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| Surname | | | | | Other Names | | | | |
| Centre Number | | | | | Candidate Number | | | | |
| Candidate Signature | | | | | | | | | |

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General Certificate of Education
 June 2004
 Advanced Level Examination



ENVIRONMENTAL SCIENCE
Unit 4 Biotic Resource Management

ESC4

Monday 28 June 2004 Morning Session

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| <p>No additional materials are required. You may use a calculator.</p> |
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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 | | | |
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| Total (Column 2) | → | | |
| TOTAL | | | |
| Examiner's Initials | | | |

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

1 Complete the table.

| Process/Technique | Description |
|-------------------|--|
| | Use of corms, bulbs or runners to produce offspring that are genetically identical to parent plant |
| | Cultivation of food without using artificial fertilisers, synthetic pesticides or genetically-modified organisms |
| Transgenics | |

(3 marks)

2 (a) What is meant by the integrated control of pests?

.....

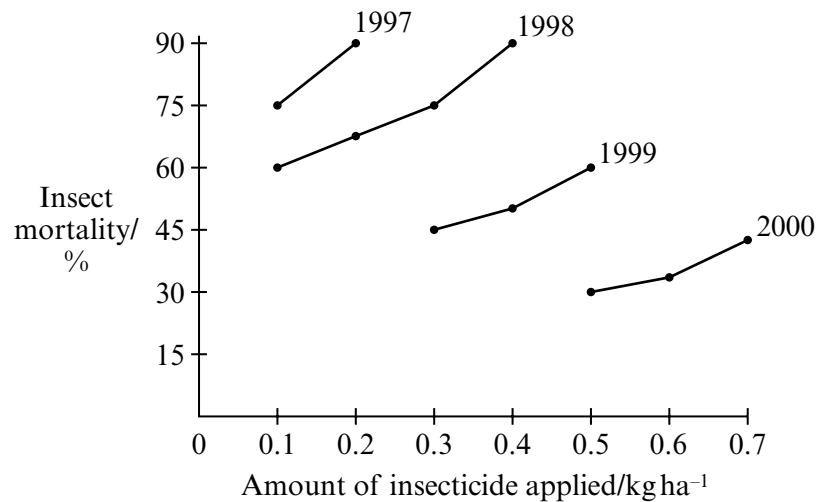
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(2 marks)

(b) The graph shows the effects of a four-year pest control programme using an insecticide.



(i) Describe the trend over time.

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(1 mark)

(ii) Explain this trend.

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(3 marks)

3 Suggest why:

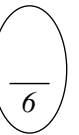
(a) a Friends of the Earth boycott of tropical hardwood in UK furniture stores may reduce sedimentation in the River Amazon;

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(3 marks)

(b) the incorporation of nitrogen-fixing genes in cereals may reduce water treatment costs.

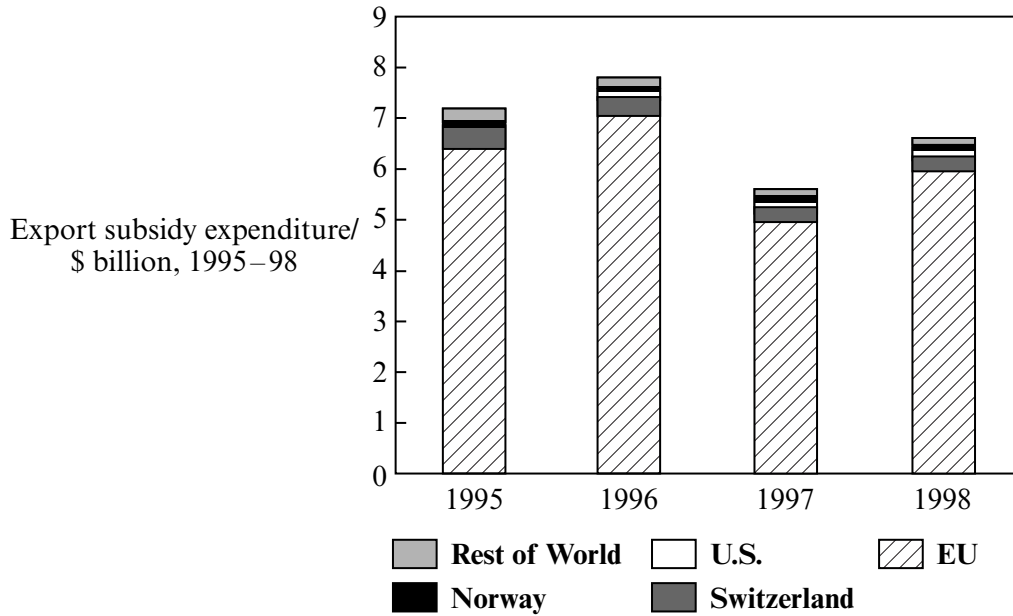
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(3 marks)

Turn over ►



4 An export subsidy is a payment made to farmers by the government, to encourage sales of domestic produce abroad. These subsidies encourage farmers to overproduce. By dumping these surpluses on the world market, subsidised farmers depress the world price for that product. This reduces even further the income of farmers in developing countries, whose governments cannot afford to offer any subsidies at all.

(a) The bar chart shows export subsidy expenditure by region 1995-1998.



Source: S. LEETMAA, *Agricultural Policy Reform – the Road Ahead* (USDA) 2001

Which region’s farmers have received the most export subsidies?

.....
(1 mark)

(b) Explain how export subsidies may have stimulated habitat loss in the UK.

.....
.....
(1 mark)

- (c) Strategies, such as the Agenda 2000 reforms, contain commitments to eliminate export subsidies and reduce overproduction.

Outline **one** method that has been used in the UK to try to reduce overproduction.

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(2 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

5 Scientists in Malaysia studied the effect of forest fragmentation on tree mortality. Some of the trees were growing in continuous forest whilst others were growing in forest fragments ranging in area from 1 hectare to 100 hectares. The percentage increase in mortality of trees at the edge when compared with trees in the centre of a patch of forest was measured. The bar chart shows this increase in mortality for trees of different sizes.

*The diagram is not reproduced here due to third-party copyright restraints.
Printed copies of this paper can be obtained by ordering ESC4 from
AQA Publications. Tel: 0161 953 1170*

(a) Summarise the data shown.

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(2 marks)

(b) How could these data be used in planning forest reserves?

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(2 marks)



6 (a) Give **three** reasons why fish farming is becoming more important than the harvesting of wild stocks.

- 1.
.....
- 2.
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- 3.
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(3 marks)

(b) Explain why the following practices may be used in intensive fish farming.

(i) The control of day length

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(ii) The application of pesticides

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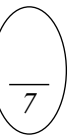
(iii) The splashing of water over boards or through screens

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(iv) The control of water flow rate in rearing tanks

.....

(4 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

7 Read the following passage and study the table.

The good news is that most analysts agree that world food production can keep up with population growth. Increased food production will be achieved by increasing the yield per plant, by increasing the amount of land used for agriculture and by increasing the intensity of

4 cropping (**Table 1**).

| | | Developing countries | Sub-Saharan Africa | Rest of Africa | East Asia | South Asia | Latin America |
|---|------------------------------|----------------------|--------------------|----------------|-----------|------------|---------------|
| Contribution to increased food production/ % | Increased yield per plant | 66 | 53 | 71 | 61 | 82 | 53 |
| | Increased land usage | 21 | 30 | 9 | 32 | 4 | 28 |
| | Increased cropping intensity | 13 | 17 | 20 | 7 | 14 | 19 |

Table 1: Estimated sources of increased crop production

The bad news is that achieving these increases will have a high environmental cost. The Food and Agriculture Organisation (FAO) of the United Nations estimates that half of the 90 million hectares that could be converted into crop lands by 2010 is currently forest. This represents a huge potential loss of carbon storage capacity and biodiversity. Another 6 million hectares is currently extensive grazing land and this could increase grazing pressure on the remaining pastures or displace livestock on to even more marginal lands.

Increased cropping intensity or the expansion of croplands on to arid areas may necessitate greater irrigation. The problems caused by over-extraction of groundwater may therefore become worse. Salinisation may mean that hard-won land has a very short productive life span. Increased cropping intensity will also mean greater energy subsidy which is unsustainable. The use of such fertilisers instead of organic matter may accelerate soil erosion. This may have immediate local effects, particularly in the tropics where fertility is concentrated near the surface. It may also threaten the economic viability of reservoirs hundreds of miles away.

Even at its current extent, agriculture is a significant contributor to anthropogenic sources of greenhouse gases, contributing 70% of the total amount of methane and nitrous oxide. Ironically, our attempts to feed the world may significantly alter regional climates, affecting productivity as well as increasing storms, flooding and erosion.

(a) Within which region will increased land usage make the smallest contribution to increased crop production (**Table 1**)?

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(1 mark)

(b) Explain:

(i) how forests act as a carbon store (line 8);

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(2 marks)

(ii) the harmful environmental effects of increasing grazing pressure on marginal lands (line 10);

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(3 marks)

(iii) why irrigation may lead to salinisation (line 13).

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(2 marks)

QUESTION 7 CONTINUES ON THE NEXT PAGE

Turn over ►

(c) Suggest why:

(i) greater energy subsidy is unsustainable (lines 14–15);

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(2 marks)

(ii) the use of artificial fertilisers may threaten the economic viability of reservoirs (lines 15–18).

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(4 marks)

(d) Explain why agriculture is a significant source of (lines 19–20):

(i) carbon dioxide;

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(2 marks)

(ii) methane;

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.....

(2 marks)

(iii) nitrous oxide (N₂O).

.....
.....

(2 marks)

8 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, also for the organisation and presentation of the essay and use of grammar, punctuation and spelling.

EITHER (a) “The environmental problems associated with agriculture, forestry and fishing are the result of simplified ecosystems.” Discuss this statement. (20 marks)

OR (b) Discuss the factors that influence the choice of an agricultural production system. (20 marks)

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Turn over ►

