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Environment: Treading lightly on the Earth

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Contents

Introduction 4
Learning Outcomes 6
1 Introduction 7
1.1 What is the carbon footprint and why is it important? 7

Introduction

As part of a review of content, this course will be deleted from OpenLearn on 18 December 2018. An updated version will be made available at this point. For more Science, Maths & Technology courses visit here.

This course focuses on the problem of greenhouse gas emissions, especially carbon dioxide, and explore what you can do to lighten those emissions to help reduce the rate of climate change. You will assess your 'carbon footprint' and see what actions you and, if relevant, other household members could take to lighten that footprint. You will also better understand which actions are more and less effective, and the scope and limits of what individuals can do at the personal and household level.

Figure 1 The greenhouse effect due to increasing concentrations of carbon dioxide and other greenhouse gases in the Earth's atmosphere

You'll explore the answers to questions such as:

- What is the carbon reduction effect of changing your eating habits, compared to driving fewer miles or flying less often?
- By how much would you need to reduce your carbon footprint to achieve an environmentally ‘sustainable’ level of emissions?

This OpenLearn course is an adapted extract from the Open University course U116 *Environment: journeys through a changing world*.

Learning Outcomes

After studying this course, you should be able to:

- understand the problem of green-house gas emissions
- understand what can be done as an individual or household to lighten those emissions
- identify how much of a reduction in carbon footprint is needed personally to achieve an environmentally ‘sustainable’ level of emission.

1 Introduction

1.1 What is the carbon footprint and why is it important?

The carbon footprint is the annual amount of greenhouse gas emissions, mainly carbon dioxide, that result from the activities of an individual or a group of people, especially their use of energy and transport and consumption of goods and services. It's measured as the ***mass***, in kilograms or tonnes per year, either of carbon dioxide (CO_2) emissions alone, or of the ***carbon dioxide equivalent*** (CO_2e) effect of other greenhouse gas emissions.

The carbon footprint can also be calculated for an event, such as a football match or music festival, or of providing a product, such as a computer or a bag of potato crisps.

The carbon footprint is an ***environmental indicator***: a way of measuring impacts on the environment. There are many other environmental indicators that measure different impacts, such as water pollution, loss of biodiversity and depletion of mineral resources (Box 1). This part focuses on only this single measure of $CO_2$and other greenhouse gas emissions, but you should be aware that the carbon footprint doesn't measure other impacts, except perhaps indirectly.

Box 1 Carbon footprint and ecological footprint

Another widely used environmental indicator is the ***ecological footprint***, which is a measure of a population's (household, city, nation, etc.) environmental impact based on the *area of land and sea* theoretically required to indefinitely support their lifestyle at a given level of technology.

The ecological footprint measures the area of land and sea required to produce the population's food and accommodate its roads, buildings, etc. as well as the forested area required to absorb the population's CO_2 emissions. So the ecological footprint measures the carbon footprint component of a population's environmental impact using land area. Sometimes 10% land area is added to the ecological footprint for biodiversity conservation. The ecological footprint is the indicator used to support the argument that about three planet Earths would be needed if everyone in the world tried to live the lifestyle of an average European, which is clearly unsustainable. You'll encounter the ecological footprint again in Part 4 of this block.

1.1.1 Carbon dioxide and other greenhouse gases

Carbon dioxide (CO_2) is used as the basis for the carbon footprint because it is by far the main contributor to the enhanced greenhouse effect from human activity (mainly burning fossil fuels, clearing forests and making cement). So, often only CO_2 is counted in the carbon footprint. However, for a more complete measure of the carbon footprint the other

human-generated greenhouse gases are converted into a CO_2 equivalent (in kilograms or tonnes CO_2e) in terms of their global warming effect and added to the footprint.

The two main non-CO_2 greenhouse gases associated with human activity are methane (CH_4, mainly from cattle belching, manure spreading, wet rice growing and decomposing waste) and nitrous oxide (N_2O, mainly from nitrogen fertilisers and industrial processes). One tonne of methane has the equivalent global warming potential of 21 tonnes of CO_2, while one tonne of nitrous oxide is equivalent to 310 tonnes of CO_2. But because the amounts of methane and nitrous oxide released are much smaller, their emissions together add about 15% to the UK's contribution, and about 25% globally, to the enhanced greenhouse effect. This means that other greenhouse gases should not be ignored when assessing a carbon footprint, at least of individuals or households, although to simplify calculations they often are.

I'll use the total CO_2 equivalent effect of carbon dioxide plus other greenhouse gases whenever possible, but where only information on carbon dioxide is available, I'll have to use only CO_2 emissions when discussing carbon footprints.

1.1.2 The carbon footprint boundary

Depending on where you draw the boundary, the carbon footprint can apply to an individual person, a household, an organisation or event, a product, a city, region or country, or the whole world. I'll mainly be considering the footprints of individuals, ***households*** and the countries they occupy.

But even then the boundary needs to be defined carefully. Sometimes the carbon footprint is taken to mean the individual's or household's *direct* CO_2 emissions, mainly from burning fossil fuels for home heating and car driving. But this leaves out the individual's or household's *indirect* CO_2 equivalent emissions arising from the production and distribution of the food, drink and other goods and services they consume, ranging from clothes to electronic products, banking and medical services, and even Open University courses (Figure 2).