Teaching Notes

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Course Information
Course: BIOS 2301 – Ecology Lab
Department: Biological Sciences
Level: **Upper Undergraduate**
Course type: **Lab**
Students: **Majors**
Number of Students: 64 (in sets of 16)

Information
Original Module Name: Investigating human impacts on stream ecology: locally and nationally
Link to Original: https://tiee.esa.org/vol/v8/issues/data_sets/nuding/abstract.html
Modified Module Name: Investigating human impacts on stream ecology: Scaling up from Local to National with a focus on the Southeast

Files associated:
- Student handout and discussion questions
- Faculty notes
- Student data file
- R code to run/modify
- Faculty data file with completed calculations

Modification Learning Goals:
Students will be able to:
- Recall specific chemical, physical, and biological indicators of stream health
- Calculate stream health using a biotic index
- Compare local sites in terms of stream health
- Plot stream health from different EPA regions using R
- Compare, contrast, and summarize patterns of stream health locally and nationally

Teaching Notes
(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):
- What did you change and why?
    - I added this activity as a capstone to an existing 2-week sampling module to get students to connect hyper-local happenings to national trends. In this way, it functions more as a mini-module (3 weeks of 3-hour labs) vs. a single class/lab activity.
    - I also moved data collection and reflection to week 3's activities as part of an in-class exercise, to allow students to complete all work in-class rather than on the students' own time (which may be limited due to their own schedules/demands)
    - I changed the activity to use open-source coding in base R, which is free, open-source, and works with screen-readers to encourage my diverse students to learn the tools that are in active use in the field.

    - I also developed the human impacts portion of the lesson a bit more by including videos of the clean-up/restoration process on our local creek and historical documents spanning the last 60 years so that students can understand the spatial, social, and temporal scales of the problem. In particular, students were asked to look over and organize the documents to tell the story of the problem and on a map, understand how campus connects to the neighborhoods in our shared watershed.
- How did the activity go?
    - What went well and why?
        - Students were engaged and worked well together. The 'live sampling' occurred prior to lockdown, and the digital work occurred at home. Students were able to work together in their sampling groups despite not being face-to-face.
    - What went wrong and why?
        - Students were able to modify their code for the region in question, but struggled to see how their locally-collected data connected to regional and national questions. I added in historical information and videos to help provide more context to the problem. Specifically, students were given subsets of the information and asked to put the documents in a timeline, and surmise a general story of the problem over time.
- What was the prep like?
    - How much time went into prep?
        - Sampling weeks (1 and 2): Field site safety visits and materials: 1 hr
        - Data week (week 3): 1-2 hr to review materials, train TAs, and post
        - Note: The sensors were used were largely plug-and-go with 1-button calibration and instructions that were 3 steps or less (fit onto a laminated index card). If the equipment you have requires more training to use or calibrate, it is advisable to set aside at least 20 minutes as additional prep to demonstrate and practice these techniques *before* taking measurements.
    - Did you have to do any prep (i.e. grow cultures, grow seeds, order supplies) ahead of implementation?
        - Yes, but only for the field site (safety visit to ensure safe sampling)
        - As noted above, depending on the complexity or age of your probes/kits, you may need to spend a bit of time on calibration or preparing quick instructions (a laminated index card secured with a zip tie to the instrument works well).
- Would you do this activity again? – Yes!
    - What would you change in the future?
        - This activity was split by COVID, so not initially designed to be completed partially remotely for week 3. I might go ahead and assign firm groups for the students so I can better track their progress and strategically combine students with different skills/abilities in order to complete the various parts of the multi-week lab.
        - This activity requires a fair bit of R knowledge, but it works with where it comes in the semester for us. A basic R tutorial which covers importing data subsetting, and plotting basic figures could be used to support learning these skills for the first time so that students are ready to apply them in this context. Swirl modules posted on QUBES can be used to

mix/match lessons for learning any background needed for students or instructors.
        - Some accountability would be good to introduce before the start of lab to ensure students can calculate the biotic index. We opted to have students just show us that they'd completed the calculations on their lab handout, but in the future, we may ask for students to turn in their calculations to ensure that students do that step before lab and that they do it correctly (or get feedback on how to fix it).
- What do you wish you'd known before you ran the activity?
    - The first week of remote learning was also the week for working with the data. It is very helpful to have an idea of Mac/PC/Linux and screen-share capabilities of the students ahead of time to know how to help them, should they get stuck on the coding or figure interpretation.
- Is there anything else you would like to make note of?
    - The data analysis portion of this lab follows several weeks of dealing with data in groups and as individuals using R. Rather than providing the code for students to modify on their own, the 'going further' portion could be done as an active demo with think-pair-share interspersed, should students need more help.
- How does this activity fit in your overall course curriculum?
    - We did this activity as a deep-dive into what it is like to do fieldwork as part of Ecology lab, specifically focused on the 4D framework and human-environment interactions and community structure.