

## **NYU – Environmental Studies Department Senior Capstone - Spring 2018**

### **Title: Historical Ecology of Jerusalem: Building on the Mannahatta Model**

**Instructor:** Dr. Eric W. Sanderson, Senior Conservation Ecologist, Wildlife Conservation Society/Bronx Zoo

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**Office Hours:** by appointment – please email

**Course Meetings:** Mondays (starting January 22, 2018) from 5-7:30pm at TBD

### **Course Abstract:**

On an afternoon, some four thousand years ago, a man and his son made their way slowly up a mountain rising above the rich, productive land that lay between the Mediterranean Sea and the deserts of the Middle East. On a rocky summit, the man lay down his burden of firewood in the midst of a thorny bramble. The man bound his son over the wood and raised his knife above the boy. The man stopped; he heard a voice in the wind. He bent down, released his son, and instead sacrificed a ram caught by the horn in a thicket nearby.

This project is to discover what else might have been in the thicket that day

Many years later, we remember the man's name was Abraham or Ibrahim, and his son was Isaac or perhaps Ishmael, and the mountain where they killed and burnt an offering of the ram was called Mount Moriah or the Temple Mount, the holiest place in the city named after peace, Ur-Shalem, Zion, or Jerusalem, the center of the world for at least 3 billion of the world's faithful.

Though the legend of that man and his child and sacrifices made and not made have been endlessly retold, few people have thought to ask what else lived on Mount Moriah that day. Jerusalem in addition to be a contested city is also a place on Earth. Setting aside religious explanations, science help explain why there was a hill, and a thicket, and a ram. It helps us unpack why that place, of all places, became a city that people have fought over again and again. For before the city was nature. Because we have forgotten that nature, in the form of plants and animals and water and soil and wind, we have forgotten a precious, even holy, aspect of the story of Jerusalem. It is this story which we will return to the city – the story of its ecological relationships to the natural world.

Our project for Jerusalem is based on adaptation of the ground-breaking work of the Mannahatta Project thousands of miles away and thousands of years later in New York City. In New York, Dr. Eric Sanderson of the Wildlife Conservation Society and his colleagues reconstructed the detailed ecology of Manhattan Island at the moment of European discovery four hundred years ago as a platform for thinking about urban sustainability (Sanderson 2009; see the expansion of the project to the other four boroughs at [welikia.org](http://welikia.org)). For Jerusalem, we will adapt the ecological modeling techniques from Mannahatta to the Mediterranean ecosystems of the Judean

Hills in the early Bronze Age, just as human society was transitioning toward agriculture and the sedentary life.

It is important to understand that this capstone is course in scientific reconstruction and synthesis; not a class in religion per se, even though we will deal with a place that figures prominently in many religions, particularly Judaism, Christianity, and Islam. We will be drawing lines on maps in one of the most contested regions of the world, where lines matter a lot. But our lines will be the ones nature drew, to the best we can understand them, prior to the founding of any of these religions or the modern quarrels that have risen subsequently.

Specifically this capstone will focus on collecting, deriving and integrating historical and geographical data to describe the historical ecology of Jerusalem in the late Bronze Age period. Building on a project plan developed by Dr. Sanderson, students will work with the instructor to (1) digitize historical maps of the topography; (2) create a digital elevation model (DEM); (3) digitize maps of the soils and geology of Jerusalem; (4) develop a list of likely vegetation types based on the soil, topography, and climate prevalent in the study period; and (5) create an initial potential vegetation map for the city. Future capstone(s) will build on our efforts to model the plants and animals in the block-by-block geography of the city of Jerusalem. All these data products will be generated and housed in cloud-based databases, so they establish the basis for future work by students and scientists at the Wildlife Conservation Society and partner institutions. At the end of the semester you will give a final presentation detailing their work. From these activities, students will gain introduction to issues in historical landscape ecology; geographic analysis and on-line databases; and issues of urban sustainability.

### **Required texts:**

Sanderson EW. 2009. *Mannahatta: A Natural History of New York City*. Abrams, New York.

Armstrong K. 1997. *Jerusalem: One City, Three Faiths*. Ballantine Books, New York.

Note: Both books have been placed on reserve in Bobst Library.

**Disability Disclosure Statement:** Academic accommodations are available to any student with a chronic, psychological, visual, mobility, learning disability, or who is deaf or hard of hearing. Students should please register with the Moses Center for Students with Disabilities at [212-998-4980](tel:212-998-4980). NYU's Henry and Lucy Moses Center for Students with Disabilities 726 Broadway, 2nd Floor New York, NY 10003-6675 Telephone: [212-998-4980](tel:212-998-4980) Voice/TTY Fax: [212-995-4114](tel:212-995-4114) Web site: <http://www.nyu.edu/csd>

### **Course Materials**

**Computer:** Students will need access to a computer, whether a personal computer or one of the university provided ones, with an update-to-date Internet browser, word processing and presentation software. You will need to be able to access the Internet, print documents, and prepare presentations, presenting them during class time. (A NYU id and a Google Slides presentation via Google Drive work well.) You will also need to access geographic information

system (GIS) software via NYU (see documentation of GIS services at <http://guides.nyu.edu/c.php?g=276822&p=3562711>). Computer laboratories at NYU are available at the Washington Place Academic Technology Center, the Third Avenue NYUHotSpot and the Kimmel Center NYUHotSpot.

**Software:** Students will need to download and install the standalone freeware program Zotero from [zotero.org](http://zotero.org). They can also request license copies of ESRI's ArcMap from NYU IT to install on their laptop computers.

**Grading and Evaluation:** Although working in groups, students will be graded individually according to NYU policies. Each assignment is worth a point value (Table 1). Grades will be assigned based on completeness, timeliness, and demonstrated mastery of the material; innovation, flair and enthusiasm will be rewarded. During presentations, all students must speak for their team in approximately equal proportions. Active inquiry and participation with your team and in class discussions is required for credit. Mid-term evaluations will be made for all students. No exams or quizzes will be given per se; rather your work will be evaluated as it is given, typically through in-class presentations and the final capstone presentation at the end of the semester. Readings are mandatory and knowledge of the reading material should be reflected in your commentary during class and in the written assignments. Note that because products build on each other over the course of the term, failure to complete one activity can lead to subsequent failures to complete activities in a cascading fashion with dire consequences in terms of final scoring.

Other details:

- No extra credit— there is nothing you can do to “improve your grade” beyond doing the assignments on time, completely and with attention to quality.
- Although this is not a writing course per se, we will be writing and presenting on the works of other persons. Please be aware that plagiarism results in automatic failure of the class. Plagiarism includes: copying sentences or fragments from any source without quotes or references; not citing every source used in your papers; citing internet information without proper citation; presenting someone else’s work as your own; or “inadvertently” copying verbatim from any source. For example:
  - Original: There is considerable debate in the scientific community as to the sources of climate change.
  - Plagiarism: There exists substantial disagreement in the scientific field about the causes of climate change.
  - Not Plagiarism: Scientists are engaged in ongoing disagreement and discussion on the sources of climate change, including ....
- Lateness is unacceptable. Repeated lateness will result in a lower participation grade.
- Be considerate. No chatting, texting, or web-surfing during class. This is difficult because we will often have computers open, but it is disrespectful to the instructor and the other students to be looking at Facebook or texting with your friends while class is in session. Repeated use of

computers/phones/etc. in class for non-class related purposes will result in a lower participation grade.

- All data and databases produced as part of this project will be retained by the Wildlife Conservation Society, a non-profit institution, which is the client for this capstone course. You are also welcome and entitled to retain copies of your own work for their own use. Student contributions will be acknowledged collectively or individually in any and all publications that result from work in the class. Please address any questions to Eric Sanderson.

Table 1. Class assignments in the Historical Ecology of Jerusalem Capstone

Date	Topic of this session	Assignment for next session	Point value of assignment
1/22/2018	<p>Welcome and introductions; review of syllabus; an introduction to Discussion of historical landscape ecology in an urban context, based on the Mannahatta/Welikia Projects.</p>	<p>Read Sanderson 2009, chapters 1 – 4 (quiz 1/29) *****</p> <p>In an approximately 1000 word written response due by the beginning of class next time (1/29), describe in general terms the historical ecology of the place where you were born from a time when human beings were not the dominant factor influencing the distribution and abundance of other species. This will require you to research the ecology of your birth place, including an investigation into historical maps, documents, and descriptions of the potential ecosystem type. Describe how you define the landscape and the time period that you chose. Provide at least one map. Use in-text citations and a short bibliography (not included in word count) to cite any relevant texts, maps, or other descriptions.</p>	<p>100 (ind.; response); 50 (ind.; quiz)</p>
1/29	<p>Process and data for historical landscape ecology.</p> <p>Quiz on reading</p> <p>Flowchart of the Mannahatta/Welikia Project</p>	<p>Read: Sanderson, chapters 5 – 7; Armstrong, chapters introduction, 1 – 2 (quiz 2/5). Review Jerusalem Project plan from Eric. *****</p> <p>Investigate the maps and resources listed in Zotero. Working in groups (TBD), students will conduct research</p>	<p>100 (group; maps); 50 (quiz, ind)</p>

	<p>Discussion of relevance to the Jerusalem Project.</p> <p>Introduction to Zotero and the SDR and Placename databases.</p>	<p>to find in New York City based archives and on-line archives <u>three</u> new map resources that describe aspects of the past or current ecology of the Jerusalem. Eric will provide some direction. Students will make Zotero entries, upload scans of the maps to the SDR database, and record any placenames listed on the maps in the placename db. Each group should prepare a short abstract (300 words or less) of each map (i.e. 3 abstracts per group) describing how and why the map was made, what it shows, and how it is relevant to our project. Also provide the full bibliographic information as it appears in Zotero.</p>	
2/5	<p>Why is the geography of Jerusalem important?</p> <ul style="list-style-type: none"> <li>• Quiz</li> <li>• Introduction to GIS (ESRI ArcMap), with a focus on digitizing. Guest speaker: Kim Fisher, WCS.</li> <li>• Discuss digitizing assignment</li> </ul>	<p>Read: Armstrong, chapters 3, 16 (quiz on 2/12)</p> <p>*****</p> <p>Each group will be assigned one or more map to process, digitize, and present on 2/26. This may require obtaining higher resolution scans of the maps, some simple image preparation, georeferencing, and then digitization. Groups will also organize themselves to enter placenames, as shown on the maps, into the placename database. Groups will be expected to work collectively to build vector “shapefiles” of their work for presentation after winter break on 2/26. Prepare a brief presentation on progress for 2/12 and a fuller presentation on completed work on 2/26. Include an area based analysis of your findings (e.g. areas in to different elevations; areas of soil and geological type; etc.)</p>	<p>300 (group digitizing); 50 (ind. quiz)</p>
2/12	<p>Spatial analysis of historical maps.</p> <ul style="list-style-type: none"> <li>• Quiz.</li> <li>• Progress report from</li> </ul>	<p>Read Armstrong (a single chapter from chapters 4 – 15, 17, or 18 to be assigned in class). Quiz on 2/26</p> <p>*****</p> <p>Continue assignment above; in addition prepare an approximately 500 word</p>	<p>100 (ind.; response);</p>

	<p>students.</p> <ul style="list-style-type: none"> <li>• Guest lecture: TBD (historian/archeologist with experience in Levant)</li> </ul>	<p>written summary of your chapter, highlighting important physical changes in the landscape of Jerusalem, including major building projects, expansion of the city, changes in population, and other noteworthy events related to the city's natural history. Summaries will be due on 2/26</p>	
2/19	No class – holiday	<p>*****</p> <p>Continue assignments above</p>	
2/26	<p>Physical geography of Jerusalem.</p> <ul style="list-style-type: none"> <li>• Quiz</li> <li>• Discuss timeline of physical changes to Jerusalem based on reading.</li> <li>• Report back and share digitized maps. Overlay looking for consistencies between them. Assign revisions as necessary.</li> <li>• Discuss placename assignment.</li> </ul>	<p>One of these three, as assigned (see below): Wilson et al. (1871); Schaff (1880); Smith (1907). Quiz on 3/5. *****</p> <p>Each group will be assigned a book (see above) to mine for placename descriptions, to be entered into the Jerusalem Project placename database. The process is (1) make sure bibliographic info is complete in Zotero; (2) add references SDR database, and (3) scan/read text extracting verbatim quotes describing historical natural history (including hills, valleys, peaks, named rocks; streams, springs, ponds, lakes; descriptions of ecosystems including forests, thickets, wetlands, etc.) Groups should subdivide this task to maximize coverage and ensure approximately equal contributions among students. Each quotation should include a page number. Assignment will be graded individually based on the number and completeness of contributions to the database. All placename entries should be complete by 3/19.</p>	<p>300 (ind. db entries); 50 (ind. quiz)</p>
3/5	<p>Landscape modelling in GIS</p> <ul style="list-style-type: none"> <li>• Quiz.</li> <li>• Progress report on placename assignment</li> <li>• Construct a DEM, topographic analysis, and</li> </ul>	<p>*****</p> <p>Continue assignment above, adding entries about how those places have changed subsequently based on readings in Armstrong. Placename entries should be complete before class on 3/19.</p>	

	overlay analysis.		
3/12	No class – spring break	Continue assignment	
3/19	<p>Placename localization</p> <ul style="list-style-type: none"> <li>Working as a class and then in groups, assign placenames to geographic localities. Placename locations may be points, lines, or polygons, as appropriate.</li> </ul>	<p>Scan accounts of vegetation: Liphshitz and Biger (1990) &amp; Frumkin et al. (2000); Danin and Fragman-Sapir (2016); or Rotem and Weil (2014). Quiz on 3/26. ***** Complete placename localization by class on 3/26.</p>	100 (group); 50 (ind. quiz)
3/26	<p>Biogeography of Jerusalem</p> <ul style="list-style-type: none"> <li>Quiz.</li> <li>Guest Lecture: TBD (a geographer, historian, or zooarchaeologist with experience in the Near East)</li> <li>Discuss classification of vegetation and assignment for next time</li> </ul>	<p>No reading. ***** Each group will be assigned one of the three vegetation references above (note that the first includes two papers). From these each group will write a short paper listing the vegetation types relevant to historical Jerusalem, important/representative overstory species; and landscape conditions that predict where those vegetation types might be found in terms of soil, geological substrate, hydrology, and topography. We will synthesize these into a single list on 4/2. (Note: midterm evaluation deadline)</p>	
4/2	<p>Synthesis of vegetation types relevant to Jerusalem.</p> <ul style="list-style-type: none"> <li>Synthesis of vegetation types and predictive factors.</li> <li>Review Muir webs.</li> <li>Discuss GIS analysis for vegetation.</li> <li>Guest lecturer: Kim Fisher, WCS.</li> </ul>	<p>Read about vegetation dynamics related to human use: Carmel and Kadmon 1999; Perevolotsky and Seligman 1998; Ne’eman et al. 2000. Quiz on 4/9. ***** Each group will be assigned 2-3 vegetation types. For each vegetation type, define in terms of the maps we digitized previously, the combination of factors to predict the location of the vegetation. Apply those locations in the GIS to predict those vegetation types. GIS maps due on 4/16.</p>	50 (ind. quiz)
4/9	<p>Disturbance of vegetation.</p> <ul style="list-style-type: none"> <li>Quiz</li> </ul>	<p>Read about climate relevant to Jerusalem: Cullen et al. 2002;</p>	100 (group);

	<ul style="list-style-type: none"> <li>• Progress report from students on vegetation mapping.</li> <li>• Discuss modelling of disturbance in vegetation</li> </ul>	<p>Kutiel et al. 2000; and Weiss and Bradley 2001. Last quiz on 4/16.</p> <p>*****</p> <p>Continue assignment.</p>	50 (ind. quiz)
4/16	<p>The Climate of Jerusalem</p> <ul style="list-style-type: none"> <li>• Quiz</li> <li>• Progress report on vegetation mapping</li> <li>• Discussion of climate with respect to vegetation and climate in Jerusalem.</li> <li>• Organize final presentation</li> </ul>	<p>No reading except in review for final presentation.</p> <p>*****</p> <p>Each person prepares their assigned portion of the presentation for assembly in class on 4/23.</p>	100 (ind.)
4/23	<p>Pulling it all together, Part I</p> <ul style="list-style-type: none"> <li>• First review of presentation</li> <li>• Guest lecture: (TBD) Discussion of modern Jerusalem</li> </ul>	<p>No reading except in review for final presentation.</p> <p>*****</p> <p>Revise presentation materials and practice final presentation.</p>	
4/30	<p>Pulling it all together, Part II.</p>	<p>Practice final presentation. Practice final presentation. Practice final presentation.</p>	
5/7	<p>Final presentation</p>	<p>Happily graduate! The datasets you prepared and your final presentation performance will stand in for the final products of this class (see below)</p>	250 (group); 250 (ind.)

In addition up to 500 points will be awarded for in class participation, good spirits, and collegiality.

### Expected Class Products

- Digitized map layers in a geographic information system representing the historical topography, soils, geology and hydrology of Jerusalem.
- A georeferenced historical placename database with descriptions of ancient natural features and subsequent changes for Jerusalem.
- A first draft map of the vegetation of Jerusalem assuming a climate similar to today and no disturbance (a potential vegetation map)



- A timeline of critical changes in the natural history of Jerusalem starting in the early Bronze Age to the present
- A video of the class presenting this project to their peers

**Readings** (all of these are available via the Jerusalem Project zotero group except Armstrong 1997 and Sanderson 2009)

Amiran DHK, Shachar A, Kimhi I. 1973. Atlas of Jerusalem. Walter de Gruyer, New York.

Armstrong K. 1997. Jerusalem: One City, Three Faiths. Ballantine Books, New York.

Balfour JH. 1885. The plants of the Bible. Thomas Nelson and Sons, London.

Carmel Y, Kadmon R. 1999. Effects of grazing and topography on long-term vegetation changes in a Mediterranean ecosystem in Israel. *Plant Ecology* 145:243–254.

Cullen HM, Kaplan A, Arkin PA, de Menocal PB. 2002. Impact of the North Atlantic Oscillation on Middle Eastern climate and streamflow. *Climatic Change* 55:315–338.

Danin A, Fragman-Sapir O. 2016. Vegetation of Israel and Neighboring Countries. Available from <http://flora.org.il/en/books/vegetation-of-israel-and-neighboring-countries/> (accessed October 14, 2017).

Danin A. 2004. Distribution Atlas of Plants in the Flora Palaestina Area. The Israel Academy of Sciences and Humanities, Gerusalemme.

Kuemmel A. 1906. Materialien zur Topographie des alten Jerusalem: Begleittext zu der "Karte der Materialien zur Topographie des alten Jerusalem. Verl. d. Dt. Vereins zur Erforschung Palästinas.

Kutiel P, Kutiel H, Lavee H. 2000. Vegetation response to possible scenarios of rainfall variations along a Mediterranean-extreme arid climatic transect. *Journal of Arid Environments* 44:277–290.

- Ne'eman G, Lahav H, Izhaki I. 1995. Recovery of vegetation in a natural east Mediterranean pine forest on Mount Carmel, Israel, as affected by management strategies. *Forest Ecology and Management* 75:17–26.
- Perevolotsky A, Seligman NG. 1998. Role of grazing in Mediterranean rangeland ecosystems. *Bioscience* 48:1007–1017.
- Sanderson EW. 2009. *Mannahatta: A Natural History of New York City*. Abrams, New York.
- Schaff P. 1880. *A Dictionary of the Bible: including Biography, Natural History, Geography, Topography, Archaeology, and Literature*. American Sunday-School Union. Relevant terms, especially “Jerusalem”
- Smith GA. 1907. *Jerusalem: The Topography, Economics and History*. Volume 1. Hodder and Stoughton, London, especially chapters 1 – 2, 5
- Weiss H, Bradley RS. 2001. What Drives Societal Collapse? *Science* 291:609–610.
- Wilson CW, Warren C, Morrison W. 1871. *The Recovery of Jerusalem. A Narrative of Exploration and Discovery in the City and the Holy Land*. Richard Bentley, London.  
Wilson's initial chapters; scan Warren's chapter 3