

# Teaching Guide

## Topic 8: Human systems and resource use

### Topic map

Sub-topic number and name	Learning outcome	Number of lessons (suggested) 1 hour per lesson	Relevant material
8.01 Human population dynamics	Models and indicators are used to quantify human population dynamics.  A range of factors affect human population growth rates.	4	Pages 350–371  Figures 8.01–8.14  Self-assessment questions 8.01.01–8.01.04  Case studies 8.01.01, 8.01.02  End-of-topic question 1
8.02 Resource use in society	The renewability of natural capital has implications for its sustainable use.  The status and economic value of natural capital is dynamic.	4	Pages 372–388  Figures 8.15–8.20  Self-assessment questions 8.02.01–8.02.05  Case study 8.02.01  End-of-topic question 2
8.03 Solid domestic waste	Solid domestic waste is increasing because of increases in the human population and consumption.  The production and management of solid domestic waste can influence sustainability.	3	Pages 389–401  Figures 8.21–8.28  Self-assessment questions 8.03.01–8.03.03  Case study 8.03.01  End-of-topic question 3
8.04 Human population carrying capacity	The carrying capacity of the environment for humans is difficult	5	Pages 402–414  Figures 8.29–8.40

	to quantify.  Ecological footprint is a model to determine whether or not human populations are living within the carrying capacity.		Self-assessment questions 8.04.01–8.04.03  Case study 8.04.01  End-of-topic question – none
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## Sub-topic 8.01: Human population dynamics

### Overview

Most students are likely to have some idea of the basics of population dynamics, particularly the birth rate, death rate, rate of natural change and concept of a population pyramid. If they studied geography at the preceding level, they are also likely to be familiar with the model of demographic transition. Total fertility rate, the concept of doubling time, population projections and the impact of national and international policies are likely to be new ideas. Most students will not have calculated values for the main demographic indicators.

Students will calculate values for crude birth rate, crude death rate, rate of natural change, total fertility rate and doubling time. They will also analyse age–gender pyramids and diagrams of demographic transition; discuss the use of models in predicting population growth; explain the nature and implications of population growth; analyse the impact of national and international development policies on human populations; and discuss the cultural, historical, religious, social, political and economic factors that influence population dynamics.

### Suggested activities

#### Possible starters

Describe the population of the region in which students live as an aid to thinking about population composition: age, gender, ethnicity, socio-economic groupings, and so on.

Calculate values for basic demographic indicators from basic data for an imaginary small island population, say 5000 in total. If, during the course of a year, there are 150 births and 60 deaths (and there is no immigration or emigration), what are: (a) the birth rate, (b) the death rate and (c) the total population at the end of the year? Once students are confident with simple calculations, they will be able to work with demographic data for actual countries with confidence.

Videos that provide good, but brief, introductions to human population growth can be found at: [www.earthsky.org/earth/video-human-population-by-the-billion](http://www.earthsky.org/earth/video-human-population-by-the-billion) and [www.npr.org/2011/10/31/141816460/visualizing-how-a-population-grows-to-7-billion](http://www.npr.org/2011/10/31/141816460/visualizing-how-a-population-grows-to-7-billion)

### Main lesson content

- Use a case study of a country that has gone through at least four stages of the model of demographic transition to introduce this topic. For example, there is detailed documentation of the demographic history of England and Wales in recent centuries. It then becomes easier to understand the demographic transition stage of individual countries at the present time and to see what is likely to occur in the future.
- Examples from earlier sub-topics can be used to assess the impact of population growth on the Earth's systems – soil, water, forests, sources of energy and minerals, and the atmosphere.
- Establish the association of age–gender pyramids with different stages of demographic transition. Students need to understand how a population pyramid illustrates the population history of a country for the previous century or so (from the youngest to the oldest people in a population). This can be illustrated with pyramids showing the impact of periods of high natural increase, rapidly falling natural increase, significant periods of immigration and emigration, and losses during major wars.
- Useful online sources of information and resources are:
  - [www.prb.org](http://www.prb.org) – Population Reference Bureau. This Washington-based organisation provides a wide range of resources relating to human populations. The annually updated World Population Data Sheet is its most popular and widely used resource
  - [www.pbs.org/wgbh/nova/worldbalance](http://www.pbs.org/wgbh/nova/worldbalance) – examines a wide range of population issues affecting countries across the economic spectrum
  - [www.demographic-research.org](http://www.demographic-research.org) – a journal of population sciences published by the Max Planck Institute for Demographic Research in Rostock, Germany
  - [www.chinadaily.com.cn](http://www.chinadaily.com.cn) – a useful source of up-to-date information on China's population and related issues.

### **Common misunderstandings and misconceptions**

Some students find it difficult to grasp that the crude death rate in rich countries can be higher than in poorer nations. Careful explanation that the crude death rate is the most general measure of mortality and that it is heavily influenced by age structure, followed by reference to age-specific mortality rates, should overcome this obstacle. Students can also confuse absolute data (e.g. natural increase in millions) with relative data (the rate of natural increase per 1000 or as a percentage).

### **Supporting struggling students**

Some students struggle with the concepts of this sub-topic. The BBC Bitesize series is a very good resource here. The 'Population' section of the Bitesize series includes sections on global population growth, population patterns, population distribution and density, and managing population changes. There is also a video on population trends:

<http://www.bbc.co.uk/education/subjects/zkw76sg>



### **Challenging high achievers**

The most able students could profitably focus on the international-mindedness section of the syllabus by examining the relationship between the economy and population in a sample of countries, as well as investigating the influence of international organisations such as the World Bank, the International Monetary Fund and the World Trade Organization.

### **Homework suggestions**

Illustrate the data in Tables 8.01 and 8.02 in the textbook using a variety of graphical methods.

Prepare for a debate, being given the role of either a neo-Malthusian or an anti-Malthusian.

The case study in the Elevate materials, 'Demographic transition in England and Wales', provides detailed material for a range of homework questions.

### **Cross-references with other sub-topics**

1.04 Sustainability, 1.05 Humans and pollution, 7.02 Climate change – causes and impacts, 8.04 Human population carrying capacity.

## **Sub-topic 8.02: Resource use in society**

### **Overview**

The term 'natural capital' is likely to be new to many students, although they should be familiar with the distinction between renewable and non-renewable resources. Students are unlikely to know the concept of natural income.

Students will outline an example of how renewable and non-renewable natural capital has been mismanaged, explain the dynamic nature of the concept of natural capital, understand the relationship between natural capital and natural income, and appreciate the marked cultural differences in attitude to the management of natural capital.

### **Suggested activities**

#### Possible starters

Attempt to list as many sources of natural capital as possible. Links with previous sub-topics should make this a relatively straightforward exercise. Students could then undertake to divide their list into renewable and non-renewable natural capital.

Use key images to illustrate the damage caused by (a) extraction, (b) transport and (c) processing of a renewable natural capital. Different examples could be discussed in terms of the level of impact.

#### Main lesson content

- Remember to give enough attention to non-living natural capital, such as groundwater and the ozone layer, as well as living species and ecosystems. Good use of selected resources can help achieve an appropriate balance.



- Examples of how renewable natural capital can be used sustainably or unsustainably can provide clarity. Examples of various degrees of resource depletion can show how quickly a resource base can be diminished when badly mismanaged.
- Give students a list of the attributes of natural capital which they can subdivide into goods and services. Discussion of different types of value (aesthetic, cultural, economic, etc.) could follow.
- Various examples can be used to show that the concept of natural capital is dynamic. The selective use of images could be very effective here.
- Useful online sources of information and resources are:
  - [www.conservation.org/pages/nature.aspx](http://www.conservation.org/pages/nature.aspx) – resources on valuing and accounting for natural capital. Resources include a series of videos (*Mother Nature, The Ocean, The Rainforest, The Soil, and Water*)
  - [www.naturalcapitalproject.org](http://www.naturalcapitalproject.org) – this website includes information on science for action, publications and news
  - [www.naturalcapitalcoalition.org](http://www.naturalcapitalcoalition.org) – provides a range of relevant video material and other resources.

### **Common misunderstandings and misconceptions**

Some students have difficulty in understanding that natural capital provides goods and services, that the valuation of natural capital can be divided into use of valuation and non-use of valuation, and that the concept of natural capital is dynamic. The distinction between natural capital and natural income can also be difficult to grasp.

### **Supporting struggling students**

Learning and understanding key terms is an important aspect of achieving clarity in terms of this section of the syllabus.

### **Challenging high achievers**

High achievers could be challenged to examine cultural differences in attitudes to the management of natural capital in more detail and present their findings to the group as a whole.

### **Homework suggestions**

Select a range of images from the internet to show the natural capital of a particular country, each student researching a different country. They could then give brief presentations of their findings.

Research the aesthetic value of a protected area of the student's choice.

### **Cross-references with other sub-topics**

1.01 Environmental value systems, 1.04 Sustainability.

## Sub-topic 8.03: Solid domestic waste

### Overview

The degree of prior knowledge that students have depends on the courses followed in the preceding couple of years. However, almost all should be aware of the main waste disposal options. Government legislation relating to waste is likely to be an entirely new topic for students.

Students will evaluate solid domestic waste disposal options, compare and contrast pollution management strategies for solid domestic waste, and evaluate pollution management strategies by considering recycling, landfill, incineration and composting. They will learn that differences in the development level of countries can influence the amount and type of solid domestic waste generated, and appreciate that pollution can be a transborder issue.

### Suggested activities

#### Possible starters

Brainstorm to identify different types of solid domestic waste. Students could be asked to keep a log of the solid domestic waste from their own household for a week. Each student could then report his or her findings to the whole class. Standard graphical techniques (bar graphs, pie charts, etc.) could be used to show the aggregated results of the whole class.

A selection of key images of different types of solid domestic waste would be useful to ensure clarity about the different types of such waste.

#### Main lesson content

- Working in groups, students could build up cost–benefit statements for landfills, incineration, recycling and composting. Each group could report back to the whole class.
- Fieldwork may be an option if there are examples of waste disposal not too far from the school/college. If not, it is likely that data on waste disposal in the local area will be available from the local authority (council). Waste disposal methods and trends could be analysed and the results illustrated in a range of different ways. Are there any examples of landfill reclamation in the local area?
- A useful online source of information and resources is:  
[www.teachengineering.org/view\\_lesson.php?url=collection/cub\\_/lessons/cub\\_environ/cub\\_environ\\_lesson04.xml](http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_environ/cub_environ_lesson04.xml) – students explore solid waste and its effects on the environment.

### Common misunderstandings and misconceptions

The detailed distinction between biodegradable and non-biodegradable waste can be a little confusing for some.



### **Supporting struggling students**

Using case studies to reinforce the knowledge and understanding requirements of this sub-topic can be reassuring for students finding the content of the syllabus difficult.

### **Challenging high achievers**

Issues that are most likely to engage high achievers in further research are the influence of cultural factors on the management of solid domestic waste and the impact of government legislation.

### **Homework suggestions**

Keep a waste diary for a week and then give a brief presentation in class.

Research the latest information about the great Pacific garbage patch.

Research information about a landfill site or an incineration plant in the local region.

### **Cross-references with other sub-topics**

1.05 Humans and pollution, 2.03 Flows of energy and matter, 4.04 Water pollution, 5.03 Soil degradation and conservation, 6.04 Acid deposition.

## **Sub-topic 8.04: Human population carrying capacity**

### **Overview**

Some students are likely to have come across the concepts of carrying capacity and ecological footprint, but much of the detail in this part of the syllabus is likely to be new to them.

Students will evaluate the application of carrying capacity to local and global human populations, compare and contrast the differences in the ecological footprint of two countries, and evaluate how environmental value systems impact on the ecological footprints of individuals or populations.

### **Suggested activities**

#### Possible starters

Students could consider how close their region is to human carrying capacity. How are they going to judge this? To what extent do opinions vary within the class? What might be the reasons for differences of opinion?

#### Main lesson content

- A useful activity is to consider occasions in the past when there were serious concerns about the capacity of the environment to cope with increases in human population. Reference could be made to the likes of Confucius, Plato, Aristotle, Malthus and Karl Marx.
- Students would benefit from using an ecological footprint calculator to measure their own ecological footprint, which they could compare with those of their fellow students.





- Alongside variations in the total ecological footprint of different countries, students should examine the variations by individual components of a sample of nations.
- Useful online sources of information and resources include:
  - [www.populationmatters.org](http://www.populationmatters.org) – Population Matters – a website promoting a sustainable family size and mindful consumption
  - [www.footprint.wwf.org.uk](http://www.footprint.wwf.org.uk) – WWF footprint calculator. Our lifestyle choices make up our environmental footprint. Measuring a person's footprint takes less than five minutes on this website.

### **Common misunderstandings and misconceptions**

Some students confuse the terms 'carbon footprint' and 'ecological footprint', forgetting that the former is one of the six components of the latter. The idea that the ecological footprint is a model (and that its composition could change in the future) can be difficult for some students to grasp.

### **Supporting struggling students**

The appropriate use of video clips and other relevant illustrations, allied to good case studies, can do much to overcome the conceptual obstacles faced by some students.

### **Challenging high achievers**

Able and enthusiastic students might want to find examples of carrying capacity being exceeded in the past, along with countries and regions that are close to or beyond that situation now. They might want to suggest what is likely to happen in such situations.

### **Homework suggestions**

Choose a location that appears to be at or near carrying capacity and select images from the internet to show why.

Students can calculate their own ecological footprint using a website such as [www.bestfootforward.com](http://www.bestfootforward.com)

Prepare a presentation entitled 'How technological advance can increase global carrying capacity'.

### **Cross-references with other sub-topics**

1.04 Sustainability, 1.05 Humans and pollution, 4.02 Access to fresh water, 5.02 Terrestrial food production systems and food choices, 7.01 Energy choices and security, 8.02 Resource use in society.