Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1984 Volume VI: Geology and the Industrial History of Connecticut

An Introduction to the Marine Environment and Geology of City Point: A Model for Experiential Teaching

Curriculum Unit 84.06.07
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1. WHY CITY POINT IS IMPORTANT AS A STUDY AREA

Tidal marshes and their accompanying mud flats are among the most biologically productive areas in existence serving, it is thought by mainstream theoreticians, as a foremost exporter of organic matter from the land mass to the marine environment. [1] They also function as feeding and spawning grounds, as nursery and sheltering area for a wide variety of marine and estuarine organisms, ranging from crustacea to water birds as well as finfish and shellfish.

Mud flats and salt marshes are inseparable as estuarine subsystems connected as they are by the ebb and flow of the tides. The tidal change, although not traditionally thought to be part of the geology of an area, must of necessity be considered here. Owing to this condition any situation which influences one part of City Point must of necessity influence the estuary as a whole.

Clemente Middle School is situated within a mile of this historically, geologically and ecologically rich area. This unit will utilize the area, as an inner city environment, as a learning lab for middle school students who benefit from the hands-on approach of such real experiences. In addition to having a look at the history and geological structure of the area, map studies will be used, both as a research tool, and as a method of introducing students to the information contained in maps and, once the information is extracted, the students will be ready to use it.

2. HISTORY AND GEOLOGICAL OVERVIEW OF CITY POINT

New Haven Harbor, the second largest harbor in New England, with its excellent natural waterways, sheltered anchorage and mercantile prospects was a definitive factor in the Massachusetts Bay Colonies' decision to found a city around it in 1637. The original nine squares of the town were situated between the two creeks that flowed over the estuarine mud flat and into what was then the main harbor channel. [2] The off loading of all deep draft vessels was accomplished in the harbor itself while smaller vessels brought passengers and freight via a ferry operation into the main city utilizing the creek channel. In the last part of the 17th century a

major ship landing was constructed at Long Wharf where the mouths of the two creeks converged. This area was the subject of continuous development and expansion until 1815. [3] In that year the commercial wharf extended the full length of the flats. With the advent of the Clipper era ship drafts became deeper and large capacity vessels became the rule. As a result rapid commercial obsolescence overtook New Haven Harbor. The Harbor suffered a century of decline as a commercial and industrial area. After the Second World War however, the harbor was dredged by the Army Corps of Engineers and in 1948 a channel was dredged with the dredge spoils being utilized to bury the old Long Wharf and most of the accompanying mud and tidal flat areas. [4]

In 1958 Interstate #95 was opened. It runs along the West side of the flats and is supported by artificially created landfill that extends the shoreline about half a mile into what was previously the harbor. This parcel of land was created by the landfill and is bounded by Hallock Street, the old railroad station and rail right of way, and the interstate highway. It is currently used for medium and light industry.

The West River was originally situated in a meadow at the point where it meets the Harbor and City Point. The meadow served originally as a grazing common for farm animals who ate the “salt meadow hay” (Spartina alterniflora) which grew there in abundance. [5] With the decline of farming in Connecticut at the latter part of the 19th century, the pasturage declined and the area was taken for use by numerous cemeteries. By the turn of the 20th century, the landfill operations had sufficiently destroyed the former pasturage to permit construction of Boulevard, which runs parallel to the East Bank of the river creek. Over the next half century construction and fill-in continued of sufficient magnitude to permit the construction of shopping malls, sports and baseball fields, and eventually an interstate throughway (I-95).

As early as the beginning of the 18th century the area of City Point was occupied by the shacks of commercial oystermen, which gave rise to the name Oyster Point by which it was known since mid 1870’s and until the decline of the Connecticut oyster industry in the first quarter of the century. Today the area is the site of Schooner Incorporated, an ecology promoting organization, a sewage treatment plant, a marina and a restaurant.

City Point Tidal Mud Flat is located in New Haven Connecticut in New Haven County. It lies at forty one degrees, sixteen minutes and 53 seconds North Latitude and seventy two degrees, fifty six minutes and 15 seconds West Longitude according to the Geologic Map of New Haven Quadrangle #N4115-w7252.5, New Haven, Connecticut. It is bounded on the North by interstate 95, on the East by the City Point development, on the West by the Kimberly Avenue Bridge and embankment; and on the South by the harbor channel leading in to the mouth of the West River. Water depths range from zero on the flat to about eight feet in the channel with sediment deposits of from two to five inches. [6] The general substrate is of soft silt clay which becomes mostly sand at the point where the water and flat meet. The water quality is poor and suitable only for “navigation, power and cooling” according to a 1978 environmental impact study by Hilgenhurst Associates, while City Point itself is “an important” area for future commercial development according to the same study and is termed an “opportunity” area for the venture capitalist.

In order to better understand City Point one must reserach not only its historical value but also its geological history. A starting point is to cover the changes over the Paleozoic, Mesozoic and Cenozoic eras with regard to the Connecticut shoreline and that of neighboring regions. During the Paleozoic ear (about 570 million years ago) Connecticut was a part of the submerged continental shelf of the Proto Atlantic. The fossil record in Connecticut, although sparse due to a later metamorphic period, shows the remains of sea animals and plants in the areas that form the Eastern boundary of the old continent. One such notable deposit (as it is one of the

very few fish fossil sites in this state) lies several miles to the North and East of City Point in the Town of Durham where a small stream has cut through the later rock and exposed fish fossils of the carbonaceous era.

During the metamorphic phase most of the rest of Connecticut's fossil record was destroyed, and what we have left is the geological evidence of metamorphosis and erosion.

A period of vigorous vulcanism occurred during the Mesozoic period in our area. The land masses west of New Haven and coastal Milford are a direct result of the spreading of volcanic rock. Large volcanic deposits can be found just east of the central Connecticut lowland. The movement of lava and molten rock which formed rifts and valleys throughout Connecticut is responsible to a large extent for the composition of the shore line and indirectly responsible for the underlying formation of the harbor basin.

The greatest geologic event with regard to New Haven harbor and Long Island Sound however, was glaciation. While the ice sheet was stationary over the region, glacial melt water carried sand and gravel (sediment) south to form sand plains, tills and moraines. This sandy, porous area was favorable to the growth of white and yellow pine, cedar and scrub oak, all of which are abundant still in Connecticut to this day. The ice sheets have covered the region and receded a total of five times. In Connecticut, the latest period of glaciation (called the Wisconsin) has erased the evidence of previous ice sheets that can be seen in other parts of the country. However it did not have a huge effect on surface topography due to its extremely slow movement.

The receding glacier carved and shaped what has come to be Long Island Sound and left us with fine natural harbors where the softer material of the sand plains interspersed with the basaltic flow of lava.

Within this capsulized view of Connecticut's geologic history, I wish now to spotlight City Point itself. Again, one must be aware that being an estuarine system, the City Point mud flats have undergone periods of natural change. Looking at the map herein included (fig. 1—map of the area) one can note the land extension protruding directly into the Harbor. This is surrounded on three sides by tidal flats. Today the sewage treatment plant (providing primary and secondary treatment to sewage) is located at the far end of City Point, an important part of Long Island Sound that has had its share of environmental activity. Commercialism, a direct effect of industrialism, also plagues the surrounding area of the city. The Boulevard has rapidly become one of the heavily commercialized centers and it is part of the City Point neighborhood.

In a study done in 1978 both the qualitative and quantitative components of the City Point mud flat community were sampled. Random sampling of vertebrates, invertebrates and vegetation of the flat and marshland formed the qualitative element. Eight species of birds were mapped and counted. Today one can see the ring-billed gull and herring gull graciously cruising the area or, at the same time, engaging in internecine warfare over the supply of fiddler crabs and periwinkles that typify the invertebrate community here. The quantitative aspect of the 1978 study (Mckay and Baker) used two line transects, each 55 feet long; each line transect was subdivided by three sampling stations. A sediment sample was taken from a depth of 20 centimeters at each of the stations. Each of the samples was sieved and the organisms were stained, identified and enumerated. Tables of scientific enumeration and labeling were made. These samples were then compared with earlier studies conducted in the City Point area. The effects of natural change, pollutants and other variables were part of the case study conclusion.

City Point has been the center of study for many reasons. The New Haven office of city engineers has reviewed periodically its interest in a water pollution abatement project. Southern Connecticut State University has data from a 1974 study and the 1978 study specifically dealing with the mud flats; with particular emphasis placed upon the environmental impact of alterations to the mud flats. It was noted in

Mckay and Baker (1978 study) that pollutional stresses eliminate the more sensitive species of the flat community, allowing only tolerant forms to exist; thus the steady increase in diversity was found between October 1974 and September 1978. This change of approximately 90% overall also may mark the lessening of pollution in the Harbor. Several area developmental projects were awaiting approval to reverse the pollutant trend and assist in the protection of deposit-feeding organisms. Schooner Incorporated has its base here at City Point with its primary interest in rebuilding the area environmentally. As with everything else, an educated consumer, in this case the human population of the area, is the best investment for future needs.

The New Haven Redevelopment Agency and the New Haven Colony Historical Society have also had a variety of reasons for gathering data, both historical and geological about City Point. I have prepared on-site 35 mm. color slides of the study area which reflect the actual day to day commercial and non-commercial events in the City Point area. Photos of the mud algae and spartina alterniflora are also included as well as natural shots of the area including the harbor. Included in the slides are:

1. Typical daily scenes of the neighborhood today.
2. Industrial/commercial uses of the area.
3. Natural habitats of birds and fishes.
4. Photographs indicating topography.
5. Water and drainage sites.

By reviewing these slides the students can readily evaluate the environmental impact, the surrounding neighborhood has had upon City Point and more importantly, how City Point impacts upon the neighborhood.

Attached to this unit will be an appendix of special interest groups for contact. They are the same agencies that the teacher may want to call upon for help in the teaching of the unit. The general goal of the unit will be clearly stated and the teaching objectives will be intrinsic to the lesson. Additional activities are also listed. Therefore, as a teacher, all one need to do is to implement the lesson plan to fit the level of the students in the classroom.

One may study the City Point area in a variety of ways. I would suggest that this be one lesson of a composite unit on shorelines and waterways so that the student can correlate information relevant to the study of Earth Science. City Point can be an avenue for the study of estuaries and waterways; or this unit can also exist in harmony with a more in-depth study of geological changes in the land formation of Connecticut. This unit lends itself to infinite possibilities including subunits on pollution, conservation and environmental studies. Waste water treatment facilities and sewage treatment plants are excellent for this type of focus, both of which are found at City Point.

Maps and map usage will be an important subskill to be taught in this unit. “On Site” specimen collecting and field trips are a definite necessity in teaching the core of the unit. These “on site” walking trips can better acquaint both teacher and students to the thrust of the unit. I would suggest previewing the slides prior to any field trip. I would review a list of terms and pertinent vocabulary before adventuring out on the entire lesson

coverage. In one of the Lesson Plans, an additional activity in Vocabulary Study of scientific terminology is available. The Institute Office will have the slides, maps and additional teacher-made materials on hand for this unit.

Much interest in nature can be developed by studying nature in one's own backyard as with the study of City Point in relation to Clemente Middle School on Howard Avenue. This important area should be a basis of study for those students who live in the environmental kline of the inner city and the sound.

Notes

1. Mckay and Baker, The City Point Mud Flats: A Continuing Study (Southern Conn. College, 1978) p.1
2. Ibid; p.1 (History)
3. Ibid; p.2
4. Ibid; p.3
5. Ibid; p.2
6. Ibid; p.3

LESSON PLANS

LESSON PLAN #1

GOAL: Students will develop map skills by utilizing topographic and surficial maps of New Haven Harbor and City Point. Students will be able to successfully read a map of the City Point area.

OBJECTIVES:
To teach map skills

To have students follow directions

To have students successfully place their school in relation to the study area

To be able to read map legends

MATERIALS:

Enough copies of Fig. 1 map for each pair of students, and surficial map of City Point.

Pencils and crayons

When utilizing the topographic map, have the students locate and color in New Haven Harbor. After discussing the Harbor and its accessibility to the city, students are ready for map labeling, that is, the students should be guided in the use of applicable terms. Compass points should be given, and directions given for finding them. The proper terminology should be used: “Let’s go North of Long Island Sound to New Haven”. Find New Haven. Each segment found and labeled can be colored a different color. Locating the Boulevard, tidal flats, lighthouse, etc. and labeling each with a different color.

FOLLOW UP ACTIVITIES:

1. Show overhead projection of the same map-

a) Is anything missing? Find Howard Avenue: Locate the Public library. Can you now place Roberto Clemente School on the map?

Students will be unable to find the school since it was built after the last topographic map was assembled. Students may wish to fill in where the school would be on a newer map. Students who nay attend Lee High, Truman School or who know the addresses of their homes in the area may wish to locate their schools and homes on the map.

b) Students may locate the sewage treatment plants on the map and note their strategic location. The teacher may wish to elaborate upon the causes and effects of pollution and the many diverse methods we have tried to control or eliminate water pollution.

c) The class could consider taking a trip across from City Point to be able to view the area from the east shore area. Name the historical points seen there and locate them relative to the study area on the map.

d) Introduce the globe to the class. Use one with latitude and longitude clearly marked. Explain that that is the system used to locate objects any where on the map. Go only so far as the readiness of your class will allow. This can get pretty esoteric. Locate New Haven and City Point via latitude and longitude. Locate somewhere else the same way. (This is for eight graders up—at least a minimal exposure to geometry is a requisite for getting anywhere).

LESSON PLAN #2

GOAL: To train students visual acuity; to observe and compare.

OBJECTIVES: Students will view slides of City Point (found in the Institute's office) and then compare them with older photographs. Students can chart the obvious differences in comparing modern environment of City Point with the historical photos.

Complete a chart of differences and similarities. Teacher will introduce concept of environmental change. Changes due to natural events (can go back as far as the glacial period) and changes due to the intercession of civilization. (Query: are man's changes not "natural"?)

Additional activities might include teaching vocabulary of necessary terms, placing words in scrambled order and having words to know. A test on terms and definitions should be given.

1. mudflat
2. boundary
3. grid
4. topographic
5. surficial
6. dominant
7. species
8. glacial
9. industrial
10. pollution
11. geology
12. oyster
13. estuary
14. harbor
15. coastal
16. tidal flat
17. marsh
18. organism
19. silt
20. harbor basin

LESSON PLAN #3

GOAL: To familiarize students with tidal mechanisms and magnitudes.
OBJECTIVES: To have students understand how tides are generated. To show the relationship between the earth and the moon and how they interact. To appreciate the complex relationships and the enormous energy exchanges that occur on a daily basis.

MATERIALS: A globe; a smaller sphere representing the moon; string for a line transect; an almanac; the daily newspaper.

1. Start with a discussion of gravitation. Demonstrate the relationship between the Earth and the moon. Show that the earth's surface is 2/3 covered with water. Explain the cause of the tidal changes.
2. Obtain an almanac and the daily newspaper. What time does it say high tide is? What time does it say low tide is? How are we able to predict when the tides will be? Why are there basically 6 hour cycles?
3. Now go out to the tidal flat. Run a line transect, that is stake out a piece of string running from the water line, up the beach. Mark with a stake where the water line is. Now come back at the predicted high tide and the predicted low tide. What is the magnitude of the difference? Are the differences consistent with the predicted results in the almanac?
4. Discuss the ramifications with your class. How could the ebb and flow of the tides be utilized as an energy source? Are there places where the tides are of greater magnitude? How come?

LESSON PLAN #4

SAMPLING THE MUD FLAT COMMUNITY

GOALS: To acquaint the student with scientific sampling techniques.

OBJECTIVES: Introduce elementary statistical sampling. Introduce the concept of species diversity. Have the students understand the differences between species diversity and species richness at an elementary level.

MATERIALS: The Line transect constructed in the previous lesson plan. A piece of window screen.

About a dozen shoe boxes. Alcohol for preserving species. A Golden Books or similar guide to sea shells and shorelife.

1. Assign a part of the class to walk along the beach front picking up sea shells for later identification.
2. For the greatest part of the class have them sample the environment by using the scientific method:
    1. Establish “stations” every 5 feet or so along the line transect.
    2. Have the students dig down into the surface and place the sample (sand and all) into the shoe boxes. Identify the shoe boxes by date and station number.
3. Screen the samples carefully (either in the laboratory or the field if there is a good source of running water).
4. Separate the findings by type: worms in one jar, mollusks (sea shell types) in another jar, crustacea (crablike animals) in the third.
5. Try to identify them from the guidebook as best you can.
    A) How many different *kinds* of organisms were found? This concept involves the idea of species *diversity* . The numbers of different organisms living in an area.
    B) How many of each kind were there? Now we introduce the concept of species richness. Why should there be more of one species than another? Why is this environment better for one kind of animal than it is for another kind?
    C) How come we used a line transect and marked where the samples came from rather than sampling anywhere? How come we tried to make the samples all the same size by putting them in shoe boxes rather than just filling bags with some sample and bringing it back to the lab?
    D) How did our transect samplers do relative to those who picked up sea shells on the beach?

The point here is multifold. The teacher can introduce elementary scientific and statistical methods in a meaningful way. The students will also learn about the twin concepts of diversity and richness as well as getting a look at the organismas that live in the intertidal regions right in our own back yard. This makes a nice full day experience. If the class has access to a woodland or some other environment different from that of the shoreline it is a fun idea to repeat the exercise in the second environment and compare the results. Why are the organisms different?

Bibliography (annotated)

Cook, Thomas A., *Geology of Connecticut* , The Bond Press, Hartford, Ct. 1933.

Although an older text, it is a useful source. Chapter III dealing with Geologic History and Events is worth reading. Photos depicting glacial drift are interesting.

Flint, Richard Foster, *The Surficial Geology of the New Haven and Woodmont Quadrangles #18* , State Geological & Natural Survey of Connecticut, 1965.

The entire booklet is informative. Of particular interest to this unit are pages 25 and 33. The map is very good. Tables, charts and graphs are excellent for the needed background info. See appendix: can be obtained from Dept. of Environmental Protection. Natural Resource Center.

Gosner, Kenneth L., *A Field Guide to the Atlantic Seashore* , Houghton Mifflin Co. Boston, 1979.

A book to be taken with you to the shore and use it. Excellent illustrations and text which describe the incredible variety of marine plants and organisms found in the tide pool and intertidal flats.

McKay, and Baker, *The City Point Mud Flats: A Continuing Study* , Southern Connecticut State College, New Haven, Ct. December 1978 Excellent recent study done in the City Point area. The information is comprehensive and factual with research data accompanying the paper. Tables categorizing birds, plants and organisms are a good scientific source. See appendix: Southern Connecticut State University—Department of Marine biology.

Maguire: Engineers and Planners, *Boulevard and East St . Water Pollution Abatement Project* : City of New Haven, Office of the City Engineer, New Haven, Ct. July 198I.

Strictly an engineering report. The engineers evaluated alternatives to convey wastewater from the Boulevard and East St. treatment facilities to the East Shore treatment plant. Very technical reading but interesting due to the current info dealing with City Point proposals. See appendix: On file City of New Haven Hall of Records.

Mills, Elizabeth, New Haven: *A Guide to Architecture and Urban Design* , Yale University Press, New Haven, 1976.

Up to date: its focus is urbanization and its effects on architectural design. All 228 pages not necessary to read but an interesting approach.

Nobile Philip & Deedy John; *The Complete Ecology Fact Book,* Anchor Books, 1972.

Interesting and factual. A good primer with up to date ecological date for use in any geology unit.

Petrides, George A., *A Field Guide to the Trees and Shrubs* , Houghton Mifflin Co., Boston, 1972.

Exactly what the title says, a guide to be used on walking trips. Gives information on various plants and identification. Nice to have on hand.

Rice, William North, *State Geological and Natural History Survey* , Bulletin #6, Hartford Press; The Case Lockwood and Brainard Co., 1906.

An old text and really not that useful. History is interesting however, the only worthwhile chapters to read are Chapter I dealing with the geography of Connecticut (pg.32) and Chapter IV Glacial Geology is also good for background material. Tedious reading.

Rodgers, John,"The Geological History of Connecticut," Discovery Magazine Vol. 15, Number I Peabody Museum Associates, Yale University, New Haven, Ct. 1981.

Good article which capsulizes time span inclusive of geological changes here in Connecticut. Surface geology of Connecticut clearly discussed; photos are included. Worth reading.

Shelton, John S., *Geology Illustrated* , San Francisco, W.H. Greeman Co., 1966.

A basic text. Some important chapters for this unit. Emphasis placed on photos and they show clearly facts relating to geological processes. Chapter 16, "Waves and Shorelines" is very good especially pertinent are pgs. 180 to 182.

Zottoli, Robert; *Introduction to Marine Environments* , C.V. Mosby Co., 1973.

Very informative for the novice marine biologist. Good basic book to have and use. 125 pp total.

APPENDIX

Special Interest Groups for Contact

List of Agencies: Phone Numbers:
City of New Haven

Planning and Zoning Commission

Hall of Records

New Haven, Ct. 06510

Attn: Ms. Willie May Walker 787-8041

Department of Commerce

National Marine Fisheries Service

Northeast Fisheries Center

212 Rogers Avenue

Milford, CT. 06560

Long Island Oyster Farm, Inc.

610 Quinnipiac Ave.

New Haven, Ct. 06513 467-6384

Department of Environmental Protection

122 Washington St.

Hartford, Ct. 06115

Attn: Mr. William Hogan

New Haven Colony Historical Society

114 Whitney Ave.

New Haven, Ct. 562-4183

Dept. of Environmental Protection

Coastal Area Management

Division of Environmental Quality

165 Capital Ave.

Hartford, Ct. 06115 566-7404

State Harbor Commissioners for

New Haven Harbor

Attn: Mr. Ben Brownstein

100 York St. 17-N

New Haven, Ct. 06511 524-8808

Commander

U.S. Coast Guard Station

120 Woodward Ave.

New Haven, Ct. 06512 467-1928

Southern Connecticut State University Biology Dept.

501 Crescent St.

New Haven, Conn.

Attn: Mr. Peter Pellegrino

SCHOONER Inc.

60 S. Water St.

New Haven, Ct.

Attn: Debbie Turnbull, Director 865-1737

The Natural Resources Center

Dept. of Environmental Protection

165 Capitol Avenue (Rm. 553)

Hartford, Ct. 06106 566-3650

Fig. 1—Map of the Area

(figure available in print form)

CITY POINT MUD FLATS

PHOTO #1— *Spartina alterniflora* and Flat

(figure available in print form)

PHOTO #2—Flat With Mud Algae

(figure available in print form)