Candidate 4 evidence

Soils investigation

Introduction:

We carried out a soils investigation on the 25th September to determine whether the altitude of land affects the type of soil in that area. Our investigation was carried out in the Aberfeldy area and We started with our highest point which was Griffin Carpark and carried out multiple soils tests to collect our data. We worked down from Griffin carpark to the banking of The River Tay which was our last site and we stopped at 8 places in total (see FIG. 15 for map of area). Our aim was to use "systematic sampling" which is a way of collecting data using a systematic procedure, for example, we aimed to stop at 50 metre intervals to make our results more accurate and give a more clear result on whether altitude does affect soil type. Systematic Sampling wasn't always possible to our minibus and Land rover not being able to park in a safe and secure location at exactly 50 metre intervals. Each group did a total of 7 soil experiments to help determine whether altitude affects soil and we collected all our results together at the end and converted them into graphs.

Methodology:

One of the methods we undertook to help determine our types of soil was how much moisture was in the soils in each area. To find this out we first attempted using a moisture meter which is a device with a probe that you stick into the ground and it gives you a reading of how wet the soil you are testing is. This unfortunately didn't work for us as the meter was giving inaccurate results so we had to think of another methodology for soil moisture. We took a sample of the soil from each site and placed it into the bag – making sure all of the air was squeezed out and the bag was sealed tightly to ensure that none of the moisture from the soil was lost. After we had collected a sample from each site, we took them back to a science lab and placed an equal amount of our eight different soils into a crucible. We drew up a table of the initial weight of each of our soils, then placed our crucible on top of a tripod with a Bunsen burner underneath and we heated up the soil until all the moisture had evaporated into the air and the soil weight was no longer decreasing. Finally we noted down the final weight, subtracting it from the initial soil weight and working out how much moisture was in each soil. This is how we determined which soil was the wettest and which was the driest to include in our soil data results (see FIG. 2)

Methodology 2:

Although soil moisture was quite a complex methodology, others were simpler. For example, we tested the PH of our soils from each site and similarly to soil moisture, we attempted to use a PH meter which was not giving us accurate results and we had to think of an alternative. Instead, we took some distilled water with us to each site (as distilled water does not affect the PH of a soil – it is neutral). When we had collected a sample of each soil we were testing, we added a few drops of distilled water to a portion of the soil and made a paste. We then took some PH- testing litmus paper and held it in the soil paste for a few seconds to allow the paper to fully change colour and give us an indication of the PH. We then noted each PH number down for each site to help us determine whether PH is affected by altitude (see FIG. 1).

Analysis of each soil test:

PH

My hypothesis for soil PH was that, as the altitude increases, the PH decreases and therefore gets more acidic. This is due to the decreased temperatures at higher altitudes because there is low pressure higher up which means the air is thinner an so, there is a high number of coniferous trees and lignin-rich plants, lignin is a substance which is in plants which need to survive harsh, cold conditions and therefore it is extremely hard to break down and decompose which leads to a build-up of acidity in the soils. My results did fit my hypothesis overall with site 1 having the lowest PH ans site 8 having the highest although, there was an anomaly at site 5 where the PH decreased from site 4 to site 5 instead of decreasing. This could be due to site 5 being on the edge of a farmer's field. This farmer could be using different types of insecticides of fertilisers to help their crops grow which could have been less acidic/more alkali than the initial soil and could have affected my results for site 5 (see FIG.1).

Moisture

My hypothesis for soil moisture was that, as the altitude increases, the soil moisture also increases. This is due to lower pressure higher up which brings wetter weather conditions and the rainfall is more frequent and heavier. My results showed that this wasn't quite the case, site 2 had the highest soil moisture and site 7 had the lowest. Site 2 had higher soil moisture than site 1 because it was a very boggy area due to being surrounded by slopes and therefore all the water ran off these slopes into it. Site 1, on the other hand, on a slope with many trees surrounding and the moisture would have therefore ran down the hill or could have been taken up by the higher number of plants. I think that site 8 was wetter than site 7 because it was right on the edge of a river meaning that some of the river water could have been soaked up by the nearby soil or there might have been recent flooding affecting the moisture of the area (see FIG. 2).

Air Temperature

My hypothesis for Air temperature was that as the altitude increases, the air temperature decreases. This is due to low pressure at high altitudes where air is thinner and it brings colder and overall harsher weather conditions. My results showed that the sites got warmer as the altitude decreased until site 6 where there was a decrease in temperature. This could be due to a "temperature inversion" which goes against to usual trend of temperature and altitude. It is where a layer of warmer air overlays a layer of cooler air making the area underneath cooler and I think this is what affected sites 6-8 which were slightly cooler than 3-5 (see FIG. 6).

Soil Temperature

My hypothesis for the temperature of soils at each altitude was that, as the altitude increases, the soil temperature decreases as it is affected my air temperature and air temperature decreases with altitude. My results showed that the overall trend of my graph did fit with my hypothesis yet, there was an anomaly at site 7 where the soil temperature decreased from site 6. This could be due to site

7 being in forest on a hill and it therefore will be more windy and may be slightly cooler than site 6 which was more flat.

Soil depth

My hypothesis for soil depth was that as the altitude increases, the soil depth decreases. This is due to their being more layers which are closer together and more distinct in a Podzol soil than a Gley soil. My results showed that this was not a very accurate hypothesis as my graph shows no trend (see FIG. 4). This was due to the layers not being very distinct at all and all merging together which meant it was extremely hard to depict when a layer had stopped and a new layer had started. The increased amount of organisms in the soils at lower (and therefore more survivable conditions) sites may have added to this as they churn up the soil making it even hard to pick out a new layer. This meant that our results were not very accurate and a new layer may not have been determined correctly

Carbon

My hypothesis for the amount of carbon at different altitudes was that the amount of carbon will increase as altitude increases. This is due to there being a lack of material breakdown and decomposition and a lack of organisms which help with this My graph for carbon showed the R squared value closest to one which means it had the best trend (see FIG. 5) . Site 1 had the highest carbon and site 7 had the lowest, joint with site 5 where there is a slight anomaly. This could be due to an increase in organisms due to more soil nutrients or higher temperatures making them more able to survive at site 6.

Evaluation

To make sure our results were as accurate as possible, 5 groups of people all undertook the same soils tests and the same areas and the data we have collected on the graph sheets are averages from all of the data we individually got. We did all of our experiments in a day, if they needed to be carried out in a lab, they were carried out the following days to ensure nothing to do with the soils had changed at all or much. Due to our investigation being carried out at multiple sites and with a fairly short space of time, we worked with limited equipment which may have affected accuracy of our results. Our first problem was with our aim to achieve systematic sampling by having each one of our 8 sites at exactly 50 metre intervals to ensure a more clear and helpful set of results as to whether altitude affects soil type. We went out in a minibus and land Rover which are big vehicles and it wasn't always possible to park at the next 50 metre interval while being in a safe location, this could have affected our results. Our results for soil moisture may have been affected by our alternative evaporation technique where some of the moisture may have been lost in the time between collecting our sample and doing the experiment which may have given inaccurate results as to which site has more moisture than another. The PH testing was one where there could have been major faults. This is due to the colours of different PH's being very similar and it was down to us to try and work out which PH the colour was indicating and sometimes it was very tricky to depict an accurate PH These faults may have altered our results slightly but will have accumulated and therefore are what left anomalies on our graphs which determined whether altitude affects soils.

Extra time

Conclusion

My soils investigation data graphs all showed that overall; the trends fitted my hypotheses which were linked to whether altitude affects soils. Although they were accurate overall there were a few anomalies which especially stood out which could be linked to personal faults or environmental. The factors which stood out where to soil and air temperature graphs which both fluctuated a lot but didn't relate to each other and I think this was because of our tests being taken at different times of the day which would have affected how cold or warm it was. Depth also stood out as it did not fit a trend at all and certainly did not link to my aim of whether altitude affects soil type. This could just be due to the fact that there aren't distinct or certain soil types which change with altitude at all areas in Scotland.

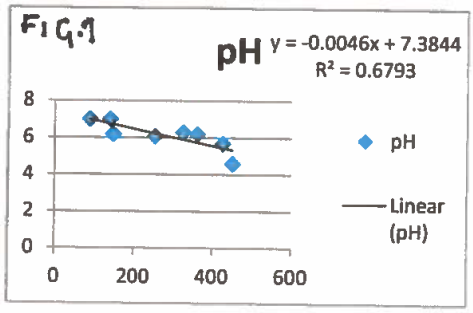


FIG.1
pH
y = -0.0046x + 7.3844
R² = 0.6793
8
6
4
2
0
0
200
400
600
pH
Linear (pH)

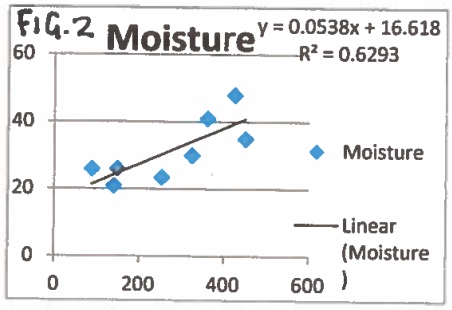


FIG.2 Moisture
y = 0.0538x + 16.618
R² = 0.6293
60
40
20
0
0
200
400
600
Moisture
Linear (Moisture)

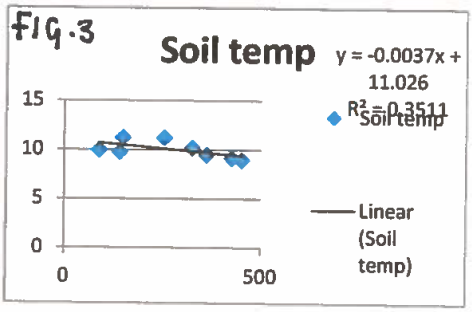


FIG.3
Soil temp
y = -0.0037x + 11.026
R² = 0.3511
15
10
5
0
0
500
Soil temp
Linear (Soil temp)

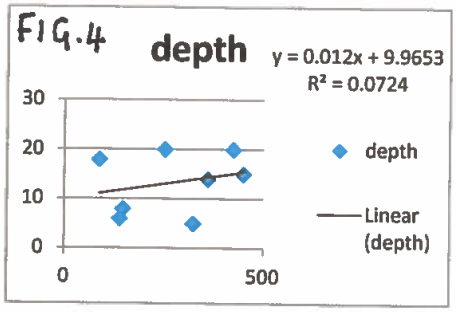


FIG.4
depth
y = 0.012x + 9.9653
R² = 0.0724
30
20
10
0
0
500
depth
Linear (depth)

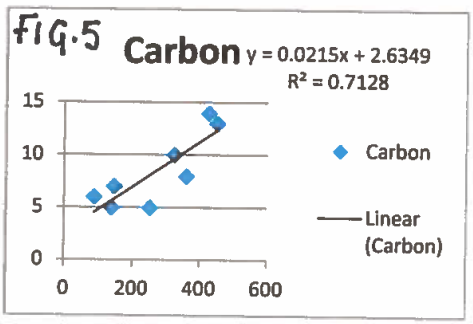


FIG.5
Carbon
y = 0.0215x + 2.6349
R² = 0.7128
15
10
5
0
0
200
400
600
Carbon
Linear (Carbon)

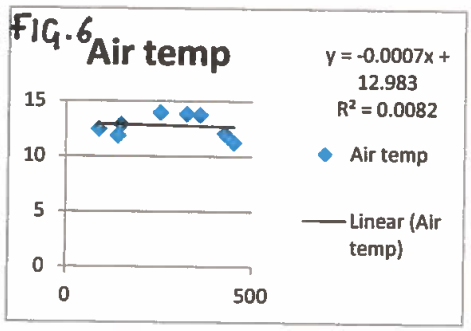
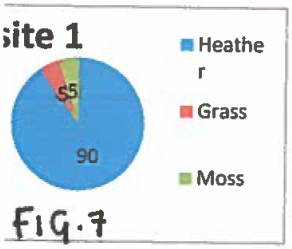
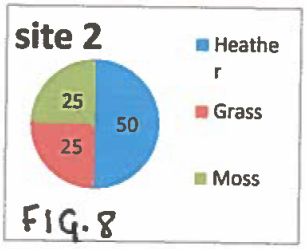
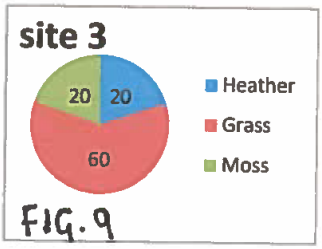
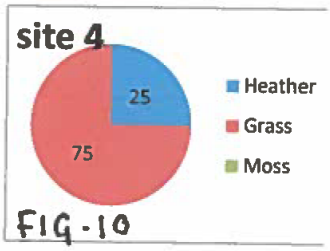


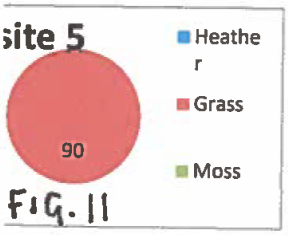
FIG.6
Air temp
y = -0.0007x + 12.983
R² = 0.0082
15
10
5
0
0
500
Air temp
Linear (Air temp)

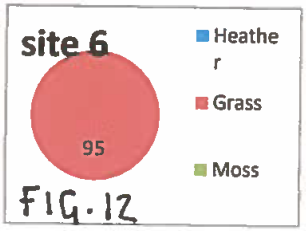

site 1
5
5
90
Heather
Grass
Moss
FIG.7

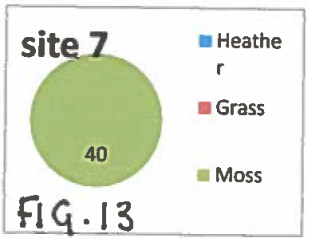

site 2
25
50
25
Heather
Grass
Moss
FIG.8

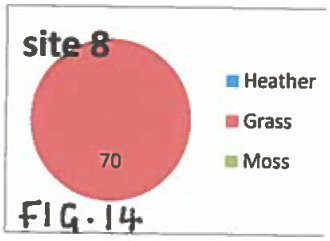

site 3
20
20
60
Heather
Grass
Moss
FIG.9


site 4
25
75
Heather
Grass
Moss
FIG.10


site 5
90
Heather
Grass
Moss
FIG.11

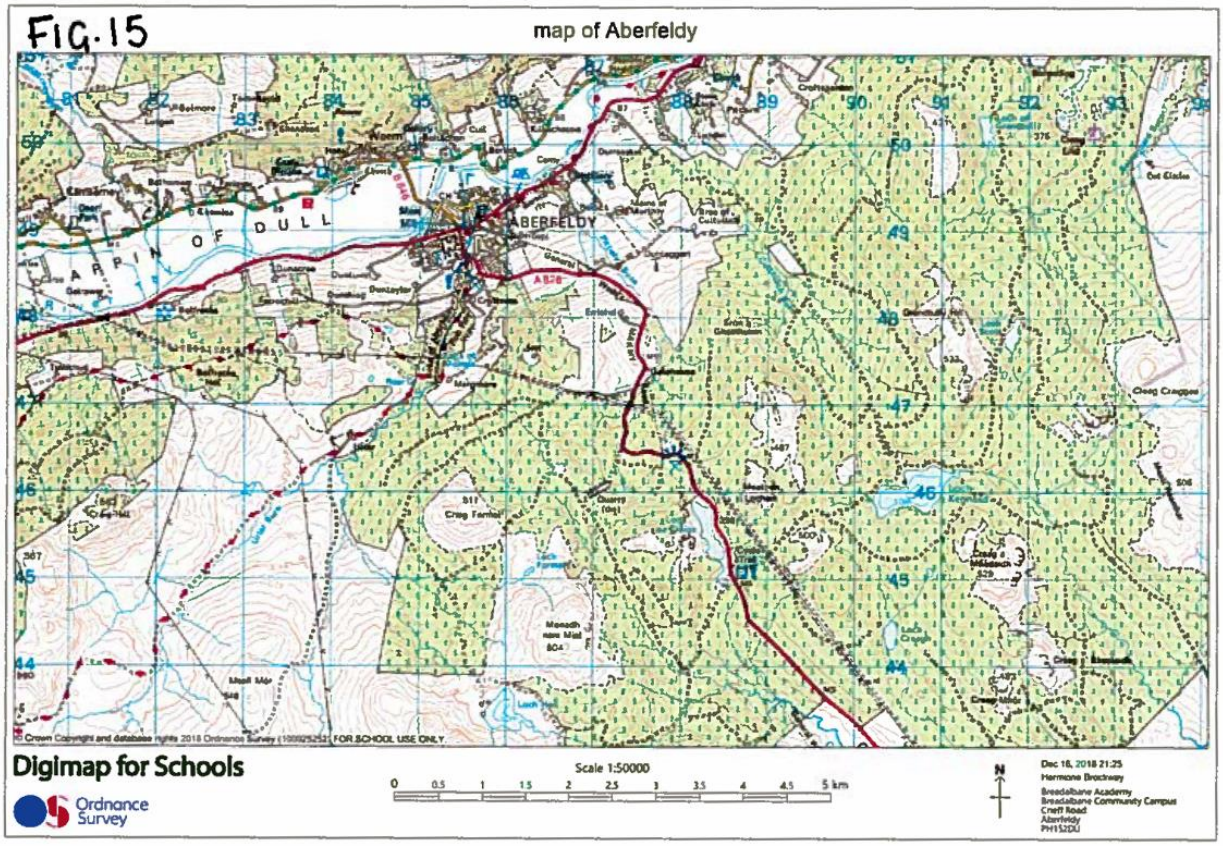

site 6
95
Heather
Grass
Moss
FIG.12


site 7
40
Heather
Grass
Moss
FIG.13

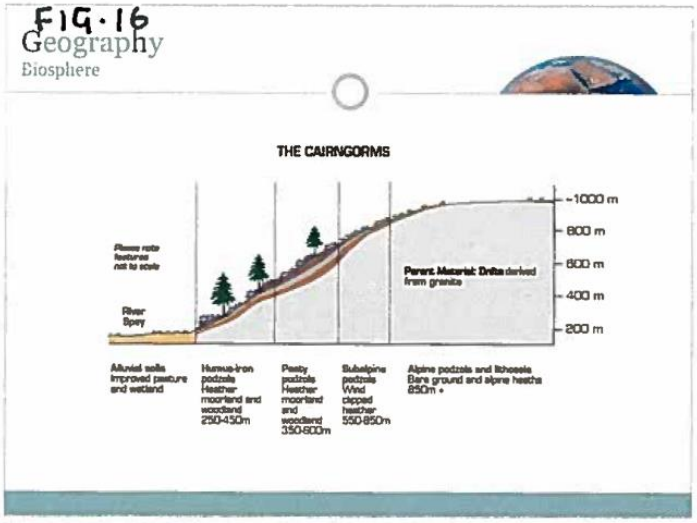

site 8
70
Heather
Grass
Moss
FIG.14

FIG·15

map of Aberfeldy



FIG·16



FIG·17