



**ENVIRONMENTAL SYSTEMS
 STANDARD LEVEL
 PAPER 3**

Friday 5 May 2006 (morning)

1 hour

Candidate session number

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all the questions from Option A and all the questions from either Option B, Option C or Option D in the spaces provided.
- You may continue your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letter of the Option answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.



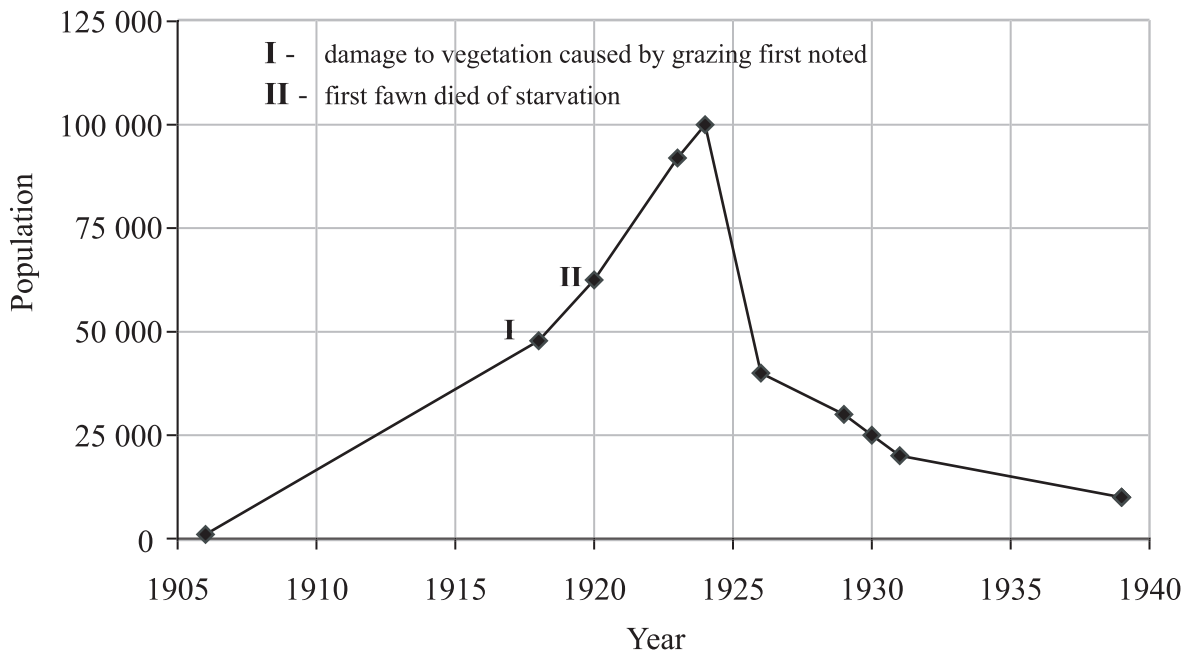
Option A — Analysing Ecosystems

The compulsory question below relates to the detailed study of ecosystems.

A1. The data in the graph below show the variation in the numbers of mule deer (a herbivore) in an area of the southwestern United States between 1905 and 1940.



[Source: Mule Deer Foundation (2003), <http://www.muledeer.org>]



[Source: D Lack, (1954), *The Natural Regulation of Animal Numbers*, Clarendon Press, Oxford]

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(Question A1 continued)

- (a) Describe and explain the shape of the graph. [4]

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- (b) Outline how data for this graph might have been collected. [3]

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- (c) Suggest what difficulties might be encountered in collecting this type of data. [3]

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(Question A1 continued)

- (d) Outline how you would measure the net primary productivity of a **named** ecosystem. [4]

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- (e) (i) For the ecosystem named in (d), identify an abiotic factor that might change over time, and suggest how this change might influence a **named** biotic component in the ecosystem. [2]

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- (ii) Outline and evaluate a method, which you could use in the field, to gather evidence for your suggestion in (e) (i). [4]

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Option B — Impacts of Resource Exploitation

B1. The table below provides data on the carbon dioxide footprint and the total ecological footprint *per capita*, for selected countries in the Asia-Pacific region.

Country	Land area / km ²	Population / millions	CO ₂ footprint <i>per capita</i> / ha	Total footprint <i>per capita</i> / ha
Singapore	693	4.35	11.03	12.35
Sri Lanka	65 610	19.90	0.28	0.95
Australia	7 686 580	19.40	4.79	8.49

Note: 100 hectares (ha) = 1 km²

[Source: World Wildlife Fund, *Living Planet Report 2000*, Gland, Switzerland and UN publications]

(a) Define the term *total ecological footprint*. [2]

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(b) State and explain the differences in the size of the *per capita* CO₂ footprint in the countries shown in the table above. [4]

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(c) Identify which country of those listed has the highest total ecological footprint for its entire population. [1]

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(Question B1 continued)

- (d) Identify any countries of those listed that have a total ecological footprint for their entire population that is greater than their land total area. [1]

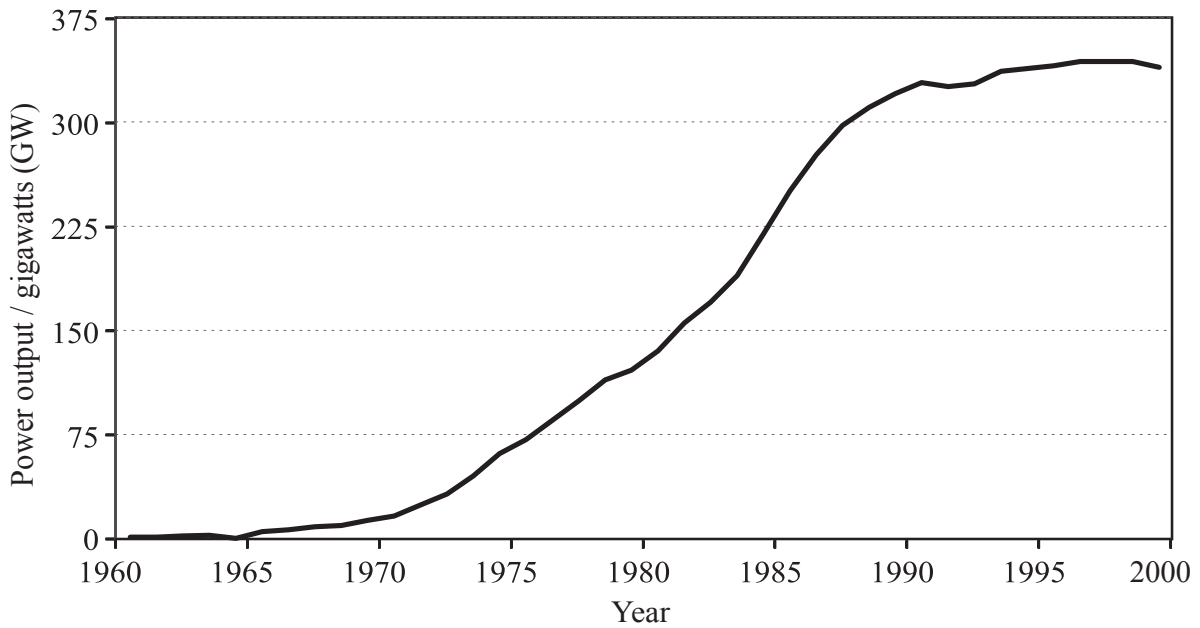
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(Question B1 continued)

- (e) The graph below shows the change in the amount of electricity produced by the world's nuclear power stations between 1960 and 1998.



[Source: Worldwatch Institute (1999) Nuclear Power Nears Peak, <http://www.worldwatch.org/press/news/1999/03/04>]

- (i) State **three** advantages and **three** disadvantages of nuclear power.

[3]

Advantages

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Disadvantages

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(Question B1 continued)

- (ii) Using the data from the graph, suggest how the evaluation of the advantages and disadvantages of nuclear power changed over the period shown. [2]

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- (f) (i) Name and briefly describe a food production system that you have studied. [2]

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- (ii) List **three** inputs to, and **three** outputs from, this food production system. [2]

Inputs:

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Outputs:

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- (g) Describe the effect that this food production system might have on the environment. [3]

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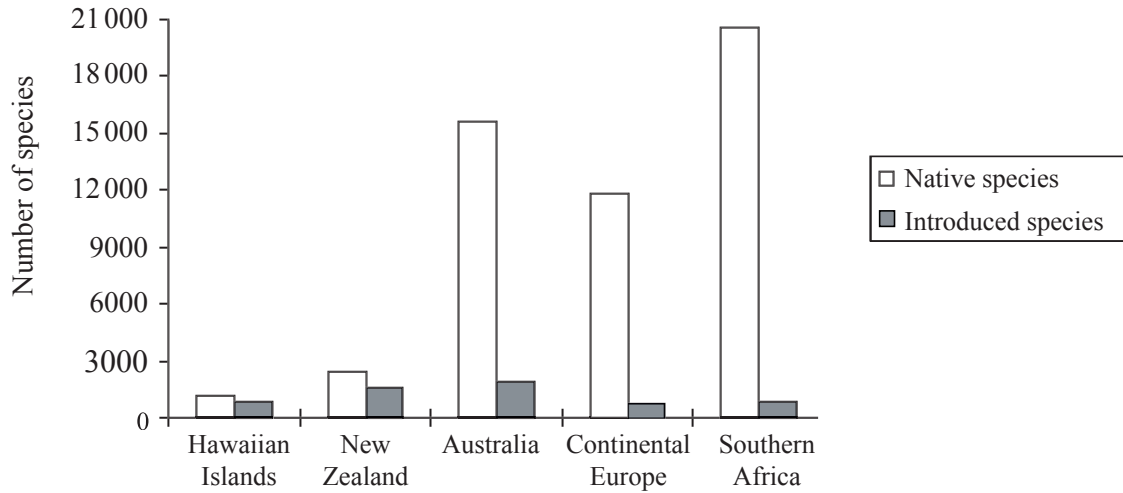
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Option C — Conservation and Biodiversity

C1. For selected regions of the world, the bar-chart below provides data for the total number of native plant species (species that occur naturally in the region), and the number of introduced species (species that have been brought in through human activities).



[Source: based on C B Cox and P D Moore, (2000), *Biogeography*, 6th edition Blackwell, Oxford]

(a) Suggest reasons for differences between the regions using the data in the bar-chart above. [4]

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(Question C1 continued)

- (b) (i) Define the terms *habitat diversity* and *species diversity*. [2]

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- (ii) Outline the evolutionary processes that link habitat diversity to species diversity. [5]

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- (c) Name a species of plant **or** animal that has become extinct since 1600, and list **two** factors that help to explain why that species became extinct. [2]

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(Question C1 continued)

(d) (i) Name a protected area that you have studied. [1]

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(ii) Suggest **three** reasons that might explain why the area was selected for protection. [3]

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(iii) Evaluate the success of the named protected area. [3]

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Option D — Pollution Management

D1 (a) Explain, with the help of an example, the term *non-point-source pollution*. [2]

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The table below gives the iron (Fe), and lead (Pb), concentrations (mg kg⁻¹) in the atmospheric fallout (solid particles) at two sampling locations near a mining centre in Sweden.

		April-May	June-July	Aug-Sep	Oct-Nov	Dec-Jan	Feb-Mar
Location 1	Pb	1.1	2.3	2.7	3.1	6.8	6.7
	Fe	26.0	65.0	76.0	86.0	259.0	222.0
Location 2	Pb	45.3	10.0	10.9	10.4	11.0	8.0
	Fe	640.0	104.0	105.0	123.0	131.0	216.0

[Source: Z Lin *et al.*, (1998), *Science of the Total Environment*, **206**, pp 47–58]

(b) Calculate the mean value for the lead concentration for each of the two sampling locations. [2]

(i) Location 1:

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(ii) Location 2:

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(Question D1 continued)

(c) The data show many differences in values (i) between the two pollutants (ii) at various times of the year, and (iii) between the locations. Identify **one** example of each and suggest an explanation for the difference. [6]

(i) between the two pollutants:
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(ii) at various times of the year:
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(iii) between the locations:
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(d) The data in the table represent an example of the *direct* monitoring of pollution. Outline, with the help of an example, what is meant by *indirect* monitoring. [3]

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(Question D1 continued)

- (e) A company specialising in waste disposal proposes to establish a facility for the incineration of domestic (municipal) waste close to your school. Explain how you would assess the probable environmental effects of such a facility. [4]

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- (f) Outline **three** strategies for the management of a named example of industrial waste. [3]

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