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Residential field studies for GCSE and A Level Geography and Geology in the UK, Andorra and Spain.

VIRTUAL FIELDWORK ACTIVITY SIX

Studying carbon capture in soils, Swanage, Dorset

Location.

Four field study sites were visited along a 4.7km long transect.

The transect crossed 4 different types of soil and a sample was taken of each soil type.

The co-ordinates of each soil sample site are in this table.

Soil sample number	Latitude	Longitude
1	50.6464	-1.9657
2	50.6285	-1.9759
3	50.6145	-1.9904
4	50.6046	-1.9942

Background

There are five different soil forming factors and the amount of carbon that is stored in a soil varies depending on these factors.

The factors can be best remembered with the acronym CORPT

C - climate

O - organisms (including plants, animals and human management / activity)

R - relief (the shape of the land)

P - parent material (the geology)

T - time (soils can take from hundreds to thousands of years to form)

We have sampled four soils on our transect, each of which has a combination of very different soil forming factors.

The aim of our study is to try and work out which factor(s) are the most significant in determining the amount of carbon that is stored in the soil.

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Carbon is stored in soil in the form of SOIL ORGANIC MATTER. Approximately half of the soil organic matter by weight is in the form of carbon.

Laboratory methodology

It is possible to work out the weight of soil organic matter in grams per cm3 of soil by a simple laboratory method as follows.

1 - Collect a soil sample of a known volume. (The volume of the sample can be worked out by a number of methods, the easiest being to use a piece of clingfilm to line the hole from which the sample has been taken, and measure the volume of water required to fill the hole = volume of soil sample).
2 - Weigh the sample.
3 - Dry the soil sample for 8 hours at 105C.
4 - Weigh the sample.
5 - Dry for a further hour.
6 - Weigh the sample.
7 - Repeat steps 4 to 7 until you get two consecutive weights that are equal, at which point you can assume that all the moisture in the soil sample has gone and all that is left is dried soil organic matter and the mineral content.
8 - Record the final dried weight..
9 - Burn the soil for 8 hours at 400C.
10 - Weigh the sample.
11 - Burn for a further hour.
12 - Weigh the sample.
13 - Repeat steps 10 to 12 until you get two consecutive weights that are equal, at which point you can assume that all the organic matter in the soil has gone and all that is left is the mineral content.
14 - Record the final burnt weight.

Calculations

To work out

% soil moisture = 100 x ((wet soil weight - dried soil weight) / wet soil weight)
% soil organic matter = 100 x ((dried soil weight - burnt soil weight) / dried soil weight)

Weight of grams of soil organic matter per cm3 soil

(dried soil weight in grams - burnt soil weight in grams) / volume in cm3

REMEMBER to subtract the weight of the foil container each time to ensure you are using ONLY the weight of the soil in the calculations

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Soil sample data

Sample number	Volume of soil sample ml / cm3	Weight of foil container grams	Weight of foil + wet soil grams	Weight of foil + dried soil grams	Weight of foil + burnt soil grams
1	40	1.71	33.17	16.98	6.56
2	60	1.73	19.87	18.7	17.42
3	70	1.71	23.47	19.22	16.95
4	65	1.74	21.08	18.84	17.25

Have a go at working out the % moisture, % soil organic matter and the weight of the soil organic matter per cm3 of soil.

Once you have the weight of the soil organic matter per cm3 you can divide this by 2 to get an estimate of the weight of CARBON per cm3.

Finally you can multiply the weight of carbon / cm3 by 3.67 (the difference in molecular weight between a carbon atom and a molecule of carbon dioxide) to estimate the weight of CO2 that is stored in each cm3 of soil.

If these sums seem daunting then the Excel spreadsheet will do them for you. You can also use this spreadsheet to check your answers, or to use with your own data if you choose to study soil carbon for your NEA.

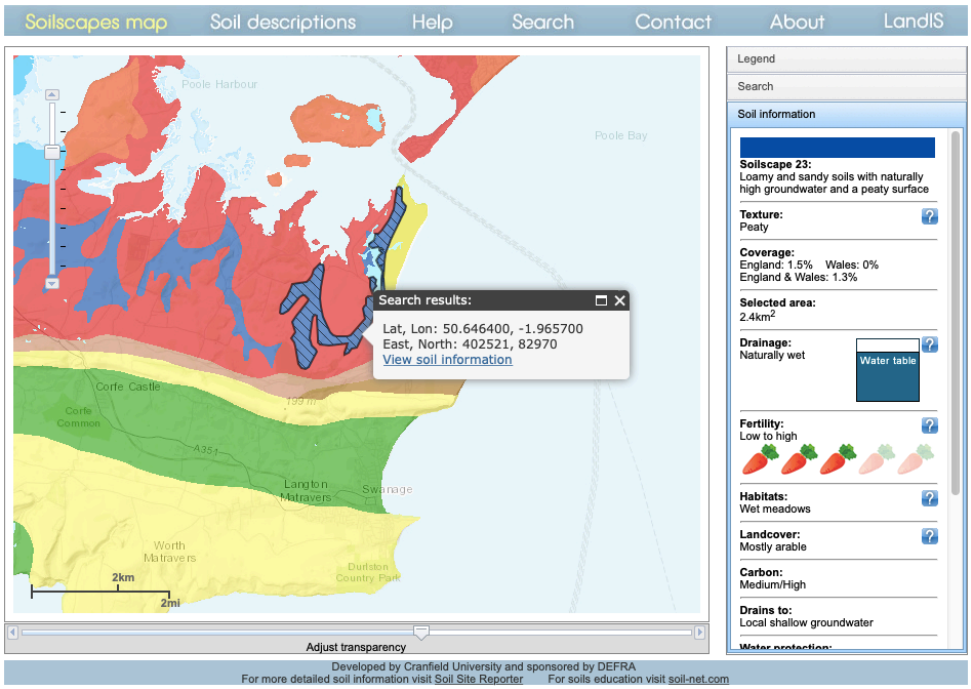
Data analysis

We need to make sense of this data.

What factors determine the amount of carbon stored in the soil organic matter in our four samples?

Why is there such a variation in the amounts?

You may find some of the answers by looking at some secondary data about the soils in our four study locations.



This website is an excellent source of secondary data on soils in the UK

http://www.landis.org.uk/soilscapes

You can find the exact locations of our field study sites by entering the latitude and longitude from page one of this worksheet into the search box.

Select GO and then click on view soil information.

Is there a consistent relationship between the different values of soil carbon and any of the other soil properties at each of our four field study sites? Moisture? Texture? Land use? Relief?

Conclusion and evaluation

What do you think is the main factor that determines the amount of carbon stored in soil organic matter?

Have a look at our study area on the BGS Geology of Britain Viewer website - what do you notice about the patterns of soil types and rock types?

https://mapapps.bgs.ac.uk/geologyofbritain/home.html

How could you extend this study to test your conclusion further?

How accurate were the field techniques? For example consider the method used to determine the volume of each soil sample. Can you think of a more accurate method?

Further research

There is a growing body of literature and research investigating the role of soil organic matter and carbon storage. Here are a few good links to get you started….

https://www.youtube.com/watch?v=Z91QsZA1l_w

https://knepp.co.uk/carbon-sequestration

https://www.youtube.com/watch?v=wgmssrVInP0