

# Teaching Guide

## Topic 5: Soil systems and terrestrial food production systems and societies

### Topic map

Sub-topic number and name	Learning outcome	Number of lessons (suggested) 1 hour per lesson	Relevant material
5.01 Introduction to soil systems	<p>The soil system is a dynamic ecosystem with inputs, outputs, storages and flows.</p> <p>Soil quality influences the primary productivity of an area.</p>	4	<p>Pages 213–222</p> <p>Figures 5.01–5.07</p> <p>Self-assessment questions 5.01.01–5.01.03</p> <p>Case study 5.01.01</p> <p>End-of-topic question 2</p>
5.02 Terrestrial food production systems and food choices	<p>Terrestrial food production systems are influenced by socio-political, economic and ecological factors, and consumers support different food production systems.</p> <p>Food supplies and land for food production are unevenly distributed, and this can lead to conflict.</p>	4	<p>Pages 223–238</p> <p>Figures 5.08–5.15</p> <p>Self-assessment questions 5.02.01–5.02.04</p> <p>Case studies 5.02.01, 5.02.02</p> <p>End-of-topic questions 1, 4</p>
5.03 Soil degradation and conservation	<p>Fertile soils require time to develop through the process of succession.</p> <p>Human activities may</p>	4	<p>Pages 239–254</p> <p>Figures 5.16–5.23</p> <p>Self-assessment questions 5.03.01–5.03.04</p> <p>Case studies 5.03.01, 5.03.02</p>

	<p>reduce soil fertility and increase soil erosion.</p> <p>Soil conservation strategies can preserve soil fertility and reduce soil erosion.</p>		End-of-topic question 3
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## Sub-topic 5.01: Introduction to soil systems

### Overview

Students' prior knowledge will vary depending on the science syllabus followed in the preceding two years, and whether or not they took geography as an option during these years. Most students should have some basic knowledge but will lack much of the detail required by this sub-topic.

Students will gain familiarity with the soil texture triangle diagram and a standard soil profile diagram. They should be able to outline the transfers, transformations, inputs, outputs, flows and storages within soil systems.

### Suggested activities

#### Possible starters

A brief field exercise could be conducted to study an area of bare soil in the school/college grounds or in a local open space and discuss what the soil looks like and how it feels to touch. Do students think it is a fertile soil? What is the type and quality of vegetation in the area? A soil sample could be taken to aid further debate back in the classroom.

There are many videos and weblinks that provide a good introduction to soil systems. *Deep Down and Dirty: The Science of Soil* [DVD, 2014, 50 minutes] at [www.greenplanetfilms.org](http://www.greenplanetfilms.org) covers the main points for this sub-topic.

#### Main lesson content

- This sub-topic provides many opportunities to use samples such as soil organisms, parent material and leaf litter. When students are examining the structure and properties of sand, clay and loam soils, samples of all three soils can be examined and tested for the characteristics listed in the syllabus.
- Another useful website is [www.soils.org.uk/teachers-and-educators](http://www.soils.org.uk/teachers-and-educators) (the British Society of Soil Science).

### **Common misunderstandings and misconceptions**

Some students may find the idea of the soil profile and the movements within it difficult to grasp. Videos that show slowly and clearly what happens within soil profiles can do much to enhance knowledge and understanding.

### **Supporting struggling students**

A useful source of easy-to-follow resources can be found at [www.thescienceofsoil.com/teacher-resources](http://www.thescienceofsoil.com/teacher-resources). Field observation and examination of samples in class can do much to support struggling students in particular.

### **Challenging high achievers**

Although this is not required by the syllabus, the most able students might want to study a few specific soil profiles such as of podzols and chernozems to see to what extent these can vary from the standard diagram in the textbook. Students can then suggest reasons for significant differences.

High achievers might also benefit from attempting to draw their own diagrams to explain processes that are not covered by a diagram in the textbook. They could present their efforts to the class and then look at established resources online to see how well they have done.

### **Homework suggestions**

The case study in the Elevate materials, 'Soil degradation and carbon farming in Australia', can provide the basis for a range of homework tasks. The case study analysis comprises five questions, and four key terms are highlighted.

Various research tasks could be set with regard to the recommended resources. The UN Food and Agriculture Organization's materials might provide a useful starting point for this type of exercise.

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

2.02 Communities and ecosystems, 2.03 Flows of energy and matter, 2.04 Biomes, zonation and succession, 2.05 Investigating ecosystems.

## **Sub-topic 5.02: Terrestrial food production systems and food choices**

### **Overview**

Most students should have some ideas about sustainability with regard to food production, but the detail of most of this sub-topic is likely to be new to them.

Students will analyse graphs and tables that illustrate the differences in inputs and outputs associated with food production systems, evaluate the relative environmental impacts of contrasting food production systems, and evaluate strategies to increase the sustainability of food production systems. They will keep a household food waste log for a week and monitor food waste in their school/college for a week.

## **Suggested activities**

### Possible starters

Brainstorm factors that influence sustainability and the extent of food inequalities around the world.

Discuss household food choices and the reasons why people eat different foods.

Discuss agricultural issues in the local region using press cuttings and photographs, and with reference to fieldwork in previous years.

### Main lesson content

- Discuss a wide range of interesting and relevant issues, such as food waste, cultural choices, and the declining availability of land for food production per capita. Websites that can provide useful resources include:
  - [www.fao.org/nr/aboutnr/nrl/en](http://www.fao.org/nr/aboutnr/nrl/en)
  - [www.globalsoilweek.org](http://www.globalsoilweek.org)
  - [www.ifpri.org](http://www.ifpri.org)
- If the opportunity for fieldwork in the local area exists, such studies could provide useful material for a number of aspects of this sub-topic.

## **Common misunderstandings and perceptions**

Some students struggle with the paradox that as the available land for food production per capita decreases (and other problems with regard to sustainability mount), global food production still continues to increase. It is useful to present the concept of time lag (which applies elsewhere in the subject): problems can mount until they have an absolute impact on production and world food supply might then begin to decrease.

## **Supporting struggling students**

Link the knowledge and understanding requirements of this sub-topic to the case studies for struggling students. If relevant local fieldwork can be organised, it really helps struggling students.

## **Challenging high achievers**

High achieving students might want to extend their analysis of case studies and examine issues of particular interest in more detail. There are many useful resources – such as [www.infonet-biovision.org](http://www.infonet-biovision.org) – which provides information on strengthening sustainable development of farmers and rural communities in Africa.

## **Homework suggestion**

Textbook self-assessment questions, case study analyses and end-of-topic questions can all be used for homework tasks. The case studies and other support materials also offer additional materials that can be used for homework.

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

1.01 Environmental value systems, 2.02 Communities and ecosystems, 5.01 Introduction to soil systems, 8.04 Human population carrying capacity.

## **Sub-topic 5.03: Soil degradation and conservation**

### **Overview**

Students should have a good understanding of the concept of succession from earlier sub-topics and have a general awareness of most of the issues to be covered in this section.

### **Suggested activities**

#### Possible starters

Brainstorm prior knowledge on succession and the way in which human activities impact on soil fertility.

#### Main lesson content

- The clear bullet-point itemisation of the knowledge and understanding section of this sub-topic provides a clear sequence of lesson topics. Issues such as deforestation, overgrazing, desertification and irrigation are likely to engender a high degree of interest. Useful websites include:
  - [www.unccd.int](http://www.unccd.int) – UN Convention to Combat Desertification
  - [www.unep.org](http://www.unep.org) – articles on a range of relevant issues
  - [www.greenpeace.org](http://www.greenpeace.org) – resources on desertification, deforestation and other relevant issues
  - [www.carbonfarmersofaustralia.com.au](http://www.carbonfarmersofaustralia.com.au) – provides detailed development on carbon farming in Australia.

### **Common misunderstandings and perceptions**

Difficulties can arise in making a clear distinction between the various soil conservation measures, and in distinguishing between processes such as toxification and salinisation.

### **Supporting struggling students**

The use of photographs and diagrams linked to specific examples can help clarify many points of difficulty.

### **Challenging high achievers**

Various extension exercises can be gleaned from websites dedicated to the content of this sub-topic. High achieving students can attempt to draw their own diagrams to explain processes such as desertification, salinisation and toxification.



### **Homework suggestion**

The self-assessment questions in the textbook can supply homework tasks, as can the case study analyses and end-of-topic questions. In addition, the teacher support materials offer additional material for homework tasks.

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

2.05 Investigation of ecosystems, 5.01 Introduction to soil systems, 5.02 Terrestrial food production systems and food choices, 7.02 Climate change – causes and impacts.