

Implementation Plan

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EDDIE Module

Module name: Remote Sensing of Plants and Topography in R

Actual dates of Implementation

03/8/2021 - 03/21/2021

Course/Course Format:

Number and length of sessions per week (e.g. Three 50 minute lecture sessions and one 3-hour lab per week)

This semester, the course is being taught asynchronously, but typically the lecture is taught as two 1.25 hours lecture sessions and one 3-hour lab section. The fully asynchronous version consists of recorded lecture videos, guided videos of software activities (in ArcGIS for the rest of lab work) and associated activities, lab lessons, discussion boards and online exams.

Course Description (From course catalog)

BIOL 533 – GIS Applications in Landscape Ecology

Explores how landscape structure and pattern affect ecological processes, at the individual, population, community, and ecosystem levels. Applications to land use planning and conservation biology will be covered. The primary enabling technologies for this new, rapidly growing discipline include remote sensing (such as satellite imagery) and geographic information systems (GIS), which will be covered during a weekly lab session.

Course Context: Describe student and/or course level, e.g., lower or upper division, major course, etc. (e.g. "An introductory course for non-majors")

Graduate level course; registered participants are primarily fourth year undergraduates and graduate students.

Course Goals and Topics (If available, extended version of learning goals and topics covered)

Landscape ecology explores how ecological scale and context influence populations, ecological communities, and ecosystems. Concepts from this relatively new field of ecology are making important contributions to many traditional ecological disciplines, and are foundational to conservation biology. Topics will include a cross-section of concepts from landscape ecology that are most important to biologists, such as: causes and consequences of landscape pattern, effects of habitat fragmentation, edge effects, metapopulation dynamics, and design of reserves. The course will be taught

asynchronously with a lecture/lab format. Lectures, supplemented by readings from the primary literature, will deal with landscape ecological concepts. Labs will deal with applications of landscape ecology, using geographic information systems (GIS) software. Labs will cover spatial data accuracy, spatial data representation, and methods for analyzing and manipulating spatial data layers. We will use industry standard software (ESRI's ArcGIS and extensions) so that lab skills can be easily used in your future endeavors.

Learning objectives

What learning objectives (content) are you planning to address in your course using the selected module materials?

Upon completion of this course, a successful student should be able to:

1. Understand how spatial and temporal patterns affect ecological processes
2. Understand how spatial and temporal scales affect our perception of patterns in ecological systems
3. Incorporate landscape context into your understanding of local-scale processes
4. Use a “constrained complexity” approach to understanding non-experimental studies
5. Recognize the complementary use of models, predictions, and field observations in making progress in ecological studies
6. Apply landscape ecological principles to conservation of biological diversity
7. Understand the differences between raster and vector GIS data
8. Query, display, and analyze GIS data
9. Construct complex GIS models

Quantitative learning objective

Several objectives from the list above are quantitative in nature, specifically the query, display and analysis of GIS data.

Working with data learning objective

The entire course incorporates use of data within each objective.

Briefly describe the pedagogical techniques you plan to use to facilitate the module and reinforce the learning objectives you identified above.

Due to the online nature of this course, providing a guided video of instruction related to the software steps will be critical to ensuring that students succeed in understanding the materials. I also hope to integrate some form of a challenge to the students to enlist their motivation for successfully achieving desired results in Part C of the activity.

Are you planning on making any adaptations to the materials? If yes, please describe them here. If no, please indicate why.

The only element that I will need to ensure is streamlined is the use of RStudio Cloud and for processing data using R in a way that emphasizes the GIS elements as opposed to the coding syntax and process. While the topic of this module aligns well with the course, we utilize ArcGIS throughout the semester, so my incorporation of R-based exercises will need to ensure a very novice user is able to complete the exercises. I envision relying heavily on R markdown/Jupyter notebook for the activities (if that is not already incorporated in the materials).

Do you think you will need to incorporate any supplemental materials with this module? If yes, please either describe what you are planning or include any materials you have already found.

Yes I added in the use of RStudio Cloud to implementation due to the asynchronous nature of the course.

What assessments are you planning on using to measure student progress? If possible, describe, attach, or provide a link here.

My assessment included evaluating their understanding of the concepts and project through the creation of a short video discussing the NEON site landscapes they selected to compare. The project included a rubric that was used to evaluate their understanding of the material and ability to complete all tasks.

Reflection Questions for after your Implementation

(Think about what you would like to read about this activity if you came back to it in 2 years)
Suggestions for this section (not all required, and extras always welcome):

Introductory Statement: The summary should start with one line that captures the context in which the module was used. This should be followed by 2-5 sentences that highlight what was particularly interesting about this particular implementation. This could include the setting, schedule, student group, an exceptional success or unusual adaptation of materials

Asynchronous Implementation of an Ecological Project Incorporating Remote Sensing GIS Analysis

Landscape ecology provides a perfect platform for teaching individuals the applications of Geographic Information Systems (GIS) for better understanding of ecological topics. The implementation of the Project EDDIE module into this course provided students with an opportunity to gain practice with an accessible GIS analytical tool. Furthermore, it allowed students to explore ecological topics of vegetation patch metrics using real data, and several students expressed their appreciation of visualizing ecological topics through use of remotely

sensed data. Students selected two NEON sites and hypothesized as to what they expected to see based on their understanding of the two ecosystems. Their efforts were implemented using RStudio Cloud, which is highly recommended for use with asynchronous, remote classes due to the ability to minimize installation issues and review work and assist with errors easily. Students had minimal problems in navigating the materials, proving that use of accessible programs such as R for GIS analysis are intuitive and well received.

How did it go? (What went well and why? What adjustments did you need make in real time and why?)

This project was fabulous, and I decided to use the first two activity as a way of introducing the techniques for analysis, then took inspiration from the third activity and developed it extensively to allow students the autonomy to explore data. Students seemed to have limited issues with the R code and data for this project, likely due to the use of RStudio Cloud, which enabled easy of review and assistance. I modified the activity sheet for these sections in order to clarify questions as they struggled with the text used in the questioning. This seemed to help them better understand correlation analysis as well as how to evaluate the data. A second week of activities involved their selection of a second NEON site to compare to the ones from the first activities. The goal in this was to have them compare the ecosystems and predict what types of correlations they might see from a second set of data. They presented their analysis and assessment through the creation of a short, narrated video. This aspect provided an active learning means of doing science and sharing their understanding of the materials. It worked really well based on their submissions and adherence to the rubric!

Student Outcomes (What did students take away? Where did students struggle the most?)

Students mostly expressed interest in being able to work with data and have some autonomy to explore on their own. They appreciated the balance of guidance in this module as well as the accessible data to select from. They struggled most with understanding how to compare two regions (e.g., mountains vs. Desert) in terms of what they expected to see in the correlation. I believe the correlation itself took a bit of time to understand as well. Additionally, while they struggled a bit with importing new data into the code, this was mitigated through the R Studio Cloud platform as an instructor can go into their file and view the issues in order to help resolve. I additionally used a screen capture tool as a means of them communicating their problems with the data. Overall, they reacted positively to the activity despite the fact that it involved introducing a new tool that was unfamiliar to most of them.

Future Use (Would you do this activity again? What suggestions do you have? What would you change?)

I would most definitely use this activity again and now am a big fan of the NEON data and appreciate the detail provided in this module. I would suggest perhaps spending a bit more time introducing R basics through guided instruction (I just had the run the lines of code and showed them what to change) - this would have helped with some of my challenges. I would also recommend R Studio Cloud use in place of installing the programs on local machines if working remotely. This was a great experience, thank you!!