



**ENVIRONMENTAL SYSTEMS  
STANDARD LEVEL  
PAPER 3**

Tuesday 22 May 2001 (morning)

1 hour 15 minutes

Name

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Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section I: Answer one Option from Section I in the spaces provided.
- Section II: Answer two Options from Section II in the spaces provided.
- You may continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the boxes below.

OPTIONS ANSWERED	EXAMINER	TEAM LEADER	IBCA
SECTION I .....	/15	/15	/15
SECTION II .....	/15	/15	/15
SECTION II .....	/15	/15	/15
NUMBER OF CONTINUATION BOOKLETS USED .....	TOTAL /45	TOTAL /45	TOTAL /45

SECTION I

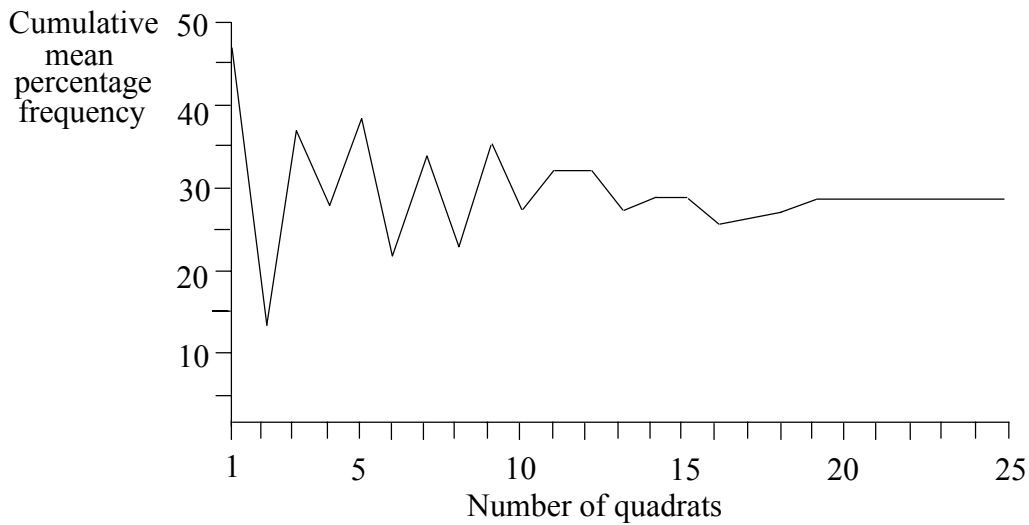
Options on analysing ecosystems – Options A, B and C

The compulsory question below relates to the detailed study of an ecosystem in either a marine, terrestrial or freshwater environment.

Indicate the ecosystem which you have studied and on which you will base your answers by marking (x) **one** box only.

Option		Mark (x) one box only
A.	Analysing Marine Ecosystems	
B.	Analysing Terrestrial Ecosystems	
C.	Analysing Freshwater Ecosystems	

1. A population of non-motile (unable to move from place to place) organisms was sampled using quadrats. Each quadrat was divided into one hundred smaller squares. In each quadrat, the percentage frequency was recorded, added to the data obtained from previous quadrats and the new mean calculated. This is the cumulative mean percentage frequency. The results of this investigation are shown in the graph below.



- (a) Name **one** species from an ecosystem that you have studied for which it would be appropriate to measure the abundance using quadrats. [1]

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- (b) What is meant by *percentage frequency*? [2]

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*(Question 1 continued)*

- (c) From the results in the graph, what would be an appropriate number of quadrats to use in sampling this population in the future? Explain your answer. [2]

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- (d) If this investigation were to be repeated using a much smaller quadrat, in what way would the new graph differ from the one shown? [1]

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- (e) Name a species of herbivore from an ecosystem that you have studied. Outline what measurements you would make in order to estimate the gross and net productivity of a population of these organisms kept in the laboratory. [4]

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*(Question 1 continued)*

- (f) Name **one** physical (abiotic) factor that might change in the natural environment of this herbivore which could influence its productivity and describe the effect it could have. [2]

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- (g) Describe a method for measuring the changes in this physical factor and evaluate the method you have selected. [3]

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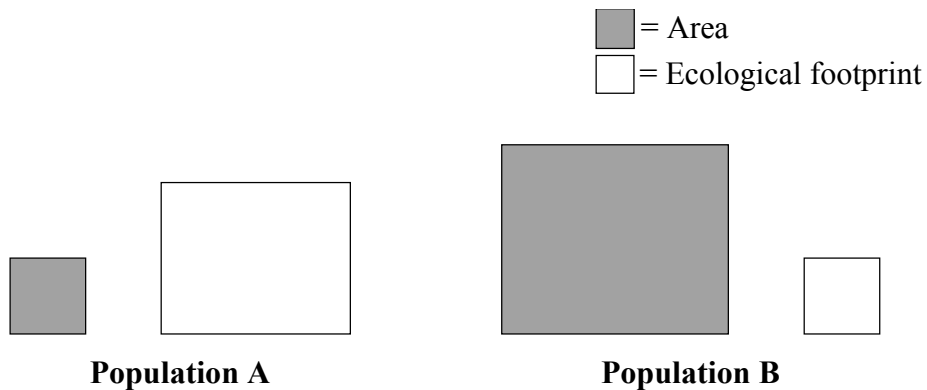
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SECTION II

This section contains a question on each of Options D, E and F. Answer **two** of these questions, related to your chosen options.

**Option D – Impacts of resource exploitation**

2. The diagrams below represent the area inhabited by, and the ecological footprint of, two human populations. One population is from a developed country and the other from a developing country. The diagrams are drawn to the same scale.



(a) Which of the populations is most likely to be a **developing** country? Explain your answer. [1]

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(b) State **four** pieces of information that would be necessary to calculate the ecological footprint for any human population. [2]

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(c) Explain **two** ways in which the latitude of a country might affect the size of the ecological footprint. [2]

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*(Question 2 continued)*

- (d) Which of the populations, **A** or **B**, is exceeding the carrying capacity of the area? Explain your answer. [2]

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- (e) (i) Suggest **two** ways in which the food production of the two populations might differ. [2]

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- (ii) Explain how these differences could influence the size of the ecological footprints of these two populations. [2]

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- (f) Compare the sustainability and environmental impacts of fossil fuels and hydroelectricity as sources of energy. [4]

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**Option E – Conservation and biodiversity**

3. (a) Explain the term *biodiversity*. [2]

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(b) On which type of biodiversity is it most effective to focus conservation efforts? Give a reason for your answer. [1]

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The table below gives the total area of various biomes and the percentage of their area that remains undisturbed by humans.

<b>Biome</b>	<b>Total area (km<sup>2</sup>)</b>	<b>Percentage area undisturbed</b>
<b>Temperate forest</b>	9 519 400	6.1
<b>Tropical rainforest</b>	11 812 000	63.2
<b>Desert</b>	29 241 000	55.8
<b>Tundra</b>	20 638 000	99.3

(c) (i) Evaluate the significance of the data in this table for biodiversity. [6]

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*(Question 3 continued)*

- (ii) In which of the biomes listed in the table would you expect extinction rates to be highest? Give **two** reasons for your answer. [2]

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- (d) Name **one** species of plant or animal that has become extinct over the last 500 years, and give **two** reasons for its extinction. [2]

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- (e) State **two** examples of steps which are being taken to prevent further extinctions. [2]

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**Option F – Pollution**

4. (a) Is the spraying of pesticides on a field an example of point or non-point source pollution? Explain your answer. [2]

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- (b) The table below shows the abundance of bird species feeding on different food sources in an ecosystem. They were observed both before and after extensive spraying of insecticides. The data are expressed in values relative to the abundance observed before spraying.

<b>Feeding habit of bird species</b>	<b>Relative abundance before spraying</b>	<b>Relative abundance after spraying</b>
Herbivorous	100	103
Carnivorous	100	78
Insect-eating	100	26

- (i) Explain why the relative abundance of carnivorous birds has decreased more than the relative abundance of herbivorous birds. [2]

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- (ii) Explain why the insect-eating birds have been most affected. [1]

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*(Question 4 continued)*

- (c) (i) Explain how a biotic index uses the presence or absence of organisms to quantify levels of pollution. [3]

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- (ii) Organic waste is discharged into a river from a sewage treatment facility. Describe the procedures you would use to assess this pollution by means of a biotic index. [4]

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- (iii) Name **one** physical (abiotic) variable in the river that could be measured as a part of an assessment of this pollution. [1]

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- (d) Describe **one** alternative to petrol (gasoline) and diesel as a transport fuel and comment on its limitations. [2]

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