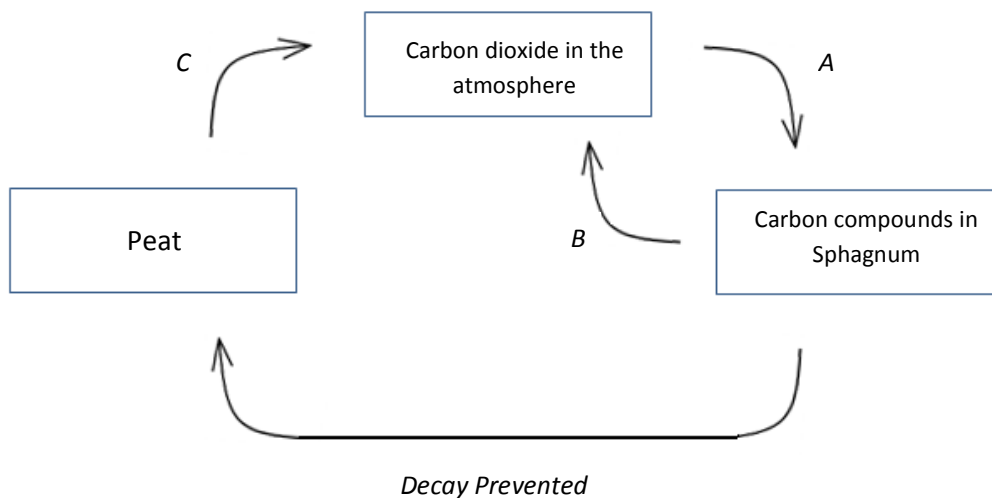




The Carbon Cycle

Peat is a type of soil made up of partially decomposed plant matter. Peat forms where the production of plant biomass is greater than its breakdown. On blanket bogs the water table is high resulting in anaerobic conditions just beneath the surface. Sphagnum moss contributes to the formation of peat because its cells hold enormous amounts of water. Cells may hold up to 26 times their dry weight in water this means that as it grows Sphagnum can slowly move onto drier land and therefore extend the bog area. In addition Sphagnum has phenolic compounds embedded in its cell walls, making it harder to decompose. Together these conditions mean that dead Sphagnum biomass decays slowly when it is near the surface, but as it becomes buried deeper within the profile decay is prevented and peat forms. Peat forms at a rate of around 1mm each year. The figure below shows part of the Carbon Cycle that takes place with a Blanket Bog.



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1. Name the processes which are represented by arrows A and B.
2. Describe why Blanket Bogs are considered to be a 'Carbon sink'.
3. Explain why an increase in rainfall and a reduction in air temperature would increase the rate of peat formation.
4. Arrow C could be represented by a number of different processes. Explain why each of the following would occur and how the process would create an increase in atmospheric carbon dioxide.
 - a. Peat burnt as fuel
 - b. Wildfires remove all the vegetation from the surface of the peat.
 - c. Atmospheric pollution kills Sphagnum moss.

Statistical Skills and the Carbon Cycle

During the restoration of Blanket Bog sites on Bleaklow Moor, the MoorLIFE Ecologists wanted to study variations in the depth of the water-table. Water-table measurements were taken from manual dip wells. Dip wells consist of long plastic pipes with holes drilled down the sides to allow water to enter the pipe and fill the hole. This creates a hole free of soil to measure the water depth.

Water depth is measured by using a length of plastic tubing. By blowing down the tubing as if it were a straw you can detect the level of water when you hear the water bubbling. The length of tube is measured, and the height of dip well above the peat surface is subtracted to give depth of the water-table below the surface.



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Joseph's Patch is a late stage restored site, having been treated with lime, fertiliser and grass seed in 2003 the vegetation is starting to re-establish. Trenches A is a heavily degraded bare peat site, which will remain untreated to use as a reference site. Penguins is an intact site which has no need for restoration.

Each site has clusters of 15 to 20 dip wells within a 30m x 30m area. All three sites were measured on the same day and so were subject to similar weather conditions.

For each site complete the following:

- a. Calculate the average dip well reading over the recording period.
- b. Calculate the standard deviation in dip well readings.
- c. Calculate the standard error to test for significant differences between the sites.

When you have done this, plot a suitable graph to show the averages and error bars for the three sites. Then answer the questions below.

1. Why are reference sites important?
2. Which variable was the independent variable and which the dependant variable?
3. Which site showed the greatest variation in its water-table over the recording period? By how much does it vary?
4. Suggest why there might be variations in water-table on a site from week to week. Can you also explain why some sites have greater variation in water table than others?
5. Using your graph, explain whether the sites have statistically significant differences in their water-tables? What might cause any differences? What conclusions can you draw about the success of the restoration of Joseph's Patch so far?

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Table 1: Average water-table depths (mm) for the dip wells on Bleaklow.

Date	29/09/2011	06/10/2011	13/10/2011	20/10/2011	27/10/2011	03/11/2011	10/11/2011	17/11/2011	24/11/2011	01/12/2011
Joseph's Patch	47.59	39.52	40.55	41.27	43.72	39.97	44.03	44.89	47.64	42.05
Trenches A	48.17	52.09	34.37	41.08	40.87	38.73	42.97	44.35	48.53	42.82
Penguins	27.0	14.9	16.5	16.8	15.5	15.6	15.5	17.0	20.6	15.6

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