**Title:** *Geographic Gradients in Community Patterns of Forest Trees*

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**Abstract:**

This exercise provides a guided inquiry approach to understanding continental scale patterns of species richness and patterns of relative abundance within community species assemblages. Students are introduced to the concept of latitudinal gradients in species richness. They are also introduced to the concept of evenness of relative abundances within a community assemblage, and how empirically it is often true that species rich communities have more even relative abundances of the constituent species. The students are then assigned a homework exercise to examine whether the patterns of relative abundances show the same latitudinal biogeographic pattern as species richness. The exercise uses the Science Pipes platform ([www.sciencepipes.com](http://www.sciencepipes.com)) that extracts data from the US Forest Service Forest Inventory & Analysis (FIA) Program (see <http://info.sciencepipes.org/help/2012/08/forest-population-structure.html>). Students are tasked to do four latitudinal transects, each consisting of a total of one county from each of four different states along the same longitude. The students generate rank abundance curves and associated data tables for each of the counties included in their transects. The students examine the patterns of the sixteen rank abundance curves among the four transects. From these data, the students evaluate whether (1) species richness varies inversely with latitude and (2) whether evenness of relative abundances parallels the latitudinal pattern of species richness. They also evaluate whether (3) coastal locations have higher species richness and evenness than continent interior locations. The exercise is designed as a homework assignment, but can also be done in class.  **Learning objectives:**

* Learn that species richness and patterns of relative abundance are two distinct but related attributes of a community assemblage.
* Learn that there are biogeographic patterns of species richness and evenness of relative abundances within communities; two fundamental biogeographic patterns are associated with latitude and position on a continent (coastal vs. interior).
* Learn how to read and interpret rank abundance curves.

**Timeframe:**The homework assignment, if done individually by students, takes a maximum of 90 minutes . An instructor can optionally take 10 - 15 minutes in class to explain the assignment, and 10 minutes after students have completed the exercise for a ‘report back’ and collective class summary of what was learned.

**List of materials:**Computer with internet access.

**Procedure and general instructions (for instructor).**

1. Plan to distribute this activity when teaching about community ecology, and particularly when covering patterns of species richness and relative abundance.
2. In class, review or introduce the concepts of (a) species richness and (b) evenness of relative abundances. Show a figure from the class text or the instructor’s own illustration that indicates how ‘diversity’ is a function of how many species are present in a community assemblage and how even the relative abundances of those species are.
3. Show a pair of rank abundance curves (as shown in every introductory ecology text) and explain how to interpret the figure (what the axes are, what the steepness of the curve indicates, etc.). Verify that students understand how to figure out from the rank abundance curves which community has more species, which community has more even relative abundances, and what the relative abundances of the most common species are.
4. Explain and show how species richness and evenness often positively covary in nature (i.e. the most species rich communities are often the most even).
5. Explain and illustrate how species richness often has a strong latitudinal biogeographic pattern. Pose the question to the students ‘what would you predict the biogeographic pattern of species relative abundances to be?’.
6. Show the students the Science Pipes site, and the basics of how to find the commands needed to completed the exercise (see the file ***CommunityStructureFIA\_Instructions***).
7. Distribute or post the assignment and worksheet (appendix files ***CommunityStructureFIA\_Instructions*** and ***CommunityStructureFIA\_AnswerSheet.docx***).

Let the students know that it takes about 90 minutes to complete.

1. After students have completed the assignment, lead a class discussion on the patterns. Did the students find the expected patterns? What patterns were unexpected? Ask them to propose a hypothesis that could be tested using the Science Pipes FIA data.

**Procedure and general instructions (for students).**Follow the exercise instructions in the attached file ***CommunityStructureFIA\_Instructions***

Answers should be recorded on the answer sheet ***CommunityStructureFIA\_AnswerSheet.docx***