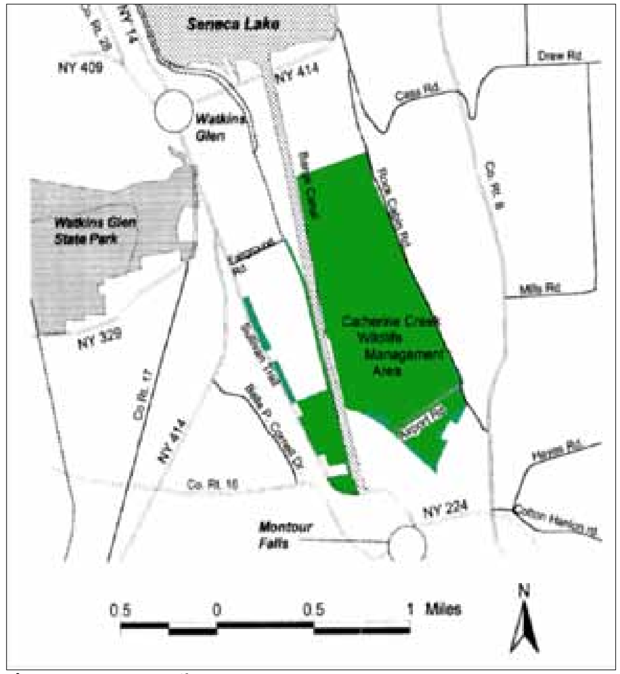


Figure 6.14 a - Trail Map: CCWMA

Figure 6.14 b - Queen Catharine Marsh by Mark Moskal

References

Catharine Creek - NYS Dept. of Environmental Conservation <www.dec.ny.gov>.

Queen Catharine Marsh – Willow Walk Trail | Watkins Glen New ... <www.trails.com/tcatalog_trail.aspx?trailid=XFP001-030>.

Watkins Glen - Hiking and Biking in Schuyler County <www.watkinsglenchamber.com>.

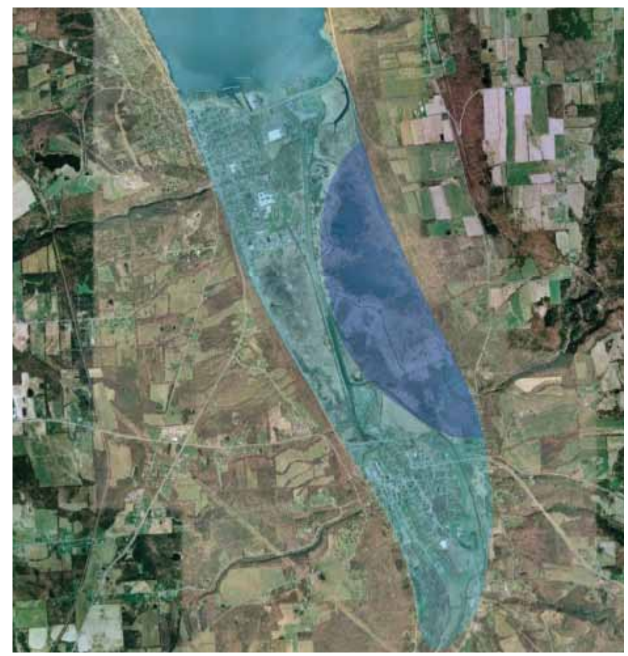


Figure 6.14 c - Dark blue, current wetlands

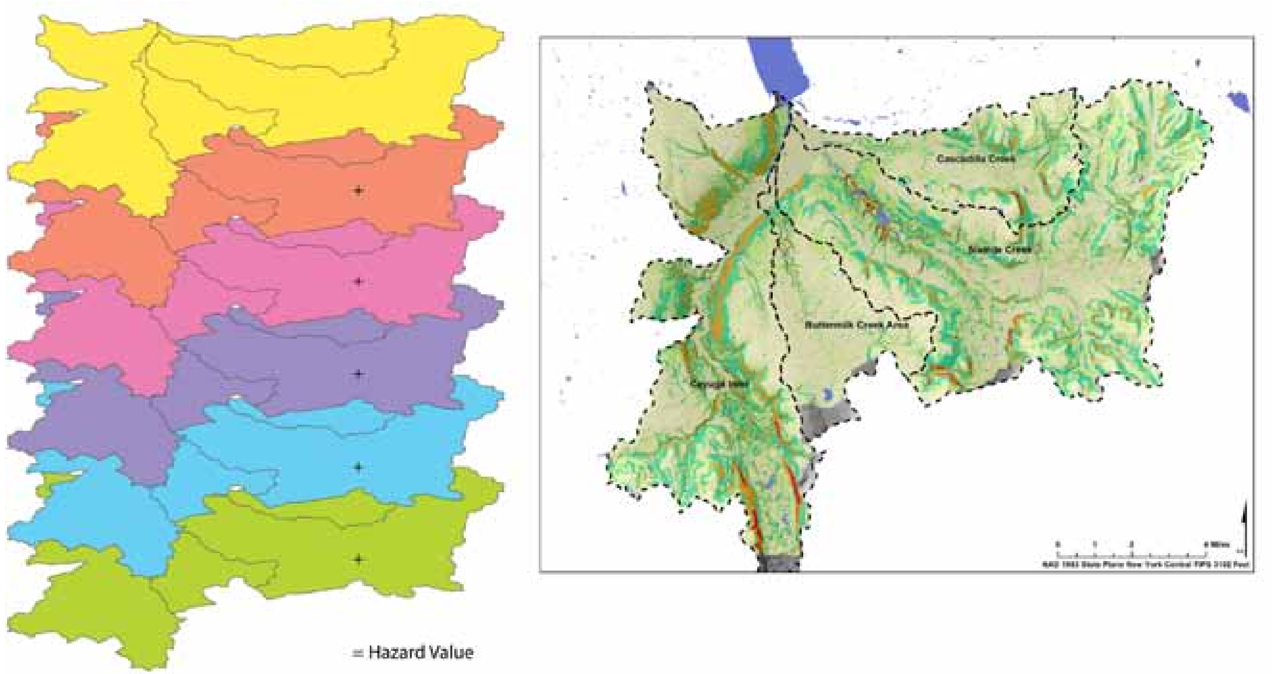
Appendix A - Landslide Susceptibility Analysis Methods

Matthew Gonser

6 Weighted Factors

Derived from DEMs
- 1) Slope

Derived from USDA SSURGO Digital Soil Survey
- 2) American Association of State Highway and Transportation Officials (AASHTO) Soil Classification
- 3) Liquid Limit
- 4) Hydrologic Group
- 5) Physical Soil Properties (as % silt + clay)
- 6) Hazard of Erosion



LANDSLIDE HAZARD ANALYSIS MATRIX						
Factor	Soil Classification (AASHTO)	Slope	Liquid Limit	Hydrologic Group	Physical Soil Properties	Hazards of Erosion
Rating	1 - 16	10 - 50	2 - 8	1 - 4	1 - 4	1 - 12
Factor rating or	1 (2)					
range and	2 (4)					
numerical rating	3 (6)	% slope			% silt and	
in parenthesis	4 (8)	0-2 (10)	0-65 as:	A through D	clay as:	Word/# modifier:
	5 (10)	3-7 (20)	00-15 (2)	A, sand and gravel (1)	0-25 (1)	slight, 0.0 (1)
	6 (12)	8-15 (30)	16-30 (4)	B, sandy-coarse (2)	26-50 (2)	moderate, 0.33 (4)
	7 (14)	16-25 (40)	31-45 (6)	C, mod.f.texture (3)	51-75 (3)	severe, 0.65 (8)
	8 (16)	>25 (50)	46+ (8)	D, clay/silt texture (4)	76-100 (4)	very severe > 0.65 (12)

Figure A.1 - Abridged methodology of landslide susceptibility analysis (adapted from a USGS/NYSGS preliminary landslide analysis algorithm (NYS Division of Homeland Security and Emergency Services, 2007)).

Appendix B - Soil Health Test Results

Jamie Nassar & Hayden Stebbins

Indicators	Reservoir	Dryden - Dredge Site	Dryden - Control Site
Physical			
Aggregate Stability (%)	8.91	32.2	87.33
Available Water Capacity (m/m)	0.27	0.1	0.24
Surface Hardness (psi)	100	100	100
Subsurface Hardness (psi)	300	300	300
Biological			
Organice Matter (%)	2.2	2.8	6.4
Active Carbon (ppm)	475.7	513.6	776.3
Potentially Mineralizable N	40.28	23.7	23
Root Health Rating (1-9)	5.6	5.1	5.9
Chemical			
pH	7.78	7.5	6.1
Extractable Phosphorus	5.1	2.6	5.6
Extractable Potassium	236.75	200.8	223.3
Overall Quality Score	51.7	56.5	79.5

* Figures are averages of samples taken from each site

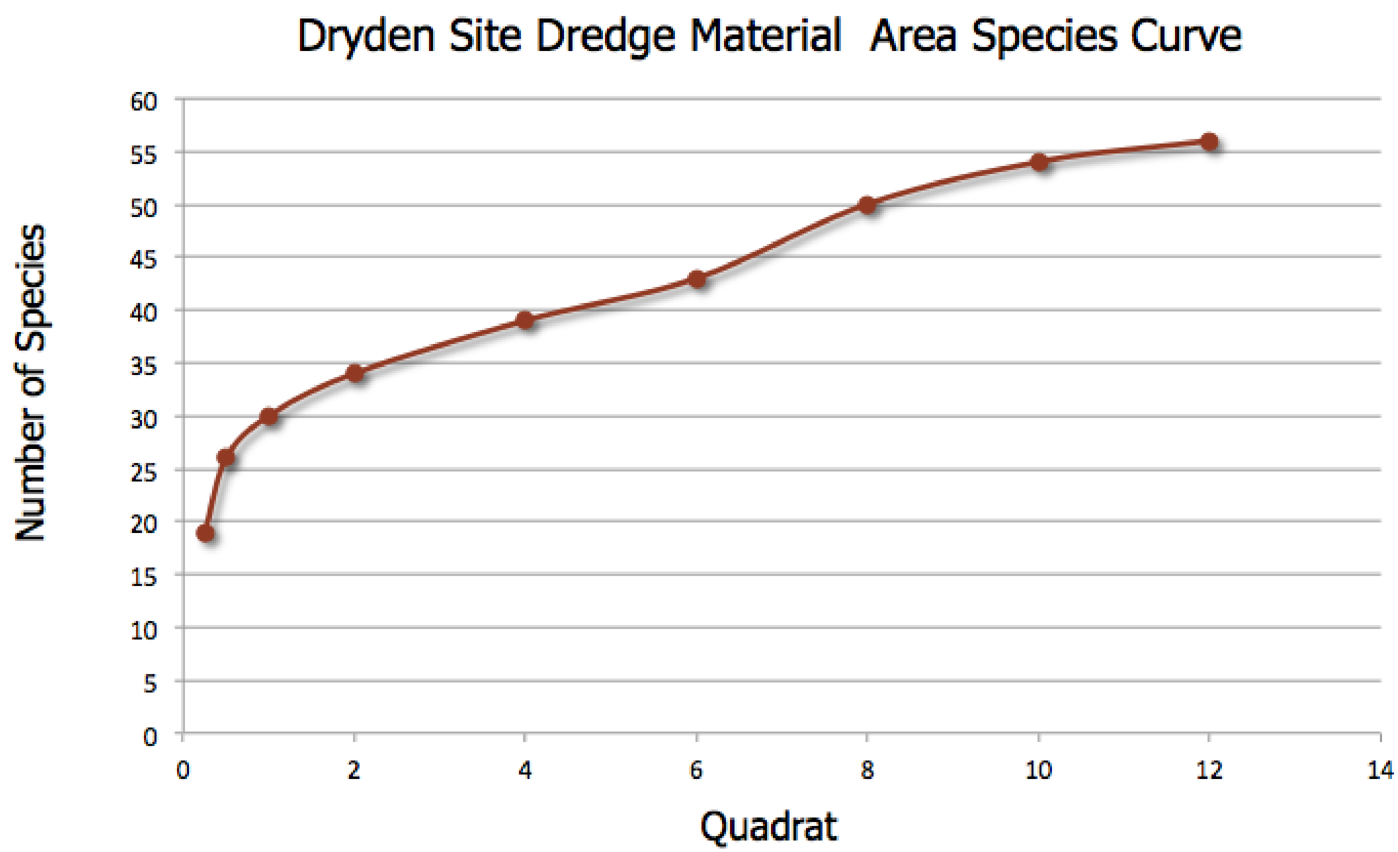
Appendix B - Soil Health Test Results

Jamie Nassar & Hayden Stebbins

SAMPLEID	MOISTURE	P	K	Mg	Ca	Fe	Al	Mn	Zn	pH_H2O	LOI	OM
	%	lbs/Ac	lbs/Ac	lbs/Ac	lbs/Ac	lbs/Ac	lbs/Ac	lbs/Ac	lbs/Ac		%	%
C1	0.59	15	870	1550	167270	215	119	1725	13.1	7.7	3.7	2.3
C3	0.6	12	400	1365	102560	71	82	1622	9.7	7.7	4.5	2.9
C5	0.61	11	415	1230	104730	133	89	1226	8.7	7.8	4	2.5
C6	0.61	9	320	1120	95200	101	76	1184	7.2	7.8	2.8	1.7
R1	0.59	12	660	1225	143820	178	102	1263	8.7	7.8	3.4	2.2
R4	0.58	11	515	1370	102020	153	102	1625	9.3	7.7	4	2.6
R6	0.64	11	455	1315	36430	69	96	587	9	7.9	3.8	2.4
L1	0.61	11	410	950	44170	108	97	737	6.8	7.8	3.7	2.3
L2	0.32	6	230	435	36710	74	52	228	3.4	7.9	1.4	0.7
L4	0.69	4	460	515	13060	67	86	286	5.1	7.7	3.7	2.4
F1	1.43	3	375	300	2160	7	140	54	1.7	6.2	7.4	4.9
F2	1.76	4	400	390	2600	5	91	68	1.6	6.4	10.3	7
F4	1.62	27	565	1020	8330	32	175	83	4.6	5.9	10.8	7.4
D2	0.91	6	335	555	13620	13	36	116	4	7.7	4.3	2.8
D3	0.68	5	420	490	11320	18	37	109	5.8	7.6	3.9	2.5
D4	0.84	5	450	450	13600	17	29	99	5.3	7.4	5.1	3.3

Appendix C - Dryden Site Species Curves

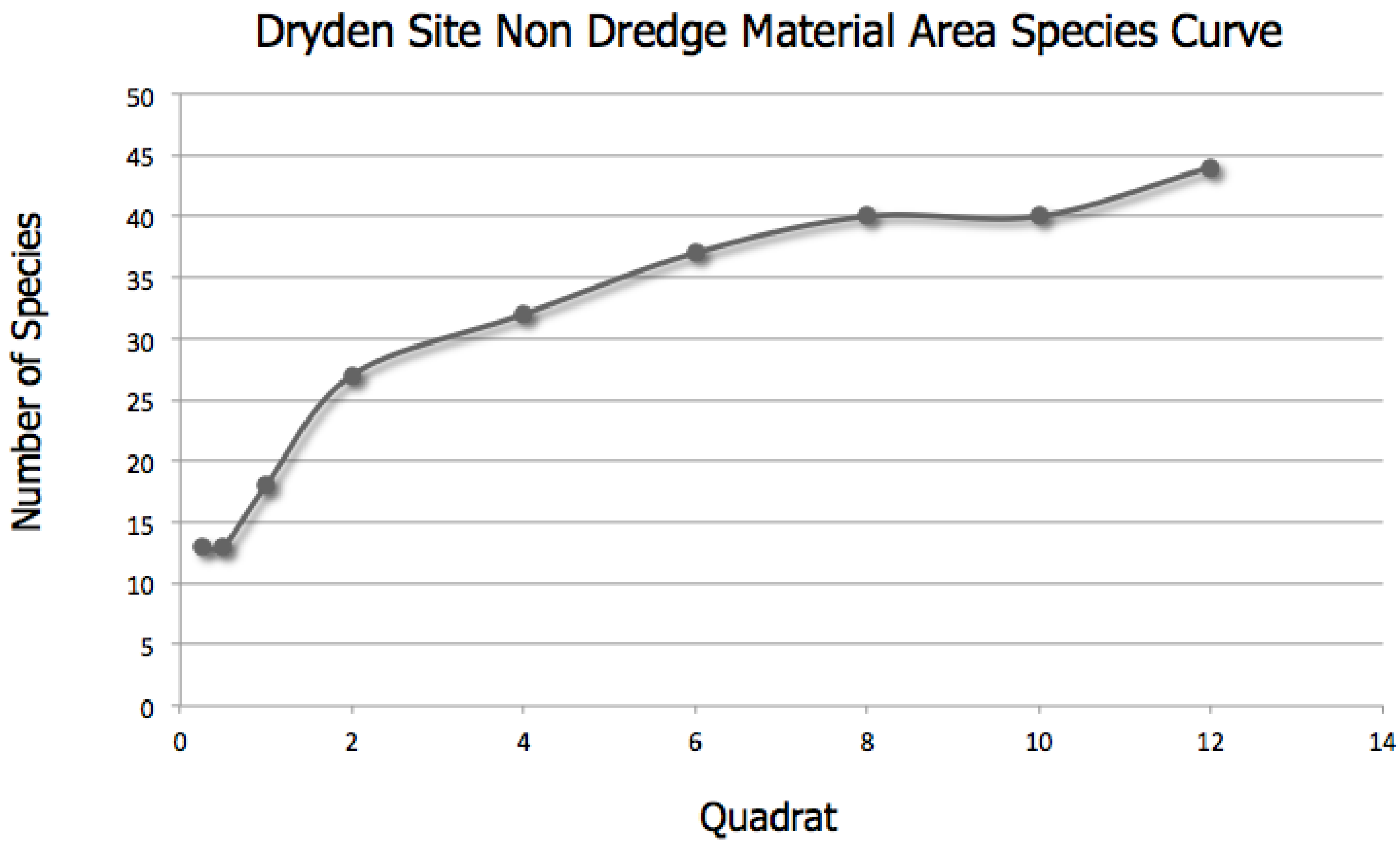
Jamie Nassar & Hayden Stebbins



Quadrat	.25	.50	1	2	4	6	8	10	12
# of Species	19	26	30	34	39	43	50	54	56

Appendix C - Dryden Site Species Curves

Jamie Nassar & Hayden Stebbins



Quadrat	.25	.50	1	2	4	6	8	10	12
# of Species	13	13	18	27	32	37	40	40	44

Thank You

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