

Surname						Other Names					
Centre Number						Candidate Number					
Candidate Signature											

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General Certificate of Education
 June 2005
 Advanced Level Examination



ENVIRONMENTAL SCIENCE
Unit 4 Biotic Resource Management

ESC4

Monday 27 June 2005 Morning Session

No additional materials are required.
 You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 70.
- Mark allocations are shown in brackets.
- You are expected to use a calculator where appropriate.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.
- This unit assesses your understanding of the relationship between the different aspects of Environmental Science.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

Answer **all** questions in the spaces provided.

- 1 Complete the table by putting ticks to indicate whether the statements are true or false.

Statement	True	False
In subsistence farming, surplus production is burned.		
The purpose of milk quotas is to ensure UK production of cheese and yoghurt is maximised.		
Genetic variability cannot be introduced by vegetative propagation.		
Typically, agroecosystems involve the maintenance of complex food chains.		
Polyploidy always results in fast-growing plants.		

(5 marks)

- 2 Many organic farmers believe that it is best not to plough the soil. When seed beds have to be prepared, shallow cultivators are used which leave the deeper soil undisturbed.

- (a) The table summarises the results of an investigation into the effect of cultivating the soil to different depths during the preparation of a seed bed.

Cultivation depth / cms	Stability of peds in top 2.5 cm where 1.0 = max stability	Organic matter content / % in top 2.5 cm
0	0.560	5.83
5	0.574	5.83
10	0.555	5.43
25	0.527	5.05

Source: N. LAMPKIN, *Organic Farming* (Farming Press) 1994 © N. Lampkin 2002

5

(i) Which cultivation depth produces the highest ped stability and organic matter content in the surface soil?

.....
(1 mark)

(ii) What is the relationship between ped stability and organic matter content?

.....
(1 mark)

(b) Organic farmers often use green manures to maintain soil fertility rather than using artificial fertilisers. Green manures are crops that are dug back into the surface soil rather than being harvested.

Explain how using green manures may reduce the:

(i) contamination of aquifers;

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(4 marks)

(ii) enhanced greenhouse effect.

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(4 marks)

10

Turn over ►

- 3 (a) A Producer Subsidy Equivalent (PSE) is the percentage of food production costs that is paid through government subsidies and grants. The table shows the PSEs and nitrate fertiliser consumption of selected countries and regions in 2001.

Country / region	PSE / %	Fertiliser consumption / t N ha
New Zealand	3	26
United States	16	75
Canada	20	68
EU	42	316

- (i) Describe the trend shown.

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(1 mark)

- (ii) Suggest an explanation for the trend shown.

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(1 mark)

- (iii) Suggest why agriculture in the EU has led to serious soil erosion.

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(3 marks)

(b) With reference to a named plant or animal, outline the principle of selective breeding.

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(3 marks)

(c) Outline a technique, other than selective breeding, which could be used to try to increase the vitamin A content of rice.

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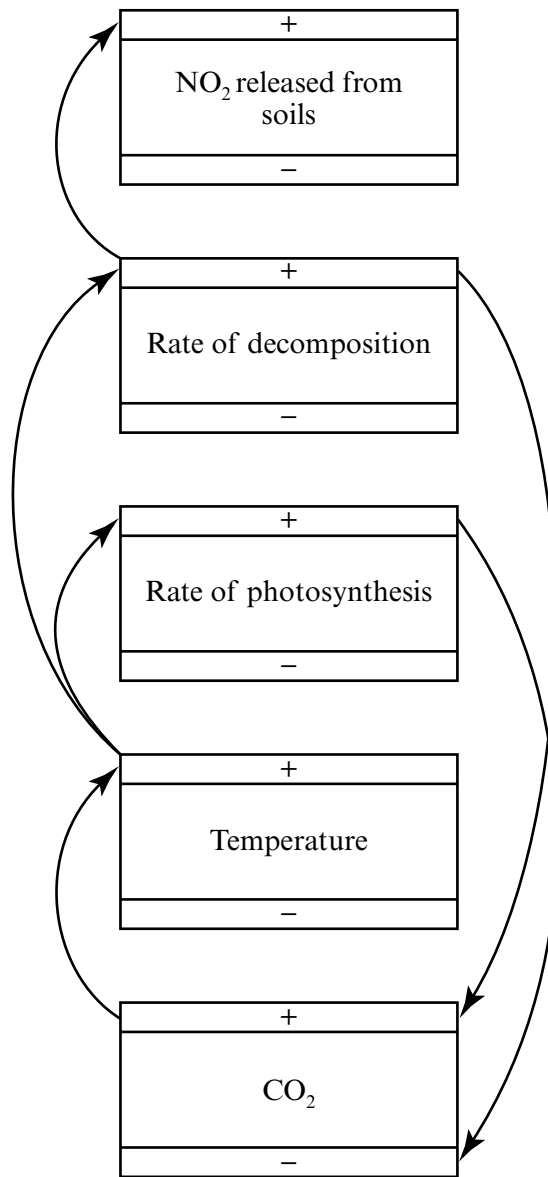
(2 marks)

$\frac{\quad}{10}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

- 4 (a) The diagram shows the possible effects of changing atmospheric conditions on soil nitrogen stores and photosynthesis.



Key: + Increasing
- Decreasing

Use information in the diagram to explain the terms:

- (i) limiting factors;

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(2 marks)

(ii) homeostasis.

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(4 marks)

(b) Using the diagram and your own knowledge, suggest how accelerating economic development in China may decrease the fertility of soils in Siberian forests.

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(4 marks)

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TURN OVER FOR THE NEXT QUESTION

Turn over ►

5 Global production of farmed fish has risen rapidly over the last 20 years from 8 million 1
 tonnes in 1984 to 40 million tonnes in 2004. Meanwhile, harvests of ocean fish have
 stabilised or declined and most scientists believe that wild stocks are being over-fished.
 Supporters of aquaculture argue that its continued growth will relieve pressure on wild
 stocks; its critics believe that it is a contributing factor to collapsing fisheries worldwide. 5

The farming of carnivorous species such as salmon and shrimp typically requires two to
 five kilograms of wild fish to produce each kilogram of high value fish. Between 1986 and
 1997, 8 of the top 20 wild species harvested from the ocean were small species, such as
 anchoveta, Atlantic herring and club mackerel, used for the production of fish meal for
 aquaculture and as animal feed. This depletes the food available for species such as cod, 10
 as well as for sea birds and seals.

Furthermore, confining large numbers of farmed fish in coastal waters, especially in
 mangroves and wetlands, threatens species diversity, generates large quantities of
 nutrients, imports disease and threatens native species with genetic contamination or
 competition. 15

The Ecological Society of America recommends:

- that governments should only encourage aquaculture of species low on the food web;
- more research into the use of soya and other vegetable based substitutes for fish feed;
- the use of microscopic plants to clean up fish wastes which could reduce pollution and
 generate a saleable product. 20

(a) How can scientists tell if stocks are being over-fished (line 3)?

.....

 (2 marks)

(b) What are the implications of the low energy efficiency of rearing carnivorous fish
 (lines 6–7)?

.....

 (2 marks)

(c) Suggest why coastal aquaculture is a threat in terms of:

(i) genetic contamination (line 14);

.....
.....
(2 marks)

(ii) the population dynamics of wild fish (lines 14–15).

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(2 marks)

(d) Use information in the text to explain what is meant by:

(i) intensive production systems;

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(4 marks)

(ii) sustainable yield.

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(3 marks)

6 Write an essay on **one** of the following topics. Credit will be given for your understanding of the relationship between different areas of the subject and also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.

EITHER (a) Discuss ways in which food resources and human population can be balanced.
(20 marks)

OR (b) Discuss the factors involved in the choice of agricultural production systems.
(20 marks)

Dotted lines for writing.

Turn over ►

