Lake Roosevelt

National Park Service
U.S. Department of the Interior

Lake Roosevelt
National Recreation Area

The River Mile

Field Methods for Establishing Points, Transects, and Plots: The Basics of Collecting Scientific Data

Introduction

The River Mile Education Program seeks to collect inventory and monitoring data of natural resources and conduct population assessments of plants and animals along the entire Columbia River. In order to collect such a large amount of data all school districts involved in the project must collect consistent data systematically. Uniform testing is the best way to collect any type of data because further study and future researchers may utilize the same techniques yielding compatible data. The following protocol (which is a detailed, step-by-step description of techniques used in biological fieldwork) describes in detail various types of data collection and methodology used.

The most important thing to know before going out into the field to collect any data is a question; you need to know what you are trying to find. In most cases, you are interested in determining a trend of a parameter that is physical, chemical, or biological. A physical example could be what percentage of rock is granite in a given area. While a chemical example would include collecting water samples to test for E. coli, mercury, or iron etc. A biological example would be in a forest ecology project if you were sampling the number of possum dens. Usually you are testing for a change over time and the direction of that change (positive or negative). Commonly in biological systems, you are interested in some level of abundance of a population demographic: *amount per unit of area or catch per unit of effort* (catch per unit of effort is actually “relative abundance”). You may know that one of your variables is more abundant than another, but you may not know exactly how many there are. For instance, based on hours of fishing in a bay you may find out that there are more Walleye than Smallmouth Bass there, but you do not know how many there are of either, thus the amount of Walleye are “relative” to the amount of

Smallmouth Bass. Examples of situations in which measuring abundance is used are Mule Deer per square mile, Ponderosa Pine saplings per acre, Tiger Beetles per square meter, or Red-side Shiners per minnow trap (the latter being "relative abundance" because you are collecting data from two species and how they are effecting each other).

Usually you want to know whether a population of interest is changing or stable over time, and how it is changing if it is. Abundance may be determined by a complete count (census), sub-sample (survey), or indirectly (indirect methods are actually an "index" to abundance; for example, counting the number of reds [a term for fish nests] in a stream or piles of moose droppings). A *survey* is used to examine some parameter of interest within a specific area (i.e., the study area) while noting specific things about it (i.e., observations). It is a way to examine an area, such as counting the number of trees in a yard or the number of birds in a bush. Types of abundance include cover (used for plants only), density (number per unit of area) and composition (makeup of a population).

All data collection should be random, except when making preliminary or opportunistic observations (i.e., getting the chance to collect more data from a linked situation, such as an osprey survey which leads to some data being collected on bald eagle nests). Random data is data that is free from observer bias. All scientific data must be as free as possible from observer bias. For example, if measuring the percent cover of clover in an area 100m by 400m, you would not want to collect data from the entire area, because this would be time consuming. One technique for this situation is to make a 1m by 1m square with PVC pipe and place it at random points throughout the research area. You want to collect data from enough of the area so that conclusions can be made yet not cover every square inch making the project unreasonable. A more detailed description of random points can be found under "Points."

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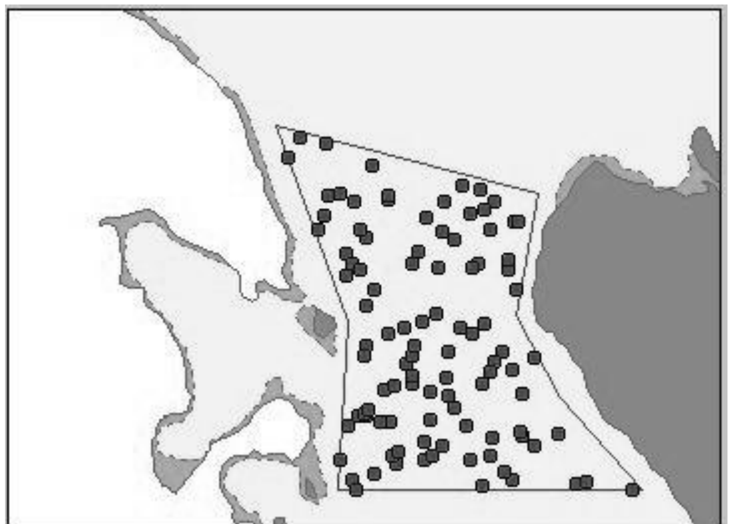
Points

Points are used when you want to perform a specific action at random locations or want to collect a lot of data over a specific area. For example, when sampling vegetation you need random points to collect data because you do not want to have observer bias.



The degree of randomization can vary from completely random, stratified random, and systematically random. *Completely random* sampling is having every point in the universe of your study area have an equally-likely chance of being sampled. *Stratified random* sampling is used when you want to take random samples of sub-sections of your whole study area. For example, there may be areas of both wetlands and forest in your study area, but you want to only sample the wetland areas. More than two wetland areas should be sampled because taking data from the forested areas of the plot would skew your data. The forest ecosystem does not have the same species or characteristics as the wetlands.

Systematic random sampling in open water from a boat

Systematic randomization is beginning with a random point found by using a random number chart or other method of your choice. From this point, samples are taken and data is collected at a fixed interval of time or space. For example, taking water samples in open water; in this situation the point at which you begin sampling should be random as well as the direction in which you collect. These two methods are different from complete randomization because not every spot in your designated universe has an equally-likely chance of being selected.

Replication is also a necessary technique used when collecting scientific data. Repeating parts of your experiment or research increases variation. Variation allows all aspects of an area to be collected because you get different data from different locations. One also needs to be aware of *pseudo-replication.* This occurs when your sub-samples are taken from only one of many possible areas (i.e., your area of inference is only that one area and cannot be extrapolated to the entire study area you want to know about). For example, taking 10 leaf samples from one garden plant to test for leaf mold, rather than taking one sample each from 10 different plants throughout the whole garden.

When choosing the points in the area to be tested, they must be selected in some random method. You may use a random numbers table, a computer program or calculator, a roll of a die, the toss of a coin, random selections within a numbered grid, or anything else you can think of that makes your selection for the location of a point random. The objective of random points is to make sure that every point you are testing has an equal chance of being chosen thus avoiding observer bias.

How to use a Random Numbers Table (found in Appendix A)

- Take the *Random Numbers Table* and without looking at it point to the sheet and select the number closest to where your finger lands (you may also use a pencil or any other slender object). That number is the grid number for your first random sample transect and plot. [Note that all grid numbers have an equally likely chance of being selected.] This method will give you random points at which to do things such as plant plants or listen for bird songs.

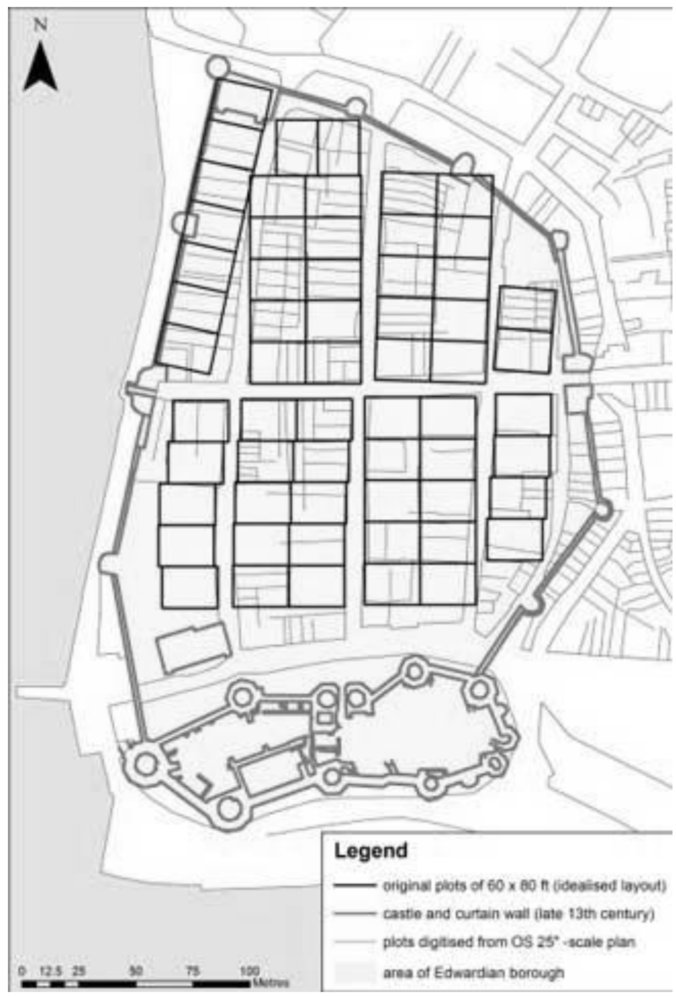
Transects

Transects are used when you want to sample along a randomly placed line either on the line or at some distance from the line. Transects have been used in the following situations. Taking the temperature and pH of water every 10 meters (i.e., systematic random sampling), counting the number of downed logs intersected by your transect or counting the number of bitterbrush covering your transect, or the number of nesting birds within 10m of your transect.

When making transects you must first get a random starting point and random direction by using the protocol described earlier for points. Once a random starting point has been established, you then need a random direction. One method is to go to that point and without looking spin your compass dial 4 or 5 times. Now you have a random direction to lay out your transect. Then use your compass to lay out a straight line with your tape or your direction of travel. For systematic random sampling along your transect you might use an odometer, number of paces, etc. along the transect. One should decide beforehand how he/she will sample (i.e., the "rules" they will use [note, that it is okay to make up rules, but they should be determined beforehand or after preliminary sampling), for example you are only going to count ponderosa pines within ten meters of the right side (your rule) of your transect.

Plots

Plots are another type of sampling unit that may be used to sample the abundance per unit area or the area covered by something such as plants or water. Plots can be any shape, but are typically square, rectangular, or circular within you study area. You can have one large plot with plots, transects, or points within it or your plot may be the sample unit. Sample plots in a study area are usually the same size, but may vary if defined by topography. To make a plot you can take random points in the area to be tested and make squares or circles around those points. This will give you several random areas to count plants, small mammals or birds you are trying to record, test, or mark. Using a slightly different technique you could designate a point to always be a particular corner of your plot (e.g., the southwest corner), and make random plots from there using the southwest corner every time as your random starting (layout) point. Plots can also be systematically placed along a random transect. For instance you could make a plot around each wetland area that is on your random transect.



VOCABULARY

Abundance	The amount of a certain thing in a certain area. Used in a sentence: The abundance of the northern pocket gopher in ponderosa pine forest was three per hectare.
ArcMap, ArcPad, ArcGIS	Computer programs for special analysis that integrate global positioning systems (GPS) and geographic information systems (GIS) using layers of information over a base layer which is commonly an aerial photograph of the landscape/graphics.
Protocol	The standard way of doing research so that all data is collected in the same way.
Random	Without pattern; equal chance of being chosen or selected.
Random Numbers Table	A computer generated table with different numbers covering the page (we have attached one for you).
Survey	A look at a specific area noting specific things about it. In other words, a way to examine an area, such as counting the number of trees in a yard or the number of birds in a bush.