Design

Defining the Problem and Selecting Variables

Aim

Our aim was to figure out the diversity of the location for each given specie we were given. We found diversity by finding the plant species percent cover, plant population density, plant species, and the percent frequency.

Introduction

We were given a map with different plant species drawn on it and asked to evaluate the diversity of the location of both the plants on it. We also had to come up with the whole procedure and use our knowledge to conduct this experiment on a simulated environment.

Controlling Variables

Since this was in a simulated environment, there were really no controlling variables. However, should this have been done in a real environment, there would be many, like the time of day, the climatical conditions, the size of the quadrat, the stratified sampling, and many other things.

Developing a Method of Collecting Data

Procedure

1. Get a map of the region.
2. Work out the scale factor from actual to map size.
3. Cut out a quadrat frame from a piece of paper, making sure the hole within the frame measures 6 cm by 6 cm (base x height).
4. Number every plant within the map, separating the numbering by each species.
5. Use a random number generator to obtain 3 numbers each for each of the given species. You should have 3 plants from each species equating to 15 selected plants on the map.
6. For those chosen, find the area for all 15. Take the average of the three of each species to find the average area that will be used. This will later be used to obtain the raw sum of trees for the quadrants later.
7. Using a random number generator, obtain 2 random numbers, one being the range from 1 to the length of the width of the map and the second being from 1 to then length of the map.
8. Starting from the bottom left corner, measure out the first numbers the generator came up with for width and height and find that point of intersection. (For example, getting 14 and 2 would result in the area of the quadrat sampling being 14 units up, 2 units left) This spot will be the centre of the quadrat for sampling, so the lines made before should pass through the center of the quadrat.
9. In that sampling area you obtained, count the amount of every given species within that quadrat. Count either full specie or half of specie.
10. Repeat Steps 7 to 9 five times.

11. Multiply the number of species of plants in each quadrat by the average area of the species and then take that area and divide by 36 then multiply by 100 to find your plant species percent cover.
12. Add all of the 5 quadrats (which equals 180); add up the raw number of plants found in each quadrat to get the number in all 5, then divide that by the total area of all 5 quadrats (36*5=180). That will give the population density for every square meter. Multiply that number by 100 to find the number of species per every given 100 meters.
13. To find plant species frequency, first count how many quadrats that species appears in. Then, divide by 5, and convert to a percentage to find the plant specie frequency.

Materials

-6x6 cm paper quadrat
-Hole punch cut outs
-Random number generator
-Ruler
-Red marker
-Hole puncher
-Ruler

Data Collection and Processing

Recording Raw Data / Processing Raw Data / Presenting Processed Data

Table 1: Average Area for Each Plant

Plant species	Estimated Area
Arctostaphylos	1.95
Ceonothos	1.06
Pinus	1.47
Populous	1.94
Salix	0.59

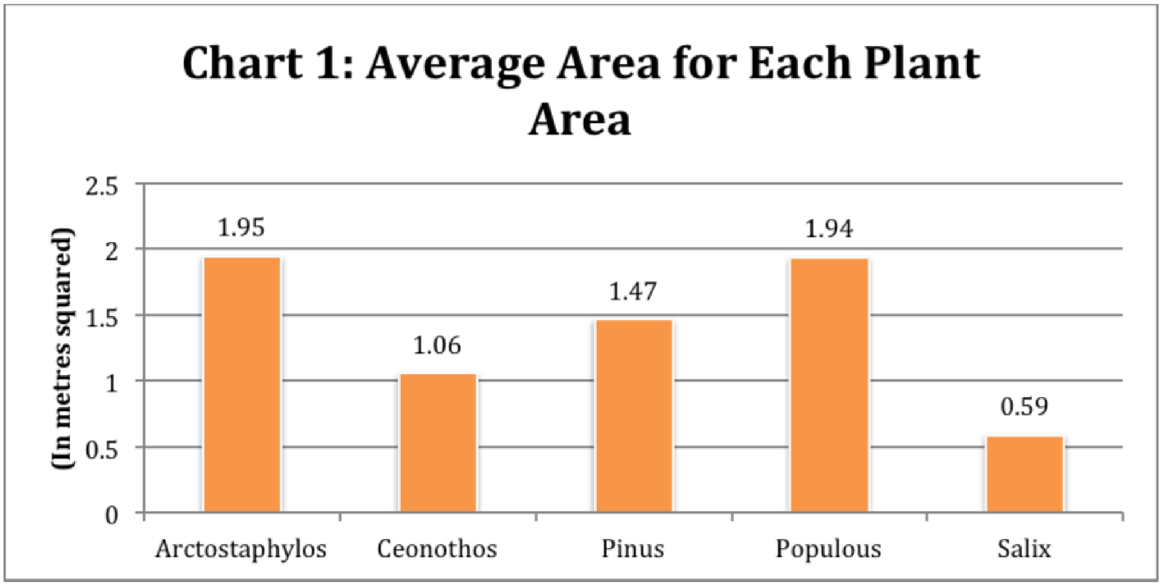


Table 2: Finding the Percent Cover

Scale: one centimeter = one meter One Quadrat = 36 m^2				
Quadrat	Species	Quantity	Sum of Area	Percent Cover

1	Arctostaphylos	--	--	--
	Ceonothos	--	--	--
	Pinus	0.5	.735	2.00
	Populous	3.0	5.82	16.2
	Salix	5.0	2.95	8.20
2	Arctostaphylos	--	--	--
	Ceonothos	--	--	--
	Pinus	1.5	2.205	6.10
	Populous	4.0	7.76	22.0
	Salix	2.5	1.48	4.10
3	Arctostaphylos	--	--	--
	Ceonothos	--	--	--
	Pinus	5.0	7.35	20.4
	Populous	--	--	--
	Salix	--	--	--
4	Arctostaphylos	5.0	9.75	27.1
	Ceonothos	1.5	1.59	4.40
	Pinus	3.0	4.41	12.3
	Populous	--	--	--
	Salix	--	--	--
5	Arctostaphylos	2.0	3.90	10.8
	Ceonothos	1.0	1.06	2.90
	Pinus	2.0	2.94	8.20
	Populous	--	--	--
	Salix	--	--	--

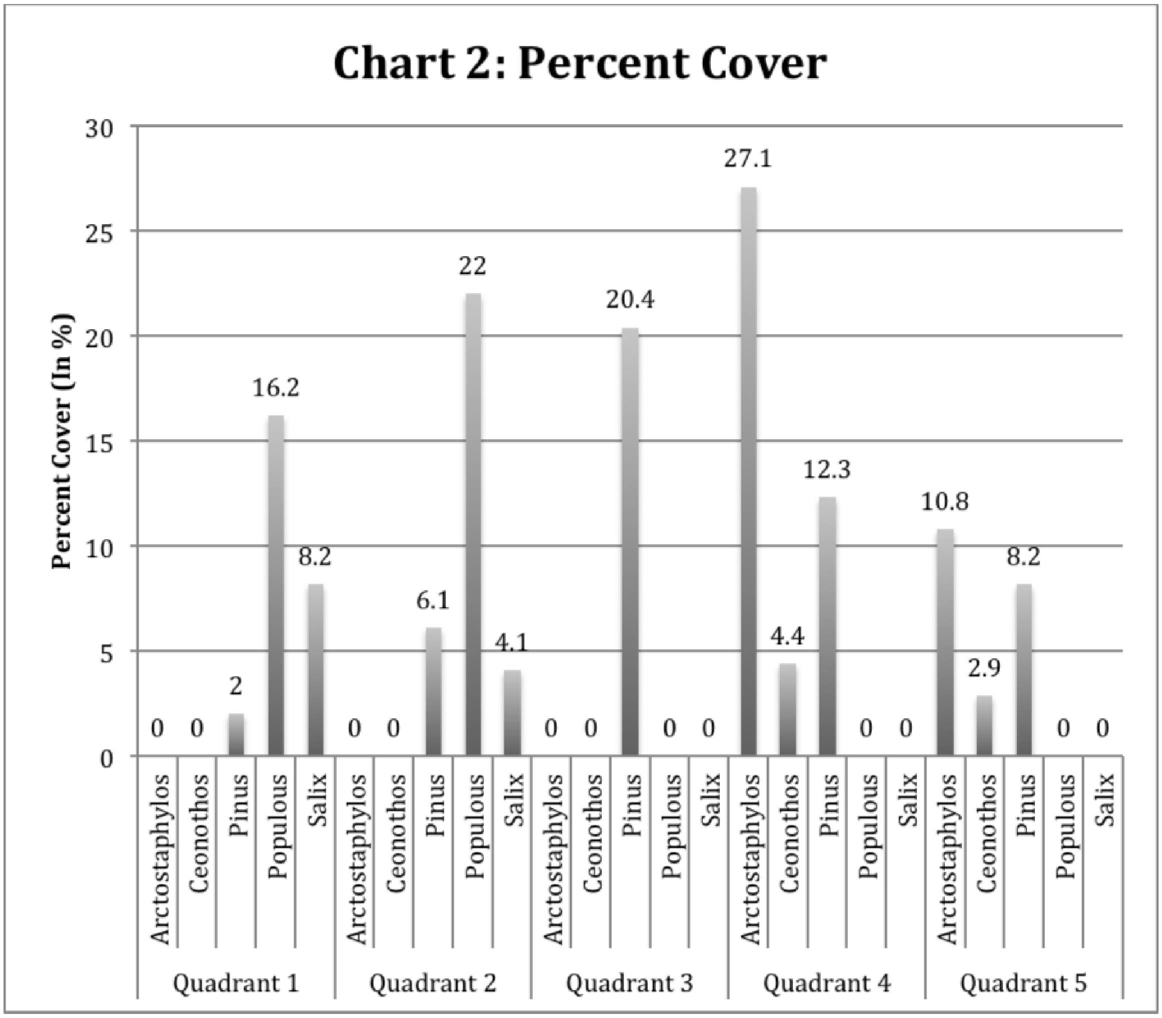


Table 3: Finding the Population Density

Species	# of Plants in all 5 quadrats	Pop. Density for 1 m^2	Pop. Density for 100 m^2
Arctostaphylos	7	0.039	3.9
Ceonothos	2.5	0.014	1.4
Pinus	12	0.067	6.7
Populous	7	0039	3.9
Salix	7.5	0.042	4.2

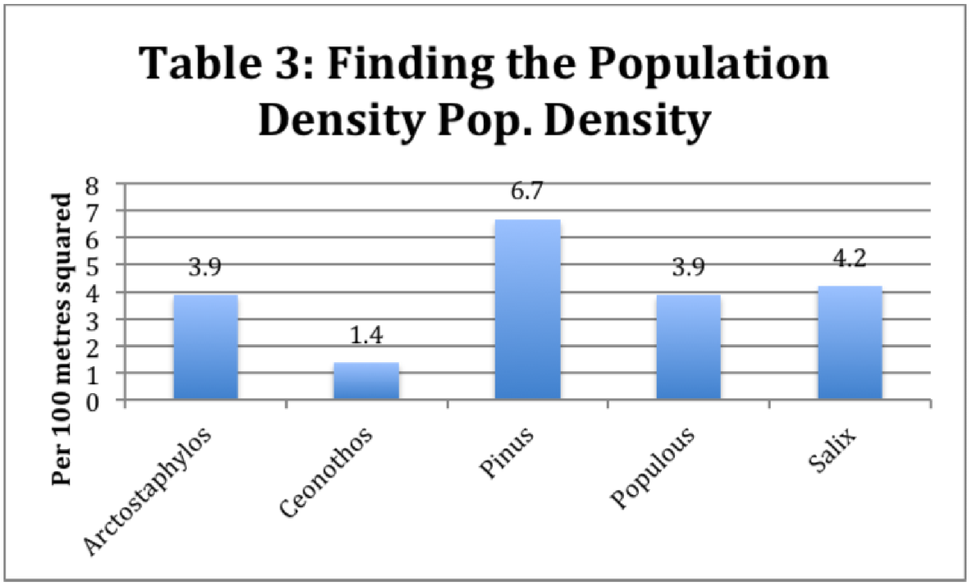
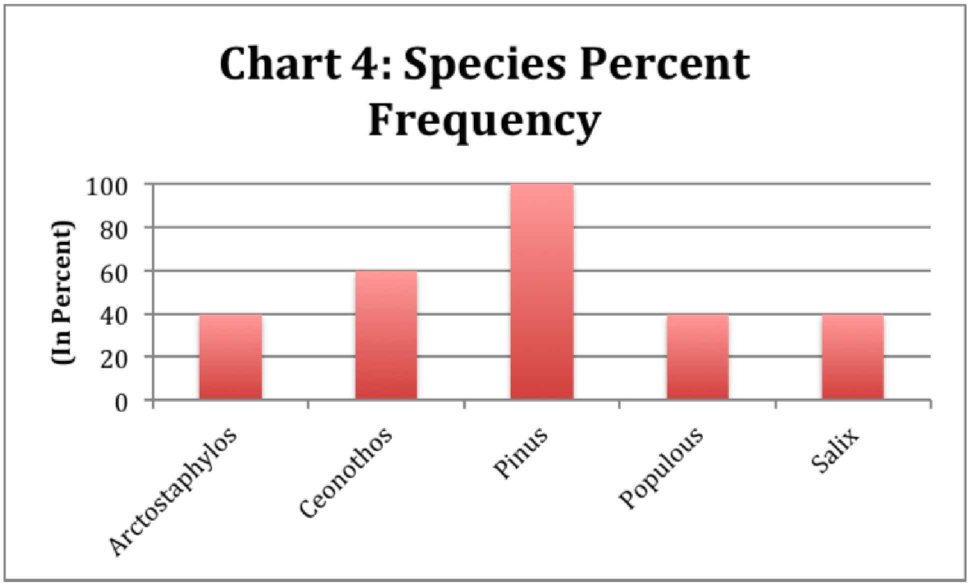


Table 4: Finding Species % Frequency

Species	Raw Mode	Raw Frequency	Percent Frequency

Arctostaphylos	2	0.4	40
Ceonothos	3	0.6	60
Pinus	5	1.0	100
Populous	2	0.4	40
Salix	2	0.4	40



Analysis
For finding the raw area of each specie, acrtostaphylos had the highest area of the five different species, with 1.95 metres squared area. However, populous was also statistically very close, with 1.94 metres squared area. Salix had the least size within the region,

measuring only 0.59 metres squared in length. However in general, the tree sizes were rather large compared to a realistic tree, which posed a weakness within the data. For the percent cover, in of the 5 different quadrats, there were no consistencies within the data. For quadrat one, populous was the most commonly occurring specie, with 16.2 percent cover of the whole quadrat. For quadrat 2, populous was the most common specie, and showed 22 percent cover of the sample. For quadrat three, the outstanding specie was pinus, at 20.4 percent cover. For quadrat four, we see arctostaphylos as the most commonly occurring specie at 27.1 percent cover. Finally, for quadrat five we see two species dominating; acrtostaphylous at 10.8 percent and pinus at 8.2 percent. The most commonly occurring specie was Pinus, having the highest population density of 6.7 metres squared per 100 metres squared. That is 6.7% of the whole 100% region having pinuses. After that, Salix, Populus, and Acrtostaphylous had roughly the same density, at 4.2 per 100, 3.9 per 100, and 3.9 per 100 metres squared respectively. Ceonothos had the least density, falling at 1.4 metres squared per 100 metres squared. Pinus again was the most frequently occurring specie within all of the species, since Pinus plants were showing up in all 5 samples, hence having a percent frequency of 100%, meaning that pinus should have a wide distribution of pinus plants over the whole map. The other species all were lower than that; Ceonthos fell that 60% frequency, which was a interesting discovery given that in Chart 3 ceonthos had the lowest density. This shows us that Ceonthos while sparsely grown over the region, has a wide distributional area of the species. You would be likely to find in many areas ceonthos trees, albeit very few of them in a given concentrated area. Populus, salix, and acrtostaphylos have a low percent frequency of 40% each, meaning that they were only found in 2 of the 5 samples.

Conclusion

Evaluating Procedure

This procedure was all hypothetical, leaving a lot of room for errors. None of this data was conducted on real land but all hypothetically on a map, rendering the data very reliable. Also, the tests could have been more frequent with more quantity. Five quadrat spots was a very small sample and could make the data less reliable. When finding the average area of each plant; only 3 plants were sampled, which is very little for this map. To make the data more reliable, there should be a more accurate way of testing average size of each plant. Also maturity of the plant wasn't taken into account. With nature, there are all of things that would need to be controlled that cannot physically be controlled. Because we are testing on nature, there is a lot of room for error and that validity goes down even further.

Improving the Investigation

This investigation could be improved in many ways. For example, one method of improving the investigation is introducing more kinds of species within the ecosystem, to further simulate an ecosystem more efficiently. Another item of improvement is to increase the amount of sampling done from 5 times to a greater number, like 20. That would increase accuracy a lot. You could also introduce different sizes of trees within the system, as to make more of an accurate representation of the system.