SHOALS MARINE LABORATORY – SUMMER 2018

BIOSM 2500 / MEFB 500

Coastal Habitat Field Research Methods

Provisional Syllabus*

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Course Description: This two-week intensive field-based course is intended for students who wish to explore and gain proficiency in various research and assessment methods of terrestrial and aquatic plant communities of the Isles of Shoals and nearby coastal habitats of the Seacoast and Great Bay Estuary. Topics covered will include quantitative surveys methods, GIS-based and aerial (UAV) mapping of plant communities, taxonomy and systematics of major vascular taxa, island biogeography, rare species ecology and conservation, and the management of invasive species. Through both field and classroom exercises, we will use a variety of sampling protocols to document the existing plant communities, contribute to ongoing plant community studies, investigate the floristic changes that the Isles of Shoals have experienced from past to present, and use these data to predict trends into the future to help preserve their unique flora. Students will use skills developed in class to design and implement independent field research projects in a related topic of their choice.

Location: Shoals Marine Laboratory, Appledore Island, ME

Dates: July 3 – July 17 **Credits:** 4

General topics will include:
- Quantitative field vegetation survey approaches (transect/quadrat, point intercept, ocular)
- Qualitative survey approaches (random, haphazard, meander, etc.)
- Habitat mapping (geo-referencing with GPS and basic GIS map production)
- Comparison of island *vs* mainland habitats and species composition
- Field identification and plant taxonomy
- Plant collection techniques, ethics and specimen preservation techniques
- Rare species (Natural Heritage) documentation protocols
- Invasive species control approaches, and associated benefits and drawbacks of each
- Vegetation management for promoting native habitat (Seavey Island Tern Colony)
- Independent, applied research project

Skills gained will include:
1. Know how to conduct terrestrial and aquatic plant surveys and apply the appropriate methodology for their intended purpose (i.e., applied research, resource management, etc.)
2. Become familiar with the flora of Appledore and other Isles of Shoals, be able to distinguish native vs invasive species, rare species, and harmful (poisonous) species
3. Document rare plant(s) using Natural Heritage's rare species occurrence forms
4. Map plant habitats using GPS, which may include natural communities, limits of invasive species stands, or location of isolated rare species
5. Contribute to an ongoing island-wide floral survey and habitat mapping effort
6. Produce plant habitat map(s) using GIS, Google Earth or other open source software
7. Understand the factors that lead to habitat stability or floristic change over time on the island
8. Completed a modest plant collection and prepare a selection of herbarium specimens to be stored at UNH's Hodgdon Herbarium
9. Develop and implement a small-scale field research project on topic of choice

Texts and Required Reading

Due to the unique nature of this course, reading will be selected from the literature and compiled into a packet for enrolled students. Links to reference material and primary literature will be made available through a mutually agreeable FTP or server (*e.g.*, Canvas, Google docs, Dropbox, etc).

Grading

Class/Lab Participation (including daily journal to be handed in on last day) – 10 pts
Plant Collection (20 plants required for full credit) – 20 pts
Waterproof Field Book (daily field data and/or field sketches required) – 10 pts
Field Quizzes (two in total, first on methods, second on plant knowledge) – 10 pts
Independent Research Project (written summary and powerpoint) – 20 pts
Final Field Test (conducted in field, answers written) – 30 pts

TOTAL – 100 pts

A = 94-100	C+ = 77-79	D- = 60-63
A- = 90-93	C = 73-77	F = 0-59
B+ = 87-89	C- = 70-73	
B = 83-87	D+ = 67-69	
B- = 80-83	D = 63-67	

Course Policies and Academic Conduct

Students enrolled in this course will be expected to follow the academic conduct guidelines outlined by the University, several of which quoted below. The complete guidelines can be found at www.unh.edu/student/rights.

Academic Honesty

Honesty is a core value at the University of New Hampshire. The members of its academic community both require and expect one another to conduct themselves with integrity. This means that each member will adhere to the principles and rules of the University and pursue academic work in a straightforward and truthful manner, free from deception or fraud. Any attempts to deviate from these principles will be construed as acts of academic dishonesty and will be dealt with according to the rules of due process detailed in the academic conduct guidelines.

Plagiarism

The unattributed use of the ideas, evidence, or words of another person, or the conveying of the false impression that the arguments and writing in a paper are the student's own. The penalty for cheating, plagiarism or misrepresentation in this class will be an automatic F for the course, and could result in dismissal from the University.

Daily Schedule (Provisional Outline)

Day 1: Course Overview

Welcome, settle in (arrive 4:30). Get the lay of the land, "Fire and Water" rules of the road presentation, settle in to housing arrangements. Island walkabout before dinner. First class meets after dinner where we will discuss the syllabus, course expectations and outline the student research project concept.

Reading #1: Nichols and Nichols 2008, focus on Appledore Island results. We will refer back to this document throughout the course.

Day 2: Introduction to Appledore's Natural Communities

Lecture: The major plant community types present on Appledore and the Isles of Shoals, including factors that influence their distribution. Overview of past/ongoing floristic research on the island. Get to know these recognizable habitats and a few of the more common plants that define them.

Field: Tour major habitats while gaining first experiences in identifying key species, as well as practices for sustainable collection of plants.

Lab: Review of basic plant taxonomy and the concept of dichotomous keys using predetermined examples.

Research Opportunity: Gather plant community data at fixed plots throughout the island to contribute to the course data base or creation of additional deliverables.

Reference #1, Borror's List: Biological inventory of Appledore Island.

Day 3: Exploring Appledore's Rare Species and Exemplary Habitats

Lecture: Threatened and endangered plants and their exemplary habitats of the Isles of Shoals. Where to find them, how to document them, and discussion of the factors that influence their distribution.

Field: Explore sites on Appledore to look for rare species and/or exemplary habitats. Utilize Natural Heritage "EO" forms to formally document occurrences.

Research Opportunity: Create a rare species inventory, database, and/or map for Appledore using present and past accounts.

Reading #2: Farnsworth et al. 2005. Ethics of rare species study/collection.
Reference #2 (*optional*). Sperduto and Nichols Natural Communities of NH. Important resource for this class. Not realistic to read cover to cover. Reference material.

Day 4: Standard Quantitative Approaches (Part I)

Lecture: Vegetation sampling design 101. How to design study and chose the best methods to fit project goals. Instruction on data collection, data sheets, estimation techniques and rationale for selecting one approach vs another.

Field: Practice setting up random sampling array; Compare fixed vs. random plot sampling, or plotwise vs meander sampling techniques. Visit locations of permanent transects and characterize habitat features, collect representative plant samples.

Lab: Process plant samples using reference materials (guide books, etc.) to identify family, genus, and species for each. Dry and label samples using plant press. Review taxonomic features to hone ID skills.

Research Opportunity: Chose an existing fixed-plot vegetation transect from Course's ongoing sampling project. Document species richness by walking transect line and listing all plants encountered. Compare and contrast results to that of fixed plot sampling. Explore the pros and cons of each approach.

Reading #3: McMaster 2005. Factors affecting plant diversity on New England Islands.

Day 5: Standard Quantitative Approaches (Part II)

Lecture: Vegetation sampling design 101 continued. Today's focus will be on various estimation techniques, comparisons of precision vs accuracy, and rationale for selecting one approach vs another.

Field: Practice estimating percent cover and documenting species richness; Compare ocular vs point intercept techniques while familiarizing yourselves with the island flora. Visit permanent transects and sample fixed plots to document community stability or change over time.

Research Opportunity: Identify several fixed plot locations (see Day 4) and use point intercept method to determine richness and cover. Compare results with prior visual estimation results or conduct both estimation types to evaluate similarities and differences.

Reading #4: Godinez-Alvarez et al. 2009.

Day 6: Remote Sensing and Technical Approaches (Part I)

Lecture: Remote sensing of terrestrial and aquatic habitats. Challenges and opportunities for landscape-level assessments. Overview of various techniques and technology from simple (GoogleEarth) to more complicated (LandSat and GIS-based) approaches.

Field: Getting familiar with GPS and handheld computer(s) to collect or verify remote mapping data. Use various instruments (provided) to navigate to fixed points for sampling and ground truth map units. Create data points on the fly using GPS software such as ArcPad or GeoOffice.

Research Opportunity: Generate random points in each previously mapped habitat unit on Appledore. Navigate to these locations and perform accuracy assessment to test quality of mapped habitats and predicted species composition.

Reading#5: TBD.

Day 7: Remote Sensing and Technical Approaches (Part II)

Guest Lecture (Ph.D. Candidate Michael Routhier, NRESS): Remote sensing of terrestrial and aquatic habitats (continued). Emphasis on UAV imagery and how to create geo-referenced photo-mosaics.

Field: Demonstration of UAV for gathering aerial imagery data, programing flight surveys, and downloading flight logs. Collect random plot data within survey footprint for ground truth exercise.

Lab: Data processing and map creation from aerial imagery. Complete one georeferenced photo-mosaic and annotate with field-collected vegetation data to generate habitat map.

Research Opportunity: Select manageable survey area and use a combination of UAV and ground survey to complete a fine-scale vegetation map of an area of interest, conservation concern, or other justification.

Reading #6: UAV's in vegetation research TBD.

[FIELD QUIZ 1]

Day 8: Invasive Species and Management Approaches

Lecture: Overview of invasive species and the factors that allow their spread and proliferation, as well as strategies to control them (examples from Appledore and the mainland, such as nearby Odiorne State Park). Differentiate terminology: weed, invasive, exotic, native, naturalized, etc.

Field: Explore island in search of common invasive species known to occur on the island and map their occurrence, quantify population, and map location and habitat features.

Lab: Process invasive species locations and add to draft map.

Research Opportunity: Develop an invasive species occurrence map for Appledore and include management considerations and recommendations for the present and future.

Reading #7. Houlahan and Findlay 2005. Effect of invasive species on wetland plant diversity.

Day 9: Wetland Habitats of Appledore Island

Lecture: Fresh, brackish and saline wetlands of Appledore. Their unique flora and the environmental factors that influence them. Topics will include adaptations to flooding, salinity, and geochemistry.

Field: Characterize the plant communities at each of several discrete wetland habitats (e.g. North Pool, Central Pond, Crystal Lake, and the tiny salt marsh near Sand Piper Beach). Collect surface and pore water for geochemical and water quality analysis.

Lab: Process plant specimen from wetland visits; process water samples for salinity, pH, redox potential and other parameters.

Research Opportunities: Map salinity gradients in sediment underlying wetland areas; Update map(s) to illustrate predominant salinity conditions across these wetland sites.

Reading #8: Nichols and Moore 2013. Salinity gradients in coastal salt pond marshes, Odiorne.

Day 10: Coastal Salt Ponds and Emergent Marsh, Odiorne State Park

Lecture: Lecture will be a discussion on boat to site, designed to outline expectations of the field trip. Focus will be on exploring differences between plant diversity of habitats share by both mainland and Shoals and the factors that influence these trends.

Field: Visit to coastal habitats of the main land with an emphasis on the exemplary habitats of Odiorne State Park. Document diversity of salt ponds, salt marsh, and brackish to fresh emergent marshes.

Research Opportunities: Odiorne Point is one of the few places that have a complete biological inventory much like Borror's List. Compare and contrast the flora of the state park and Appledore.

Reference #3. Bioblitz - Odiorne State Park.

[FIELD QUIZ 2]

Day 11: Plant Communities as Critical Tern Habitat

Guest Lecture (Dr. Liz Craig, SML): Overview of the tern colony project, its goals, and role vegetation plays in nest success. 2017 vegetation survey shows a relationship between percent cover and canopy height on nest site selection and success.

Field Trip: Vegetation sampling on White/Seavey Island tern colony pilot study. Use taxonomic and vegetation metric skills to assess species richness, percent cover, and canopy height in experimental and control plots.

Research Opportunity: Process field data and explore results using basic statistics to determine if significant differences can be found between experimental and plots. Develop recommendations for future management.

Reading #9: Pilot Study Grant Proposal

Day 12: Submersed Aquatic Vegetation of Great Bay National Estuarine Research Reserve

Lecture: Lecture will be a discussion on boat to site, designed to outline expectations of the field trip. Emphasis will be on the role eelgrass plays in the health of Great Bay Estuary, as well as eelgrass adaptions, habitat requirement, threats and conservation issues.

Field Trip (with Guest Coastal Ecologists from UNH's Jackson Estuarine Laboratory): Travel by boat through Portsmouth Harbor and up in to the Great Bay Estuary making stops at known eelgrass beds. Collect basic water quality data at sites. Participate in SeagrassNet sampling protocol at one of the programs long term monitoring sites in Great Bay and visit JEL.

Research Opportunity: Compare SeagrassNet data from field trip to past years of data collection to determine if eelgrass is on the rise, stable, or in decline in Great Bay.

Reading #10: Short, Moore and Mills 2012. Comparison of eelgrass sampling techniques in Great Bay.

Day 13: Floristic Changes, Past, Present and Future

Lecture: History of vegetation changes on Appledore, including natural and anthropogenic influences on vegetation of the Isles, past, present and future.

Field: Return to transects and conduct annual vegetation sampling at as many sites as possible.

Lab: Process results and work to revise, update, or improve vegetation community maps for Appledore.

Evening Recitation for Exam.

Day 14: Exam and Student Project Presentations

Morning: Field-based Exam covering plant knowledge, habitat characteristics, natural history and methods.

Free Time to complete/refine Student Presentations

Evening: Student Research Project Presentations (15min max per presentation, see assignment details in Course Packet).

Day 15: Wrap up and Departure

Morning Meeting to hand in required course elements (plant collection, field note books, written project summary, etc). Group wrap up and goodbyes.