BOSTON UNIVERSITY College of General Studies

CAPSTONE 2014

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About the Capstone Project

The Capstone represents the culmination of your experience at CGS. It was conceived and designed as an interdisciplinary experience because our College's pedagogical mission centers around the Liberal Arts, which are, by definition, interdisciplinary. You may view it as the final course that caps two years of study and that ties together all of your educational experiences at CGS. In this year's syllabus you will find that every question is interdisciplinary in nature—"science" *per se* is not the focus; instead, you will find that all questions combine ecological problems that require solutions from technology and will involve ethics, local governance, and local politics.

As you begin this project, keep three thoughts in mind. First, the construction of a building is not an individual effort, but the culmination of labor undertaken by an organized group. You are expected to work together, to share ideas, and to collaborate for the success of your group. Second, successful capstones address relatively narrow topics and devise local solutions to global problems. Finally, the Capstone paper is not a fifty-page term paper. Instead it should be a synthesis, combining separate elements to form a coherent whole. Research, to be sure, is indispensable; but beyond research, your group is expected to analyze, synthesize, make proposals, and justify your conclusions. The most effective Capstone projects provide meaningful solutions to well-documented problems. In your written product, your group will present a logical argument based on evidence, sound rhetorical practice, and well-documented sources of information.

Think Globally, Act Locally

Change is a natural aspect of any ecosystem, but rapid change has been documented to cause unforeseen and often unwanted effects. Just as the production of oxygen by the first photosynthetic organisms changed the Earth, the activities of humans have the potential to greatly modify the biosphere. Today, human-induced environmental change is a more powerful force than ever before. For example, early human societies began the deforestation of Mediterranean and other regions from Neolithic times onward. Humans have continued to destroy forests as they spread throughout all regions of the Earth, but our modern technological ability to extract and burn forests is greater than ever before. Another example is the large-scale movement of human populations. Historically, this occurred through migration due to warfare, or to escape famine or poverty. With increasing global travel and commerce, many harmful species have been introduced to new regions and continue to be spread inadvertently, often having devastating effects on endemic populations and significant economic impacts on local regions. Likewise, as the human population grows, our activities have an even greater impact on the biosphere. Human populations create wastes (both biological and artificial), over-utilize water resources, and place enormous stresses on ecosystems. There is strong evidence that human activity is accelerating global climate change, which will shift temperature and rainfall patterns causing tremendous consequences for coastal regions, regional agriculture, and the spread of disease.

All of these issues are not just concerns for one country or one region of the world, but are truly global in nature. However, national responses and global responses to the problems facing our planet today are slow in coming and rarely combine to create effective change. Many argue that real solutions will come about through change at the local level that forms a model for adoption in other similar regions. Hence, this Capstone requires that you examine local solutions to global problems by focusing solely on Boston and surrounds. This region is an excellent model for developing local solutions to many problems because it has an oceanic coastline and contains urban, suburban, and rural areas with lakes, rivers, watersheds, and a variety of soils that may be greatly influenced by human activities.

Mechanics of the Capstone Project

Groups

The Capstone Project is a group project. You will be a member of a group during the entire project and each group will need to work out for itself some form of division of labor and responsibility. Each member of the group will be responsible not only to herself or himself, but to the other members as well. We encourage you to use Google Documents as a way to easily add to, edit, and co-edit your Capstone paper. We also encourage all students to document their specific contributions by using e-Portfolio. Each student should create a specific Capstone tab in e-Portfolio for his or her work.

Project Grades

You will receive one grade for the project as a whole. This grade will make up 25% of your semester grade in Natural Science, Social Science, and Humanities. There are three components to the Capstone grade: the paper itself, the oral defense, and peer evaluation of your participation in the activities of the group. You will be evaluated as a group on the written report (in other words, each member of the group will receive the same paper grade), but as individuals on the oral defense and participation. Your final Capstone grade will be a combination of these three components, and is determined by consultation among your three professors. We take this process seriously and discuss each student's performance at the conclusion of the oral defense and reconsider grades again at the end of the entire process of oral examinations before finally settling on a recorded grade. Be aware that we do not look kindly on students who decide to travel for substantial periods of time during the project duration or on students who do only the minimum amount of work for the project.

Understand from the outset that our teaching and learning endeavor at CGS is a process, and the Capstone project is simply a part of that process. Faculty and students should come to the examination prepared to engage in discussion about both the capstone process and the finished product. Rather than a "checklist" of strong and not-so-strong points about the finished product, faculty will use this opportunity to engage with you one more time. The evaluation rubric that we present here addresses the evaluation process in greater detail, in order to provide underlined guidelines for everyone's participation in the oral examinations. An individual team may modify the details of the rubric or may require additional aspects to the projects, such as presentations involving videos, websites, e-Portfolios, PowerPoints, or posters. Your team faculty will discuss the specifics of their approach with you at the beginning of the project.

Reporting of Grades

No Capstone grades will be released until all oral exams are completed. This is necessary because team faculty do not assign Capstone grades until all orals are finished. Your faculty will discuss the mechanics of reporting grades to you. Note that you will receive only **your individual Capstone grade**, as this is what constitutes 25% of your semester grade in each course. This grade is final since it involves substantial deliberation and discussion among the team faculty members. <u>Do not expect the faculty to re-evaluate the grade, once given.</u>

The Written Report

The length of the Capstone paper should be no more than 50 pages typed, double-spaced. This does not include preliminary pages (table of contents, etc.), endnotes, bibliography, or appendices. Copies of the report must be provided for each faculty member and also each member of the group in order to prepare for the oral defense. Generally, faculty copies are provided by student teams as paper versions; however, some faculty and/or teams may request electronic copies of the Capstone Project on memory sticks. The form preferred by your team faculty will be discussed early in the process. Many students today keep copies of their report on their computers and bring those computers with them to meetings and the final oral exam. Some students choose to bring paper copies instead.

The Oral Defense

After the final report has been submitted to the faculty, your group will meet at an appointed time to defend its work before your team faculty. The oral defense can last up to two hours. Each group member should have his or her own copy of the Capstone Project and should be prepared to answer questions on all aspects of the report. Do not expect to be questioned only on the section which you contributed – you must know the entire Capstone and be able to address any part of it to have a successful oral exam.

Statement on Plagiarism

To plagiarize is "to take (ideas, writings, etc.) from another and pass them off as one's own" (<u>Webster's New World Dictionary</u>, 3rd College Edition, New York: Simon and Schuster, 1988, p. 1031). You are expected to indicate sources using approved techniques. Since students are often confused about the use of quotation marks, the faculty has established the general rule that whenever five words are copied consecutively from another author, the material must be put in quotation marks; failure to do this is plagiarism. Students should note that the sources of ideas and thoughts, even though paraphrased in one's own words and expressed in what is commonly called an indirect quotation, must be credited.

Students will be required to submit their own individual portions of the project to an online plagiarism checker. BU has a contract with Turnitin and team faculty will set up a Capstone Turnitin project via their Blackboard Learn sites. This service not only checks your writing for originality by comparing it to thousands of other websites, both internal to BU and external, but also provides a grammar and spelling checking service to improve writing. Both faculty and students can learn more about this service via: http://www.bu.edu/tech/support/desktop/distribution/turnitin/blackboard/. Students may submit multiple revisions of their writing to this service and faculty will be able to access reports on all students. Students should submit their portions of the Capstone prior to the final editing of the project to ensure that all group members have properly attributed sourced material and have eliminated all spelling and grammatical errors. Failure to submit your own portion of writing to this service may have an impact your individual grade on the Capstone Project, depending on the specific requirements of your team's faculty members.

Use of the Internet

The Internet can be a valuable resource for you during this project, but most information available on the Internet is not checked or regulated, and therefore is not necessarily accurate. However, you can find authentic research sources through the Internet by carefully reading a web site. Often, a helpful bibliography is posted at the end of a web site. Use of Google Scholar can often point you to helpful primary sources, but note that the BU Library website and its physical building will provide you with the greatest and most useful sources. In addition, the BU librarians will have set up a special site for the Capstone topics that will greatly help you find sources—you should use this site as much as possible when getting started on your topic. Finally, you will note that under each topic listed in this year's syllabus, a set of links has been provided to help you better understand each issue. Prior to choosing a specific topic, you should examine and read the material found at these links. A source that will be highly useful for all topics is an eBook that is owned by the BU Library and that can be viewed on your computer or smartphone/tablet. You can access this eBook by going to www.bu.edu > RESEARCH tab > Libraries > scroll down to eBooks > search for "The Routledge Handbook of Urban Ecology" (2011). This handbook has chapters on nearly every topic found in the syllabus and will be a good starting point for all teams. You should consult with your team faculty regarding other types of information that they consider acceptable for use in the Capstone, and for guidance in proper methods of citing internet sources.

Capstone Format

The Group's Identity

Each Capstone group is charged with the task of formulating a policy recommendation on an issue that is related to the theme of **Thinking Globally, Acting Locally**. For that purpose, each group will constitute itself as a panel of experts that has been charged with the responsibility of surveying the history and scope of a particular problem in the Boston metropolitan area. The group must consider many possible solutions before recommending what it determines to be the best solution for the local area. The group may be a special commission of inquiry, bureaucrats in a government agency, or an independent panel of scientists, scholars or citizens. The group will consider the ethical, philosophical, sociological, political, scientific, and technological implications of the chosen problem and of the policy. Some groups may want to argue two sides of an issue in an adversarial approach (for example, the group may wish to argue the pros and cons of developing a required composting program in Cambridge to reduce landfill waste, or may want to argue both sides of water privatization). The research necessary to formulate such policy recommendations and arguments supporting such recommendations should reflect data-driven research rather than opinion. Primary data collection, which can supplement opinions of other experts in the field, is a recommended means of involving group members in the real issues of their chosen topic. Your faculty team can guide you on what kinds of primary data collection may be appropriate for your project.

Format for the Written Report

Your group will develop a recommendation that is presented to a government agency or another appropriate group. If your group chooses the adversarial approach rather than a straightforward policy recommendation, you will be presenting the arguments to adopt one of two policies.

Through your investigation you will develop a realistic recommendation as a solution to the problem. Your recommendation will be presented to a government agency, organization, or even a private research group. Your paper should follow these general guidelines:

A. **Background:** You will include an introduction that puts your topic into a context that is understandable to general readers. Clearly state the problem you are investigating, why it is important to investigate this problem, and to whom you will be presenting your recommendation. Your work on this section will be evaluated

for clarity, brevity, and how effectively you describe the topic. *This section should occupy approximately 10% of your final written work.*

B. <u>Discussion and Development of the Problem:</u> Here you will pinpoint an issue from your background section. The problem you identify will be a contemporary issue, so you will use contemporary sources (newspapers, etc.) to shape this section of your work. By using contemporary sources you will be able to uncover the "experts" or other crucial players who hold opinions, provide ideas, act on, consult, legislate, oppose, etc. the problem you identify. It is these people and their work that you will want to research more to shape your solution. Your work on this section will be evaluated for its clarity, focus, and connection with a real contemporary problem. *This section should occupy approximately 30-40% of your final written work.*

C. <u>The Recommended Solution:</u> Your recommendation should be a logical outcome of the data and background you presented in sections A and B. You will propose a solution to the problem you have identified. You may draw from many sources for this section but it is logical that you will want to rely heavily on the work of key players you identified in the problem section. In order for your solution to be effective you **must** have the following components**.** (1) The group must have a persona: who are you and to whom are you presenting your solution? (2) Your solutions must consider opposing viewpoints, potential opposition, and barriers. "Magic bullet" solutions are not acceptable for this project. (3) You should base your solution on the background you provided and the problem you identified. Your project must represent a unified, logical idea. Your work on this section will be evaluated based on the points above as well as clarity, accuracy, focus, and effective writing. *This section should occupy approximately 50-60% of your final written work.*

D. <u>Citations:</u> Citations occur within the text and are done in an author/year format. Unlike Humanities or Social Sciences, page numbers are not normally included in the citation unless you are using a direct quote. However, direct quotes are RARELY used in scientific or technical writings, so learn to properly paraphrase the information being presented by the authors of works you are using. Also be aware that if you mention specific species, you MUST properly format the species name – the genus name is capitalized and both the genus and species name are italicized (ex. *Homo sapiens*). The following citation example should help you understand how you appropriately cite using the Council of Scientific Editors (http://writing.wisc.edu/Handbook/DocCSE.html). The preferred version of citations is the name-year system rather than the citation-name or citation-sequence systems. An example of the name-year citation system follows below.

Made naturally, antibiotics are designed to interfere with or kill other microorganisms (Ambile-Cuevas et al., Ludgar, 1995; Levy, 1998). Microbes that make the antibiotics have devised ways to protect themselves from their self-manufactured toxins (Ambile-Cuevas et al., 1995). This resistance can also be passed on to other bacteria, even those of different species. When a population of bacteria is exposed to an antibiotic (which occurs, for example, when we take antibiotics), those bacteria NOT resistant to the drug die first. The resistant ones are left behind to produce more resistant bacteria (Ambile-Cuevas et al., 1995; Levy, 1998). Some bacteria acquire the DNA of other bacteria, and therefore gain antibiotic resistance genes more readily than others (Grady, 1996). This has produced particularly pathogenic strains of some food borne bacteria, such as *E. coli* and *Salmonella*, which no longer respond to antibiotic treatment (Holmberg et al., 1987).

Please use electronic *The Writer's Handbook* provided by the Council of Scientific Editors to aid you in citing various types of publication sources (http://writing.wisc.edu/Handbook/DocCSE_NameYear.html).

Deadlines

The Capstone Project begins immediately after final exams. Your Team Faculty will do all scheduling of meetings and your oral defense. Below is a sample outline of the expected progress of your Capstone. Specific details may vary by team.

Dates	Capstone Progress
March 28th	Capstone Kickoff with Team Faculty during regularly scheduled Humanities lecture. MANDATORY ATTENDANCE
March 31st – April 11th	Attend scheduled meetings with faculty, Capstone group meetings, and conduct lots of research
April 14th – April 18th	Additional conferences with faculty, completing research, and writing the paper
April 21st – April 24th	Editing, reproducing, and binding the written report

April 25th	**All sophomores are required to be present in Jacob Sleeper Auditorium FRIDAY APRIL 25TH, at 12 pm at which time all Capstone Projects will be collected by faculty teams.** **THERE WILL BE NO EXTENSIONS.**
April 28th – May 9th	Capstone Oral Defenses
May 12th	Final grades will be posted

Your Meetings With Professors

Your group will likely meet with your team of professors three to four times during the Capstone project, but, again, this may vary by team. Length of meetings will be set by your team faculty and these meetings will be discussed in greater detail during the Capstone Kickoff. **Unless otherwise requested by your team faculty, all written work must be typewritten in 12-point Times Roman font, paginated at the lower right hand side of the page, and presented immediately at the time of the meeting.**

Meeting 1: During this meeting you will report on:

1. Your topic (your faculty can help you focus your topic at this meeting)
2. Your group coordinator(s)
3. Any questions you have

Meeting 2: During this meeting you will discuss progress made on your topic. For most teams, you will likely be bringing the following to the meeting:

1. Three copies of a 1-2 page outline of the work you propose based on the "Background, Problem, Solution" format. *Your outline must be in formal outline style.*

2. Three copies of a 1-2 page bibliography in CSE (Council of Scientific Editors) name-year style. *All of your citations throughout the project must be done in this style—no exceptions and <u>no other styles</u> accepted*. See http://writing.wisc.edu/Handbook/DocCSE_NameYear.html.

Meeting 3: For some teams, this may be the last formal meeting with your professors before you deliver the project; other teams may require an additional meeting with your group. During this meeting, your professors will comment on your final outline and the

status of your project. Your group will be assigned a final meeting time (oral examination) at this meeting. You must bring:

1. Three copies of a 4-5 page outline of your project. You should be ready to write directly from this outline. You must include your group's persona and your audience persona in this outline. *The outline must be in formal outline style.*

2. Three copies of an expanded bibliography **in the appropriate citation style**.

3. A list of all group members' final exam times. IT IS CRITICAL THAT YOU HAVE THIS PIECE OF INFORMATION so that the oral examination for your group can be determined.

The Oral Examination

Your professors will have read your written work and agreed on a provisional grade for the work. The oral examination then takes the form of a discussion between you and your professors. It will be in two parts.

1. Your group will be invited to engage in a discussion about the Capstone process and your approach to the final project.

2. Your professors will ask general and specific questions about your final project. Your answers will help the professors understand your work on the project and it will help them evaluate the work based on the criteria previously outlined.

At the end of the oral examination, you will be asked to evaluate your own performance as well as that of your fellow team members on the Capstone project. Your evaluations will be strictly confidential.

Rubric for Success

The most successful Capstone projects will take into account the following.

Written Portion:
1. Did your background section sufficiently introduce the contemporary issues with which the Capstone was concerned and identify appropriate stakeholders and players?

2. Was your research of the issue sufficient in scope and detail to provide the reader with a good working knowledge of the extent of the problem at hand? Did you use appropriate examples and infer from those examples the kinds of solutions that had been tried in other local areas? Did you assess the success or failure of similar solutions elsewhere and analyze the reasons for those successes or failures? Did you extrapolate how solutions would work in the region or locality on which you focused your attention in the Boston area?
3. Did you provide data (tabular, graphical) demonstrating why this topic is an important issue facing the Boston region?
4. Did you locate appropriate local resources (via interviews, visits, surveys, etc.) that would help you better understand the problem, current local responses, and potential solutions (and/or previously attempted solutions)?
5. Did you account for how local implementation of your solutions would occur (what were the responsible agencies, councils, governmental bodies that would be involved)? Did you account for how local populations would be impacted by your solutions? Did you account for the likely reactions of local populations to your solutions?
6. Is your solution based on logic and driven by available data?

Oral Portion:
1. Could each of you, individually, define the problem on which you focused?
2. Could each of you, individually, describe to the faculty the background of the problem and the solution you propose?
3. Could each of you, individually, defend your entire position?

List of Topics

1. Urban Resiliency in the Face of Hazards

Living in a dense urban environment comes with benefits and costs. In times of crises, or in the face of hazards, citizens ideally will work together to help each other. Likewise, the local governmental and other authorities and organizations will help see to the needs of the population. However, due to the density of urban populations, the effects of any crisis or hazard may be more widespread and devastating than in a rural setting.

Boston is a major metropolitan center and it has experienced various hazards and crises in the past. Realistically, more will come in the future. Hazards and crises can range from acts of terrorism (think back to the Boston Marathon bombings of 15 April 2013) to change in the

groundwater table, which causes buildings to sink. Boston, like other urban areas, also faces hazards due to climate change (such as rising sea levels potentially resulting in the flooding of major portions of the city, especially during storm surges; increases in severe weather, droughts, and heat waves), earthquakes, major fires, power outages, epidemics, and so forth. Often one hazard may be associated with another, such as power outages caused by ice storms or other severe weather events. Or a crisis may be caused inadvertently, for example an "incident" resulting in the release of toxic substances from a hazardous biological laboratory.

What can be done to ameliorate on-going problems, such as the sinking of the Back Bay (built on landfill over swamp land)? How can urban planners address potential contingencies with regard to possible future hazards and crises? A current approach is to take resiliency into account during urban planning and infrastructure design (where resiliency can be defined as "the ability to recover from or adjust easily to misfortune or change", Merriam-Webster, 2013; quoted in "Building Resilience in Boston", 2013, p. 5 [see pdf link below]).

For a project, your group may want to pick a particular form or type of crisis and/or hazard. What is the past history of these events? What can and should be done to address such events in the future? What should the role of the state be in ameliorating crises and building resiliency? Should the federal government play any role, and if so, what role and how would citizens push such an agenda given the current climate of stalemate and inaction at the federal level?

An excellent way to start thinking about these issues is to carefully review the following document ("Building Resilience in Boston"):
http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf

Useful background information on Boston can be found in the "City of Boston Open Space Plan, 2008-2014": http://www.cityofboston.gov/parks/openspace0814.asp

To get started on the issue of groundwater decline and how it is affecting Boston, take a look at:
http://dspace.mit.edu/bitstream/handle/1721.1/37467/123899168.pdf?sequence=1

The lawyer, singer, and political blogger David Kravitz of Blue Mass Group (http://bluemassgroup.com/about/) has listed a number of references and links that might be useful to you as you ponder the topic of urban resiliency:
http://bluemassgroup.com/2013/09/resilience-and-climate-change/

2. **Urban Climate**

The city of Boston was initially located in 1630 on a 3.193 square kilometer (789 acre) peninsula that was bounded by Massachusetts Bay to the east and the Charles River to the west and north. This narrow peninsula, which corresponded to Boston in the early seventeenth century, now comprises the neighborhoods known as the North End, Beacon Hill, and modern Boston's

financial district. Some sections of Boston, including the Back Bay-Fenway neighborhood, were built on landfill. Some of the hills of Dorchester and surrounding communities were leveled to provide fill dirt. As a result of these changes to the natural landscape of the city, Boston faces some unique challenges with the advent of climate change and alterations in sea level.

a. **Sea Level Rise**
The Intergovernmental Panel on Climate Change (IPCC) estimated in 2007 that climate change may result in an increase of sea level of 18 to 59 centimeters by the end of the twenty-first century. Since significant fractions of the cities of Boston and Cambridge were built on landfill and have relatively low elevations, will these sections be threatened by the rising sea level? What can be done to ameliorate this problem? Should there be increased construction of sea walls for protection of parts of Boston or the New England coastline? Moratoriums or other limits on future construction along the Florida, New Jersey, and New York coastlines have been seriously discussed or even implemented in some cases. Should there be a moratorium on building permits and construction of new buildings in low elevation sections of Boston or along the New England coastline? How would such a moratorium affect the future economic development of the Boston metropolitan area? How can the city protect the economic centers it already has? The following links will help you better understand the issues and can point you to suggested plans so that you, too, can propose solutions to this serious coastal problem:
http://www.tbha.org/boston-harbor-sea-level-rise-maps
http://www.theatlanticcities.com/neighborhoods/2013/02/these-scary-maps-explain-what-sea-level-rise-will-mean-boston/4591/
http://oceanservice.noaa.gov/facts/sealevel.html
http://www.tbha.org/preparing-rising-tide-report
http://coastalresilience.org/geographies/new-york-and-connecticut/what-can-be-done/post-storm-redevelopment-planning

b. **Water Runoff and Combined Sewer Overflows**
Modern sewerage systems convey sewage from houses and commercial buildings and rainwater through separate pipes under normal conditions, but the system of separate pipes for sewage and rainwater sometimes proves inadequate for Boston because of its geography and weather patterns. During periods of very heavy precipitation, combined sewer overflows act as relief valves and allow overflow water to be released into nearby bodies of water. The immediate advantage of the combined sewer overflows is that they prevent rainwater mixed with untreated sewage from backing up in houses or flooding the many low lying streets in the Boston metropolitan area. The disadvantage is that in times of heavy rainfall the sewage-rainwater overflow is discharged into the Charles River, Mystic River, Neponset River, or Boston Harbor, and thus the water quality of these bodies of water are degraded.   The Massachusetts Water Resources Authority has eliminated many uncontrolled combined sewer overflows in recent years, but should

this program be expanded and improved? What financial costs will these improvements entail? For more information on this topic, see:
http://www.mwra.state.ma.us/03sewer/html/sewcso.htm

c. **Green Roofs and Catchment Basins with Vegetation**
The relatively high population density of Boston metropolitan area and the presence of buildings, pavement, and asphalt for streets and parking lots have contributed to Boston as an "urban heat island."   In other words, these structures and the associated activities and emissions seemingly have elevated the temperatures of the city relative to those of the surrounding more rural areas; this is an effect that is especially unwelcome in the heat of the summer. The buildings, highways, streets, and parking lots of Boston also have been significant elements in rainfall runoff during times of high precipitation. Boston University recently constructed the Center for Student Services building with a green roof or living roof, a roof with a significant amount of vegetation growing on it. Such green roofs or living roofs decrease rainfall runoff and thus lessen the contamination of bodies of water because of uncontrolled combined sewer overflows. The green roofs also lower the urban heat island effect. Should there be tax credits or other incentives that encourage industries, universities, and schools to construct more buildings with green roofs or living roofs? Should there be incentives to create catchment basins with vegetation around the perimeters of large parking lots?

For more information on this topic, see:
http://web.archive.org/web/20080411230309/http://www.news.utoronto.ca/bin6/051117-1822.asp

d. **Eastern Massachusetts Coastal Waters and Eutrophication**
In recent decades scientists have recognized "dead zones," coastal waters with depleted amounts of oxygen. The presence of excessive amounts of nitrates or phosphates in the water, which is called eutrophication, can occur because of sewage effluence or agricultural runoff containing fertilizers and can result in dense "blooms" of algae. When the algae die and sink to the bottom, they decompose. The decomposition process uses oxygen and thus reduces the concentration of oxygen in the deeper levels of the waters, which, in turn, may kill fish and other aquatic organisms and yield a dead zone. Scientists have measured decreased concentrations of oxygen in the coastal waters of Massachusetts. What can be done to remedy this problem? Should septic systems in eastern Massachusetts be monitored and controlled more closely so that sewage does not enter the coastal waters? Should the application of fertilizers on farms, lawns, and golf courses be more tightly regulated to lessen the amount of nitrates and phosphates in rainwater runoff? Maryland has instituted some of the most stringent environmental regulations in the nation in an effort to try to return the Chesapeake Bay to a healthier state and has even instituted a rainwater runoff tax. Should Massachusetts adopt similar

measures to protect and improve its coastal waters? To get you started on this topic, see the following links:

http://www.bu.edu/today/2013/fulweilers-message-in-a-bottle/
http://articles.baltimoresun.com/2013-04-16/news/bs-ed-rain-tax-20130416_1_stormwater-law-local-government-chesapeake-bay

3. What is the Value of Urban Biodiversity?

Humans are part of the biological diversity (biodiversity), yet at the same time many human activities act to reduce this diversity. The most extreme case of this is the development of large urban areas, which modify and fragment existing natural environments thereby impacting the biodiversity of the area. What aesthetic, sociological, economic, and ecological value does biological diversity have and is it important to maintain this in an urban setting? Should urban wildlife preservation be a goal or should we regard such organisms as pests? Focusing on one specific aspect of urban biodiversity, such as green spaces, waterways, or urban wildlife will allow groups to define the problem and investigate and propose solutions.

Specific potential topics could include:

a. **Living with Urban Wildlife**
Have you ever watched people interacting with wildlife in an urban setting? For example, in many urban parks humans seem entranced and attracted to the activities of eastern grey and fox squirrels – even opting for interspecies communication through feeding and taking pictures. Edward O. Wilson, the internationally known Harvard evolutionary biologist, calls this *Biophilia* or love of life/other living organisms. One possible topic is to explore the specific aspects of how humans co-exist with urban wildlife (from squirrels, skunks, raccoons, and coyotes to hawks, owls, and wild turkeys). What is the esthetic value of contact with other species? How can the needs of humans be balanced with those of other species? Or should they? Potential starting links include:
www.Bostonnatural.org/urbanwilds.htm
www.urbanwildliferehab.org (urbanwildlife initiative – through the Boston Parks)

b. **Urban Green Spaces**
In a city like Boston, space for human activities is limited. Yet, a major initiative of the Boston city government has been and continues to be access to and management of green spaces. While Boston University is not known for its green spaces, try to image what it would be like with no trees lining Commonwealth Avenue, no BU beach, no Charles River Esplanade, no small parks/sitting areas scattered around campus. Now expand this view to the entire city. Clearly green spaces have value on many levels. For example, a study conducted in Germany in 2010 found that any exposure (even looking out the window at trees) had a calming and healthful impact on city dwellers. Examine

the value and role of green spaces in an urban environment. Is Boston a "green" city compared to other cities? How can the need for economic and living space for humans be balanced with the need for green spaces when space is limited? This topic can be focused in many ways from a re-examination of what we mean by green spaces to being able to quantify the quantity and quality of open green spaces in an urban environment. Possible starting links:

www.cityofboston.gov/parks/about/openspace.asp
www.greenspace.boston.com
www.greenspacealliance.org
www.bostongreenscene.net

c. **Biological Diversity (Biodiversity) as an Urban Goal**.

In the past 50 years (since the start of the "new" conservation movement in the 1960s), a great deal of information on the biological diversity of our planet has been generated. Most famously is the loss of biological diversity in the tropical rainforests. However, a topic that is much less discussed is the potential role urban areas may play in maintaining and enhancing biodiversity. While the view of urbanization is one of a reduction of biodiversity, does this have to be the case? Do we even know what the biodiversity of an urban area is? How could we and should we assess biodiversity in Boston? Is diversity restricted to larger green spaces like parks or does it occur across the urban environment? This is a challenging and potentially sticky problem since many organisms that may make up urban biodiversity are not "sexy" in the public relations sense. For example, could there be rare or endangered species that thrive in urban settings and live well with humans? Possible starting links include:

http://urbesproject.org/
http://www.projectnoah.org/missions
http://www.urbanbarcodeproject.org/projects.html
http://www.urbanbarcodeproject.org/files/UrbanBiodiversity_BioScience_Feb.2013.pdf
http://www.urbanbarcodeproject.org/images/pdf/Barcoding-to-conserve-diversity.pdf
http://www.planetizen.com/node/62094
http://www.pnas.org/content/early/2012/09/11/1211658109

4. **Transportation**

In terms of human ecology, transportation is a paradoxical activity. The paradox lies in the fact that transportation provides socioeconomic benefits while it has clear impacts on the environment. Greenhouse gas emissions, degraded waterways, disturbed ecosystems, compacted soils, polluted air and water, the introduction of invasive species, and noise are some of the ecological impacts of transportation systems. The major goal of transportation is connectivity, yet neighborhoods and whole cities have been disrupted because of transportation.

The history of transportation in Boston is long and complex. As a regional and world hub, Boston has long developed transportation systems via sea, land, and air. As a compact, space-constrained urban space, Boston has developed unique approaches to transporting people and goods, but not without problems.

For this project, you should address one transportation issue as it applies to human ecology. Whether you choose safety, security, congestion, emissions, pollution, or any other topic is up to you. You may focus on any mode of transportation from cargo ships to bicycles, roadways to pedestrians, bridges or sidewalks, public transport, or private vehicles. This dynamic topic provides an array of study opportunities.

Here is an excellent link to start you off:
(http://people.hofstra.edu/geotrans/eng/ch8en/conc8en/ch8c1en.html). As you gather ideas from this link you should search for other academic sources and/or proposed plans of action for the city (such as the Environmental Impact Statements concerning the proposed deepening of the harbor to allow for larger cargo ships from the Army Corps of Engineers or concerning the siting of liquid natural gas reserves in the city). As you continue to focus in on specific problems you will need to find more focused sources that provide insights into local conditions in and around Boston.   An example of this focused approach can be found below for bicycles, but you should feel free to examine any aspect of transportation and develop your own focused model.

  a. **Should Boston "Go Dutch?"**
      In the 1970s, Amsterdam, The Netherlands, was considered one of the most dangerous cities in the world to ride a bicycle, while today it is the safest city to ride. Can or should Boston be the next Amsterdam? What aesthetic, sociological, economic, and ecological value does a bike centered city offer? Specific problems like separating bicycle lanes from motor vehicle lanes, the access to public-use bicycle systems, inclusion of electric bikes, and putting cycling at the center of future transportation planning can all be considered. Is private personal transport by bicycle suitable and sustainable in a city like Boston? Is there environmental value to adding bicycles into a greater Boston transportation plan? This topic demands focus and a great deal of research into what is being done locally, and in other cities (both nationally and internationally). Possible starting links:
      http://www.cityofboston.gov/bikes/
      www.bostonglobe.com/metro/2013/09/21/bicycling-dutch.../story.html
      www.thehubway.com/

5.   **Urban Waste**

Waste is a serious issue for any community, but often presents greater issues in cities that lack the open space in which to dump and bury their garbage. Some large cities export their waste

to suburban or rural areas for disposal; some even send their waste out of the state. Boston is a moderately size city (ranks 21ˢᵗ in size in the US) with a population estimated at 636,479 individuals, roughly 13,143 people per square mile. When examining the population of Greater Boston (most of the eastern third of the state), its population is estimated to reach 4.6 million people. Waste produced by that many people must go somewhere. One can examine the broader issues of city landfills and their challenges, population numbers and the pollution they create, or one can focus on specific issues, each of which may help to reduce the waste stream. Some examples of these specific issues follow:

a. **Banning Plastic Bags**
   Environmental groups have decried the use of plastic bags used in so many of our shopping excursions. Plastic bags are not biodegradable, but they do degrade via mechanical action and exposure to light; however, these degradation processes can take 300 to 1000 years to occur and, in the meantime, the environment fills with smaller bits of plastic that animals often mistake for food. In the U.S. an estimated 8.4 billion plastic bags, sack and wraps are consumed and disposed of yearly.* Despite recycling efforts at local grocery stores, fewer than 20% of the single use plastic bags are recycled. Hence some states are considering a statewide ban on single-use plastic bags (Massachusetts is one of these 6 states), while other states (8) are considering imposing a fee or tax whenever a consumer chooses to use a plastic bag. While waiting for action by the states, some localities have undertaken efforts to ban plastic bags: Brookline, for example, initiated a ban on plastic bags on December 1, 2013 that will affect about 70 businesses and Hawaii is considering a state-wide ban. Both plastic bag manufacturers and recycling firms argue that bans on plastic bags will cost jobs and are not necessary. They argue that these bags can be recycled into other plastic products that people will use and say that we simply need to improve the recycling of these bags. What are the risks of plastic bags in the environment? Are plastic bags as bad as environmentalists claim? Are there any benefits to using these bags? What have other localities or countries done to deal with this issue? How effective have other solutions been in reducing the presence of plastic bags in our environment? Some links that should help you understand the issues include:
   *United States Environmental Protection Agency Office of Solid Waste, "Municipal Solid Waste in the United States: 2007 Facts and Figures" (Adobe PDF, 5.8 MB).
   http://plasticbagbanreport.com/category/massachusetts-2/
   http://swampscott.patch.com/groups/business-news/p/industry-spokesperson-say-plastic-bag-ban-not-backed-by-science
   http://www.bagtheban.com/learn-the-facts/recycling
   From the Movie "Bag It": http://www.bagitmovie.com/about_issues.html

b. **Dealing with the Electronic Trash Stream**
   Boston is one of the most "wired" cities on the planet. Discarded electronics and enormous electrical consumption are two of the by-products of our computer and smartphone culture. In the recent past, we took our used electronics to a recycling

center that then sent the material to places in Africa, India, China, and Pakistan for dismantling and recovery of metals – we did this because these countries have no environmental protection measures in place for the hazardous materials in used electronics and have a cheap workforce that has none of the protections afforded to U.S. workers.   Properly discarding this e-waste and sending it to environmentally sound end-of-life processors costs municipalities a great deal of money which is passed on as additional taxes to citizens. Some have argued that states/cities should pass legislation that shifts the costs of disposing of e-waste to the manufacturers instead of the consumers. Producers of electronic devices argue that this will drive up the price of the product to the consumer. What actions should cities like Boston take to resolve e-waste issues and to dispose of these products in a more eco-friendly and responsible way? Or should we continue to send these products to developing countries to fuel their economies? Some links that will help you understand current policies and problems include:

http://www.mass.gov/eea/agencies/massdep/recycle/reduce/electronics-recycling.html
http://news.nationalgeographic.com/news/2005/11/1108_051108_electronic_waste_2.html
http://www.pbs.org/frontlineworld/stories/ghana804/video/video_index.html
http://news.cnet.com/8301-11128_3-10457390-54.html
http://www.massrecycle.org/getinvolved/advocacy/e-waste-epr
http://www.sciencedirect.com/science/article/pii/S0048969709009073

c.   **Banning Plastic Water Bottles**
In January 2013, Concord became the first U.S. city to ban single use plastic water bottles. Advocates argued that this would reduce plastic waste in their community, save valuable oil reserves (oil is used to make the plastic), and save the consumer money since bottled water costs more per gallon than gasoline. Opponents argued that this was an over-reach of government, that it denied the consumer choice, and that it deprived the consumer of the benefits of drinking a healthier drink. Are plastic water bottles a significant pollution problem? If so, in what way? Is bottled water a "healthier drink" as the water bottling industry claims and should city dwelling consumers have a choice about how they obtain their water? Should other communities go the way of Concord or should Concord's ban be reversed? ? What is the value in eliminating single use water bottles? What is the value in leaving them as an option for consumers?

What about university and college campuses? Many universities have already banned single use water bottles on campus and some have even provided their campuses with filtered, refill stations. Harvard University students recently voted for a ban on Harvard's campus, though the administration has yet to act on that vote. Should universities like BU ban bottled water? If such a ban were to occur on campus, what should the administration provide (if anything) as an alternative to single use water bottles?

Some links that will help you get started with this topic and understand the debate include the following:

http://www.businessinsider.com/bottled-water-costs-2000x-more-than-tap-2013-7
http://www.bottledwater.org/economics/real-cost-of-bottled-water
http://newswatch.nationalgeographic.com/2012/02/13/bottled-water-is-silly-but-so-is-banning-it/
http://newswatch.nationalgeographic.com/2012/05/17/u-s-bottled-water-sales-are-booming-again-despite-opposition/
http://www.npr.org/blogs/thesalt/2012/02/12/146692656/battling-the-bottle-students-and-industry-face-off-over-water
http://www.naturalnews.com/043252_harvard_students_bottled_water_endocrine_disruptors.html

d. **Recycling – Is it as Green As We Suppose?**

What is the reality behind recycling? When we separate our recyclables from our garbage, do these items really get reused or do some so-called recyclables still find their way to landfills? Should people be forced to recycle (consider the case where many communities fine households if they put recyclable materials into their garbage)? How should college campuses deal with the issue of recycling and getting more students to be compliant with recycling efforts? What happens to our recycled materials? Is recycling an environmentally sound and sustainable practice?

You can explore many aspects of this issue and focus it broadly (examine the entire Boston area) or narrowly (look at Boston University's efforts). Some links to get you started include:

http://qz.com/122003/plastic-recycling-china-green-fence/
http://vangelinc.com/recycling/exporting-recycling/what-does-chinas-green-fence-mean-for-the-recycling-industry
http://www.dailykos.com/story/2013/09/18/1239747/-Think-your-plastic-is-being-recycled-Think-again
http://science.howstuffworks.com/environmental/green-science/recycling1.htm
http://www.cato-unbound.org/2013/06/03/michael-c-munger/recycling-can-it-be-wrong-when-it-feels-so-right

e. **Urban Composting Centers**

The city of Cambridge received a MADEP grant in 2006 to work with a company called "Save that Stuff" to offer food waste recycling services to Cambridge businesses. Participants (78) in this pilot program included universities, supermarkets, hotels, cafeterias, restaurants, bars, florists, and coffee shops and items set aside for composting were food scraps, food soiled paper, and plant/floral trimmings and clippings. In April 2014 and through March 2015, Cambridge is expanding this program to curbside composting for about 500-800 households. During this second pilot program, participation is voluntary. By removing food wastes from the garbage stream, the city

hopes to reduce trash by 30-80%. Is this something that should be done throughout the city of Boston or even statewide? Should such programs be mandatory rather than voluntary (i.e., impose fines for those who throw food/yard waste into their normal trash)? For more information on Cambridge's program, see: http://www.cambridgema.gov/theworks/ourservices/recyclingandtrash/faqrecyclingand rubbish/compostingquestions/compostpilot.aspx

f. **Grey Wastewater**

We use a tremendous amount of water in our daily activities, much of which could be reclaimed and reused for toilet flush water or gardening. As populations grow, the burden on our water resources increases, both in terms of maintaining adequate supplies of drinking water and ensuring that we conserve as much water as possible. Some have argued that water will become the new "oil", such that countries will fight wars over it and usage will be taxed at higher and higher rates. One way to help ameliorate dwindling clean water supplies is to become more proactive and conservative in how we use and dispose of our water. Where does your wastewater go? Follow the waste water stream from BU. Can Boston University initiate policies that mitigate water use and advance waste water treatment? What would the costs/benefits be for BU to become more proactive in water use and wastewater treatment? Alternatively, consider the water resources of the city of Boston. What concerns are there about how we deal with the water usage patterns of the city, the waste products, and the dumping of millions of gallons of treated water into Massachusetts Bay? Are we creating "dead zones" in our coastal regions? How could the city ameliorate the amount of treated water released by the reuse of grey water from businesses? Can green architecture in new construction, as well as rehabilitating established buildings, work in a highly urban setting? Some links to get you started, include:
http://extension.umass.edu/landscape/fact-sheets/recycling-gray-water-home-gardens
http://greywateraction.org/content/about-greywater-reuse
http://www.level.org.nz/water/wastewater/on-site-wastewater-treatment/greywater-recycling/greywater-systems/
http://www.sciencedirect.com/science/article/pii/S027312239700190X
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3262001/
http://ascelibrary.org/doi/abs/10.1061/41036(342)561

5. **Urban Waterways and Drainage**

Humans have always relied on waterways for food and transport. Hence, urban and suburban centers have tended to "grow" around such waterways and entire economies have developed around these centers. Nevertheless, much of the development of such urban centers was restricted by taking into account flood plains and storm surges. Today, however, humans have often ignored historic flood plains and have not only built on those plains, but have developed entire urban landscapes along flood plains. Likewise, we have built on barrier beaches,

ignoring the fact that the beaches are a "barrier" to erosion from wave action. Today, with changing climate and more severe storm patterns, we are seeing more and more effects of floods on urban dwellings and people are now beginning to question the intelligence of rebuilding in these flood zones. In addition, the current urban centers along these waterways have imposed a cost on the waterways: increased pollution via direct and indirect sources, loss of biodiversity, and filling in of marshes and swamps. Many of these waterways provide essential ecosystem services to us by providing us with food, nursery habitats for fish and mollusk populations, clean drinking water, and areas that help us clean grey wastewater and sewage water. So what should we do to ensure that our waterways are resilient features of our landscape in the future?

a. <u>**Maintaining the Local Riverways and Beaches**</u>
The landscape of the Charles, Merrimac, Mystic, and Muddy Rivers is dynamic. Likewise, the landscape of coastal beaches surrounding the city of Boston, as well as north and south of Boston, is highly dynamic. From a tidal swamps to polluted industrial and transportation loci, to today's mixed-use capabilities, our riverways and coastal beaches reflect the communities that surround them. How can we preserve these environments, and in particular, how can we rebuild the natural plant and animal communities that they once hosted to make them more resilient to storms and changing climate? How can we continue to use them for commercial purposes, while ensuring their health and keeping them clean from pollution sources? How much money should surrounding communities be required to pay for restoration purposes? Should we continue to allow community growth around these waterways or should we establish "zones" of undeveloped tracks along the banks of these rivers? What should we do when flood events damage current structures along shorelines (i.e., should we allow rebuilding of structures)? Think about what happened to the urban centers in NY and NJ during Hurricane Sandy. What should be the policy for similar shorelines in and around the Boston area that are already impacted by hurricanes and nor'easters via storm surge? Should we allow rebuilding of structures along barrier beaches or should the state take that beach way by eminent domain and prohibit re-building? Some links to get you started on these issues include:
https://www.cityofboston.gov/parks/emerald/Riverway.asp
http://www.environmentmassachusetts.org/reports/mae/toxic-waterways
http://necir-bu.org/investigations/raw-sewage-continues-to-contaminate-waterways-in-new-england/
http://necir-bu.org/investigations/toxic-sites/
http://www.mass.gov/eea/agencies/massdep/water/watersheds/waterways.html
http://www.crwa.org/cr_resources.html

b. <u>**Who Should "Own" the Rights to our Waterways?**</u>
Many of us drink bottled water. Is bottled water regulated in the same way that municipal water is regulated? What are the safety standards for bottled water? Should commercial entities be allowed to tap in and use the water reservoirs of local

communities? Consider this: Nestle's former CEO claimed that water was not a right of people and that water supplies for the public should be privatized. This is not as unusual as you might believe, since the World Bank often requires privatization of water resources in order to provide developing countries with loans. Would privatization lead to more stable supplies of water and safer drinking water? What value, if any, should citizens receive for leasing public supplies of water to corporations? To explore some of these issues more fully, look at the following links:

http://www.trueactivist.com/nestle-ceo-water-is-not-a-human-right-should-be-privatized/
http://academic.evergreen.edu/g/grossmaz/VANOVEDR/
http://www.nap.edu/openbook.php?isbn=0309074444

6. **Fisheries**

In September 2012, the Commerce Department declared that the New England Fisheries were in a state of disaster. This declaration opened the door for federal monies to be used for relief for struggling fishermen and the ports that relied on fishing activity. While the fisheries have been managed for decades, and fishermen have been catching certain species at the rate mandated by regulators, stock models have not been reliable for determining overfishing levels. As a result, the regulations haven't been stringent enough and stocks have not been given sufficient time to rebuild properly. In 2010, many new regulations were enacted that cut fishing levels by 70% on some species and this has endangered the fishing industry. Gulf of Maine shrimp fisheries were just closed in December 2013 and are likely to remain closed for 2 years. Regulators argue that the Southern New England lobster fishery should have been closed in 2011 as it was both depleted and overfished and in September 2013, regulators closed the nearby Long Island Sound lobster fishery.   New England historically has been considered a rich fishing region for a number of species of fish and crustaceans, yet we have seriously depleted these once-rich grounds since the heavy mechanization and commercialization of fishing post-1950. With an ever-increasing demand by consumers for seafood, more and more species of fish are overexploited.   How do we solve the problem of supplying seafood products for consumer demand while, at the same time, ensuring that the wild fish and crustacean stocks remain sustainable populations? Some possibilities for projects are suggested below, but students should feel free to develop their own projects for this broad topic.

a. **Marine Protected Areas/Fishery Closures**

As coastal fish stocks are depleted and some species are pushed into commercial extinction, the idea of permanent or temporary fishery closures in particular regions of the ocean becomes more and more appealing to regulators in charge of ensuring the sustainability of fish stocks over the long term. Generally, these closures are proposed over a coastal region (e.g., the coastal waters off Newfoundland for cod fishing, or the Southern New England coastal region for lobster fishing) or a particular area of the ocean is closed to all fishing (e.g., George's Bank). Are fishery closures effective? Are

marine protected areas effective? Should more such closures or protected areas be established? This project should investigate the scientific data on the efficacy of such closures or protected areas, should consider any unintended consequences arising from their establishment, and should determine if these are effective fisheries management tools that could be implemented more broadly along the New England coast. Links that will help you understand the issues and get started include:
http://www.nefmc.org/habitat/nefmc_mpa_workshop_report_2005.pdf
http://www.whoi.edu/oceanus/feature/do-marine-protected-areas-really-work
http://www.southernfriedscience.com/?p=8999
http://www.theecologist.org/News/news_analysis/1304082/do_protected_areas_for_wildlife_really_work.html

b. **Fish Farming**

Because of the overwhelming demand for fish products not only in the US but also in most countries of the world, many regions have set up fish farms for both oceanic and freshwater species. In some of these farms, fish are fed fishmeal composed of wild-caught species (usually anchovies and menhaden), but it takes nearly 5 lbs of fishmeal to produce 1 lb of farmed fish. Thus, many environmentalists argue that this is not a sustainable model. Other farmed fish are fed cornmeal. In most of the fish farms, fish are stocked at high population numbers so that disease is common and antibiotics are required. Again, many environmentalists object to food growth practices that require high doses of antibiotics, claiming that such practices can imperil human health. As a potential solution, Martin Schreibman of Brooklyn College in NY claims he has developed an advanced water recirculation system that allows one to use tap water and that can be done in urban settings in old warehouses, on rooftops, or even in one's backyard. He claims that his system reduces the need for using antibiotics, hormones, or pesticides to keep the fish healthy and growing large. His system involves using hydroponics to grow edible plants on the surface of the tanks that then filter the water of the fish waste. Is this "urban" fish farming better and safer than traditional fish farming? Is this something that Boston and surrounding communities should invest in, given that many communities have unused, empty warehouses? Is this something that fishermen, now displaced from fishing activities in the sea, could pursue or should pursue to keep a fishing tradition alive? The following links can help you get stated:
http://www.npr.org/2011/07/03/137588931/urban-fish-farming-wave-of-the-future
http://www.insideurbangreen.org/2012/01/meet-martin-schreibman-dr-of-aquaponics-at-brooklyn-college-.html

c. **Labeling of Sustainability of Fish Sold in Supermarkets, Groceries, and Restaurants**

In 1997, the World Wildlife Fund and Unilever founded the Marine Stewardship Council to recognize and reward fisheries that engage in sustainable fisheries practices, to work with fisheries and commercial entities to build a market for sustainable seafood, and to give consumers an easy way to identify fish they wish to purchase as coming from a

sustainable source. Today the MSC certifies wild capture fisheries as sustainable if they are willing to undergo an independent, third-party assessment by an accredited certifier and team of experts who will visit the fishery multiple times, if their fishery is located in an ecosystem where ecosystem management is practiced, and if there is sufficient biological evidence to show that the fishery under its current regulations is actually sustainable. If a fishery meets all of the standards, then fish coming from that fishery can be labelled with the MSC stamp. In New England, stores like Hanaford, Whole Foods, Aldi, and Walmart all carry fish with the MSC label, although all of these stores also carry fish products coming from fisheries that are not considered or certified as "sustainable". Walmart recently upset Alaskan salmon fishers by refusing to sell their product since it was not certified as sustainable by the MSC. Alaskan salmon fishermen claimed that their product once was MSC certified, but they let their certification lapse because they did not want to spend the $150,000 necessary to complete the certification process and they further argued that the MSC had reduced its standards in order to certify more fisheries to deal with Walmart's huge market share of fish demand, while at the same time ignoring the fact that Alaska's salmon fishery has been highly regulated by state biologists who have no compunction in shutting down the fishery if necessary under the Responsible Fisheries Management program. So how and by whom should sustainable fisheries be certified? What processes should be in place to consider a fishery well-managed and "sustainable"? Should Massachusetts require this labeling at all supermarkets conducting business in the state? Should Massachusetts require restaurants to note which fish on their menus is from sustainable sources and which is not? Just how informed should the consumer be about "wild" species that he or she may wish to eat? Some links to help you understand the issues include:
http://america.aljazeera.com/articles/2013/10/20/alaska-fishermenbattlewalmartoversustainabilitylabel.html
http://www.npr.org/2013/02/11/171376509/is-sustainable-labeled-seafood-really-sustainable
http://www.takepart.com/article/2013/04/16/sustainable-seafood-not-sustainable-fishing
http://www.scientificamerican.com/article.cfm?id=sustainable-seafood-labels-come-under-fire
http://sustainableseafoodcoalition.org/labelling-code/
http://e360.yale.edu/feature/green_intelligence_toward_true_ecological_transparency/2190/

d. **Regulation of or Moratorium on the Sale of Endangered Fish Species**
   Some highly desirable and high-end fish are currently considered endangered or severely threatened: examples include bluefin tuna; Atlantic halibut; Beluga, green, Gulf, and shortnose sturgeon; Acadian redfish; orange roughy; winter skate; Bocaccio , canary and yelloweye rockfish; European eel; Goliath grouper; Maltese ray; Atlantic, Chinook, chum, and sockeye salmon; largetooth and smalltooth sawfish; and steelhead trout. Despite their endangered status with both U.S. governmental agencies (such as NOAA) and United Nation agencies (such IUCN),

these fish often find their way to high-end fish restaurants or sushi houses. Sometimes, they are substituted with a different fish and yet the consumer is charged the normal price for the fish (i.e., the consumer is sold a fish that is labeled as something else). In fact, due to the difficulty in obtaining some of the endangered species, seafood fraud is happening more and more commonly, as detected by DNA testing of fish tissue. This fraud can happen anywhere along the supply chain: the restaurant, the distributor, the processing and packing plant, the fisherman. Should the State of Massachusetts ban the sale of endangered fish products to local businesses to prevent seafood fraud and to decrease the desire for endangered species of fish? What other measures could the state adopt to prevent both the sale of endangered species and the nondisclosure that other species are being substituted for these endangered species? Is this even an important issue for the consumer? Some links to help you understand the problems and controversy include:
http://oceana.org/en/our-work/promote-responsible-fishing/seafood-fraud/overview?gclid=CK-cpfHTo7sCFWJo7Aod-3IAIA
http://www.boston.com/business/specials/fish_testing/
http://www.boston.com/businessupdates/2013/06/11/state-house-panel-considers-options-aimed-preventing-seafood-mislabeling-massachusetts/jPtmYGTon6UbXtG3DCyJtI/story.html
http://www.bostonglobe.com/business/2013/02/21/fish-mislabeling-common-throughout/kHVFNwzerS9Ws84SuvZC1H/story.html
http://www.urbanbarcodeproject.org/images/pdf/Identifying-%20Freshwater-Fish.pdf
http://www.urbanbarcodeproject.org/images/pdf/Identifying-sushi-Tuna.pdf

7. Human Health and Welfare in the City

A healthy city is a city that can thrive into the future. Creating and maintaining healthy communities, however, are multifaceted challenges for large cities like Boston. The American Public Health Association defines a number of policy initiatives that are desirable to protect and maintain the health of urban communities. Some of these initiatives are quite broad, such as those that define adequate safety standards in public areas for both children and adults. Others are much more focused, such as creating programs for treatment of narcotic drug abuse within neighborhoods.

How can the health of communities within the greater Boston area be improved? What standards for public health should be created, maintained, and enforced? How can communities be protected from health hazards? Can the childhood obesity epidemic be addressed through community efforts as well as by organized medicine?

These are only a few examples of the local public health issues that might be addressed by a Capstone group. Here are a few others:

a. **Emerging Disease and Boston Neighborhoods**

Is Boston, with all its colleges and international communities, a crucible for emerging diseases? One aspect of increasing human population density is the emergence of density dependent diseases. What is the history of this type of communicable disease? What can and is being done to respond to disease issues in neighborhoods and on campuses?   To learn more about these issues, examine the following links:
http://www.bu.edu/neidl/
http://mbio.asm.org/content/3/6/e00494-12.full
http://jama.jamanetwork.com/article.aspx?articleid=395076
For information on the controversy surrounding the National Emerging Infectious Diseases Laboratories ("BioLab") at the Boston University Medical Center ("BUMC"), see:
http://www.bu.edu/neidl/2013/10/02/us-judge-rules-bu-biolab-plan-ok/
http://www.bu.edu/neidl/files/2013/10/Judge-Saris-Ruling.pdf

b. **Urban Gardens and Food Pantries**

Should Boston advocate the use of locally grown and raised food for use in neighborhoods and on college campuses? The "slow food" movement is a real force in many communities. Could Boston become more environmentally friendly if it actively embraced this movement? Could Boston become more sustainable if we relied on locally grown and raised foods? Should Boston invest in local farms so they will provide foods to more neighborhoods in Boston? Should Boston invest in rooftop farming efforts? How can local food pantries provide more locally-grown produce to families and individuals at risk for malnutrition and obesity? Some links that will help you explore these issues are:
http://seacoasteatlocal.org/get-involved/food-for-all/
https://data.cityofboston.gov/browse?tags=food+access
https://data.cityofboston.gov/browse?tags=food+initiatives

c. **How Should We Respond to Increased Exposure to Endocrine Disruptors?**

An endocrine disruptor is a substance that is not produced in the body but acts by mimicking or antagonizing natural hormones. It is thought that endocrine disruptors may be responsible for some reproductive problems in both women and men, as well as for the increases in the frequency of certain types of cancer. Endocrine disruptors have also been linked to developmental deficiencies and learning disabilities in children. Because hormone receptor systems are similar in humans and animals, effects observed in wildlife species raise concerns of potential human health effects. Exposure to endocrine disruptors can occur through direct contact with pesticides and other chemicals or through ingestion of contaminated water, food, or air. Chemicals suspected of acting as endocrine disruptors are found in insecticides, herbicides, fumigants and fungicides that are used in agriculture as well as in the home. Industrial workers can be exposed to chemicals such as detergents, resins, and plasticizers with endocrine

disrupting properties. Endocrine disruptors enter the air or water as a byproduct of many chemical and manufacturing processes and when plastics and other materials are burned. Endocrine disruptors can also leach out of plastics, including the type of plastic used to make hospital intravenous bags. Many endocrine disruptors are persistent in the environment and accumulate in fat, so the greatest exposures come from eating fatty foods and fish from contaminated waters. How can we ensure that our water supplies are adequately treated for these chemicals and how can we reduce our use of plastic containers that leach these compounds? To learn more, examine this links:
http://www.hhs.gov/asl/testify/2010/02/t20100225a.html
http://www.rsc.org/chemistryworld/2013/09/worrying-molecule-bottled-water-endocrine
http://www.epa.gov/endo/

e. **Your Drinking Water.**
Boston boasts one of the most pristine drinking water sources in New England, the Quabbin Reservoir. Recently, however, the safety of the infrastructure that brings the Quabbin water from western Massachusetts to Boston-area homes has been questioned. Are the pipes new enough – and clean enough? Despite the excellence of the Quabbin water, many in the Boston area prefer to buy and consume bottled drinking water. Is bottled water any healthier than tap water? It is certainly more expensive, and companies that bottle water may deplete communities of their natural resources. Is tap water in Boston safe to drink – and preferable to bottled water? How can Boston residents be assured of the safety and security of their municipal water systems?
http://water.epa.gov/drink/local/ma.cfm
http://www.nrdc.org/water/drinking/uscities.asp
http://www.mwra.com/04water/html/qual4concerns.htm

8.   **Energy Use and Development in Massachusetts**

The American Council for an Energy-Efficient Economy recently ranked Boston in the top tier of cities doing the most to save energy (www.aceee.org/press/2013/09/report-ranks-us-cities-efforts-save-). Based on data from 2011, Massachusetts was generating 68% of its electricity from natural gas, 11% from coal, 6.2% from renewables (biomass and hydroelectricity), with the remainder coming from nuclear energy and other renewables. The state emits 79 million metric tons of carbon dioxide emissions, ranking 29th in the country in such emissions. To reduce emissions for energy production, Massachusetts has the first federally approved offshore wind farm (Cape Wind) and may seek to open more offshore wind farms, yet this first-of-its-kind-project in this country has met with considerable opposition and has been delayed due to many lawsuits. Despite the opposition to newer, "green" technologies like Cape Wind that would provide energy to a large region like Cape Cod and the Islands, the state legislature has passed legislation that was signed by Governor Deval Patrick requiring emission reductions of 10-25% below 1990 levels by 2020 and an 80% reduction below 1990 levels by 2050. Such mandates may

require the use of more expensive technologies for new construction and thus may increase housing and business costs in the state. These mandates also may require that more projects like Cape Wind be used and some suggest that we should even start building new nuclear energy plants in the state. Are these mandates reasonable? In what ways and by using what technologies does the state expect to reduce emissions as mandated? How should the state incentivize energy consumers reducing their emissions footprint? The current program has some voluntary pilot incentives, but consumers may or may not approve or buy into these incentives. If consumers balk, should the state mandate these programs and by what methods? What should businesses expect to have to do to reduce their footprints? What energy resources should the state develop? Avoid? This topic is rich for exploring how local governments might attempt to contribute to ameliorating climate change in the absence of federal action.

For more information, see:
http://www.eia.gov/state/?sid=MA#tabs-4
http://www.mass.gov/eea/agencies/massdep/air/climate/reducing-greenhouse-gas-emissions.html#1
http://www.masslive.com/news/index.ssf/2010/12/massachusetts_unveils_plan_to.html
http://www.massdot.state.ma.us/GreenDOT/GreenDOTImplementationPlan.aspx
http://www.capewind.org/index.php
http://www.bostonglobe.com/business/2014/01/22/opponents-file-new-suit-block-cape-wind-project/1T2Mh3zCza9LExTWzIYlXK/story.html
http://www.capecodonline.com/apps/pbcs.dll/section?category=special01
http://thinkprogress.org/climate/2013/12/02/3007401/massachusetts-fracking-ban/
http://www.geo.umass.edu/stategeologist/frame_shalegas.htm?shalegas.htm