As of 24 Aug 2023

Landscape Ecology Laboratory (BIO 319 / BEE 574)
Fall 2023

Stony Brook University
College of Arts and Sciences
Department of Ecology and Evolution

Important note: *Every effort will be made to avoid changing the course schedule, but the possibility exists that unforeseen events will make syllabus changes necessary. It is your responsibility to check Brightspace for corrections or updates to the syllabus. Any changes will be clearly noted in course announcements or through Stony Brook email.*

Course Information

Course description

A computer lab course focusing on spatial concepts, methods, and tools for addressing ecological and environmental problems. The course will be based on fundamental concepts in ecology and environmental science and extend that knowledge, as well as teaching technical skills, including the use of geographic information systems (GIS) software, image processing, spatially explicit modeling, and spatial statistics. The lab exercises will introduce a variety of spatial approaches for addressing problems in environmental protection, ecotoxicology, natural resource management, conservation biology, and wildlife management.
3 credits; Pre- or Corequisites: BIO 201;
Advisory Pre- or Corequisites: BIO 211 or AMS 110; and BIO 351

Course sections, class locations and, times (*all times are Eastern*)

Undergraduate	Location	Type	Time	Instructor / TA
BIO 319 01	Javits Center 110	Lecture	Mon 10:00 am – 10:53 pm	Anna Thonis
BIO 319 L01	Life Sciences 022	Laboratory	Mon 11:00 am – 1:50 pm	Ariek Norford
BIO 319 L02	Life Sciences 022	Laboratory	Tu 10:00 am – 12:50 pm	Moses Elleason
BIO 319 L03	Life Sciences 022	Laboratory	Tu 1:00 pm – 3:50 pm	Matthew Sirotkin
BIO 319 L04	Life Sciences 022	Laboratory	Mon 2:30 pm – 5:20 pm	Ariek Norford
BIO 319 R01	Life Sciences 022	Recitation	Fr 10:00 am – 10:53 am	Ariek Norford
BIO 319 R02	Life Sciences 022	Recitation	Fr 11:00 am – 11:53 am	Moses Elleason
BIO 319 R03	Life Sciences 022	Recitation	Fr 8:00 am – 8:53 am	Matthew Sirotkin
BIO 319 R04	Life Sciences 022	Recitation	Fr 9:00 am – 9:53 am	Ariek Norford

Instructor and TA information (*all times are Eastern*)

Role	Name	Email	Office hours
Instructor	Anna Thonis	anna.thonis@stonybrook.edu	Wed, 1:00 - 2:00
Lecture TA	Ian Shuman	ian.shuman@stonybrook.edu	Mon, 11:00 – 12:00
Lab TA, section 1	Ariek Norford	ariek.norford@stonybrook.edu	Thurs, Fri 3:00 – 4:00
Lab TA, section 2	Moses Elleason	moses.elleason@stonybrook.edu	Wed, 4:00 – 5:00
Lab TA, section 3	Matthew Sirotkin	matthew.sirotkin@stonybrook.edu	Thurs, 11:00 – 12:00
Lab TA, section 4	Ariek Norford	ariek.norford@stonybrook.edu	Thurs, Fri 3:00 – 4:00

Section assignments and office hours are subject to change; please see "Instructor Information" on Brightspace for up-to-date information. Temporary changes will be announced by email.

Course Structure

This is an in-person course, consisting of lectures, lab sessions, and recitations.

Lecture format: Each weekly lecture will introduce a set of concepts, methods, and approaches in the spatial analysis of environmental problems.

Laboratory format: Each laboratory session will consist of a series of computer exercises, focusing on a particular spatial approach or a particular type of environmental issue. The laboratory sessions will use a variety of spatial and statistical software, including GIS and image analysis software (TerrSet, which includes Idrisi; in 9 labs), habitat suitability modeling (or, ecological niche modeling) software (MaxEnt; in 3 labs), metapopulation modeling software (RAMAS Landscape; in 7 labs). You will be required to submit weekly lab reports.

Computer lab exercise instructions and files will be made available on the BIO 319.01/BEE574.01 Brightspace page under the Content tab. Some of the programs required for the lab exercises are accessible through a connection to a Virtual SINC site. To establish a connection to a Virtual SINC site, follow the instructions at the following link: https://it.stonybrook.edu/services/virtual-sinc-site.

At least 24 hours before you come to the first lab session, you must install DUO Security Two-Step. For information, see https://it.stonybrook.edu/services/duo-security-two-step-login

Recitation format: Recitations will follow the same format as laboratory sessions and will focus on helping students complete the week's laboratory assignment and answering questions that link the lecture material and the lab exercises. In addition, there will be quizzes during recitation hours.

Office hours: Office hours of the instructor and the TAs will be virtual or hybrid (this is up to the individual instructor/TA). Zoom meetings will be open for the instructor and individual TAs during the designated times. The instructor and TAs will also respond to email inquiries during their office hours.

Technical Requirements

This course uses Brightspace (https://it.stonybrook.edu/services/brightspace) for the facilitation of communications between faculty and students, submission of assignments, and posting of grades and feedback.

In order to complete this course successfully, students must be able to use email, a word processor, spreadsheet program, and presentation software. The use of other required software (such as TerrSet) will be taught during the course.

Technical assistance: If you need technical assistance at any time during the course or to report a problem with Blackboard you can:

- Phone: 631-632-9800 (client support, Wi-Fi, software and hardware)
- Submit a help request ticket: https://it.stonybrook.edu/services/itsm
- If you are on campus, visit the Walk-Up Tech Support Station in the Educational Communications Center (ECC) building.

Grading and Late Work Policies

Grading:
Your grade is based on:

- **Lab Reports (60%).** Because this is a laboratory course, the majority of your final grade will be based on the reports you write for each lab. There will be 13 lab reports (one each week). Your grade will be based on the best 12 of 13 grades for reports that are actually submitted. In other words, the lowest grade will be excluded from your average if you have submitted all reports. If you did not submit a report, you will get a zero, and this grade will **not** be excluded from your average. If your report was referred to the Academic Judiciary (see Policies section below), it will **not** be excluded from your average. Lab reports are due at the beginning of the next laboratory session; if you hand in your report after the lab begins, 20% (i.e., 1% of your course grade) will be deducted; and 20% will be deducted for each day it's late.
- **Quizzes (25%):** There will be weekly or bi-weekly quizzes testing how well you have studied the class material. These quizzes will be held during recitation time. You will be provided with a schedule of the quizzes once the semester begins.
- **Midterm revisions assignment (15%):** This assignment involves revising your previous quizzes (the quizzes you have taken during the first half of the semester). The assignment will be discussed more in lecture.
- **Extra credit:** There may be an extra credit opportunity, which will be announced in class.

The use of generative AI tools (such as ChatGPT) is not permitted in this class; therefore, any use of AI tools for work in this class will be considered an act of academic dishonesty.

Approximate grading scale: Your letter grade will be determined approximately as follows.

A	100	–	93
A-	92.9	–	90
B+	89.9	–	87
B	86.9	–	83
B-	82.9	–	80
C+	79.9	–	77
C	76.9	–	73
C-	72.9	–	70
D+	69.9	–	67
D	66.9	–	60
F	<60		

Requirements for lab reports: Read the document titled "Guidelines for lab reports" that is posted on Blackboard. This document describes how to write and submit your lab reports.

Attendance and make-up policy: If you are unable to attend a lecture, lab, or recitation, inform your Teaching Assistant. If you miss a quiz or a lab because of an illness or emergency, you may be allowed to take a make-up quiz or to complete your lab report late. There will be a maximum of 2 make-up quiz opportunities. In order to take a make-up quiz or submit your lab report late, you will need to present documentation verifying your excused absence. This must include a phone number and contact information. We will follow up with the information you provide. Any false excuse or

falsified documentation will be considered as a case of academic dishonesty (see *Academic Integrity Statement* below).

Note to BEE 574 students:

If you are registered for BEE 574, the requirements are the same with the following exceptions:

1. Your lab exercises will often be different, with fewer hints and explicit instructions so you need to figure out how to accomplish certain goals on your own.
2. There will be additional questions at the end of your lab reports that require a deeper synthesis of the discussions in the lecture and the exercises in the lab.
3. Your exams will be different; you will be asked to answer more or different questions.
4. You will be expected to read additional material related to each lecture.

Course Objectives

This course aims to

1. Expand on fundamental concepts in ecology and environmental science, with a special focus on spatial concepts.
2. Teach technical skills, including the use of GIS methods and software, image processing, spatially explicit modeling, and spatial statistics.
3. Introduce a variety of spatial approaches for addressing problems in environmental protection, natural resource management, conservation biology, and wildlife management.

By the end of the course, the students will

1. Learn basic concepts of geographic information systems (GIS), and basic operations with digital maps, such as displaying maps, measuring distances, and reclassifing and overlaying maps.
2. Understand the basics of remote sensing and image processing; learn how to create land-cover maps from satellite images using supervised and unsupervised image classification.
3. Understand the ecological meaning and importance of habitat and niche.
4. Learn how to use a niche modeling program to create a habitat map, and evaluate the habitat model with accuracy measures based on the confusion matrix.
5. Understand the ecological importance of movement, dispersal, and connectivity.
6. Analyze the movement path of a species to estimate its preference of land cover types while dispersing, calculate the total cost of the dispersal path, find paths that minimize dispersal cost.
7. Learn the core concepts of population dynamics, age structure, and stochasticity.
8. Learn how to use an age-structured, stochastic model to find harvest strategies that maximize harvest while minimizing risk of population decline.
9. Learn the core concepts of metapopulation dynamics and spatial population structure.
10. Explore and use a metapopulation model that incorporates dispersal among multiple populations, spatial autocorrelation, a simple age structure, and stochasticity.
11. Explore effectiveness of conservation measures such as habitat improvement, habitat corridors, and translocations (human-assisted movement between selected populations).
12. Learn the concepts related to reserve design for the protection of a species; use spatially explicit metapopulation models to explore management and conservation options that will increase the viability of a threatened species in a fragmented landscape.
13. Learn concepts of land cover and land cover change; analyze spatial patterns of land-cover change with the aim of understanding the nature of drivers of change, and predicting change.
14. Learn about habitat loss and habitat fragmentation; assessing the impact of habitat loss and fragmentation on the viability of a species.
15. Learn about climate change, and the impact of climate change on species.

16. Use maps and models to predict shifts and contractions in a species' range--and the resulting changes in population size--due to climate change.
17. Learn about pests, invasive species and diseases in the landscape, and the spatial spread and control of unwanted species.
18. Learn about and apply methods used to determine which species are threatened.
19. Use a metapopulation model to simulate various control measures to slow the spread of an invasive species; and simulate the dynamics of an economically important species affected by a disease that spreads among its populations.
20. Learn about effective conservation measures; design realistic scenarios of conservation alternatives for a specific case and use a metapopulation model to explore these alternatives in terms of their effectiveness in decreasing the extinction risk of this species.

Schedule of Lecture and Lab Topics

Week of	Lecture	Lab*
28 Aug	Introduction: Landscape Ecology, GIS, Remote Sensing	1
4 Sep	*NO CLASSES - Labor Day*	
11 Sep	Habitat	2
18 Sep	Dispersion, Scale, and Movement	3
25 Sep	Population Dynamics	4
2 Oct	Metapopulation Dynamics	5
9 Oct	*NO CLASSES - Fall Break*	
16 Oct	Reserve Design	6
23 Oct	Landscape Change	7
30 Oct	Habitat Loss and Fragmentation	8
6 Nov	Global Climate Change (Part 1)	9
13 Nov	Global Climate Change (Part 2)	10
20 Nov	Invasive species, Pests, Diseases	11
27 Nov	Identifying Threatened Species	12
4 Dec	Biodiversity Conservation	13
11 Dec	Biodiversity Conservation - CONTINUED	

* *See description of labs below.*

Description of labs:

1. Introduction to GIS and Remote Sensing: Introduction to basic concepts of geographic information systems (GIS) and the GIS software TerrSet. A brief introduction to several approaches for processing and interpretation of remotely sensed images, with the goal of understanding how data layers used throughout the course are produced. Students learn how to display maps, measure distances, reclassify maps, and overlay two maps in Idrisi. Students use a set of Landsat Thematic Mapper (TM) satellite images to learn about and create true-color and false-color composite images and convert satellite images into land-cover maps using supervised and unsupervised image classification.

2. Habitat analysis: Using a set of raster maps and data on occurrences of a threatened species, students create a map of the species' habitat in Idrisi. Students analyze habitat preferences of the species based on a land-cover map and an occurrence map. They then use this information to manually create a habitat map. They then use the niche modeling program MaxEnt to create a habitat

map for the same species in the same area. They evaluate the habitat model with accuracy measures based on the confusion matrix.

3. Organisms in landscapes: Concepts and methods related to movement, dispersal, and connectivity. Students analyze the movement path of a species to guess its preference of land cover types while dispersing. They calculate the total cost of the dispersal path, first based on equal cost for all land-cover types, then based on assigned "friction" values. They then try to manually find paths that minimize dispersal cost for another species. Finally, they repeat the same analysis with Idrisi modules, and they also learn how to use the macro modeler.

4. Population dynamics: Concepts of population dynamics, age structure, harvest, and stochasticity; methods of data analysis and modeling. Using data for a fish species, students construct an age-structured, stochastic model. Using this model, they find harvest strategies (fishing limits on number and size) that maximize harvest while minimizing risk of population decline.

5. Metapopulation dynamics: Concepts of spatial population structure and connectivity, and conservation measures relevant for species in multiple populations. Students build a metapopulation model for a threatened species. The model incorporates multiple populations, dispersal among populations, spatial autocorrelation, a simple age structure, and stochasticity. Students explore the effectiveness of three conservation measures: habitat improvement, habitat corridors, and translocations (human-assisted movement between selected populations).

6. Reserve design for single species: Linking habitat and population; using spatially explicit metapopulation models (see previous lab) to explore management and conservation options that will increase the viability of a threatened species. Students first develop a habitat model for a threatened bird species using multiple logistic regression. They then use this habitat model to determine the spatial structure of the metapopulation (number, size, and location of its populations). They modify the model to incorporate different configurations of proposed reserve systems, trying to find a set of reserves that would maximize the viability of the species.

7. Land change analysis, Part I: Analysis of past landscape changes to quantify the landscape change and analyze spatial patterns of change with the aim of understanding the nature of drivers of land-use change. Students use two historic land-cover maps (that are 8 years apart) to calculate transitions between different land types using the Land Change Modeler (LCM) of Idrisi. They correlate these changes with a number of predictor variables. This and the next lab are based on the tutorial exercises for the LCM module.

8. Land change analysis, Part II. Using the past patterns of change (e.g., with transition matrix analysis) and its spatial patterns and dependencies to predict future changes in the landscape. Students use the past land-use maps from the previous lab to estimate the rules of landscape change and apply these rules to predict future land-use and evaluate the predictions using measures such as AUC.

9. Habitat loss and fragmentation: Assessing the impact of habitat loss and fragmentation on species viability. Students use the landscape change maps from the previous two labs to create habitat maps for a threatened bird. Based on these they create two metapopulation models, one that includes anthropogenic land-use changes and the other that assumes no change takes place. They run simulations with both models, compare results (of population size and risks of decline), and interpret the results in terms of the impact of habitat loss and fragmentation on this bird species.

10. Climate change: Assessing the impact of climate change on species viability. Students first develop a habitat model for a threatened bird species using the niche modeling program MaxEnt, with environmental layers that include land cover and climatic variables (average annual temperature

and precipitation, and seasonality). They then create maps for future habitat by substituting future climate variables, as predicted by global circulation models. They use these maps in a metapopulation model to predict shifts and contractions in this species' range and population size due to climate change.

11. Pests, invasive species and diseases in the landscape: Spatial spread and control of unwanted species. Students explore the spread of an insect pest with data from a mountain pine beetle outbreak in the state of Colorado from 1995 through 2007 in both ponderosa and lodgepole pine. They use a metapopulation model to simulate various control measures to slow the spread of an invasive species. Finally, they simulate the dynamics of an economically important species affected by a disease that spreads among its populations.

12. Identifying threatened species. Using available spatial and temporal information about the distribution and population dynamics of a species to assign it to one of threatened species categories using the IUCN Red List Categories and Criteria.

13. Conservation: Finding the most effective conservation measure. Students use a metapopulation model of a threatened bird species to explore conservation options. Unlike in previous labs, they are not given the options; instead, they are asked to come up with realistic scenarios of conservation alternatives (such as habitat improvement, habitat corridors, reserves, translocation, etc.) and to simulate their effectiveness in decreasing the extinction risk of this species.

University and Course Policies

Academic integrity statement:
Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Professions, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at
http://www.stonybrook.edu/commcms/academic_integrity/index.html

More on academic integrity:
In this course, the instructors will refer all suspected cases of academic dishonesty to the Academic Judiciary without further warning to the student who is suspected of wrongdoing. **This paragraph will be your only warning**. For correct protocols of referring to other people's work in your lab reports, see the section on ***Citing and Quoting in Lab Reports and Other Assignments*** in the document titled "Guidelines for lab reports" that is posted on Blackboard. The penalty for academic dishonesty in this course will range from **F** in the course to a full-grade reduction. The minimum penalty for plagiarism or other forms of academic dishonesty will be a full-grade reduction of your course grade (e.g., from B− to C−) for each incident.

Course materials and copyright statement:
Course material accessed from Blackboard, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the

copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity.

COVID protocols
Students are expected to follow the latest campus guidance and protocols on COVID. For the latest guidance and protocols, see
https://www.stonybrook.edu/commcms/strongertogether/latest-covid-information.php.

Online communication guidelines and learning resources:
Maintain professional conduct both in the classroom and online. The classroom is a professional environment where academic debate and learning take place. We will make every effort to make this environment safe for you to share your opinions, ideas, and beliefs. In return, you are expected to respect the opinions, ideas, and beliefs of other students—both in the face-to-face classroom and online communication. Students have the right and privilege to learn in the class, free from harassment and disruption. The course follows the standards set in the Student Code of Conduct, and students are subject to disciplinary action for violation of that code. If your behavior does not follow the course etiquette standards stated below, the grade you receive may suffer. We reserve the right to remove any discussion messages that display inappropriate language or content.

Online etiquette:
- Offensive language or rudeness will not be tolerated. Discuss ideas, not the person.
- Avoid cluttering your messages with excessive emphasis (stars, arrows, exclamations).
- If you are responding to a message, include the relevant part of the original message in your reply, or refer to the original post to avoid confusion;
- Be specific and clear, especially when asking questions.
- Use standard punctuation and capitalization. Using all UPPERCASE characters gives the appearance of shouting and makes the message less legible;
- Remember that not all readers have English as their native language, so make allowances for possible misunderstandings and unintended discourtesies.

Student accessibility support center statement:
If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: https://ehs.stonybrook.edu//programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities and search Fire Safety and Evacuation and Disabilities.

Critical incident management:
Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most

academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Understand when you may drop this course:
It is the student's responsibility to understand when they need to consider withdrawing from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration:

- Academic Calendar
- Undergraduate Course Load and Course Withdrawal Policy
- Graduate Course Changes Policy

Incomplete policy:
Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an incomplete. If you need to request an incomplete for this course, contact me for approval as far in advance as possible.

Student Resources

Academic and Major Advising (*undergraduate only*): Have questions about choosing the right course? Contact an advisor today. Phone and emails vary-please see website for additional contact information; website: https://www.stonybrook.edu/for-students/academic-advising/

Academic Success and Tutoring Center *(undergraduate only)*: https://www.stonybrook.edu/tutoring/
Amazon @ Stony Brook: Order your books before classes begin. Phone: 631-632-9828; email: Bookstore_Liaison@stonybrook.edu; website: http://www.stonybrook.edu/bookstore/
Bursar: For help with billing and payment. Phone: 631-632-9316; email: bursar@stonybrook.edu; website: http://www.stonybrook.edu/bursar/

Career Center: The Career Center's mission is to support the academic mission of Stony Brook University by educating students about the career decision-making process, helping them plan and attain their career goals, and assisting with their smooth transition to the workplace or further education. Phone: 631-632-6810; email: sbucareercenter@stonybrook.edu; website: http://www.stonybrook.edu/career-center/

Counseling and Psychological Services: CAPS staff are available by phone, day or night. http://studentaffairs.stonybrook.edu/caps/

Ombuds Office: The Stony Brook University Ombuds Office provides an alternative channel for confidential, impartial, independent and informal dispute resolution services for the entire University community. We provide a safe place to voice your concerns and explore options for productive conflict management and resolution. The Ombuds Office is a source of confidential advice and information about University policies and procedures and helps individuals and groups address university-related conflicts and concerns. http://www.stonybrook.edu/ombuds/

Registrar: Having a registration issue? Let them know. Phone: 631-632-6175; email: registrar_office@stonybrook.edu; http://www.stonybrook.edu/registrar/

SBU Libraries: access to and help in using databases, ebooks, and other sources for your research.

- Research Guides and Tutorials: http://guides.library.stonybrook.edu/
- Getting Help: https://library.stonybrook.edu/research/ask-a-librarian/

Student Accessibility Support Center: Students in need of special accommodations should contact SASC. Phone: 631-632-6748; email: sasc@stonybrook.edu; https://www.stonybrook.edu/sasc/
Support for Online Learning: https://www.stonybrook.edu/online/
Writing Center: Students are able to schedule face-to-face and online appointments. https://www.stonybrook.edu/writingcenter/