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Project Activity Log

Learner Name _____ Learner number _____

Centre Name _____ Centre Number _____

Unit Name Unit 2 Field project Unit number 2

Teacher Assessor _____

Proposed project title How does pH variation and moisture content in soils influence plant cover on the sand dunes at Studland

This form should be used to record the process of your project and be submitted as evidence with the final piece of work.
You may want to discuss:

- what you have done (eg, from one week to the next)
- if you are working in a group, what discussions you have had
- any changes that you have or will need to make to your plans
- what resources you have found or hope to find
- what problems you are encountering and how you are solving them
- what you are going to do next

Date	Comments
Feb 09	Decision about field work title after discussion in class
1st-4th March	Field trip to Dorset to collect data
11th-13th March	Lab work to establish soil PH levels and moisture content
16th-	Analysis of data and write up of report

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Project Proposal form

Learner Name

Learner number

Centre Name

Centre Number

Teacher Assessor

Date 3/2/09

Unit 2

Proposed project title How does pH variation and moisture content in soils influence plant cover on the sand dunes at Studland.

Section One: Title, objective, responsibilities

Title or working title of project (in the form of a question)

How far does PH variation and moisture content in soils influence plant cover across a transect in the Studland sand dunes.

Project objectives (eg, what is the question you want to answer? What do you want to learn how to do? What do you want to find out?): Whether PH aggects the species of plants and the amount of them. Do humans need to intergere with the planting of vegetation to stabilize sand dunes.

If it is a group project, what will your responsibilities be?

Not a group project, but data collected by group, results used individually.

Section Two: Reasons for choosing this project

Reasons for choosing the project (eg, links to other subjects you are studying, personal interest, future plans, knowledge/skills you want to improve, why the topic is important): It will give me an understanding of how vegetation evolves, this topic is important because vegetation helps to stabilize dunes and prevent erosion. The world heritage coastline is under increasing threat grom rising sea levels so it is important to understand about areas most at risk.

Section Three: Activities and timescales

Activities to be carried out during the project (eg, research, analysis, writing, preparing for the presentation, etc):	How long this will take:
Carrying out a beach transect	2 Hrs
Collecting soil samples along transect	2 Hrs
Using Clinometer calculate angle of the slope	2 Hrs
Measure moisture and PH levels in soil	24 Hrs in oven
Using spearmans rank establish whether positive or negative correlation.	1 Hr

Milestone one: Research for hypothesis and collection of primary data on field trip

Target date (set by tutor-assessor): March 4th 09

Milestone two: Lab tests and write up of results

Target date (set by tutor-assessor): May 5th 09

Section Four: Resources

What resources will you need for your research, write up and presentation (eg, libraries, books, journals, equipment):

I will require the use of a lab and an oven to carry out PH and moisture tests. PH testing kit.

What your areas of research will cover?

Vegetation types along beach.

Comments and agreement from tutor-assessor

Is the learner taking this project as part of the Diploma? ~~Yes~~/No

If yes, which Diploma are they taking? _____

Comments (optional):

Is project derived from work which has been/will be submitted for another qualification? ~~Yes~~/No

Which qualification (title and unit)? _____

Comments (optional):

I confirm that the project is not work which has been or will be submitted for another qualification and is appropriate.

Agreed: (name) (date) 4/2/09

Comments and agreement from project proposal checker

Comments (optional):

I confirm that the project is appropriate.

Agreed: (name) (date) 06/02/09

How far does PH variation and moisture content in soils influence plant cover across a transect in the Studland sanddunes?

Candidate number -

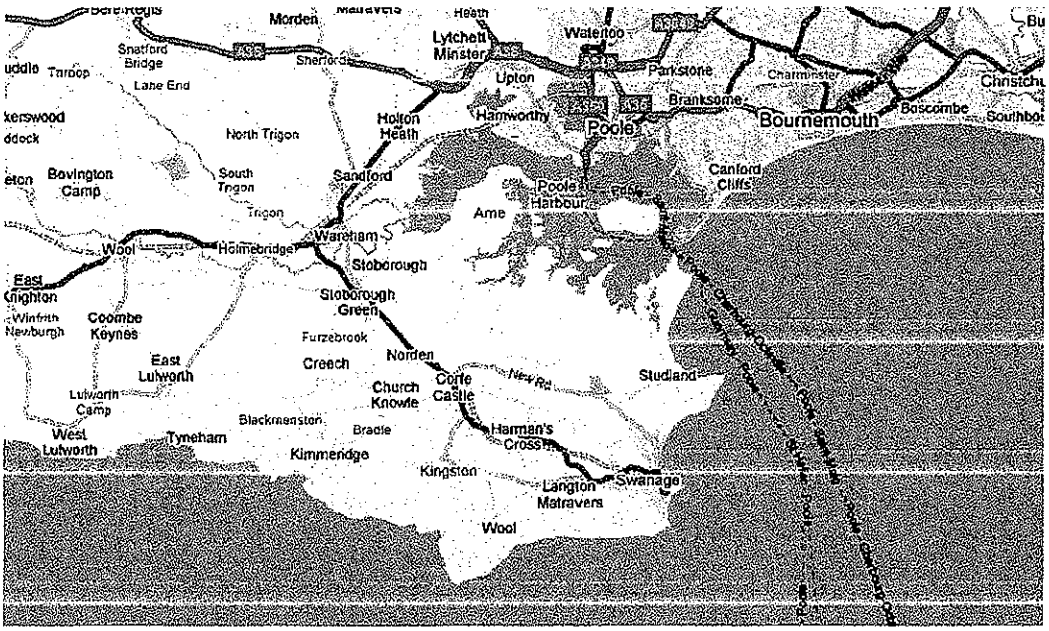
Contents

How far does PH variation and moisture content in soils influence plant cover across a transect in the Studland sand dunes.

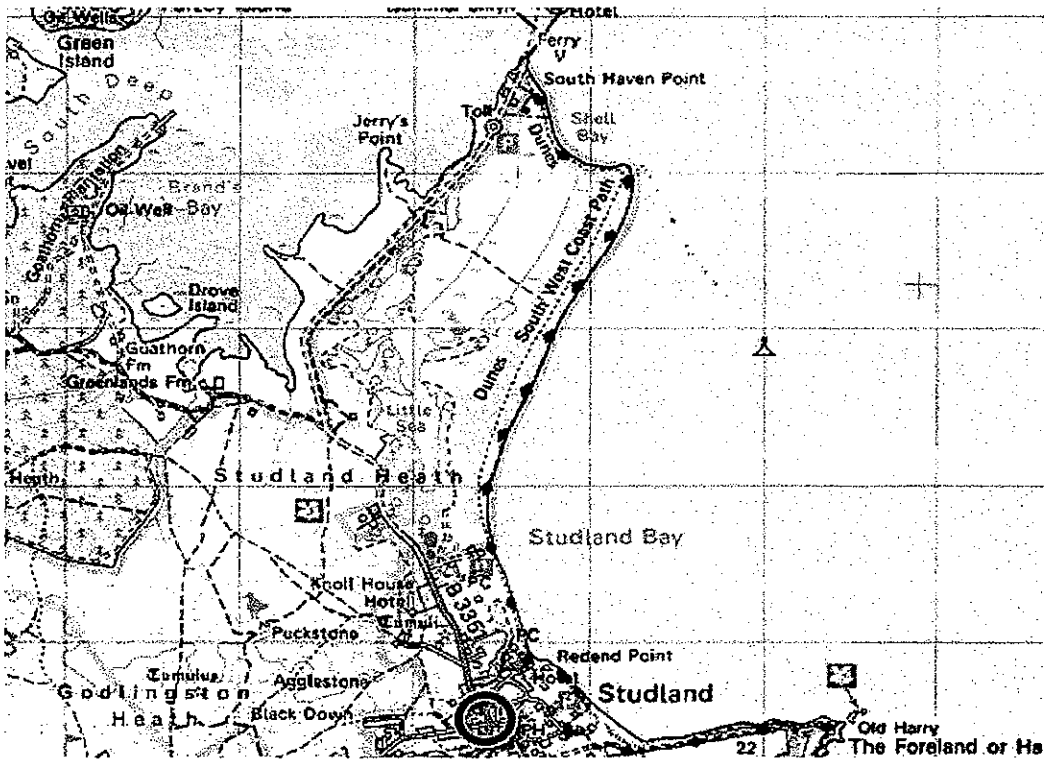
The Studland sand dunes are located on the isle of Purbeck in Dorset (map reference- OS explorer OL15). The Studland area is protected from prevailing winds by the cliffs and old harry rocks which separate Studland from Swanage which has resulted in the sandy beaches over a period of 600 years. I plan to prove my hypothesis that PH and moisture content in soils influences the amount of vegetation, by carrying out tests and research on soil that I collect from the dunes. Plant cover is a very important issue when looking at the protection of sand dunes. The plants provide vital support to the dunes via there roots which keep the sand together in strong winds and without these sand dunes there would be no barrier between land and sea and would put the coastline at a greater risk of flooding and erosion. So it is important to look at the state of the dunes soil content to understand how badly it affects plant cover and whether human management schemes are needed to conserve the sand dunes plant cover.
The flood threat is a becoming a bigger issue with rising sea levels due to global warming and so it is vitally important that the sand dunes are in effect working to there most capable to lessen the threat of flooding due to rising sea levels.
Damage to vegetation from humans is something that largely affects the structural qualities of a sand dune and so is important that there are footpaths introduced to prevent damage to plants and make sure they are preserved to stabilize the dunes.
By carrying out the research and the collection of data to answer the question I hope to gain an understanding of what plants require from the soil that surrounds them to help them live and grow to help stabilize and preserve the sand dunes. I also would like to know whether human interference is required to help support and preserve the plants that are needed to keep the sand dunes together.

Location

Studland bay is situate in Dorset within the Isle of Purbeck
The map below shows a wide area map of Studland bay and the surrounding towns and area.



This map shows the town centre, amenities and types of land surrounding the area. Along with the Old Harry rocks in the bottom right hand corner.



Methodology

When looking at the sand dunes I collected soil samples and measured the angle and length of the sand dunes to do this I used a variety of methods and a number of different pieces of equipment to acquire data.

When measuring the sand dunes length and angle of the slope these were the pieces of equipment I used-
Measuring tape
Ranging rods
Clinometer

To start with I placed a ranging rod at the very beginning of the beach just before the sea line. I then got someone in my group to place to next ranging rod at the point in which there was a noticeable incline from that of the first rod. This distance was then measured. Then using the clinometer I aimed the scope towards the other ranging rod at the same point as where the scope is positioned on the first rod. To maintain accurate results I needed to make sure that each ranging rod was in the ground at the same depth.

To collect soil samples these are the pieces of equipment I used
Shovel
Bags

To collect an appropriate number of samples to establish whether the hypothesis is true I collected soil samples in between every ranging rod. When collecting samples I randomly chose where to dig samples in between the ranging rods. I did this to make the test fair. The bags where then labelled according to there location along the transect.

To establish vegetation cover these are the pieces of equipment I used
Quadrat

To make sure I obtain random and therefore fair results I randomly threw the quadrat between the ranging rods looking away from where I was throwing it. I then looked at the 10x10 squares in the middle of the quadrat and calculated the percentage of vegetation within the squares. I then specified which species of plant they were and how much of different types of vegetation there was e.g. 80% Maram grass and 20% ling heather.

Problems that I encountered when carrying out these methods were-
When measuring the length of the dunes sometimes we encountered obstacles such as large ling heather bushes and silver birch trees were we wanted to place the next ranging rod, this meant that we had to place the rod slightly off course from an exact straight line to obtain the angle of slope and distance.

To establish water content this was the equipment that I used-
Ceramic dishes
Spatula
Oven
Digital scales

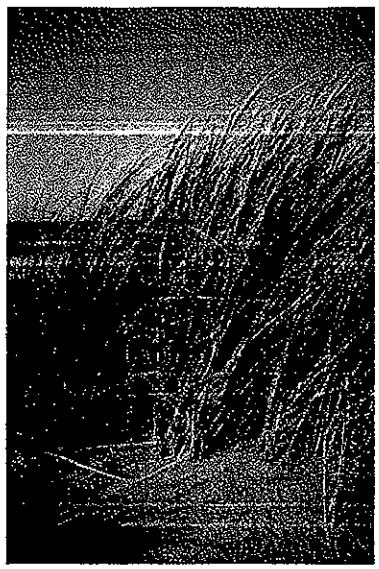
The soil samples were taken and put into small ceramic dishes which were then weighed. These dishes were then placed in an oven so that all the water could evaporate. The dish was then weighed again to see how much of the mass was lost that was water.

PH tests, to establish the PH levels this was the equipment that I used
Small beakers
Stirring rods
Universal indicator
PH colour chart

After I took the soil out of the oven I placed a small amount of each soil sample in different beakers. I then added water and universal indicator and stirred them together. I then compared the colour of the solution against the PH colour chart.

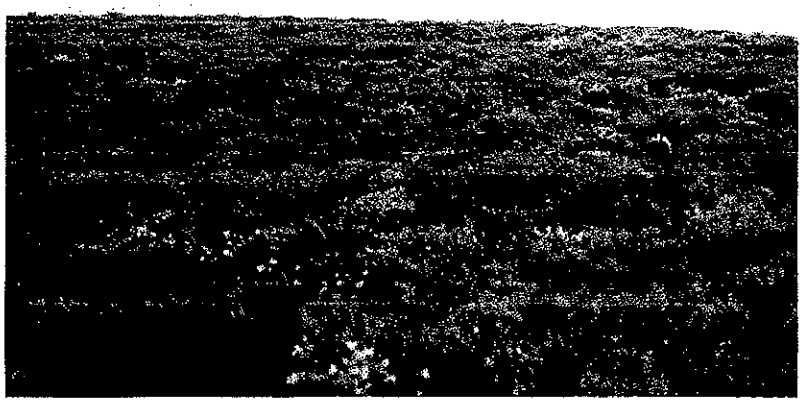
Vegetation types

I encountered a number of different types of vegetation as I was going along my transect. Below are the main plant species that were commonly found throughout the transect.

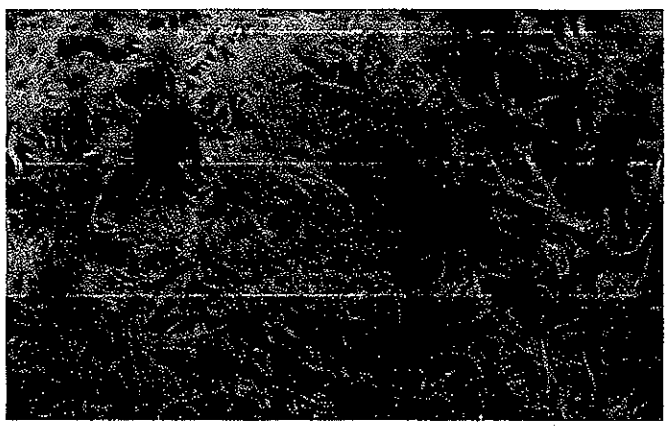


Marram grasses- are found in dune systems mainly yellow where it dominates. When covered by sand the stems lengthen allowing the grass to resurface. Marram grass is widely known as a plant which can withstand arid conditions such as deserts or sandy beaches. The plant is xerophytic (can survive in dry conditions) adaptations allow it to thrive under conditions most plants could not survive.

Ling heather- is found widely in Europe on well drained acidic soils in open sunny conditions and in reasonable shade. It is tolerant of moderate grazing and can revive from occasional burning. It is a common and often dominating component of heath and peat bogs. The flowers come out in late summer and in wild species these are usually of a purple colour.



Sphagnum moss- bogs depend upon precipitation as the main source of water and nutrients, therefore making them a favourable habitat for sphagnum moss as it retains water well. Moss can hold large quantities of water inside its cells. Some species of moss can hold up to 20 times their dry weight in water.



Transect

When at Studland bay I needed to collect data so that I could create a transect of the dunes. I collected data such as angle of the slope, vegetation type and amount the different types of soil.

Angle of slope/ □	**Distance between ranging rods /m**	**Quadrat**	**Readings**	**Observations**
		1	2	
+3	7.10			Sand/no soil
+4	9.85			Sand/no soil
+8	5.20	30% marram 70% sand	20% marram 70% sand	
+12	3.98	25% marram 75% sand	50% marram 50% sand	
+13	4	45% marram 55% sand	30% marram 70% sand	
-1	4	80% marram 20% sand	55% marram 45% sand	
+10	3.98	50% marram 40% other small grasses 10% sand	85% marram 15% sand	
+10	1.10			
+12	0.90	100%sand	100% sand	Footpath erosion meant no vegetation
+11	1.40	90% ling heather 10% sphagnum moss	100% ling	
+5	5.5	50% ling 10% marram 40% sand	20% ling 5% marram 75% sand	
0	4.40	80% sphagnum 20% small grasses	50% sphagnum 50% marram	
-5	1.80	80% ling 20% marram	100% ling	
-9	4.40	30% marram 70% ling	90% ling 10% marram	
0	4.58	50% ling 50% marram	100% marram	
-10	2.85	100% ling	30% moss 70% marram	
-1	1.35	20% marram 80% ling	80% marram 20% sand	

-12	2.70	100% ling	100% ling	
-12	6.90	30% ling 70% marram	80% marram 20% ling	
+10	4.40	90% gorse 10% dead trees	70% gorse 30% ling	
+2	4.36	10% grass 90% marram	45% marram 55% grasses	
-10	6.18	80% silver birch 20% gorse	30% sand 70% sphagnum	
0	14.25	10% Dry grass 45% marram 45% gorse	20% ling 40% marram 40% sand	
+3	6.10	60% silver birch 40% sphagnum	100% silver birch	
+11	2.25	30% sand 70% sphagnum	80% sand 20% maram	
+4	9.54	80% gorse 20% dead wood	50% ling 50% gorse	
+15	6.40	55% ling 45% moss	60% moss 40% ling	Boggy ground
-1	6.75	100% ling	70% ling 30% sand	
+4	8.80	100% ling	100% ling	
-12	3.85	70% ling 30% sand	20% ling 40% marram	
+5	19.73	20% ling 80% gorse	100% gorse	
+3	8.35	80% sand 20% marram	35% marram 65% sand	
-20	2.96	20% ling 40% marram 40% sand	30% ling 70% sand	
-10	21.40	50% ling 50% gorse	100% gorse	

Transect graph

For the results that I obtained measuring the angle of the slope, vegetation cover and species and distance I constructed a graph showing the length to scale the angle of the slope to scale and the percentage of specific vegetation in kite diagram form.

For the transect graph I plotted the distances with a scale of 2m=1cm. along the x axis was distance in metres and along y axis, angle of slope.

To produce the kite diagram I needed to work out the average reading from my two quadrat readings. I recorded these percentages into a table and was then able to plot the points and produce a kite diagram. I feel as this was the best method of displaying my vegetation results as it is very easy to understand and provided a result for each distance measured between ranging rods which contained vegetation. I plotted the kite diagram above the transect in line with the same point as the transect.

The transect- the beach was bare until it started to incline when Maram grass started to appear in small amounts, the further up the slope Maram grass became dominant. This was so until about halfway down the transect were I started to see ling heather and small grasses. This then progressed on to contain ling, gorse, silver birch and sphagnum moss were the ground was wetter and more acidic.

Lab tests- water content

I ran some lab tests to see how much water each soil sample contained, I worked out how much water each soil sample contained using the following equipment and steps.

Equipment-

- Small ceramic dishes
- Spatula
- Weighing scales
- Oven

1. I removed a sample of soil from the sealable bags for each soil sample using the spatula. The soil was put onto the ceramic dishes and then weighed
2. after weighing the sample I recorded its weight in a table, I then placed a label on the dish to ensure I knew which part of the transect the soil belonged to.
3. I then repeated these stages for the rest of my soil samples making sure to wipe the spatula each time as not to contaminated with one another and therefore making my results more reliable
4. after all of the samples weight had been recorded I placed the dishes into a preheated oven at 80□ C and left them in the oven for 24 hours
5. after 24 hours I took the soil samples out of the oven and then weighed them again. Also recording these results
6. from looking at the previous weights of the dishes and the weights of them after the oven I was able to determine how much mass had been lost through water evaporating.

Water content

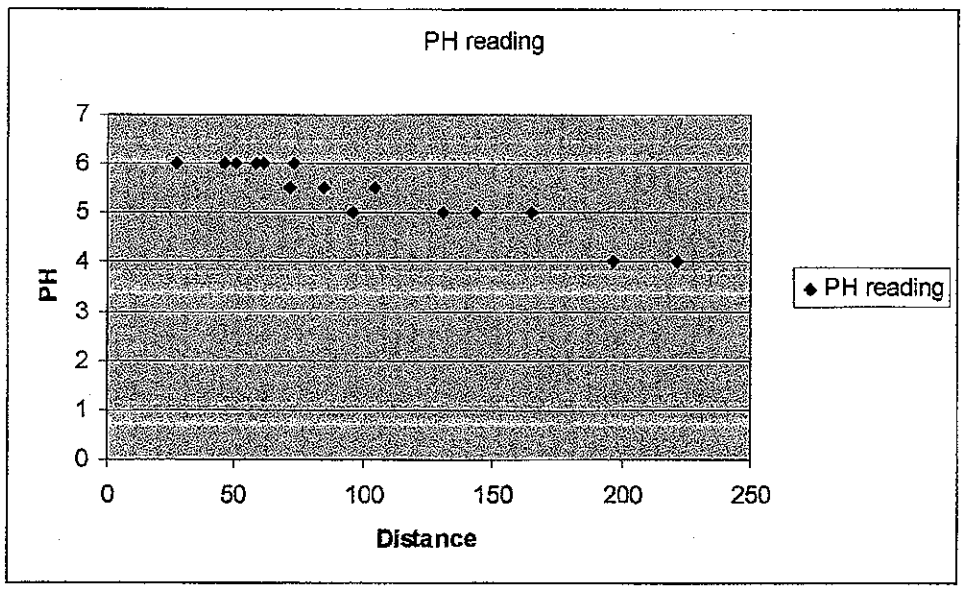
The soil samples from the transect were weighed and then placed in an oven and then weighed again. The change in weight demonstrated how much mass had been lost through evaporation. The results for the samples before and after the water content was lost is recorded in the table below.

Soil sample number	Distance from sea inland (m)	Mass of soil (g)	Mass after oven (g)	Total water mass lost (g)
1	27.25	45.17	43.58	1.58
	37.10			
	42.3			
2	46.25	46.20	45.30	0.9
3	50.25	41.65	40.22	1.43
	54.25			
4	58.23	51.47	48.98	2.49
	59.33			
	60.23			
5	61.63	62.27	60.68	1.59
	67.13			
6	71.53	55.75	45.01	10.74
7	73.33	41.75	36.12	5.63
	77.73			
	82.31			
8	84.89	74.27	72.91	1.36
	86.24			
	88.94			
9	95.84	78.24	63.47	14.77
	100.24			
10	104.6	70.10	64.85	5.25
	110.78			
	125.03			
11	131.13	117.72	100.73	16.99
	133.38			
12	142.92	70.41	58.74	11.67
	149.32			
	156.07			
13	164.87	74.66	71.54	3.12
	168.72			
	188.45			
14	196.8	108.12	88.45	19.67
	199.76			
15	221.16	80.94	72.95	7.99

PH results

The table and graph below shows how the PH of the soil varied as I went from the sea inland, the PH varied due to the different type of soil and is a major factor when looking at vegetation.

Soil sample number	Distance from the sea inland (m)	PH reading
1	27.25	6
2	46.25	6
3	50.25	6
4	58.23	6
5	61.63	6
6	71.53	5.5
7	73.33	6
8	84.89	5.5
9	95.84	5
10	104.6	5.5
11	131.13	5
12	142.92	5
13	164.87	5
14	196.8	4
15	221.16	4



Spearmans rank

Spearmans rank formula is used to determine the strength of a link between two sets of data.

The formula for spearmans rank is $(R^2) = 1 - \frac{6\sum d^2}{n^3 - n}$

R^2= spearmans rank value
$\sum d^2$ = the sum of all values in d^2column
n = the number of values in d^2 column

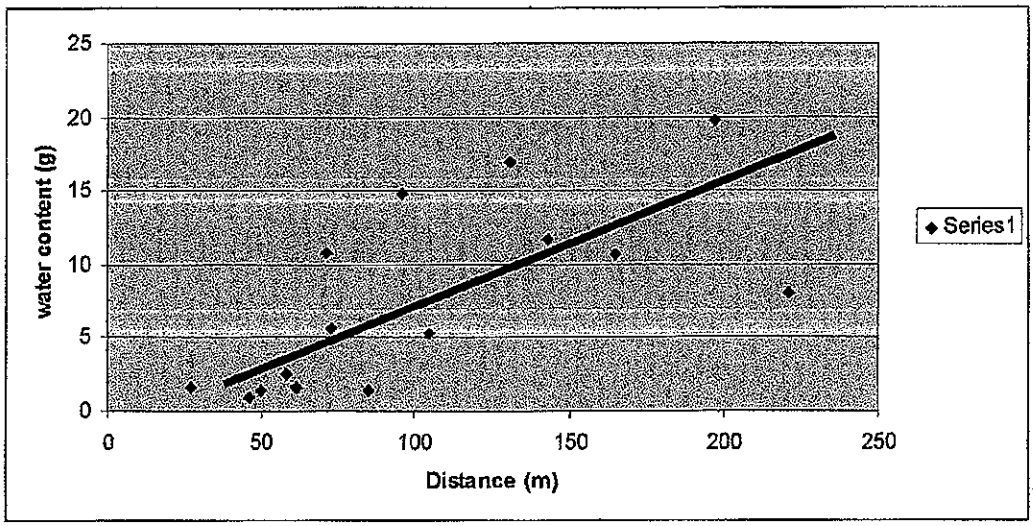
Rank	Distance	Rank	Water content	d	d^2
15	27.25	4	1.58	11	121
14	46.25	1	0.9	13	169
13	50.25	3	1.43	10	100
12	58.23	6	2.49	6	36
11	61.63	5	1.59	6	36
10	71.53	11	10.74	-1	11
9	73.33	8	5.63	1	1
8	84.89	2	1.36	6	36
7	95.84	13	14.77	-6	36
6	104.6	7	5.25	1	1
5	131.13	14	16.99	-9	81
4	142.92	12	11.67	-8	64
3	164.87	10	10.62	-7	49
2	196.8	15	35.35	-13	169
1	221.16	9	7.99	-8	64

$\sum d^2 = 974$

$R^2 = 1-((6+\sum d^2)/15^3-15))$
$= 1-((6+974)/3375-15))$
$=0.71$

The closer R^2 value is to +1 or -1, the stronger the likely correlation. A perfect positive correlation is +1 and a perfect negative correlation -1. The R^2 value of 0.71 suggests a fairly strong positive relationship.

Graph showing water content against distance along transect.



The direction of the line is going up so suggests a positive correlation.

Conclusion

How far does PH variation and moisture content in soils influence plant cover across a transect in the Studland sand dunes?

Conclusion-

Main findings-

- As you travel along the transect inland the PH levels within the soil begin to reduce and therefore is more acidic inland than on the actual beach. I was able to establish this by collecting soil samples along the transect and then testing them as explained earlier to find out the PH readings.
- The moisture content within the soil is not entirely consistent as you move inwards towards land. This is because the varying heights of the dunes means that moisture content can vary significantly. Due to the varied height from the water table.
- The type of vegetation that grows along the transect depends upon the PH level of the soil as some plants prefer acidic soil to alkaline and therefore explains why certain plants are found further inland than on the beach.

But to answer my question of whether or not PH variation and moisture content influences plant cover. I can say from looking at my findings that plant cover is affected by these factors and that certain plant types can tolerate different conditions compared to that of others. Different plants have an ability to tolerate more acidic or more alkali soil conditions than others.

Evaluation

Overall this investigation went well, however there were limitations that may have affected the final outcome of my results and therefore possibly affected any conclusions that I came to.

As we needed to transport the soil samples back to school to carry out tests, some evaporation may have taken place within the soil samples. To prevent this we would have needed to carry out the tests upon the same day as collecting the samples to make sure that as little moisture was lost as possible.

When carrying out the transect at some points we were unable to go into a complete straight line as there were either large bushes, trees or water pools in the way. This is however a factor that we could not have resolved and so could not of been avoided.

I felt however that the techniques we used for obtaining these results were good and with the use of appropriate and specialists equipment was able to carry out a good and fair test with accurate results.

Bibliography

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Books-
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Global challenge: A level