Comparison of Vegetation Monitoring Techniques

Madison Crowell
Telluride Institute
Bridal Veil Living Classroom
2007

Abstract:

This study evaluates the efficiency of three vegetation monitoring techniques in Bridal Veil Basin located outside of Telluride, Colorado and was conducted in August 2007. The research gathered compared the Square Meter Method, the Transect Method, and the Frisbee Toss Method within an area of 400 square meters, located in one long term study site. The validity of the Square Meter Method, which had been used in previous years, was called into question and an evaluation of this method as well as other methods was needed. In order to obtain a more thorough, long term vegetation analysis of the Bridal Veil area, a study needed to be conducted in order sustain a biodiversity overview. Over the three day research period the species richness was measured for each method. Overall the Transect Method resulted in the highest species richness with 49 different species identified within the study site. Data from the study also resulted with a species richness of 40 from the Frisbee Toss Method and a species richness of only 22 from the previously used Square Meter Method. The study concluded that the Transect Method was the most effective because of its dynamic slope coverage within the plot, allowing a thorough accounting of many diverse species from most micro-habitats existing in the 400 m^2 biodiversity monitoring plot.

Introduction:

Vegetation monitoring is an important aspect in creating data analysis for environmental conditions. Various methods are used in the field by the Forest service such as Frequency Methods, Community Structure Analysis Method, Cover Board Method, Density Method, Harvest Method, and the Comparative Yield Method. Previous vegetation monitoring has been conducted in the Bridal Veil Basin area providing information on plant species richness. However certain concerns have been made about the actual accuracy and this method of investigation was currently put into question. Past surveys have accumulated over sixty different plant species around the research site, but approximately only 1/4 (16 species found previously in plot of a total of 60 species observed in the entire area randomly) of the species have been identified using the preceding method of four square meter plots randomly placed within a larger 20m by 20m plot. By comparing three different plant monitoring methods and recording the species richness, it can be determined which method produces the most effective and diverse results within the area of a 20m by 20m plot. In addition to the Square Meter Method, the Frisbee toss and the Transect Method will be added to the scientific research for comparison.

The importance of this study is to re-evaluate the previous study method concerning plant biodiversity and species richness in Bridal Veil Basin area. In order to sustain better research tactics for future scientific plant investigation, this study will demonstrate the most effective method of plant identification so that biodiversity can be accurately accounted for. Through precise monitoring of the environment, the Bridal Veil Basin habitat can serve as an index to how well vegetation is prospering and therefore, demonstrate how well the surrounding habitat is excelling under current environment conditions. This study predicts that the Transect Method will obtain a species richness because variation of elevation across the sloping plot as well as the more diverse variety of area covered within the plot will be accounted for.

Site Description:

Study site is located above Telluride area in the headwaters of the upper San Miguel River in the San Juan Range of the Rocky Mountains. Study area is above Bridal Veil Falls, in the Bridal Veil Basin, on the east-facing slope with an elevation of 10,600 feet. Bridal Veil Basin is a glacial valley composed of metaphoric and igneous rock. The study site is a 20-meter by 20-meter plot, set up on the east-facing slope. Meadows and spruce and fir forests dominate the slope. The study site is a result of an avalanche run out zone, which increases levels of soil moisture due to deep snow coverage throughout most of the spring. The Bridal Veil Creek runs approximately 5m from the southeast corner of the study site creating diversity within the plot itself. This sub alpine meadow is part of this riparian zone, and creates even enough stability for willows to grow. All four corners of the plot are marked with rebar and the southwest corner represents (0, 0) with a UTM (Universal Transverse Mercator) reading of (0256454E and 4199723N). The northwest corner runs 20 meters north (0, 20) from (0, 0), the northwest corner runs twenty meters east at (0, 20) and the southeast corner is 20 meters east and then 20meters north at (20, 20). Look to Appendix 1A for visual.

Methods:

One 20m x 20m plot, located in Bridal Veil Basin, was surveyed for each separate method of vegetation monitoring through a 2 day period from August 6-10, 2007. This site had formerly been surveyed and sampled in 2005. The observed area was initially mapped out with meter tape measures running along the perimeter as well as through half way marks in both directions (look to map drawing in Appendix 1Afor clearer distinctions). This site was sampled for species richness, and each method recorded the species and a certain count variation. This vegetation survey was a representation of a random 400 square meters in Bridal Veil Creek, and demonstrates all the species within the plot. Each separate method is described in detail below.

Description of Method One
Square Meter Plot Method:
Four 1m x 1m plots were distributed randomly in the 20m x 20m plot by throwing a 1 meter x 1 meter square formed by 1 meter sticks tapped together to a random section. Each smaller plot was labeled A, B, C, or D and marked with a meter tape measure around its perimeter. Each plot was observed and recorded for canopy cover with a densitometer of the ground in a percentage. All different species were identified by Latin name as well as common name. Also, the average height and total number of each species was recorded on each data sheet. (Specific Observations can be viewed or Meter Square Method in Table A.)

Description of Method Two:
Transect Method
Two diagonal meter measuring tapes were spread across the 20m x 20m plot measuring 26.5 meters (square root of 400). The first transect began at (0, 0) and stretched diagonally across to point (20, 20). The second transect was located at (0, 20) and stretched diagonally to (0, 20). A third tape measure ran from the point (0, 10) to (20, 10) straight through the middle of the plot. These three tape measures were the guidelines of

where the Daubenmire frame would be placed. A Daubenmire frame calculates the percent coverage of each species within the frame. It is separated into colored sections to help identify the percent coverage. All vegetation within in the frame was recorded, and nothing that overlaps or exceeds the frame is recorded in the percent coverage. A randomly selected number was chosen between 0 and 1, this served as the starting point on the measuring tape. A coin was flipped (heads for right side and tails for left side) to determine which side of the tape the Daubenmire frame would be placed on. For this study a Daubenmire frame was recorded for every two meters, beginning at .5m on the left side of the tape. Every two meters the Daubenmire frame was used to identify species of plants. The Latin and common name were recorded. For the first transect the plants were identified based on percentage range coverage of the frame based on a corresponding code number, which can seen in Appendix 1A. For the second and third transects only a species count was conducted in order to preserve time.

Description of Method Three:
Frisbee Method
This method was conducted randomly by standing in the center of the 20m x 20m plot (10m, 10m). The observer spun around at this spot (eyes closed) for 10 seconds and then threw the Frisbee. Each species that was located within the circumference of the Frisbee was identified by its common name and its Latin name. Only species that were fully inside the circumference were recorded. A species count was conducted of each species for every toss. The toss was repeated 65 times in order to cover the same area of the plot as the Square Meter Method and the transect method.

All data was entered into spread sheets and permanently stored and recorded.

Results:

Each method had a different series of results as well as recording method. All raw data can be seen in the Tables attached at the end of the paper, which have been labeled accordingly.

Species Richness per Sampling Method

Methods	***Species Richness***
Square Meter	***22***
Transect Method	***49***
Frisbee	***40***

Square Meter Method:
The Square Meter Method was conducted on August 9, 2007 between 11:00am and 1:00pm. For meter square A there were a total of 16 different species. For meter square B there were a total of 14 different species. For meter square C there were 18 different species identified. In meter square D 13 different species were identified. A total of 492 plants were identified in 16 square meters resulting in a species richness of 22 different

species. (Specific Observations can be viewed for each Meter Square and species in Table A.)

Transect Method:
The Transect Method was conducted on August 6, 2007 at 11:00am to 2:00pm. For transect number one (running diagonally from (0, 0) to (20, 20) a total of 26.5m) there were 29 species found. For transect number two (running diagonally from (0, 20) to (20, 0) a total of 26.5m) there were 24 species found. For transect number three (running from (0, 10) to (20, 10) a total of 10m) there were 24 species found again. Altogether the transects resulted in species richness of 49 different species. A total plant count was not recorded because for the first transect species were identified for their percentage range coverage of the frame based on a corresponding code number. Therefore only the second and third transect have recorded plant counts, so no overall complete count and be done. This was in a total area of 4 square meters, which is the equivalent to 40 separate Daubenmire frame counts along all three transects. (Specific Observations can be viewed for Transect and species in Table B.)

Frisbee Toss Method:
The Frisbee Toss Method was conducted on August 9, 2007 at 1:30pm to 3:00pm. A total of 248 plants were identified in a 2.6 square meter area, which is equivalent to 65 tosses. The total species richness was 40. (Specific Observations of all 65 tosses can be viewed in Table C.)

Attached Graph 2A shows the biodiversity for each method covering an area of one square meter (larger and clearer image is attached). This graph shows a comparison of the three methods with in a one square meter area. To create this graph ten random Daubenmire frames were observed from Transect 2 (because species were based on an actual plant count), 24 random frisbee tosses and one of the four meter by four meter plots.
An overall comparison for method of species richness can be viewed in Graph 1A.

Discussion/Conclusion:

The data collected supports the main hypothesized function of the transect method. Throughout the entire vegetation sampling method comparison the species richness was greatest in the Transect Method (49 different species). The Frisbee Toss Method came in second (40 different species), followed by the Square Meter Method, which had the lowest species richness (22 different species). The Square Meter Method resulted in considerably fewer species than the two other methods, and the Transect Method found over twice as many species.

When the methods were compared on an area coverage base of one random square meter sample (ten transects, twenty-four Frisbee tosses, and one square meter plot) the result were similar. The Frisbee Toss Method identified 26 different species and 99 plants, the Transect Method identified 25 different species, but observed 171 plants, and the Square Meter Method was the lowest (sp) again with only 17 different species and 142 plants identifies. Essentially, the Square Meter Method was the most ineffective method by a significant difference.

The effectiveness of the Transect Method and the Frisbee Toss both surpass the previously used meter square method's ability to attain representative species sampling. In July of 2007 only 16 species were identified in the four square meter plots. In August the Transect and Frisbee Toss surpassed this old species richness by over 50%.

Testing these new techniques demonstrated the lack of accuracy the square meter plot method has throughout the entire plot. The Transect Method enabled observation across a huge section of the plot, following the slope. The monitoring plots lie adjacent to Bridal Veil Creek so the sub-alpine zone faded into a riparian zone rich with species adept to wetter conditions. The Square Meter Method was not expansive enough to be able to reach this area of the plot. Like the Transect Method the Frisbee Toss was able to get the majority of the microhabitats within the plot covered and gather a much greater diversity of species than the Square Meter Method. However, in a flat monotonous meadow, the Square Meter Method might have been more efficient in the sense that a diverse area wasn't being covered and therefore greater coverage would not need to be obtained. In a monotonous meadow the Square Meter Method would be a time saver

The Transect Method was the most efficient, but also was the most time consuming. Plants can be recorded on a percent coverage or the total number observed, either way is effective and it is up to the observer to decide how to record for their specific needs The Transect Method can be added to, and the average height can be recorded as well to match the Square Meter Method. For this study site the Transect Method had the advantage of transcending down through a range of micro-habitats, like the riparian, willow, and meadow habitats represented in this specific site. The Frisbee toss became tedious and almost too repetitive to feel effective in the field. The Transect Method also allows the observer to study any part of the plots depending on the study. The Transect Method identified ten new species in the study site that had previously been over looked (look to Appendix 1B to see the list of added species). Overall the Transect Method was much more accurate than the Square Meter Method and identified 27 more species than the previously used method.

Works Cited

Guennel, G.K. Guide to Colorado Wildflowers. Englewood: Westcliffe Publishers, Inc., 2004.

Watershed Education Project. Bridal Veil Living Classroom 2007 Handbook Telluride Institute, 2007.

Nelson, Ruth A. Handbook of Rocky Mountain Plants. Estes Park: Skyland Publishers, 1977.

Kershaw, MacKinnon, and J. Pojar. 1998. Plants of the Rocky Mountains. Lone Pine Publishing, Edmonton.

Weber, William A, and Wittmann, Ronald C. Colorado Flora. Boulder: University Press of Colorado, 2001.