The simpson diversity index essay sample

Using statistics to determine the correlation of plant population between the rugby and football fields at school.

Introduction:

The Simpson Diversity Index (SDI) is used to analyze the biodiversity of two local communities. In this investigation, students were required to use the SDI to compare the biodiversity of the rugby and football fields, with the use of cameras and the computer software, Logger Pro 3. 8. The data will be collected from random placement of 10 quadrats in both fields, and thus will be required to estimate, based on the diversity of the quadrats, the overall diversity of each field. The following is the mathematical relationship used in this activity:

SDI =

Where ‘ N’ = total number of organisms of all species found in the field.

‘ n’ = number of individuals of a particular species.

The T-test will further be used to compare the two sets of data to see if they are the same or different, with the critical P level at P = 0. 05 (5%). The null hypothesis is accepted when the value is above 0. 05, stating that the data is the same. However, is rejected when it is below 0. 05, stating that the data is different from each other.

Hypothesis:

There is significant difference between the biodiversity of plant species/flora found in the rugby and football fields.

Variables:

Dependant

– greater population of species provides for Intraspecific and Interspecific competition, resulting in a the dominance of fewer types of species, thus less biodiversity.

Independent/Manipulated

– No variable in this activity was changed, since it was mere collection of data with controlled and uncontrolled factors.

– Biodiversity of species in both fields is the independent variable.

Controlled (Fixed)

– Quadrat area (used two rulers as boundaries marking the specific length and width of the quadrat, keeping it 1m2.

Uncontrolled

– number of plant species present / population of each species.

Materials:

– 2 rulers to mark both length and width

– 1 camera

– 2 different fields

– Digital data analysis software, Logger Pro

Procedure:

Refer to the instruction sheet.

DATA COLLECTION:

Table 1: Number of plant species found in both fields:

Field

Quadrat

Species

Rugby

– 10 dandelions (2)

– 6 plantain (1)

– 2 crab grass (1)

– 4 unknown (1)

– 12 dandelions (2)

– 8 unknown (1)

– 10 dandelions (2)

– 3 unknown (1)

– 13 dandelions (2)

– 8 plantain (2)

– 4 dandelions (1)

– 2 unknown (1)

– 16 dandelions (2)

– 2 plantain (1)

– 11 dandelions (1)

– 22 plantain (2)

– 10 dandelions (1)

– 19 plantain (2)

– 13 dandelions (1)

– 35 plantain (3)

– 17 dandelions (2)

– 16 plantain (1)

– 8 clovers (1)

Football

– 15 dandelions (1)

– 32 plantain (3)

– 30 dandelions (2)

– 3 plantain (1)

– 30 dandelions (2)

– 5 plantain (1)

– 42 dandelions (2)

– 2 plantain (1)

– 37 dandelions (1)

– 1 plantain (1)

– 44 dandelions (1)

– 1 plantain (1)

– 45 dandelions (2)

– 3 plantain (1)

– 41 dandelions (2)

– 8 plantain (2)

– 57 dandelions (2)

– 46 dandelions (2)

– 3 plantain (1)

Qualitative Observations:

Many quadrats with large populations or with plants that were easily blended with the grass were investigated, and as a result, when analyzing almost all quadrat images, it was difficult to distinguish between the plant and grass. Also, due to the blurriness of some images, it was difficult to determine which type of plant species was being observed.

(Refer to images at the back of this write-up for reference).

CALCULATIONS:

Given: – Area per quadrat = 1m2

– Number of quadrats per field = 10

– Total area investigated in the field = 10m2

– Total area of both fields: 1600m2 80m2 (as retrieved from another group)

Count of Species present in 10 quadrats:

Rugby:

– Dandelions = 102 + 122 +102 + 132 + 41 + 162 + 111 + 101 + 131 + 172

= 116 16

– Plantain = 61 + 82 + 21 + 222 + 192 + 353 + 161

= 108 12

– Unknown = 41 + 81 + 31 + 21

= 17 4

– Clovers = 8 1

– Crab Grass = 2 1

– TOTAL SPECIES (in 10m2 area of all quadrats) : 251 34

Count of species with respect to entire field:

Dandelions:

x = 18560 dandelions 6368 dandelions

Uncertainty:

=

= 6368 dandelions

Diversity of other species:

– Plantain = 17280 2784

– Clovers = 1280 224

– Crab Grass = 320 176

– Unknown = 2720 776

TOTAL = 40160 10328 plant estimation

Simpson Diversity Index for Rugby Field:

SDI =

SDI =

= 2. 47

Count of Species present in 10 quadrats:

Football:

– Dandelions = 151 + 302 + 302 + 422 + 371 + 441 + 452 + 412 + 572 + 462

= 387 17

– Plantain = 323 + 31 + 51 + 21 + 11 + 11 + 31 + 82 + 31

= 58 12

– TOTAL SPECIES: 445 29

Count of species with respect to entire field:

– Dandelions = 61920 5816

– Plantain = 9280 2384

– TOTAL = 71200 8200 plant estimation

Simpson Diversity Index for Football Field:

SDI =

= 1. 29

T-Test – Calculation:

Using the dandelions as the species for testing, as they occur in every quadrat, the data can be used to arrive at a P value, either supporting or disproving the null hypothesis. The following data was inserted into a Graphic Display Calculator:

As a result, the P value generated from the GDC was 1. 25×10-6, meaning that it is less than 0. 05, and thus rejects the null hypothesis.

CONCLUSIONS AND EVALUATIONS:

Both the Simpson Diversity Index and T-test calculations were used to arrive at an answer for the comparison of flora in the rugby and football fields. As a result, the SDI calculated for the rugby field was 2. 47, whereas the SDI for the football field was 1. 29, stating that the biodiversity in the football field is much lower than that of the rugby field. As a supporting tool, the T-test proved that since the P value of 1. 25×10-6 is smaller than the critical P value of 0. 05, it rejects the null hypothesis, stating that the two sets of data are different, which in turn supports the claim that this difference is due to the difference in biodiversity in both fields.

A possible reason for why this change in biodiversity occurs, is maybe due to the use of both fields, which are different from in a sense from each other. For example, the football field is used a lot more often in practices and thus has its flora damaged or affected by human interference at a higher level than the rugby field, which does not have as much interference, and the

plants are left a lot more secure. The plants, dandelions and plantain, are steady from their stem as they grow in the similar form of rosettes, which make them strong enough to handle to pressure of the feet of humans, and can thus last these conditions. Whereas flora such as clovers and crab grass, which are very weak in physical nature would not last such interference and are thus nonexistent in the football field. This allows for the dominant plant, dandelion to increase in population, also slightly due to decreased interspecific competition.

Even though the method seems very simple to use and achieve easy results, there are some weaknesses that may have altered the interpretation of the quadrat. On possible weakness in the method of this activity is the way in which the camera was used to take images for future use. Using a camera, one is unable to observe the details of each section of the quadrat and is unable to clearly distinguish between what is a plant and what is grass, or what plant species it may actually be. As stated in the qualitative observations, many images from the camera did not provide a clear cut image of each individual plant species, and for example, made it difficult to distinguish between grass and small dandelion plants. Also, small sized Plantain could also have been confused with dandelion plants, and only the fairly large species were accurately counted with confidence.

White lines on the field itself (due to practices) also made it hard to determine the population within the quadrat, as the colour of the plant had been completely changed. All these factors relating to the use of a camera as a data recorder may have lead to an inaccurate count in the population, thus greatly affecting the biodiversity per quadrat. Even though the camera

method was used in order to further use Logger Pro for analysis, improvements should be made. Using the original form of recording data by manually counting the species during the activity and thus having a closer look at the quadrat would eliminate the difficulty in counting the population of the species in the quadrat, and will further provide a more accurate interpretation of the data. The only aspect to focus on would be to not recount the species, which can obviously be controlled by having another person mark the region already counted. The camera should also be a lot more focused on the quadrat itself, thus eliminating blurry images and any external irrelevant areas other than the quadrat. Another possible weakness may have been that out of the whole area of 1600m2, only 10m2 or ground was investigated, as a best representation of the field with removed bias.

However it may not have been the best/most accurate representation of the overall population present, as various species may appear in clusters with each other, rather than spread across the field. This would then provide a false result for the biodiversity present, as various species would not have been included into interpretation of the overall field. As an improvement, rather than having to choose the next location for the quadrat during the activity, which may be influenced by bias, the quadrat placement should be decided at random prior to the investigation, without having seen the field. During this, they should be spread across the field, rather than focused on several clustered regions of the field, as performed in this activity. This would then provide for a better representation of the flora present in both fields and thus provide a much more accurate value for the biodiversity present. This may further influence the T-test P critical value, and depending

on how accurate it is, may alter it from rejecting to accepting the null hypothesis. These may not appear to be major weaknesses, however an inaccurate measure of the flora present in one quadrat can affect the overall value of the field, as that value is based on the population count in the quadrats.

– High population of one species, dominance, sunlight

– One used a lot more often (football), which supports the fact that a lot of the steardy flowers, dandelion hubs and some plantain exist even with the constant use fo the field. And with a lesser use, the rugby field’s flora is more secure from human interference. This resulted as a dominance in the species, taking over most resources, also supporting a high population found. No tall plants, or ones with weak stems are present.

– ERRORS:

– One possible weakness in the method of this activity is the way in which the camera was used to take images for future use. However using a camera, we are unable to see the details of each section of the quadrat and able to clearly distinguish…which may have altered greatly the population count, and thus the diversity. Should be more focused on the quadrat. Or just use normal recording method, but use a way in which you don’t have to worry about plants being recounted. More focused on area.

– Another: in the whole area, only 10m2 area was investigated to take a best representation by removing bias, however it may not have been the best

representation…it is merely our assumption. Use more quadrats or more spread out in the area.

– **using logger pro, its much easier to keep track of which ones have been counted, while doing manual counting, one may unintentionally count the same one more than once. More reliable tool. Distinguish between grass and dandelion. In some areas, only the big ones can be spotted. Might not be able to distinguish between the different species…it may be dandelion or taproot?

***Uncertainty varies from experimenter, as it is based on the lack of observance, and affected by amount of other speicies/population in the quadrat.

*** *diversity tells that one is more diverse than other, and ttest ensures that the two fields do have diff biodiversity

*since null hypothesis is rejected

Errors:

– Take a closer picture at the quadrat, so that all plants are accounted for (no inaccurate counts)

***share data with another group

Given:

http://images. google. ca/imgres? imgurl= http://landscapingboise. com/Weed%2520Images/Plantain%2520broad%2520leaf%2520N400.

jpg&imgrefurl= http://landscapingboise. com/Weed%2520Pages/Weed%2520Gallery. htm&usg= __8VRRQYNwu0011OKC0r0PWXzucRg=&h= 400&w= 260&sz= 105&hl= en&start= 9&um= 1&tbnid= UXKGQ4HcT60YQM:&tbnh= 124&tbnw= 81&prev=/images%3Fq%3Dbroad%2Bleaf%2Bweeds%26hl%3Den%26rlz%3D1C1CHNB_en___CA349%26sa%3DN%26um%3D1

http://images. google. ca/imgres? imgurl= http://commodities. caes. uga. edu/turfgrass/georgiaturf/WeedMngt/images/ARTVU2. jpg&imgrefurl= http://commodities. caes. uga. edu/turfgrass/georgiaturf/WeedMngt/&usg= __FM9kuPhnGNmE6XILQG3WgoM6Tv8=&h= 499&w= 800&sz= 46&hl= en&start= 50&um= 1&tbnid= EvtprwlcutLJ2M:&tbnh= 89&tbnw= 143&prev=/images%3Fq%3Dbroad%2Bleaf%2Bweeds%26ndsp%3D20%26hl%3Den%26rlz%3D1C1CHNB_en___CA349%26sa%3DN%26start%3D40%26um%3D1