IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N06/4/ECOSO/SP1/ENG/TZ0/XX

88066301

ECOSYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 1

Thursday 16 November 2006 (afternoon)

1 hour

Candidate session number

0	0							

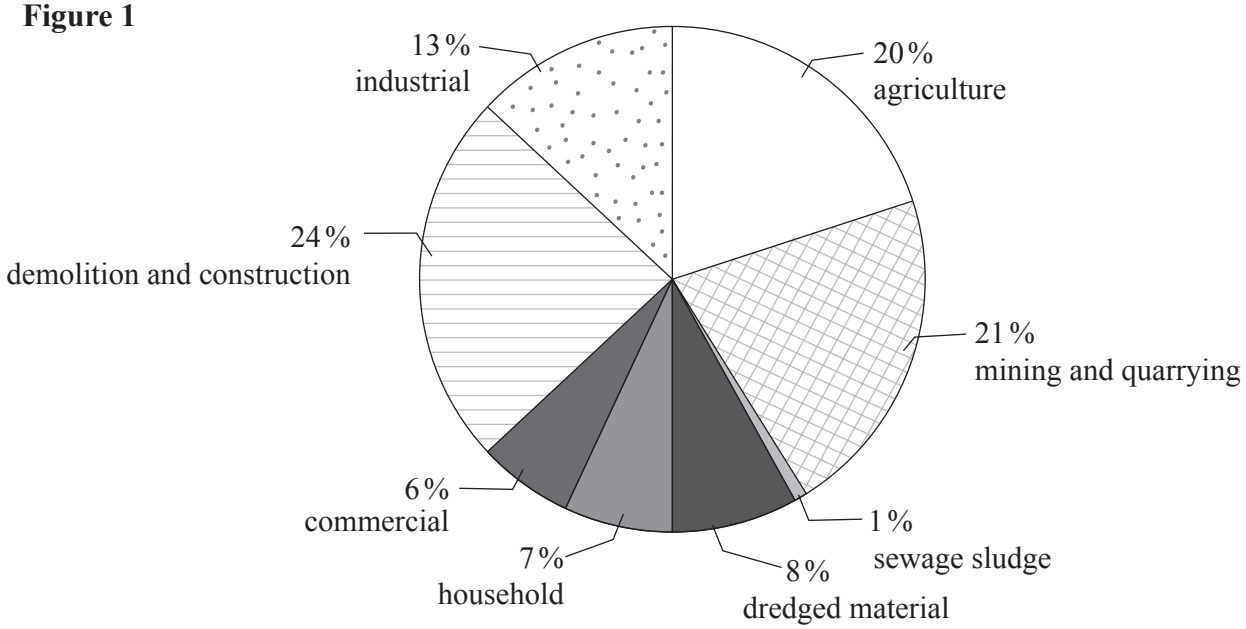
INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions 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 number of answer sheets used in the appropriate box on your cover sheet.

0113

1. **Figure 1** below shows the estimated percentage weight for waste by sector for the United Kingdom in 2001.

Figure 1



[Source: DEFRA, National Statistics, 2003]

(a) Suggest what type of material accounts for most agricultural waste. *[1]*

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(b) The total waste for the United Kingdom in 2001 was estimated at 430 million tonnes. Calculate the weight of waste (to the nearest million tonne) for agriculture and industrial combined. *[2]*

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(This question continues on the following page)

(Question 1 continued)

Figure 2 below shows changing trends in recycling from 1984 to 2002 in kilograms per person per year.

Figure 2

	1984	1992	2000	2001	2002
Waste not recycled	394	417	455	455	455
Waste recycled/composted	3	11	52	58	65
Total Waste	397	428	507	513	520

[Source: DEFRA, National Statistics, 2003]

(c) (i) In which year was the **greatest** percentage of waste recycled? *[1]*

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(ii) What was the percentage of waste recycled in the year you have named in (c) (i)? *[1]*

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(d) Suggest **two** reasons why attitudes to recycling may have changed between 1984 and 2002 in more economically developed countries (MEDCs). *[2]*

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(e) Identify a negative environmental trend from the data in **Figure 2**. *[1]*

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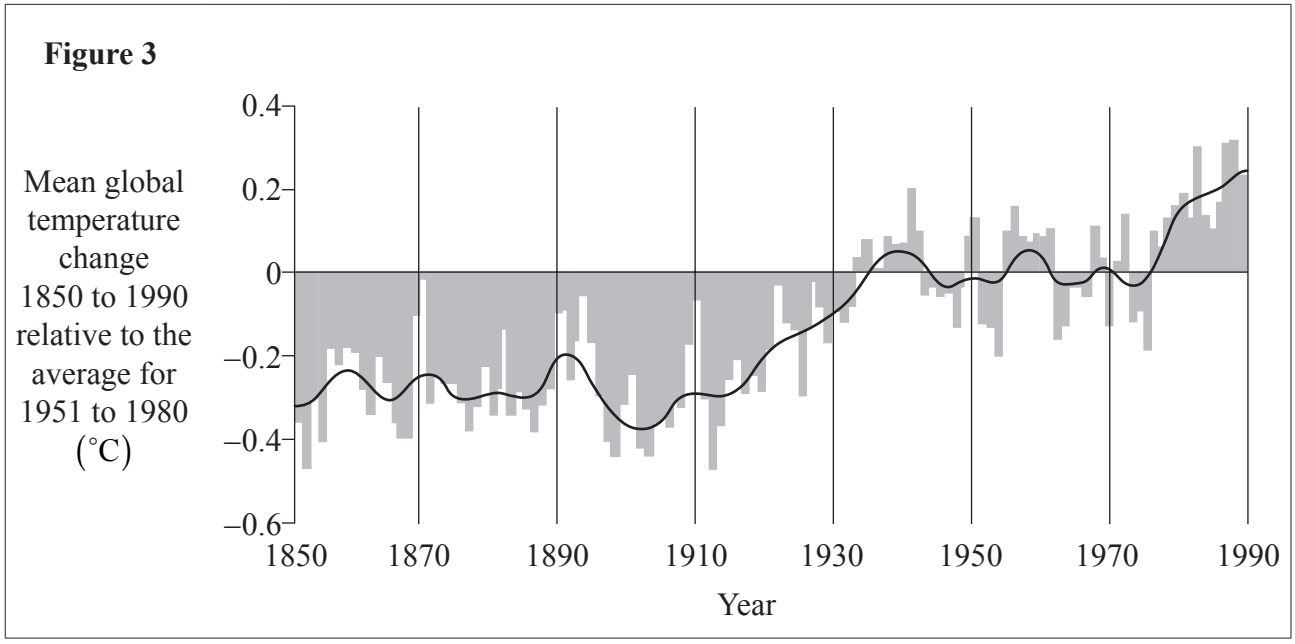
2. **Figure 3** below shows mean global climate change from 1850 to 1990.

Figure 3



[Source adapted from: UNEP, National Statistics, 2003]

(a) With reference to **Figure 3**, describe the trend in mean global temperature between 1870 and 1990. *[2]*

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(b) Suggest **two** explanations for this trend. *[2]*

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(c) Suggest **one** method of preventing further increases in mean global temperature. *[1]*

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(This question continues on the following page)

(Question 2 continued)

Figure 4 below is a table showing different aspects of the environment and society which might be affected by climate change.

Figure 4

Impact on the Environment		**Impact on Society**	
	Impact		*Impact*
Ice and snow		Water resources	
Ocean and coast		Food and agriculture	
Hydrology	increased flooding	Coastal living	
Ecosystems		Human health	

(d) Complete **Figure 4** to state likely impacts of global warming on the environment and society. *[4]*

(e) Predict, giving reasons, whether the impacts outlined in part (d) are likely to have a greater effect on less economically developed countries (LEDCs) **or** more economically developed countries (MEDCs). *[2]*

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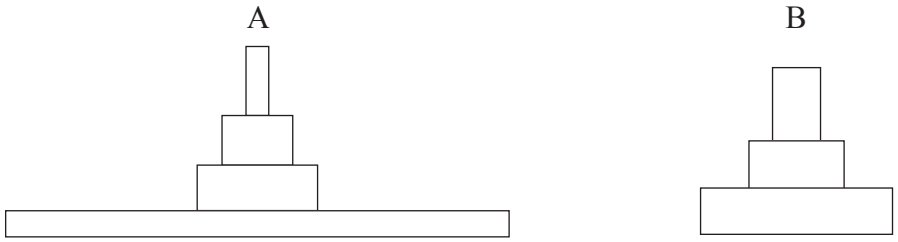
3. **Figure 5** below shows contrasting age-sex pyramids for two animal species.

Figure 5



(a) State, giving a reason, which of the population pyramids in **Figure 5** is more likely to be an *r*–strategist. *[2]*

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(b) In a field experiment 60 edible dormice (*Glis glis*) were captured using Longworth mammal traps laid out in a grid within a 500 m × 500 m quadrat. Each individual was marked and released. Two days later a second trapping exercise caught 50 edible dormice, 15 of whom were previously marked.

dormouse

Using the equation below calculate the Lincoln index for this population. *[2]*

$$N = \frac{n_1 \times n_2}{n_3}$$

N = Population index
n_1 = number captured and released
n_2 = number captured second time
n_3 = number marked in second capture

edible dormice population = ...

(This question continues on the following page)

(Question 3 continued)

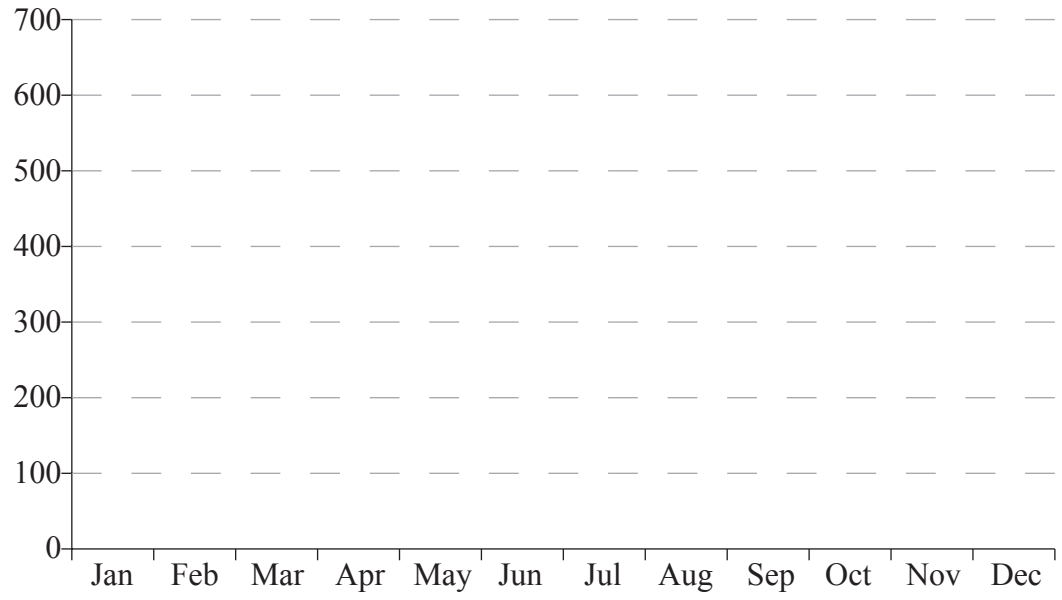
Figure 6 below shows changes in population density for the edible dormouse (*Glis glis*) as measured by the experiment in question 3(b) over a year.

Figure 6

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Density	70	80	120	300	400	550	650	400	200	150	67	55

(c) Plot the data from **Figure 6** onto the graph provided in Figure 7 and label the axes including units. *[3]*

Figure 7 – Dormouse population density change over time



(d) Describe the trend in the population density of the edible dormouse (*Glis glis*) shown in **Figure 7**. *[1]*

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(Question 3 continued)

(e) Suggest **two** explanations for the trend you have described in (d). *[2]*

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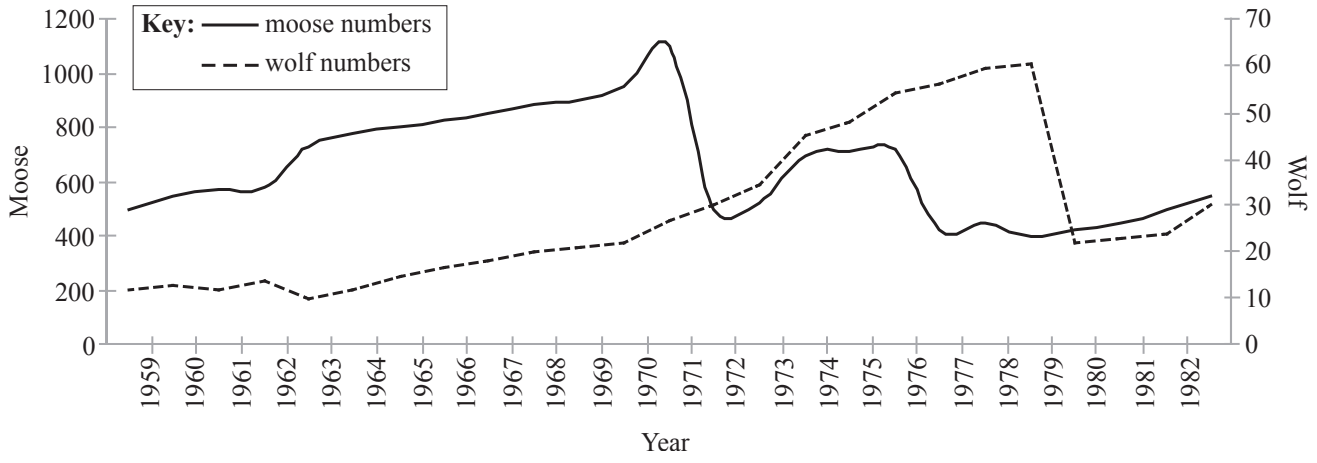
4. **Figure 8** below shows wolf (predator) and moose (prey) population trends from 1959 to 1983.

Wolf (carnivore)

Moose (herbivore/grass eater)

Figure 8



[Source adapted from: Paul Colinaux (1993), *Ecology*, John Wiley and Sons, page 282]

(a) Using data from **Figure 8** describe the trend between wolf and moose numbers between 1972 and 1979. *[2]*

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(Question 4 continued)

(b) Suggest **two** possible explanations for the dramatic fall in wolf numbers in 1979. *[2]*

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(c) Predict what might happen to the moose population and their habitat if wolves become extinct. *[2]*

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(d) Wolves are often described as a pest species. Outline the arguments for protecting wolves. *[3]*

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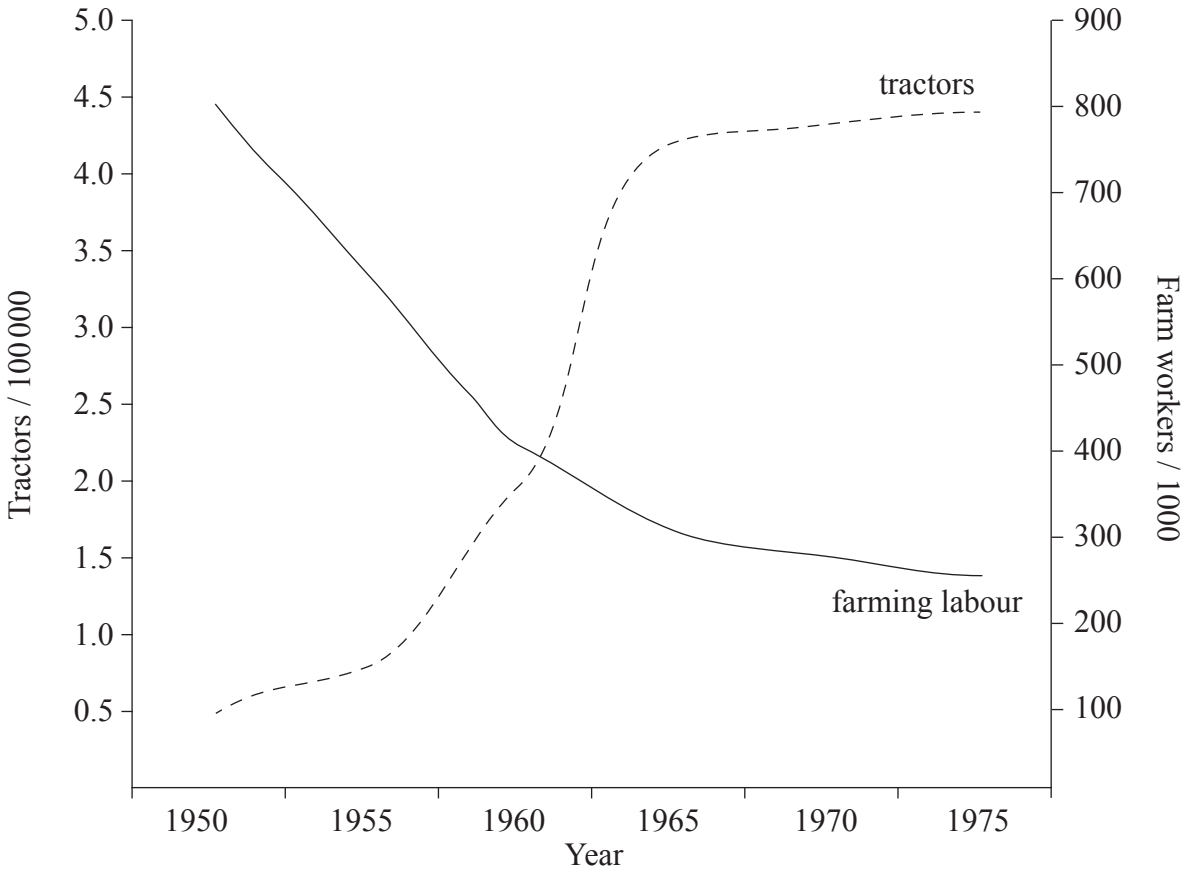
5. **Figure 9** below shows data for farming labour and tractor use in an economically developed country.

Figure 9



[Source adapted from: Kevin Byrne, (1997), *Environmental Science*, Nelson]

(a) Suggest what **Figure 9** implies about changes that have taken place in agriculture. *[2]*

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(Question 5 continued)

(b) Outline **two** strategies for increasing agricultural production in less economically developed countries (LEDCs). *[2]*

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(c) Outline an environmental impact of a **named** agricultural system that you have studied. *[1]*

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(d) Discuss how the status of soil as a natural resource has changed over time. *[2]*

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MARKSCHEME

November 2006

ECOSYSTEMS AND SOCIETIES

Standard Level

Paper 1

10 pages

Subject Details: Ecosystems and Societies SLP1 Markscheme

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a "/" either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- Words that are underlined are essential for the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the mark scheme, then award the mark.
- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have got wrong.
- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with "**ECF**", error carried forward.
- Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by "**U-1**" at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

1. (a) animal waste products / old machinery *e.g.* tractors / broken tools / crop waste (stubble); ***[1]***
Do not accept organic material.

(b) 430 million / 100 × (13% [industry] + 20% [agriculture]);
= 142 million tonnes; *(do not accept 141.9 tonnes)* ***[2]***
Answer must specify units.

(c) (i) *year*: 2002; ***[1]***

(ii) $\frac{65}{520} \times 100$

12.5%; ***[1]***

(d) better environmental awareness;
better environmental education;
economic incentives to be waste friendly;
more laws preventing dumping;
better waste collection facilities;
government incentives to recycle waste; ***[2 max]***
Accept other appropriate answers.

(e) from 1984 until 2002 the amount of waste produced per person has increased; ***[1]***

2. (a) the trend shows temperature with high years and low years with an overall upward trend;
accelerating in the last quarter of the graph;
temperatures prior to about 1935 were below the average (for 1951-1980);
but from 1980 they were above the average; ***[2 max]***

(b) the onset of global industrialization;
and the subsequent production of fossil fuel derived pollution;
deforestation, particularly of rainforest;
perhaps volcanic activity;
sunspot activity; ***[2 max]***

(c) control the amount of atmospheric pollution;
reduce atmospheric pollution;
stop forest clearance;
increase forest cover;
develop alternative renewable energy sources;
improve public transport;
set national limits on carbon emissions;
carbon dioxide capture; ***[1 max]***
Accept other reasonable answers.

(d)

Impact on the Environment		**Impact on Society**	
	Impact		*Impact*
Ice and Snow	deglaciation / glacier retreat;	*Water resources*	may cause drought;
Ocean and Coast	sea level rise / coastal flooding;	*Food and Agriculture*	agriculture moving north / south;
Hydrology	*increased flooding*	*Coastal living*	flooding / storms;
Ecosystems	biome shifts / species change;	*Human health*	increased disease;

[4 max]

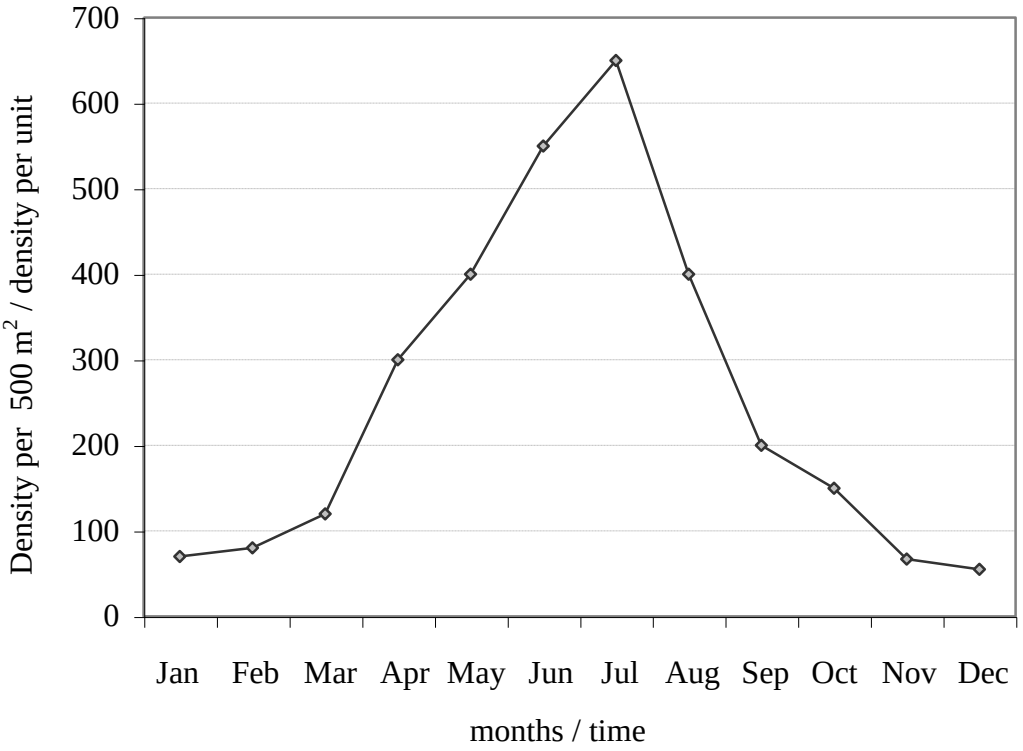
*Award **[4 max]** for seven impacts, **[3 max]** for five or six impacts, **[2 max]** for three or four impacts and **[1 max]** for one or two impacts.*

(e) LEDC
because technologically/economically less able to cope;
greater percentage of population already vulnerable;
weak infrastructure/communications/emergency services; ***[2 max]***
Accept other reasonable suggestions.
*Award **[0]** for LEDC on own.*

3. (a) population A;
the population pyramid demonstrates a large juvenile element, *i.e.* there appears to be many offspring;
and high mortality rate; ***[2 max]***
*Award **[0]** if population identified without reason.*

(b) $\frac{60 \times 50}{15}$;
$= 200$; ***[2]***

(c)



[3]

*Award **[2 max]** for the plot and **[1]** for the labels.*

(d) population is low in spring and winter months/November to March;
the population rises (dramatically) in summer; ***[1 max]***

(e) low numbers in winter due to naturally high mortality rates caused by extreme conditions/lack of food;
predation;
numbers increase dramatically in summer as females produce numerous offspring;
r-strategy; ***[2 max]***

4. (a) from 1972 to 1975 both species show gradual increase trend;
from 1975 to 1976 moose numbers crash/fall;
wolf numbers continue to rise;
1978 to 1979 wolf numbers crash; ***[2 max]***

(b) poor climate conditions, winter deaths due to cold;
disturbance;
hunting / trapping;
disease;
loss of prey species / decline of moose earlier; ***[2 max]***
Accept other appropriate answers

(c) moose numbers may increase further;
leading to greater densities;
greater grazing and a change in habitat type;
vegetation change would occur as moose preferentially graze;
moose may ultimately outstrip their own food supply;
may cause a habitat shift;
decline in moose numbers; ***[2 max]***

(d) ethical arguments – wolves have a right to exist;
aesthetic arguments – beautiful creatures;
genetic arguments – loss of diversity once it is gone it cannot be regained;
ecological arguments – role in food web, maintaining numbers of prey species;
commercial arguments – pelts / wildlife tourism / trophy hunting; ***[3 max]***
Accept other reasonable arguments.

5. (a) as tractor use increase farm labour use goes down;
agriculture is becoming more mechanized;
agriculture may be more intensive;
less need for labour on farm;
farms becoming larger require more machinery;
farming/agriculture is becoming more technocentric; ***[2 max]***

(b) greater use of pesticides to protect crops and livestock;
use of high yielding crops and livestock;
the use of GM crops and livestock;
greater agricultural industrialization/mechanization;
improving irrigation;
soil management techniques *e.g.* terracing;
agroforestry; ***[2 max]***

(c) *Award **[1]** for named agricultural system and associate impact.*
e.g. prairie grassland US, loss of biodiversity;
e.g. Norfolk grasslands UK, loss of marshland from drainage;
e.g. slash and burn subsistence farming, loss of forest habitat;
e.g. extensive cattle farming east-Africa, introduction of disease; ***[1 max]***

(d) soil has become more valuable as it has become more scarce;
increasingly seen as a resource requiring protection with special techniques *e.g.* shelter and salinisation of soil resource due to poor management;
decline in soil quality due to poor management *e.g.* salinisation (over irrigation);
loss of soil due to soil erosion;
soil degradation and lowered productivity; ***[2 max]***
Accept other reasonable responses.

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88066302

ECOSYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 2

Friday 17 November 2006 (morning)

2 hours

Candidate session number

0	0							

INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided. Refer to the resource booklet which accompanies this question paper.
- Section B: answer two questions from Section B. Write 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 numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

SECTION A

Answer all of Section A in the spaces provided.

The resource booklet provides information on the Albufera marsh, in Mallorca, Spain. Use the resource booklet and your own studies to answer the following.

1. (a) With reference to the resource booklet suggest why biodiversity within the Albufera marsh is so high. *[3]*

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(b) With reference to the resource booklet, outline **four** threats to the wildlife **or** habitats within the Albufera marsh. *[2]*

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(Question 1 continued)

(c) (i) With reference to **Figure 4**, describe how you might expect plant species at site 1 and site 5 to differ. *[2]*

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(ii) Suggest reasons for the differences you have described in (c)(i). *[2]*

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(d) With reference to **Figure 4** suggest, giving a reason, what results you might expect to find if Simpson's Diversity Index was applied to insect data collected from site 2 and site 4. *[2]*

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(e) The Albufera marsh represents an important reserve in the Mediterranean. Discuss the criteria used to design reserves. Support your answer with evidence from Albufera and other case studies you have studied. *[4]*

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(This question continues on the following page)

(Question 1 continued)

(f) With reference to the resource booklet deduce how the Albufera marsh's future, as an important wetland environment, has benefited from national and international organizations. *[2]*

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(g) (i) With reference to the resource booklet deduce how the management of the Albufera marsh represents a holistic view of conservation and ecosystem management. *[2]*

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(ii) Explain why a holistic approach to ecosystem management is so important. *[2]*

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(h) What biological process does the data in **Figure 7(a)** suggest has taken place due to the presence of the main road dividing the ecosystems at the marsh. *[2]*

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(This question continues on the following page)

(Question 1 continued)

(i) Suggest what impact increased tourism may have on the Albufera marsh. *[2]*

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SECTION B

*Answer **two** questions. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.*

*Each essay is marked out of **[20]** of which **[2]** are for clarity of expression, structure and development of ideas:*

[0] *Quality of expression, structure and development is poor.*
[1] *Quality of expression, structure and development is limited.*
[2] *Quality of expression is clear, structure is good and ideas are well developed.*

2.

"loss of biodiversity threatens human well being"

[Source: Hamdallah Zedan, Secretary of the Convention on Biological Diversity, 2003]

(a) Explain how human well being is threatened by the loss of biodiversity. *[6]*

(b) Evaluate the role of local support, government agencies and research in the protection of a **named** protected area you have studied. *[6]*

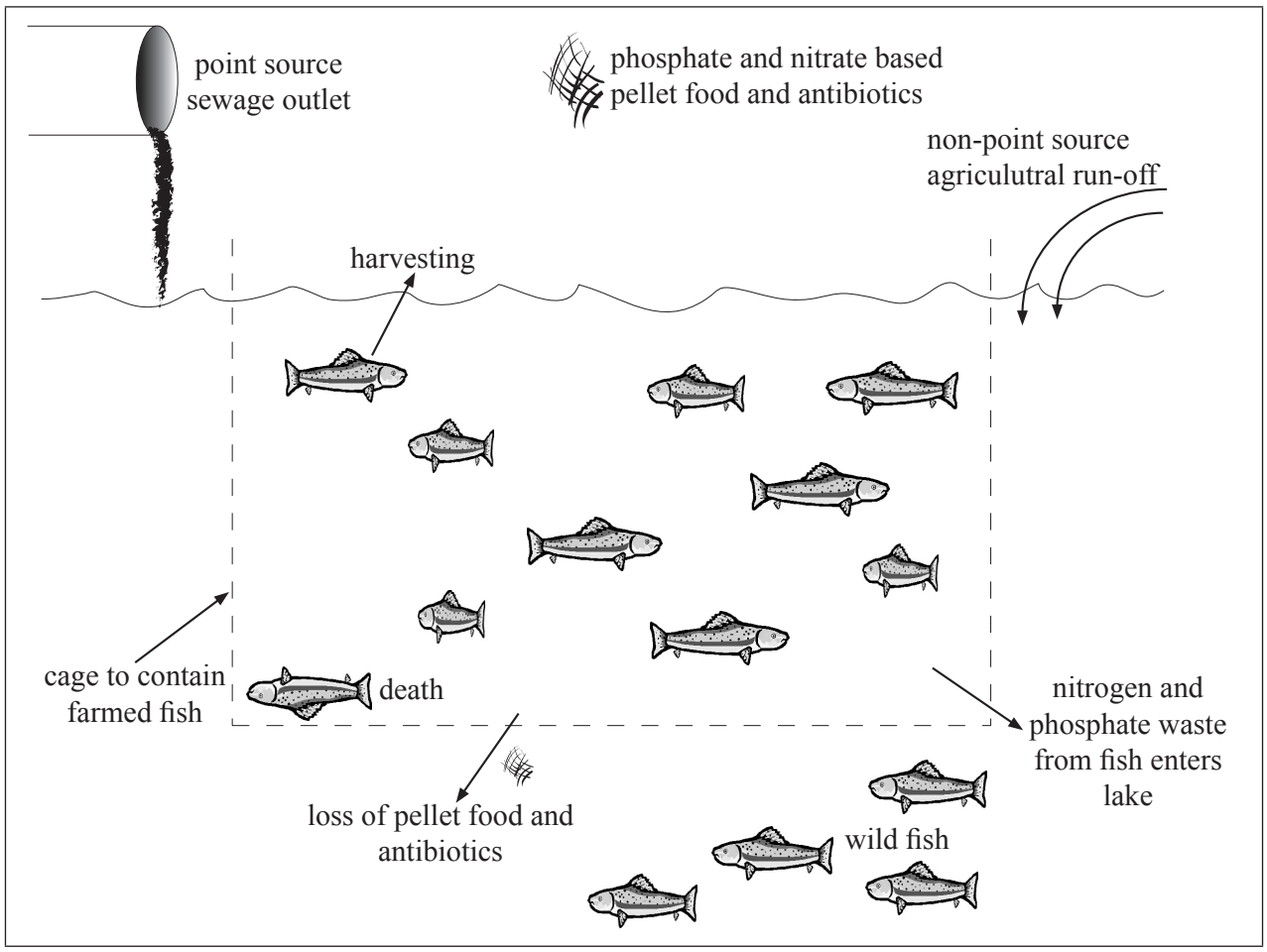
(c) Evaluate species based conservation as an approach for preserving biodiversity and suggest why trophy hunting (*i.e.* hunting animals for sport) may represent an acceptable method of achieving this goal. *[6]*

Expression of ideas *[2]*

3.

"Lake pollution and eutrophication are problems affecting all countries. Domestic sewage and industrial effluents mainly cause pollution, but non-point pollution from surrounding land areas and inappropriate fishing practices are increasingly significant contributing factors at present".

[Source: UNEP, Division of Technology, Industry and Economics, 2005]



(a) Describe the concept of eutrophication and the role played by sewage, agricultural run-off and fisheries in the development of eutrophication in a freshwater environment. *[6]*

(b) Evaluate methods of controlling eutrophication in a freshwater lake. In your answer you should address sewage and industrial waste, non-point source agricultural inputs and inappropriate fish management. *[6]*

(c) Compare the efficiency of terrestrial and aquatic food production systems. *[6]*

Expression of ideas *[2]*

4. (a) Explain the increasing global demand for water and discuss the problems this causes for managing water resources sustainably. Support your answer with reference to examples. *[5]*

(b) Describe the concept of an ecological footprint and evaluate its role as a model for assessing the demands of humans on their environment. *[5]*

(c) Compare the approaches of technocentric and ecocentric resource managers to the issue of an increasing demand for water resources. *[8]*

Expression of ideas [2]

5.

Sustainable tourism depends on:

(a) meeting the needs of the host population in terms of improved standards of living in the short and long-term

(b) satisfying the demands of increasing tourist numbers

(c) safeguarding the environment to achieve the two foregoing aims.

[Source: Cater and Goodall, *Environmental Issues in the 1990s*, edited Mannion and Bowlby, publishers John Wiley and Sons Ltd, (June 1992)]

(a) With reference to the statement above, and examples of ecosystems you have studied, explain why safeguarding ecosystems is so important for sustainable tourism. *[8]*

(b) Predict and justify what impact global warming may have on tourism trends in the future. *[5]*

(c) Discuss the concept of sustainable development, and explain why it is a problematic term. *[5]*

Expression of ideas [2]

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88066303

ECOSYSTEMS AND SOCIETIES
STANDARD LEVEL
PAPER 2

Friday 17 November 2006 (morning)

2 hours

RESOURCE BOOKLET

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until instructed to do so.
- This booklet contains **all** of the resources required to answer question 1.

Figure 1(a) — Location map of Mallorca relative to the Spanish mainland

Figure 1(b) — Mallorca with Albufera marsh marked

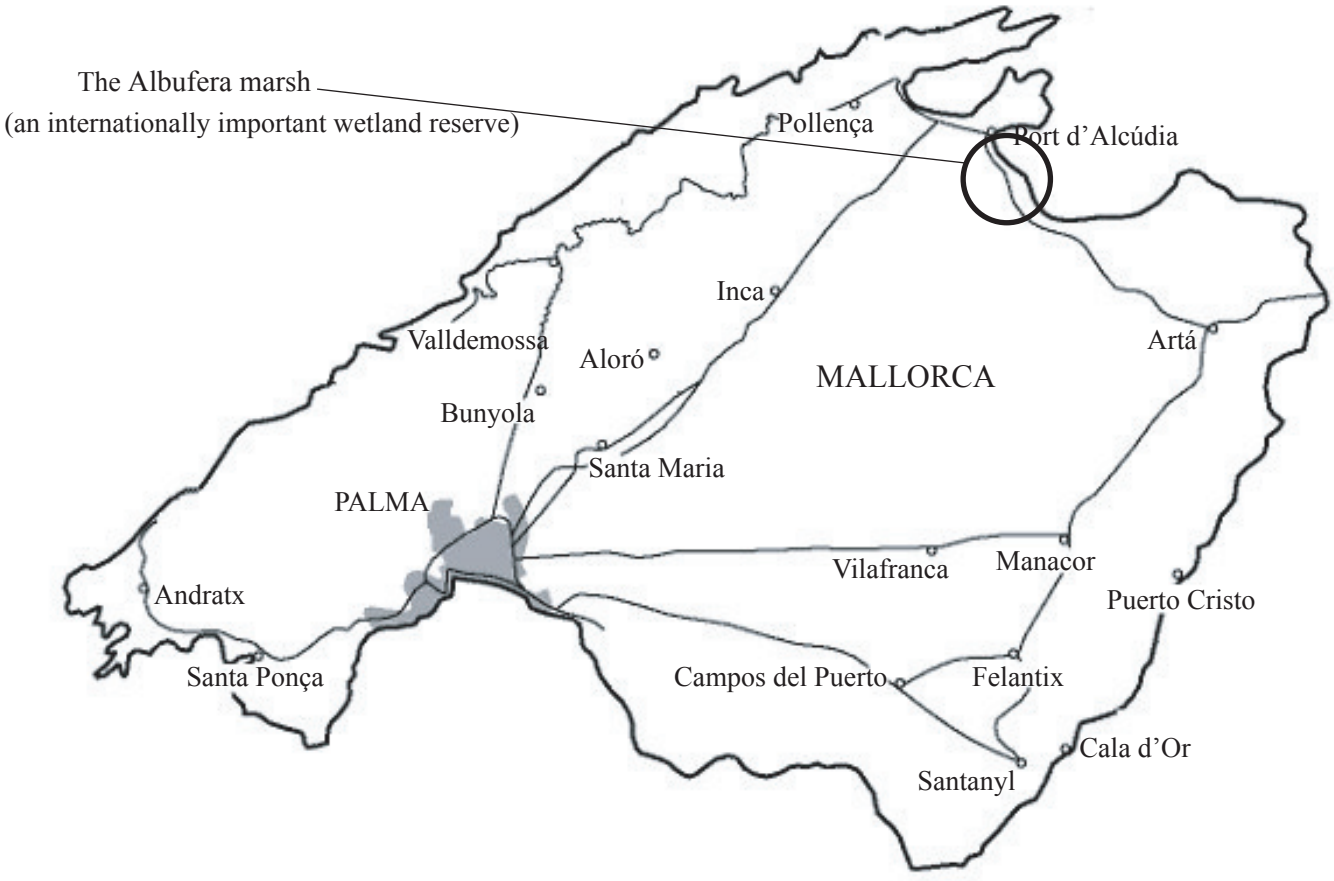


Figure 2 — Mallorca background literature

Background

Mallorca is one of a string of islands (the Balearic Islands) representing the most easterly corner of Spain. The island chain represents approximately 1 % of Spain and is situated in the western Mediterranean. The other islands, Menorca, Ibiza, Formentera and Cabrera along with Mallorca form a chain some 200 km long.

Mallorca is dominated by three main geomorphic units, northern calcareous uplands, a central lowland plain and moderately high southern uplands. The rock is Jurassic and Cretaceous in age and composed of marine limestone and inter-tidal deposits.

The islands are presently separated from the Spanish mainland but over geological time have been both attached to the Spanish mainland and to each other during periods of low sea level.

Climate

Mallorca has a Mediterranean climate characterized by moderate monthly temperatures with a mean around 16 °C. Winter is dominated by northerly winds and summer winds predominantly coming from the east and southeast. Mallorca is exposed on its eastern margin to a cold dry wind known as the "Tramuntana".

Mean annual precipitation is approximately 600 mm, concentrated mainly in late summer and autumn. October is a particularly wet month. Rainfall is strongly related to topography: Mountainous areas may have rainfall in excess of 1400 mm per year whereas lowland coastal margins may have less than 200 mm. Summer rainfall is almost non-existent. Cyclones occasionally deliver over 200 mm of rain in twenty-four hours leading to flash floods. In general Mallorcan weather patterns appear to be becoming dryer and warmer.

Habitats

Mallorca has a distinctive biogeography controlled by underlying calcareous geology and the nature of the climate. The area has fewer species and lower biodiversity (than mainland Spain) but has a greater number of endemic species. Holm Oak (*Quercus ilex*) covers 22 % of the island and Alopa Pine (*Pinus halep*) covers a further 28 % of the land area. Scrubland represents approximately 13 % of total land cover. Wetland areas are dominated by *Phragmites australis* or *Juncus maritimus*, depending on the quantity of water and background salinity.

Cultivated land represents approximately 50 % of the total land area. Urban and tourist driven development continues to invade more and more habitats.

Figure 3 — Background to the Albufera marsh

The Albufera marsh is an internationally important reserve. It represents the largest and most important wetland area in the Balearics. The marsh is contained behind an extensive costal dune system. The marsh and dunes cover an area of some 1708 hectares. The site represents the greatest biodiversity in the Balearics. The water feeding the marsh is derived from seasonal rainwater and underground springs.

The marsh formed around 10 000 years BP (before present) during the Holocene. The sand dune system fronting the marsh was formed as a result of rising post glacial sea levels.

The biology of the site is dominated by phragmites reed and saw sedge. Flooded areas are dominated by pondweed, fennel and hornwort. More brackish (salty water) areas support rush and glasswort. The dominant tree species in the marsh are poplar and elm.

There are twenty-nine species of fish, mostly marine. There are eel and several species of mullet. The marsh also holds water snake, terrapin and frog.

There are some two hundred species of birds with numbers climbing above 10 000 over winter. Birds include waders, ducks, passerines and raptors.

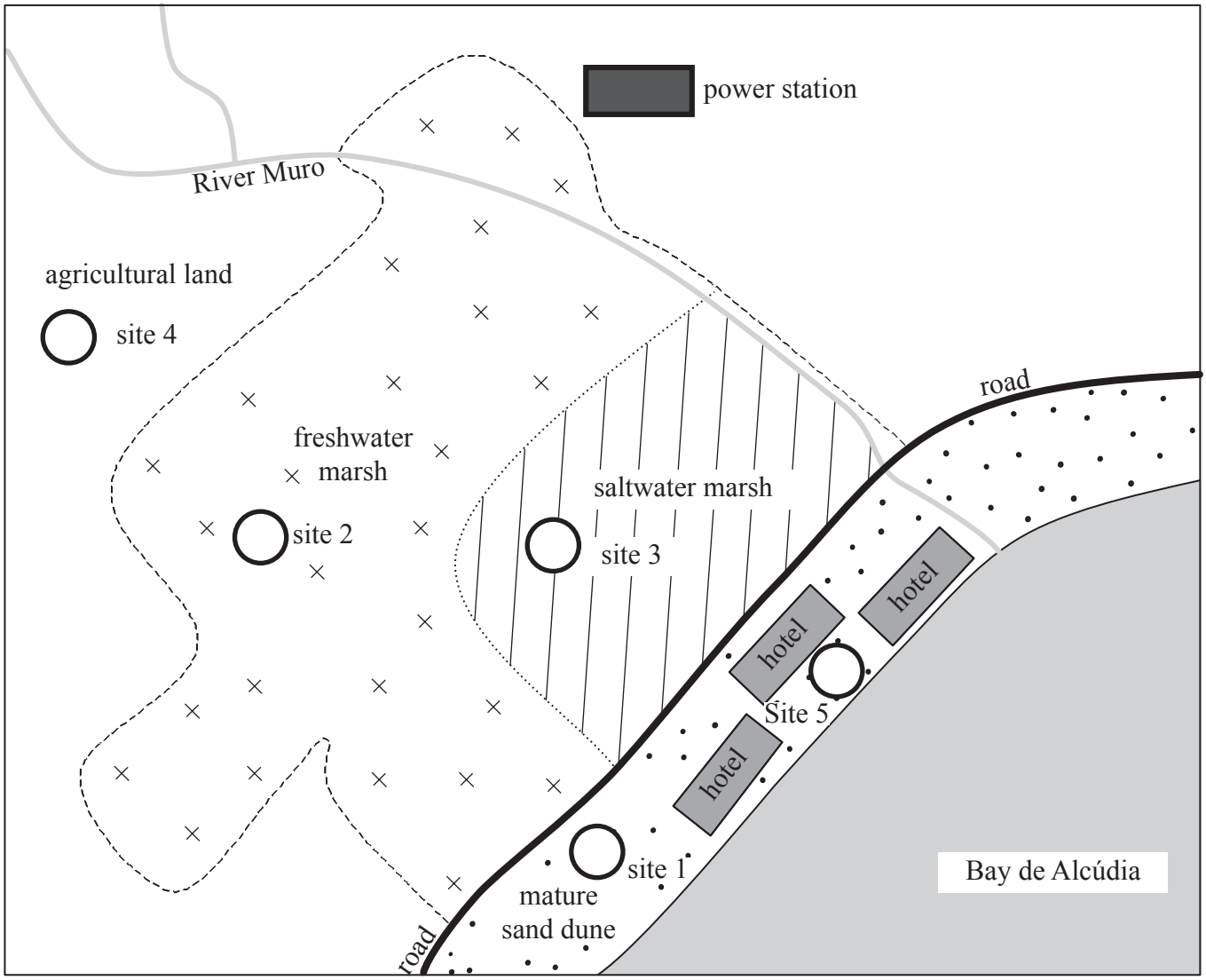
The Albufera marsh became a national reserve in 1988, making it the first nationally protected area in the Balearics. The underlying ethos of the reserve is:

- *the conservation and restoration of the reserve's natural and cultural value*
- *empowerment of educational and scientific research activities*
- *contact between man and nature*
- *a venue for rest and relaxation.*

In 1989 the Albufera de Mallorca was registered as an internationally important wetland site with special reference for birds under the Ramsar Convention.

The site is now viewed locally and nationally with pride by the Mallorcan people. Local people and pressure groups from outside Mallorca have protected and continue to protect the site from development.

Figure 4 — Map of Albufera marsh and sand dunes



Key:

freshwater marsh ecosystem

saltwater marsh ecosystem

sand dune ecosystem

river

road

Hotel building

agricultural land

Site 1 – mature sand dune

Site 2 – freshwater marsh

Site 3 – saltwater marsh

Site 4 – agricultural land

Site 5 – developed sand dune

Figure 5 — Generalized Mallorcan rainfall statistics

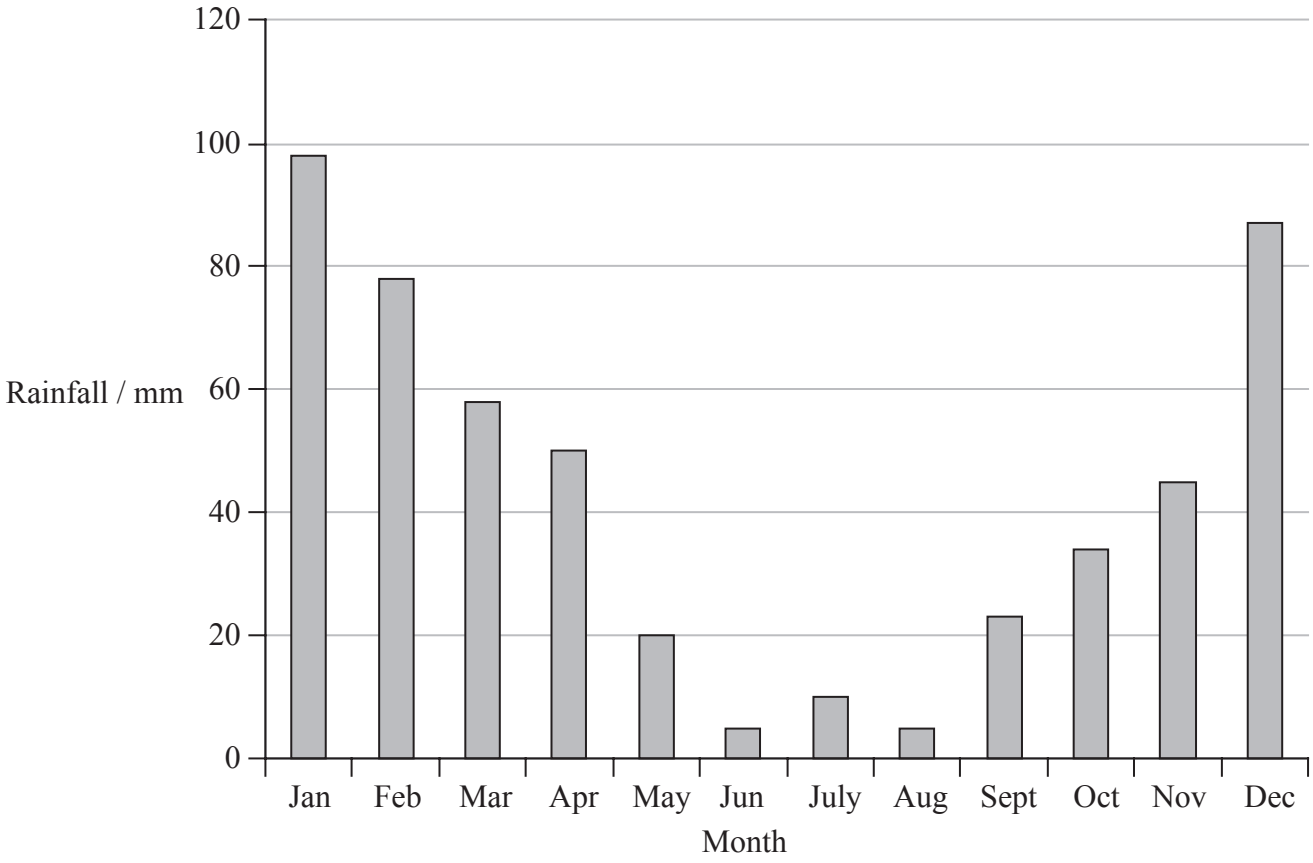
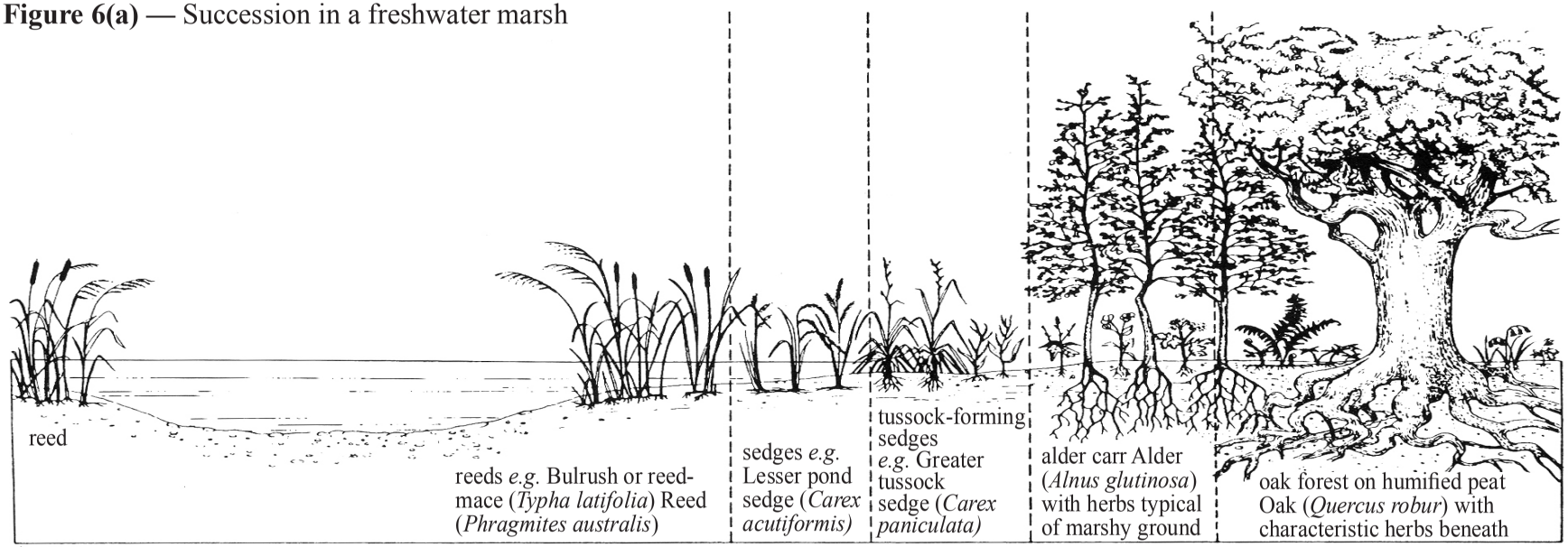
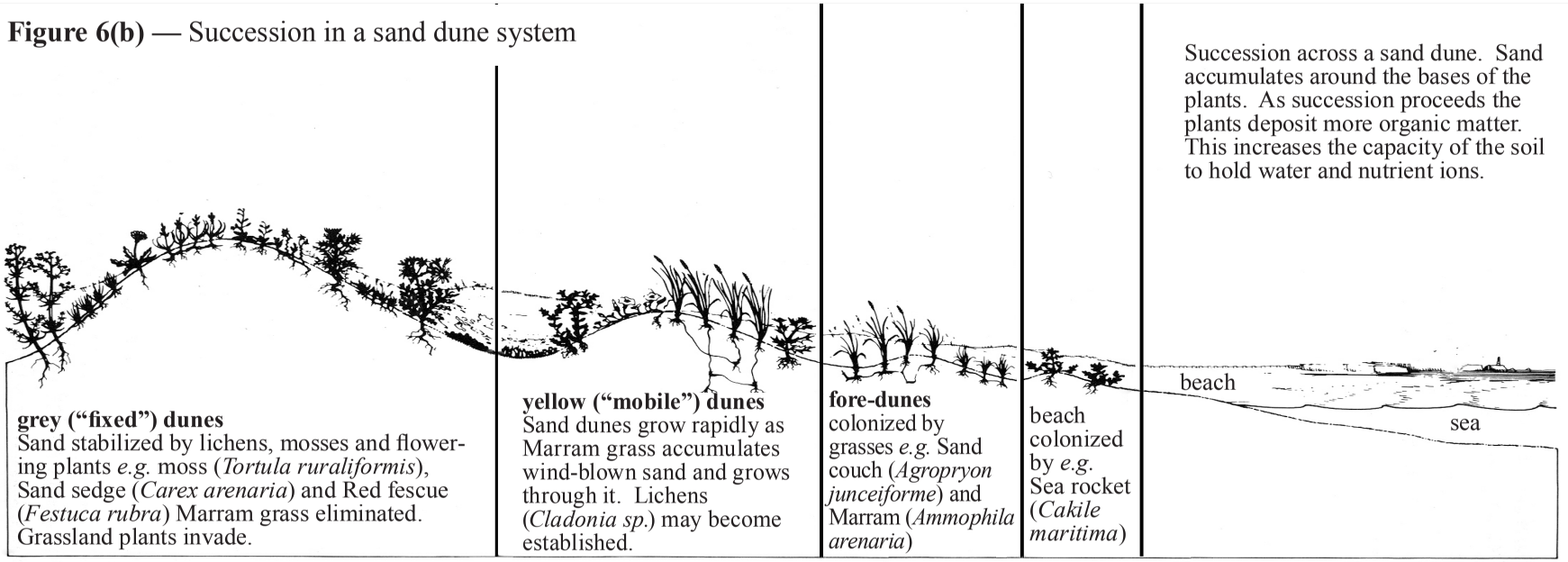


Figure 6(a) — Succession in a freshwater marsh



[Source: T J King (1989), *Ecology*, page 80, Nelson]

Figure 6(b) — Succession in a sand dune system



[Source: T J King (1989), *Ecology*, page 83, Nelson]

Turn over

Figure 7(a) — Banded snail shell morphology types from saltwater marsh and sand dunes

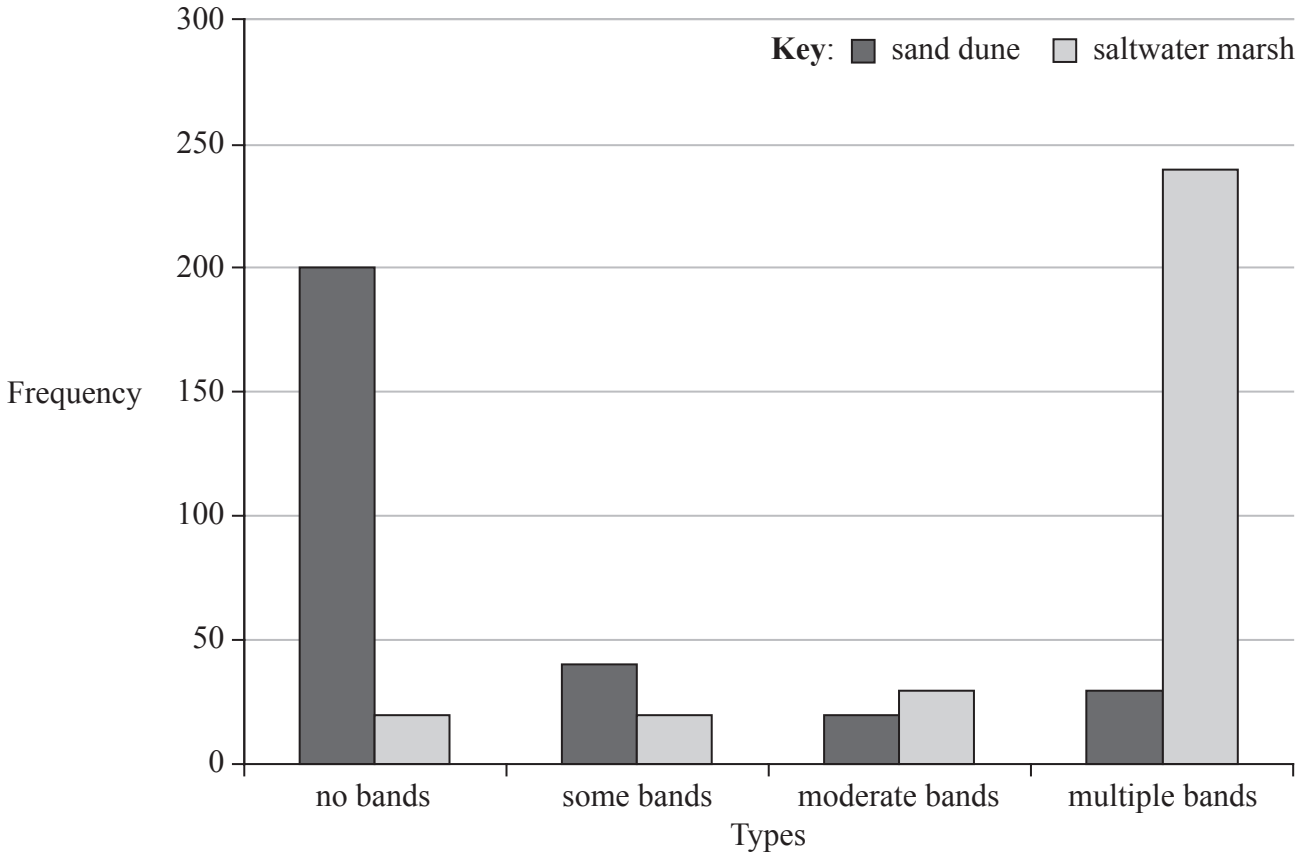
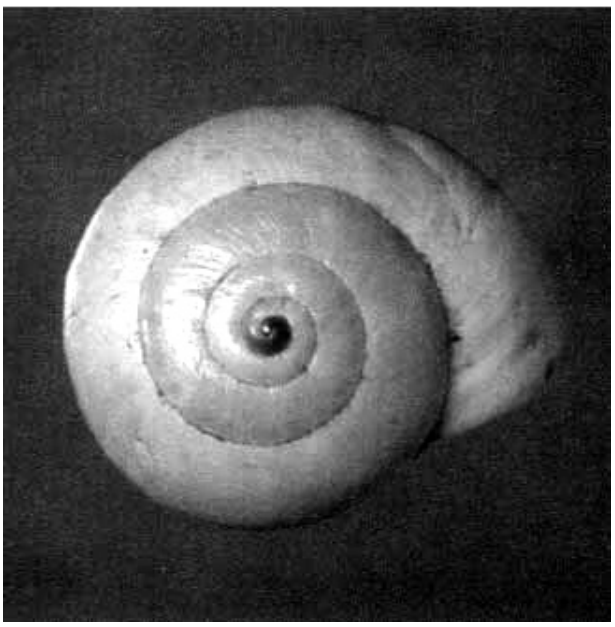


Figure 7(b) — Images of banded snails and non-banded snails

banded



non-banded

Figure 8 — Wetland management

"Wetland management is necessary for populations of water birds, fish, amphibians, aquatic plants and a host of other species. Yet parks become direct competitors for water resources with irrigation projects, flood control schemes and hydroelectric dams."

"The Ramsar Convention on wetlands was established in 1971 to halt the continued destruction of wetlands; to recognize the ecological, scientific, economic, cultural and recreational value of wetlands."

"The Ramsar Convention includes sites covered by national legislation and assists in their protection by giving them international status."

Richard B Primack (1993)
Essential in Conservation Biology

IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

N06/4/ECOSO/SP2/ENG/TZ0/XX/M+

MARKSCHEME

November 2006

ECOSYSTEMS AND SOCIETIES

Standard Level

Paper 2

12 pages

Subject Details: Ecosystems and Societies SLP2 Markscheme

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).
- An alternative answer or wording is indicated in the markscheme by a "/"; either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- Words that are underlined are essential for the mark.
- The order of points does not have to be as written (unless stated otherwise).
- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the mark scheme, then award the mark.
- Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalising them for what they have got wrong.
- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with "**ECF**", error carried forward.
- Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by "**U-1**" at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

SECTION A

1. (a) the Albufera has such high diversity due to a wide range of habitat types;
therefore, many niches for many species;
the area is physically large;
there is a mix of aquatic and terrestrial environments;
the area is preserved and the biodiversity is proactively protected and encouraged; ***[3 max]***
Award credit if data is cited.

(b) *Answers need four of the following threats to receive **[2 max]**. If only two of the following threats are addressed, award **[1 max]**.*
power station producing terrestrial and atmospheric pollution;
agriculture / run-off pollution and drainage;
tourist pressure causing disturbance and pollution;
road / road kill / disturbance;
further development;
dune erosion / habitat loss; ***[2 max]***

(c) (i) site 1 will have a greater range of species;
species community more complex at site 1;
will include trees, shrubs and ground cover; ***[2 max]***

(ii) site 1 more mature;
site 1 older;
site 5 newer, not gone through full succession;
site 1 more stable, greater range of niches; ***[2 max]***

(d) site 2 would demonstrate a much higher diversity index than site 4;
site 2 is much more mature and has a range of habitats with a large range of niches for insects;
site 4 may be a monoculture favouring few species;
chemical pesticides may limit species in site 4; ***[2 max]***

(e) reserves are often controlled by the principle of island geography;
good reserves need to be large (as the Albufera marsh is);
small reserves have problems supporting biodiversity;
larger animals need large areas;
biodiversity is high due to multiple habitat types;
background environmental conditions are good *e.g.* water quality;
organisms safely move in and out of the marsh;
multiple habitats have many edges, edges provide new niches thus higher diversity; ***[4 max]***

(f) Albufera was designated the first national reserve in the Balearics by the Mallorcan government;
Ramsar Convention recognition and registration raises the profile of the Albufera;
local communities support the Albufera; ***[2 max]***

(g) (i) Albufera is not just an area of wildlife protection;
educational activities encouraged;
research takes place;
people use it as an area of relaxation;
cultural value encouraged; ***[2 max]***

(ii) experience demonstrates that protection without considering other factors *e.g.* economics, culture and development is unlikely to be successful;
multiple use reserves are more popular and easier to fund;
more sustainable;
mixing education, research, protection has long-term benefits; ***[2 max]***

(h) speciation may occur;
the two geographically separate groups of snails may ultimately become separate species; ***[2]***

(i) continued tourism expansion may lead to increased pressures on local resources that will directly and indirectly affect the marsh;
more pressure for development land may lead to the marsh edges being developed;
more tourists mean more potential pollution, which may damage the marsh;
more tourists need more water and more water extraction may lower levels in the marsh and cause damage;
however, more people are also more revenue and more awareness, which may be positive factors; ***[2 max]***

SECTION B

General Essay Markscheme
Each essay is marked out of ***[20]*** of which ***[2]*** are for clarity of expression, structure and development of ideas.

[0] Quality of expression, structure and development is poor.
[1] Quality of expression, structure and development is limited.
[2] Quality of expression is clear, structure is good and ideas are well developed.

2. (a) low biodiversity reflects poor ecological/environmental conditions;
low biodiversity is a measure of a stressed environment;
factors which cause low biodiversity also may lead to an environment unsuitable/stressful for humans, *e.g.* toxins, pollutants, contaminated land and water, drought;
biodiversity can be seen as a gauge for environmental quality;

a more diverse environment is likely to be more resource rich/abundant;
opportunities for discovering new resources are more likely in areas with high diversity;
loss of biodiversity is the loss of potential new resources, *e.g.* medicines;

areas of high diversity are more aesthetically pleasing than areas of low diversity, thus better places to live;

a society that ignores the need for high biodiversity/allows biodiversity to be lost, shows little respect for the environment, this attitude may also be reflected in its government's care of its people, society, *etc.*; ***[6 max]***

*Award **[6 max]** if arguments are supported with appropriate evidence. Award **[4 max]** for more than one line of argument. Award **[3 max]** if answer considers only one line of argument.*

(b) *local support:* ***[2 max]***
local guides and rangers earn a living assisting tourists within the park and prevent poaching;
their economic future and the future of the park are intrinsically linked;
they have a positive vested interest in the park;
they have a respect and pride for the park that they view as theirs;

government agencies: ***[2 max]***
government through its employees, wildlife agencies, rangers, guides, provides the park with security and infrastructure;
they monitor and control visitor numbers;
co-ordinate anti-poaching activities;
punish poachers;
manage park funding;
maintain communications;
provide resources;
liaise with local groups, non-government groups and international organizations;

research: ***[2 max]***
scientific research discovers change/damage/stress/new species/monitors abiotic and biotic conditions within the park;
highlights new information;
research identifies new hazards and new goals;
produces information that supports the parks existence and informs management decisions;
helps educate those inside and those outside the park; ***[6 max]***

Award ***[4 max]*** *if no named protect area.*

(c) *species based conservation:* ***[3 max]***
concentrates on one <u>or</u> two key species;
usually organisms that possess strong aesthetic qualities, tigers, bears, pretty birds *etc.*;
habitat conditions are maximized to meet the needs of the key species;
indirectly such management techniques may benefit many non-target species and the ecosystem per se;
habitat protection for one species may protect many species;
however, a species based approach may result in a species being conserved artificially outside its habitat, thus the organism and not the habitat it belongs in is protected;

trophy hunting: ***[3 max]***
the protection of animals for sport/hunting may also be seen as a species based approach to conservation;
though the animal is being maintained for economic gain and pleasure, it is none the less being conserved;
numbers are kept high by managing habitat, controlling predators providing additional food;
managing habitat for "game" may have benefits for many other species;
game reserves may have less disturbance, less alien species (*e.g.* cattle and sheep); ***[6 max]***

Expression of ideas: ***[2 max]***

Total: ***[20]***

3. (a) eutrophication represents the nutrient enrichment of a body of water;
it can occur naturally but is often triggered by the addition of external anthropogenically derived material, waste fertilizer *etc*.;
nutrients cause an explosion in algae / blue green algae within the water column;
the massive growth rate consumes a high proportion of available O_2;
physiological stress due to lack of O_2 causes population crashes in many other aquatic organisms;
food chains, habitats, ecosystems collapse;
positive feedback situation;
sewage waste, agricultural run-off rich in phosphates and nitrates and fisheries food and excrement all represent sources of nutrient enrichment within the aquatic system; ***[6 max]***

(b) treatment of sewage before entering the watercourse to remove organics and dissolved nitrates and phosphates will reduce enrichment;
e.g. the use of filters and scrubbers to remove phosphates from domestic sewage;
the use of agricultural fertilizers in a way that prevents/reduces nitrate/phosphate loading *e.g.* controlling the rate and timing of fertilizer application and controlling the chemical content of fertilizer;
not applying fertilizers during rainy periods and using reduced phosphate fertilizers;
addressing run-off and intercepting contaminated water;
managing the fishery such that stocking density of fish and fish feeding practice minimize nutrient enrichment within the system;
removing un-eaten food and fish waste mechanically from the system; ***[6 max]***

(c) the key difference between aquatic and terrestrial food production systems is the level from which food is harvested;
terrestrial systems harvest the bulk of food from much lower in the food chain;
aquatic/marine systems from much higher up;
aquatic/marine systems harvest primarily animal protein (fish, birds, mammals, crustaceans *etc*.);
whereas terrestrial systems harvest primarily carbohydrates/plant material (cereals, grains, root crops *etc*.) with some additional animal protein (livestock);
aquatic/marine systems are predominantly hunter-gatherer systems (sometimes on an industrial scale);
stocks are left to recover naturally after harvesting;
terrestrial systems are predominantly farmed systems with food crops being planted, tended and harvested;
terrestrial systems use domesticated plant and animal species;
aquatic systems generally harvest wild species; ***[6 max]***

Expression of ideas: ***[2 max]***

Total: ***[20]***

4. (a) societies demand for water has continued to grow throughout the industrial period;
demand for water is expanding in both MEDCs and LEDCs ;
in LEDCs, expanding populations / changing agricultural practice / expanding industry (often heavy);
general per person increase in water needs are making demands heavier;
in MEDCs social lifestyles require more water, *e.g.* people wash more, water plants more, wash cars more;
water is a finite resource and countries are reaching their resource availability limit;
water resources need to be managed more carefully;
new water resources need to be found / resource use needs to be controlled; ***[5 max]***

(b) an ecological footprint represents the hypothetical area of land required by a society/group/individual to fulfill all their resource needs;
the footprint size considers both resource needs and waste assimilation;
it is the opposite of carrying capacity, a finite area can support a finite population;
technological advancement may reduce footprint size;

as a model for monitoring environmental impact the ecological footprint can allow for direct comparisons between groups and individuals, *e.g.* MEDCs and LEDCs;
in addition it can highlight sustainable and unsustainable lifestyles, *e.g.* populations with a larger footprint than actual land area are living beyond sustainable limits; ***[5 max]***

(c) the technocentric manager approach to water resource management would suggest that future needs can be met by technology, innovation and the ability to use "untapped" reserves;
technocentric managers would support desalination/iceberg capture and transport/wastewater purification, synthetic water production/rain seeding/deep aquifer extraction;
would also look at innovative ways to reduce water use *per se*, both in industry and at a domestic level;

the ecocentric manager approach would highlight the overuse and misuse of water;
encourage the conservation of water;
encourage greater recycling;
encourage water use within sustainable level;
encourage water use that had few detrimental impacts on habitat, wildlife and the environment;
monitoring use to remain within sustainable limits;
encouraging industry and society to use less water; ***[8 max]***

Expression of ideas: ***[2 max]***

Total: ***[20]***

5. (a) tourism can only be successful if it can have a long-term future;
a long-term future is only possible if the tourism enterprise is sustainable;
to be sustainable the tourism venture must not deplete local resource bases by direct/indirect impact;
it must not pollute the local environment;
good tourism is sustainable tourism, tourism that values its environment;
ecotourism is often sustainable; ***[8]***
*In addition to the above points, award **[1]** for each case study, up to **[2 max]**.*

(b) global warming will ultimately change weather patterns;
summer seasons may be extended (*e.g.* coastal beach holidays);
coastal resorts selling sun, sea and sand may develop further north;
winter sports holidays may be curtailed by lack of snow and ice;
failing rains may make some resorts obsolete due to lack of water resources; ***[5]***
Supporting case studies or examples are relevant.

(c) sustainable development (a phrase coined in 1987 in Our Common Future) is defined as development that meets our current needs without depleting resources in the future;
sustainable development also does not deplete the environmental quality of an area;
sustainable development varies in definition depending on viewpoint;
economists view sustainable development in pure commercial terms whereas environmentalists will also include environmental quality as an element;
some believe that development (particularly development designed to allow LEDCs to compete with MEDCs) can never be sustainable (within a free market);
development and sustainability in the mind of many economists are contradictory positions even though environmentalists hold the concept of "sustainable development" as the best way forward for society and the planet; ***[5 max]***

Expression of ideas: ***[2 max]***

Total: ***[20]***