EEOS Capstone Class Spring 2011
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Mondays 5:15 -7:30 pm

Course website: http://www.faculty.umb.edu/anamarija.frankic/eeos476/eeos476home.html

Course Vision

The premise for this course and my research is that *the environment sets the limits for sustainable development.*

The methodology I use in my research is derived from a 1500 year old Native Hawaiian *Ahupua'a* approach. "This approach defines sustainable relationships among land, water and humans from the tops of islands to the coral reefs and open-ocean. The main connection - as well as impediment - among the different self-sustaining units in this approach was both the quality and quantity of the water. Land stewardship practices were established to ensure that water used for agricultural purposes higher on the mountains was either unharmed or enhanced for downstream uses." (Frankic and Greber, 2010)

The work you will do in this course will help evolve a similar interconnection between the City of Boston and Boston Harbor.

Course Description

The goal of this Capstone Course is for you to have the opportunity to become a steward engaged though working in interdisciplinary teams on a selected local environmental issue(s) and project sites.

In general, the environmental problem solving model involves five steps:
1) Identify and diagnose a problem
2) Set goals and objectives with stakeholders' feedback,
3) Design and conduct a study,
4) Propose alternative solutions based on stakeholders' feedback, and
5) Implement, monitor, and reevaluate.

Your groups will address the problems from both a social sciences (law, policy, economics, ethics, history, management, etc) and natural sciences (biology, chemistry, physics, geology, ecosystems, etc) perspective. Learning and teaching by doing a project will incorporate biomimicry approaches in potential solution and project designs. In addition, we will make sure that your projects will incorporate stakeholder feedback in the process.

Selected site activities and deliverables will include:

1. Basic environmental assessment – site inventory – including geological, biological, etc
2. Basic socio-economic assessment – local activities (historic and future ones)
3. Use conflict assessment – what can and cannot coexist on the selected site; where are the current and potential use conflicts and why; what are the current and potential issues;
4. Potential solutions and scenarios – based on the students findings and existing information students will develop and design solutions scenario(s) for selected sites;

5. Establish a project ‘feedback loop’ – select natural and socio-economic monitoring sets of indicators;

Weekly Timeline – Pending and subject to change

Week	Date	Planned Topic
1	**1/24/2011**	Class Introduction
2	**1/31/2011**	Select Project Sites
3	**2/7/2011**	Group initial site presentations (5 minutes)
4	**2/14/2011**	Field trip - Neponset salt marsh/Squantum
5	**Presidents Day**	Field trip - Pier 5
6	**2/28/2011**	Urban watershed issues
7	**3/7/2011**	Group presentations (10 minutes)
8	**3/14/2011**	Visit BAC class – landscape architecture
9	**3/21/2011**	Urban watersheds – current management (Speaker from EPA)
10	**3/28/2011**	Biomimicry as a watershed solution
11	**4/4/2011**	Field trip - Savin Hill Cove
12	**4/11/2011**	BAC class visit us - design and visualization
13	**Patriot's Day**	Field Trip - Deer Island
14	**4/25/2011**	Conservation Law Foundation
15	**5/2/2011**	Class Conclusion, discussions, evaluations
16	**5/9/2011**	Final presentations

Project Sites

UMass Boston was recently selected by the EPA to lead the urban waters/watersheds restoration in the Boston area; therefore, this capstone class will have an opportunity to work on several (7) pilot sites:

1) Mystic River watershed open space priority sites:
    a. Chemical Lane/Monsanto
    b. GE Site in Everett (Rivergreen Technology Park)
    c. Draw Seven Park in Somerville
    d. Sandy Beach on Upper Mystic Lake
    e. DCR Properties in Chelsea

2) Pier 5 in Charlestown,
3) Savin Hill Cove site at UMass Boston (addressing dredging, salt marsh and mudflat habitats)

In addition, you will have a unique opportunity to work on these sites together with a landscape architecture team from the Boston Architectural College (BAC) led by Prof. Kevin Benham.

PROJECT SITE EXAMPLES

To give you a flavor for the work we are going to do this semester, the following are descriptions of two of our course sites, including future visions for the site, as well as selected activities that might be implemented either to study, restore, or design within the site.

A. Vision for Pier 5 – based on the local stakeholders' inputs

How to establish a pilot site facility for applied research, education and outreach activities? The envisioned potential facility would consist of a 'wet lab' that will have monitoring stations, underwater cameras, and in situ observation for:

A) water and energy uses (solar and mini wind turbines);

B) water and air quality;

C) biodiversity monitoring (invasive species and native species assessments and monitoring on and off the bottom - by positioning number of monitoring plates, floating vegetative eel grass beds, and salt marsh floating structures);

The main goal is to establish applied research, education and outreach activities that will address the water-energy nexus:

1. water cycle:

by having a green roof small facility (wet lab type) + floating salt marsh + oysters hanging from the pier; the major goal is to establish water monitoring in situ with different YSI probes to foresee relationship between green roofs and surrounding pier water - new bioindicators - oysters and floating eelgrasses - to rate the water quality changes and health of these organisms;
2. Energy cycle - by running the whole facility by solar (panels are part of the green roof) - this energy would support the lab and the public restroom (Clivus technology in practices - similar to the one on Spectacle island);
3. Electric boat - the first one on the harbor (MIT - developed one)
4. Oyster (or mussel) upweller – for monitoring oyster growth and potential reproduction;
5. Build Sea perches (remotely operated underwater vehicle) for research, outreach and education how to assess coastal water conditions (MIT);

B. Savin Hill Cove site description (Fig.1)

Savin Hill Cove, in Dorchester, MA is located between the Vietnam Memorial, the Savin Hill Yacht Club and UMass Boston. Savin Hill Cove has been accumulating debris as well as sediments, compromising the marsh's capacity to function properly. Tidal and human deposition have resulted in the build-up of approximately 100 tons of debris in the marsh and water. Some of this debris has been found to contain hazardous materials that may negatively impact the marine environment. The majority of the debris, however, consists of large pieces of wood and metal which shift with high tides, crushing the existing vegetation, increasing erosion, and churning sediments within the cove. Removing the debris and restoring salt marsh, soft shell clam beds and eel grass beds would prevent additional loss of marshland, promote improved habitat, and increase flood and erosion control as well as the capability to improve water quality.

The majority of the coastline surrounding Savin Hill Cove has been fortified with rip rap or seawalls. There is a small remnant of a salt marsh, making it one of the few remaining "natural" sections of the coast in Savin Hill Cove and the surrounding area. Restoring this marsh would protect against floods and erosion, enhance water quality, and provide habitat for many species.

Due to the interconnectedness of coastal and marine systems, the importance of this project extends beyond the bounds of Old Harbor and Savin Hill Cove into the larger encompassing area of Boston Harbor – an area NOAA has designated as an Essential Fish Habitat (EFH). At least twenty four species of fish rely on the habitat provided by Boston Harbor during one or more life stages. Species and habitats will benefit from the improved water quality, reduced disruption of sediments, and restored marsh habitat generated by this project.

'Dredging' in the Savin Hill Cove

- Frequency – determine interval of dredging needed to maintain optimal flushing in cove, basin depths for Salt Water Pumping Station, and keeping navigable waters within depth tolerances.
- Volumes – determine cubic yards of material needed to remove in order to align with frequency schedule.
- Permitting – establish calendar showing permitting schedule needed.
- Scope – project area to include: Savin Hill Cove; Salt Water Pump Station discharge pipe (SE of Campus Center); John T. Fallon State Pier channel and basin
- Review – existing data including: hydrographic studies; coring sample composition; bioaccumulation study; marine fish/shellfish studies; dredge pre/post studies; mooring field plans.
- Interview – UMB personnel; ACOE; Mass State Fisheries; Boston ConCom; Boston Harbormaster; others?
- Deliverable – Dredge Schedule; cost estimate; Environmental Impact assessment; more?

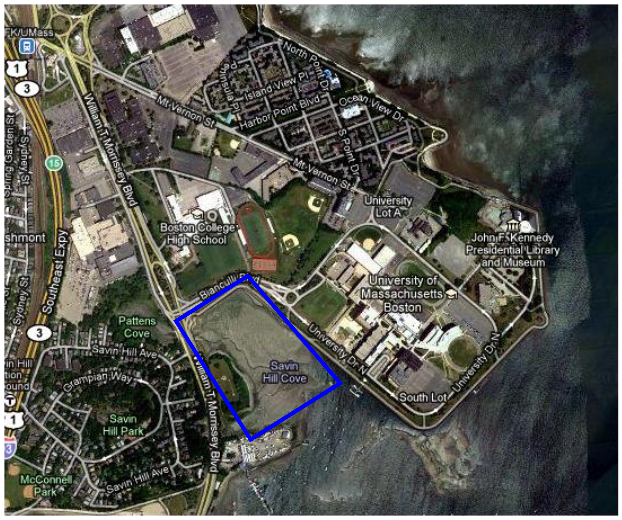

Figure.1. Savin Hill Cove project Site (blue)

<u>Addressing the salt marsh and shellfish restoration in Savin Hill Cove</u>

Implementation activities at this site will likely include

1. A survey of the flora and fauna within the pilot scale study area to evaluate the types of invasive and native species.
2. Bathymetric and topographic survey of the area such that potential cuts and fills can be evaluated.
3. Assessment of required permits
4. Assessment of the debris within the area as to size, type, and composition.
5. Three piezometers should be installed within the area and monitored over tidal cycles to understand the interaction of the tidal impacts with the existing grades.
6. Collection of core samples for physical and chemical analyses.

Samples should be classified in the field as to changes in stratigraphy

- * Physical analyses should include grain size, Atterberg Limits, and Hydrometer.
- * Chemical analyses should include CAM 14 metals, Polycyclic aromatic hydrocarbons (PAHs), pH, and TOC7. Liquid samples should also be collected and analyzed for specific conductivity, pH, dissolved oxygen, etc.

8. Evaluation of the physical, hydrogeological, and chemical characteristics of the area to assess the need for replacement/augmentation of the existing materials.
9. Perform bench scale studies to monitor salt marsh plants development in the existing soil matrix or the augmented matrix
10. Based on the results of this exercise, a solid plan can be developed to create a small salt marsh in this area.

As part of the project implementation activities - students would perform the flora and fauna survey, the topographic survey, the physical analyses, oversee and log the stratigraphy, perform the pilot studies, and assess the feasibility of up-scaling the bench scale work to a pilot area.