Math 10: Invasive Species Study Using Transect Line Data
A Hands-on Brightwater Experience
Developed By Aditi Garg and Brightwater (Fall 2014)

We will be observing the height variations and population count using transect line data. This method is suitable for single megaflora comparison and is easily repeatable. The use of quadrats and percentage covering could both be used in the future if desired. Students should be familiarized with the terms even if they are not used. Quadrats provide more information over complex areas and percentage covering also provides more surface area of data. Point-intercept along a transect line is also suitable for students who are observing many species along a line. With this data, we will estimate the growth of the plant and population size of the community.

Pre-lesson

To introduce the concept of transects in the classroom, we draw on the lesson of Joanna Philippoff, who helped facilitate OPIHI (Our Project In Hawaii's Intertidal) an intertidal monitoring program with nine teachers over 20 intertidal sites from 2000-2009.

Sample Lesson to Introduce Transects and Quadrats: Sweet Species

One way to introduce transects and quadrats is through the use of candy "sweet species". Buy an assortment of candy (or cut up different colored index cards), of various sizes and shapes, to represent different species at your monitoring site. This activity works best if the sweet species are substantial in size or grouped in "snack bags" that candy companies sell at Halloween. Small candy will be hard to monitor, just as small species in the field are harder to monitor. Throw the candy on the classroom floor and ask the students how they would go about monitoring the species in their classroom study site.

Learning How to Lay Transects: Divide the class into groups and give each group a transect. Without giving any additional information, ask each group to lay out their transect in a location to best monitor the sweet species. You will most likely get a spider-web of transects laid out over the study site. Point out that where transects cross, organisms or candy at the intersections will be recorded multiple times, falsely increasing their perceived abundance. To prevent this, the transects should be laid parallel to each other (an equal distance apart)."

The next step is to have students practice all of the techniques in a relatively simple area, such as the school lawn or garden. Have the class decide the best way to lay the transects, determine how long they should be, and how often they should sample (ie. every meter or half meter) to most accurately monitor the site. Students should determine how specific their designations will be as a class before starting the activity so everyone records the same type of data. For instance will they differentiate between dirt and sand? Different types of grasses? Ask what would happen if they didn't decide on these guidelines before monitoring an area. As they try out each technique they can reflect on how each technique works in this setting, and think about how best to use them alone or in combination to accurately and efficiently gain the most information about an area. They may consider which techniques might be best to use in different kinds of areas. Finally, they can plan which technique or combination of techniques they might use to quantify an area, and then employ their plan in the field.

Philippoff, J & Cox, E (2007) Measuring Abundance: Transects and Quadrats. OPIHI:Our Project in Hawaii's Interdental. http://www.hawaii.edu/gk-12/opihi/classroom/measuring.pdf [Accessed September 29th 2014]

Transects - *Pre-lesson, Activity and Post-Activity*

SCI10-CD3 Examine biodiversity through the analysis of interactions among populations within communities.

Indicators:

d. Estimate the abundance of organisms in a local ecosystem using random (e.g., quadrat), systematic (e.g., line transect and belt transect) and/or stratified sampling techniques. (SJ

e. Analyze primary or secondary population data to determine the population density, percentage frequency, and/or percentage cover of one or more organisms in an ecosystem. (SJ

f. Discuss ethical and cultural perspectives related to studying biotic components of ecosystems, including the potential benefits and consequences of technologies (e.g., radio collar) and techniques (e.g., mark and recapture) used to collect data.

Activity: Observing population size and growth of pine species on Brightwater land.

(GPS coordinates)

"The native pines are tough trees adapted to growth on dry sands or rocky sites. Lodgepole pine {Pinus contorta) and jack pine {P. banksiana) are sister species thought to have arisen from an ancestral pine whose population was split by the last continental ice sheet. Jack pine is found from the prairie-forest ecotone to the NWT border, while lodgepole pine is restricted to the Cypress Hills. Both species have 2-4 cm-long needles, grouped in pairs. Both attain heights of 20-25 m and diameters of over 40 cm. The cones are serotinous, i.e., their scales stay firmly closed until heated in a forest fire or by sun-warmed ground. The cone scales of lodgepole pine are armoured with prickles. These pines grow in pure stands, but associations with trembling aspen, white birch or black spruce (for jack pine only) are fairly common. Jack pine is an important lumber species."

Wright, Robert A. {2007) Trees. Encyclopedia of Saskatchewan. University of Regina and Canadian Plains Research Center http://esask.uregina.ca/entry/trees.html [Accessed September 30th 2014)

Biologist Nicole Crane outlines the following adapted goals of using transects to study biotic features.

1. Define terms and concepts applied to field sampling and habitat characterization
2. Identify major species found in the field
3. Use a table of random numbers
4. Correctly collect data using the transect technique
5. Describe our method of estimating abundance
6. Use computers to analyze and present your results from the field

Crane, Nicole (2014) QUADRAT/TRANSECT SAMPLING: habitat characterization in the Santa Cruz inter-tidal. Biology C: Plant Biology and Ecological Principles. Cabrillo College: Aptos, USA. http://207.239.98.140/upperschool/science/classes/apes/text/activities/quadrat0304.htm [Accessed September 30th 2014]

Philippoff highlights some key tips:

- Use clipboards to keep data collection sheets together and easy to use.
- Only record what is on the surface layer, if objects are layered, count the top most object
- Only record data directly under your line or within a predetermined buffer.
- Do not record dead or transient objects like rubbish, twigs, or water
- If you plan to monitor a site over time, it is important that you use the same modifications every year.

Activity

- Notice and write down the major biotic and abiotic factors affecting this community.
- When making entries in a databook, remember that this information is not just for you, but for anyone else who may need to use it in the future. Be clear and concise!
- Determine orientation of lines as the best fit perpendicular to direction of population spread.
- Using a tape measure, have students mark off parallel lines of 10 m, 5m apart, and drive a stake into the ground at each end. If no tape measure is available, pace off this distance. These lines can be geotagged so that the same coordinates are used yearly/seasonally.
- Only record data within 20 cm of your line. This is distance based on the species, but can be adapted or changed.
- Height counts should be done for each tree individually in a single column.
- Population counts should be the count of all trees measured along the line.
- Collect all data sheets at the end of the survey.

Post-Activity

Arrange for student access to computers. Have students complete a write-up to your desired format outlining an introduction, purpose, the methods, data tables, results and conclusion.

For the data table:

1. Enter data into a common spread sheet, and calculate average height and count per transect. Have students share data so that each one can analyse the full area.

For results, modify to class level and integration with Math FP10 or MF20:

2. Find standard deviation for the population. Graph trees by their transect region and determine if there is a difference in population and height (maturity) over the spread of transects.

For discussion/conclusion:

3. Explain the graphs. Are there any noticeable trends? What factors could have contributed to these trends? List the major biotic and abiotic factors leading to the characterization of this habitat. Did any abiotic factors contribute to similarities or differences in the population sizes?

5. Based on the data collected, and the analysis of it, have students propose a question (or two) on zoning methods (transect vs quadrat)

6. Discuss problems with the sampling methods. What kinds of things are not being addressed by this sampling? What assumptions are we making? What inaccuracies were inherent in our methods?

Questions modified and adapted from:

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Sok, Veronica (undated) AP Environmental Science. The Bryn Mawr School: Maryland, USA. http://207.239.98.140/upperschool/science/classes/apes/text/activities/quadrat0304.htm [Accessed September 30th 2014]

list of sources in alphabetical order:

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Norn :

Sur/En-dessous man transect ## _____

Objet	Dimensions

Objet	Dimensions

Facteurs qualitatifs des objets :

Facteurs abiotique (non-vivants) de l'environnement :

Facteurs biotique (vivants) :

Coordonnées:

moyenne de chaque transect

max (foncé)

Légende

min (pâle)

1 étape = $\frac{\text{max} - \text{min}}{10 \text{ boîtes}}$

1 étape =

moyenne = $\frac{\text{la somme des hauteurs}}{\text{nombre des arbres}}$

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Région (échelle)

2 Scm = 10m

Largeur : 5cm = 20m

Longueur : 17 sections × 5m + 2m = 87m

87m = 18 lignes = 4,8m

à échelle : 4,8m = 1,2 cm