

# Year 12 Transition Work Part 1a:

## Physical Geography Carbon Article



This activity will help prepare you for the Water and Carbon Cycles topic, which is part of the first topic that you will study in physical geography.

Read the following article and make notes by selecting the important information for each of the paragraphs in the article. Note the key terms, processes, facts, causes and effects. Consider these at a variety of scales. This can be typed or hand written.

Here's an example of the notes that you might take from the first paragraph:

### Introduction

- The Arctic is warmer faster than other areas on Earth.
- There are complex food chains in the Arctic.
- Organic detritus builds up due to incomplete decomposition.
- UK contains peatbogs with large amounts of organic detritus.

You may wish to categorise your notes, such as: facts, key terms or processes

## THE PERMAFROST CARBON FEEDBACK

# The permafrost carbon feedback

## The impact of global warming on Arctic ecosystems

Philip Wooley

The Arctic is warming faster than the rest of the planet, and this is affecting processes at all scales, from the molecular to the ecosystem. This article looks at the melting of permafrost, which not only impacts on landscapes, habitats and human activity, but could lead to massive increases in greenhouse-gas emissions

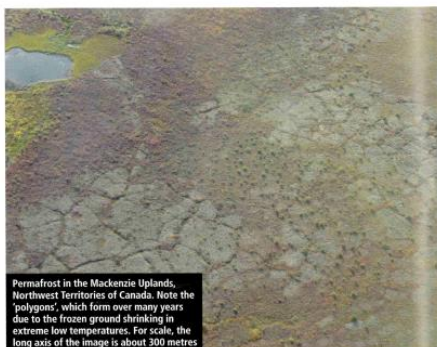
Despite extremes of cold and months of darkness, the Arctic supports complex food chains, from algae and cyanobacteria to large mammals. When these organisms die, their remains become part of the 'detritus' system. Organic detritus which does not fully decompose plays an important role as organic matter in soil in all environments. But in cold environments such as the Arctic, incomplete decomposition can lead to massive accumulations of organic matter, and thus carbon, in soils and sediments.

A similar process in UK uplands following the retreat of the British-Irish ice sheet between 27,000 and 11,500 years ago produced our peatlands and blanket bogs, where cold and wet conditions have restricted decomposition processes.

These areas of preserved organic matter act as huge carbon stores.

### Permafrost

Much of the Arctic land surface, and adjoining land to the south, is underlain by permafrost. This is defined by the International Permafrost Association as 'ground (soil) or rock and



Permafrost in the Mackenzie Uplands, Northwest Territories of Canada. Note the polygons, which form over many years due to the frozen ground shrinking in extreme low temperatures. For scale, the long axis of the image is about 300 metres



Figure 1 Permafrost extent in the northern hemisphere

included ice or organic material) that remains at or below 0°C for at least two consecutive years'. Much of this permafrost formed during colder glacial periods, but persists in locations

where the mean annual temperatures are too low, and the thaw season too short, for thaw to penetrate much more than a metre or so below the ground surface. Permafrost now occurs beneath 24% (23 million km<sup>2</sup>) of the exposed land area in the northern hemisphere (Figure 1). This is an area 95 times the size of the UK and it extends well beyond the Arctic land surface (which covers around 14 million km<sup>2</sup>). See Box 1.

### 'detritus deep-freeze'

The decomposition of plant and animal remains in soils is mainly carried out by

### GeographyReviewExtra

For a quiz on the Arctic and Antarctic, go to: [www.hoddereducation.co.uk/geographyreviewextras](http://www.hoddereducation.co.uk/geographyreviewextras)

### Box 1 What is the Arctic?

In planetary terms, the Arctic comprises the area within the Arctic circle, an imaginary line that circles the globe at approximately 66.5°N. The Earth's axis is tilted 23.5° from the plane of its orbit around the sun (90° minus 66.5°). So, at the (northern hemisphere) winter solstice, areas north of 66.5°N receive no direct sunlight. This varies in duration from just 1 day of the year at the Arctic circle, to 6 months of the year at the north pole. Conversely, at the summer solstice, areas to the north of 66.5°N receive direct sunlight 24 hours a day.

There are several other ways in which Arctic regions are defined (see [www.tinyurl.com/y9s6a4x4](http://www.tinyurl.com/y9s6a4x4)), depending on context: environmental, biological, economic, legal or social. Biologists often consider the Arctic treetline (to the north of which boreal forest gives way to treeless tundra) as delimiting the Arctic, but this excludes large areas of forest, and also permafrost regions, both north and south of the Arctic circle.



Midnight on the Arctic tundra of Northwest Territories

\*See attached article

Please complete the other Transition Tasks.