Teacher Resource Bank

GCE Environmental Studies

ENVS4 Sample Questions and Mark Schemes

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Topic 1: Human Populations

1 Discuss ways in which food resources and human population can be balanced.

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 for grammar, punctuation and spelling.

(20 marks)

20

2 Discuss the statement that 'human population growth is the source of all environmental problems'.

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 for grammar, punctuation and spelling.

(20 marks)

20

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Mark scheme – Topic 1: Human Populations

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Malthus and Boserup
Club of Rome
government policies eg one child
health care/contraception
education/literacy
food distribution problems
distortion of agriculture in developing countries
intensive food production
GM
trade/aid

scientific/technological factors
choice of production systems/crops
breeding
genetic engineering

Total marks = 20

Essay Questions

The essay questions are marked using the following marking criteria.

Scientific content
(maximum 14 marks)

Category	Mark	Descriptor
	14	
Good	12	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A Level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	10	
	9	
Average	7	A significant amount of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A Level study. Generally accurate with few, if any

		fundamental errors. Shows a sound understanding of most of the principles involved.
	5	
	4	
Poor	2	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A Level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	0	

Breadth of Knowledge

(maximum 2 marks)

Mark	Descriptor
2	A balanced account making reference to most if not all areas that might realistically be covered by an A Level course of study.
1	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
0	Unbalanced account with all or almost all material based on a single aspect.

Relevance

(maximum 2 marks)

Mark	Descriptor
2	All material present is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
1	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
0	Some attempt made to relate material to the title but considerable amounts largely irrelevant.

Quality of Written Communication

(maximum 2 marks)

Mark	Descriptor
2	All material is logically presented in clear, scientific English and continuous prose. Technical terminology has been used effectively and accurately throughout. At least half a page of material is presented.
1	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate. Some minor errors. At least half a page of material is presented.
0	The account is generally poorly constructed and often fails to use an appropriate scientific style to express ideas.

Question 2

Rapid human population growth/exponential/ref population explosion
mostly in developing countries
urbanisation
deforestation/loss of habitat
soil exhaustion/erosion
sedimentation
intensive/chemical agriculture
fossil fuel use for (agriculture/industry/travel)
finite
named/air pollution
named/H_2O pollution
global climate change/eghe
demand for water/dams/conflict/flooding
overfishing/by-catch
species extinction/trading
Gaia/correct ref to negative/positive feedback/runaway
transboundary nature
humans only species capable of global problem/damage
other causes unrelated to population growth eg El Niño, volcanoes
differential ecological footprints/comparative effect of MEDC v LEDC/lifestyle impact
(Refer to guidance on essay questions from Q1)

Total marks = 20

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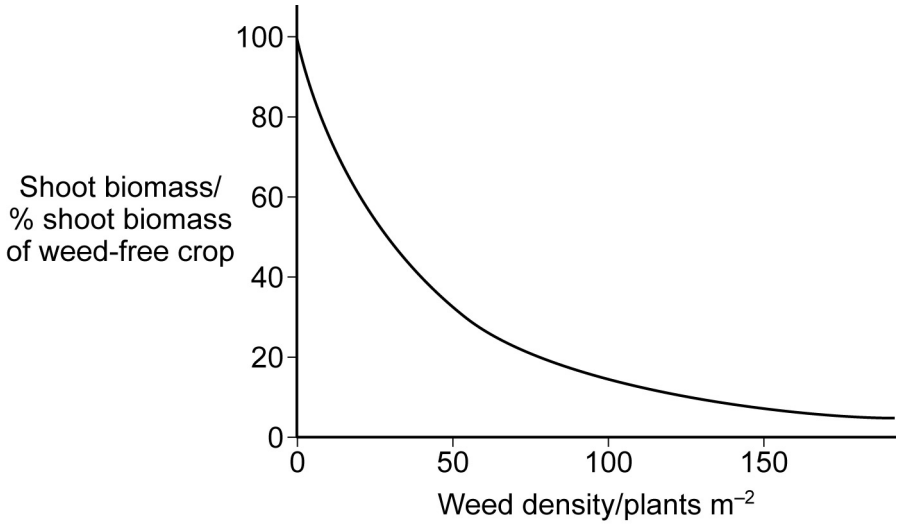
Topic 2: Food Production Systems

Agroecosystems

1 The graph shows the effect of weed density on the shoot biomass of maize.



1 (a) Describe the relationship shown.

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(1 mark)

1 (b) Explain the relationship shown.

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(1 mark)

1 (c) Suggest **three** useful properties of an efficient pesticide.

1 .....

2 .....

3 .....

(3 marks)

1 (d) Suggest **three** advantages of using organic fertilisers instead of artificial fertilisers.

1 .....

2 .....

3 .....

(3 marks)

8

2 Discuss the importance of selective breeding and genetic manipulation of crops and animals.

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 for grammar, punctuation and spelling.

(20 marks)

20

3 Discuss the factors that influence the choice of an agricultural production system.

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 for grammar, punctuation and spelling.

(20 marks)

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4 Discuss the scientific principles of organic farming.

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 for grammar, punctuation and spelling.

(20 marks)

20

Environmental and social impacts of agriculture

5 Discuss ways in which intensive food production in the UK has caused environmental damage.

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 for grammar, punctuation and spelling.

(20 marks)

20

6 Read the following passage on the population : resource balance.

Land degradation has contributed to the decline of a number of ancient civilizations and it may now threaten our own. Such degradation, in the form of soil erosion and salinisation, results from the increased intensification of farming, itself a result of increasing population. A study of sedimentation in Mexican lakes found that episodes of major soil erosion coincided with dense farming populations. Depopulation after the Spanish conquest resulted in less sedimentation.

Intensification usually leads to reduced fallow periods. Native forms of agriculture often left the land to recover for 5 –10 years before re-cultivation. This reduced soil erosion by providing cover, replenishing organic matter levels and by cycling soil nutrients between deep and surface soil layers. When farmers returned, the rejuvenated soil had gained the carbon-rich humus and nutrients needed for another crop cycle.

Unfortunately, population is now increasing faster than food production and some scientists argue that countries with less than 0.07 hectares of arable land per person cannot feed their populations without the unsustainable use of artificial fertilisers. The most successful traditional cultivation systems, such as those of eastern Asia, were able to feed a mainly vegetarian diet to about 12 persons per hectare of farmland. This involved a closed system that maintained soil fertility by mixing crops and recycling crop, animal and human wastes and provided 0.08 hectares of arable land for each person. Others argue that, if meat consumption continues to increase in poorer countries, the minimum amount of land needed per capita (per person) will be much greater.

Both the number of people and the proportion of the population experiencing a shortage of arable land are increasing. Between 1960 and 2000, the number of people living in arable land-scarce countries more than tripled from 97 million to 292 million. Ironically, many of these countries became more dependent on imports of basic foodstuffs, whilst increasing the proportion of their land used for growing cash crops for export.

6 (a) Explain why increasing population densities may lead to:

6 (a) (i) sedimentation (lines 3-6)

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(3 marks)

6 (a) (ii) salinisation (lines 3-6)

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(3 marks)

6 (b) Explain how, in fallow areas, nutrients may be cycled between deep and surface soil layers. (lines 9-10)

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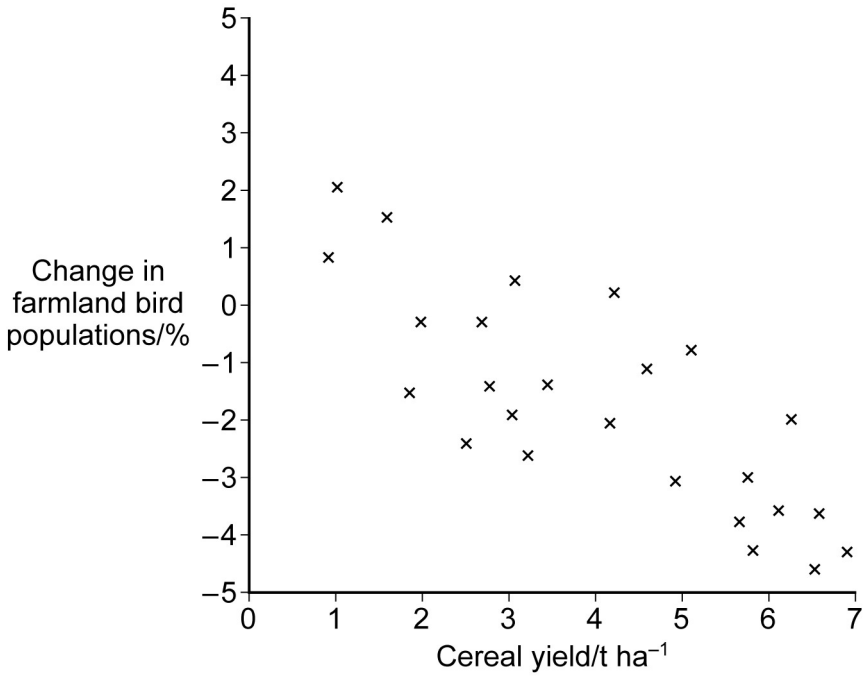
(3 marks)

9

7 (a) The graph shows the relationship between cereal yield and changes in the farmland bird populations in European countries.



7 (a) (i) Describe the trend.

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(1 mark)

7 (a) (ii) Suggest explanations for the trend.

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(2 marks)

7 (b) As part of the UK and European agri-environment scheme, organic farmers are entitled to claim additional payments because it is recognised that this particular farming system benefits the environment.

Explain how organic farming benefits the environment.

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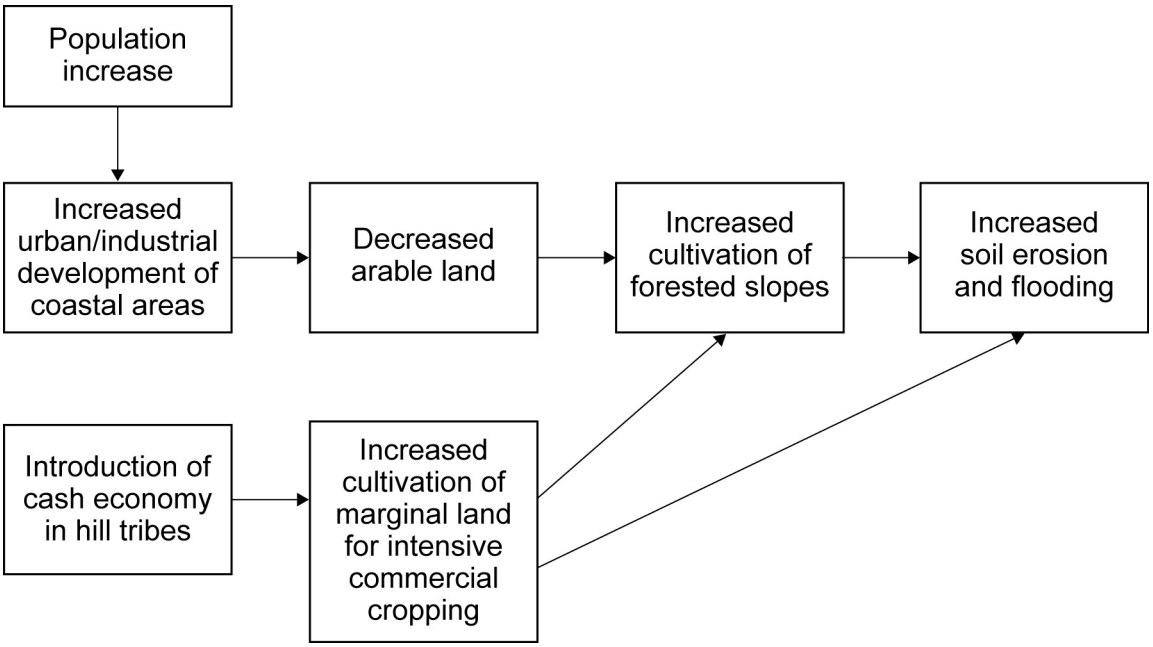
(5 marks)

8

Agricultural Energetics

8 The diagram shows how economic development in Korea has led to environmental damage.



8 (a) Using the information in the diagram suggest why per capita food production has decreased, despite increasing pesticide and fertiliser use in Korea.

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(2 marks)

8 (b) Explain why meat production is **not** considered to be an energy-efficient means of feeding Korea's population.

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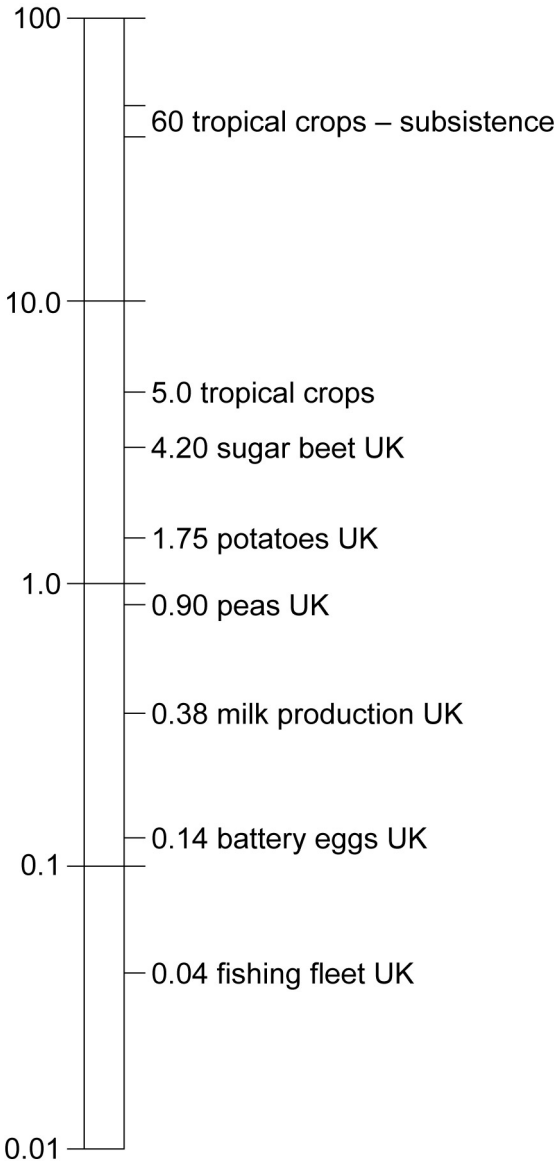
(2 marks)

4

9 The diagram shows energy ratios for some food crops and agricultural systems. The energy ratio is given by:

$$\frac{\text{Energy Output}}{\text{Energy Input}}$$



9 (a) Suggest an explanation for the *energy ratio* of:

9 (a) (i) UK milk production

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(1 mark)

9 (a) (ii) subsistence farming.

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(1 mark)

9 (b) Explain:

9 (b) (i) the benefit to agricultural production systems of shortening food chains

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(2 marks)

9 (b) (ii) why organic farming is not as energy subsidised as non-organic farming.

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(2 marks)

6

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Mark scheme – Topic 2: Food Production Systems

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Agroecosystems

Question 1

1	(a)	As weed density increases biomass decreases/negative correlation**;**	1
1	(b)	Competition for water/minerals/light/carbon dioxide**;**	1
1	(c)	Specific/only kills the pest or weed**;** biodegradable/no residues/not persistent/doesn't accumulate**;** fast acting**;** cheap**;** easy application**;**	MAX 3
1	(d)	Adds humus/OM/improves structure/improves water-holding capacity**;** cheap because waste/ref to recycling/ref to waste**;** slow release/less likely to leach or wash away/decreased etrophication**;** no fossil fuels used in manufacture/less energy used**;** [**R** biodegradable/persistence]	MAX 3

Total marks = 8

Question 2

Factors affecting selection of species
species availability**;**
suitability for conditions**;**
ease of cultivation**;**
productivity/nutrient content**;**
pest and disease resistance**;**
uniformity**;**
polyploidy**;**
transgenics**;**
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 3

Types of system
subsistence
commercial
organic
artificial
inputs and outputs
soil factors
climate factors
topography
economic factors
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 4

No artificial fertilisers
nutrients maintained by recycling
legumes
rotation
no pesticides
pest control via biological control, cultivation techniques/companion planting, natural pesticides
maintain complexity
minimise unsustainable inputs eg fossil fuels
sustainability
no GM
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Environmental and social impacts of agriculture

Question 5

Reference can be made to excess use of nitrate/phosphate fertilisers leading to eutrophication, contamination of aquifers, organic pollutants eg silage, pesticide residues on food, pesticide effect on non-target biota, antibiotics, hedgerow removal leading to habitat loss and soil erosion, use of monoculture, loss of genetic diversity, excess mechanisation leading to unemployment, soil compaction, excess runoff, flooding etc., deforestation, destruction of SSSI's, land drainage, effect of irrigation demand on aquifers, fish farming.
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 6

6	(a)	(i)	Intensification/overgrazing/vegetation removal/compaction/ deforestation**;** reduced OM**;** weakened structure/reduced binding**;** reduced interception/infiltration/increased impact**;** increased wind/wash/runoff/overland flow**;** gullies**;** soil erosion**;**	MAX 3
6	(a)	(ii)	Increased water use for agriculture/industry/irrigation**;;** water table changes**;** evaporation salts left behind**;** salt water incursion	MAX 3
6	(b)		Deep/long/tap**;** roots absorb nutrients**;** biomass**;** fall/litter**;** decay**;** ref fluctuating water table**;** biota tunnelling**;**	MAX 3

Total marks = 10

Question 7

7	(a)	(i)	As cereal production increases, mean bird populations decreases/negative correlation**;**	1
7	(a)	(ii)	Removal of habitat/hedgerows/trees/nesting sites**;** named herbicides/pesticides killing food sources/ thinning egg shells**;** drainage**;** biomagnification**;** herbicides/fertiliser reduces plant diversity/use of monoculture**;** more birds eat more crops**;**	MAX 2
7	(b)		Avoids artificial pesticides/herbicides**;** less contamination of food/water/leaching/eutrophication/ref soil biota**;** less biomagnification/bioaccumulation**;** biocontrol uses natural predators**;** named green/natural fertilisers/avoids named chemical fertilisers**;** reduced fossil fuel use (in manufacture)/global climate change/ acid rain/E greenhouse effect**;** no hormones**;** no GM contamination**;**	MAX 5

Total marks = 8

Agricultural energetics

Question 8

8 (a) Population increased more than food production**;**
decreased fertility due to soil loss/loss of nutrients through leaching**;**
less land available because of flooding/development/industry/
urbanisation/cash crops**;** MAX 2

8 (b) Energy loss between trophic levels/energy lost at each stage/
part of chain**;**
ref to respiration/inedible parts/egestion/homeothermy**;**
needs energy inputs – hormones/antibiotics etc**;** MAX 2

Total marks = 4

Question 9

9 (a) (i) High inputs/electricity/fuel/lighting/heating/milking/
antibiotics**;** 1

9 (a) (ii) Few inputs/little mechanical energy/in form of human labour**;** 1

9 (b) (i) Less energy lost (between trophic levels)**;**
respiration/faeces/movement/indigestible elements/not all of
preceding organism eaten**;** 2

9 (b) (ii) Less fossil fuels used/more labour intensive**;**
in pesticides/fertilisers/machinery/shelters/artificial
environment creation**;** 2

Total marks = 6

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Topic 3: Aquatic Food Production Systems

Fishing

1 Discuss the management of fishing and fish farming.

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 for grammar, punctuation and spelling.

(20 marks)

20

2 Global production of farmed fish has risen rapidly over the last 20 years from 8 million 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.

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, 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.

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.

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

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(2 marks)

2 (b) What are the implications of the low energy efficiency of rearing carnivorous fish? (lines 7-8)

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(2 marks)

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

2 (c) (i) genetic contamination (line 14)

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(2 marks)

2 (c) (ii) the population dynamics of wild fish (lines 15-16)

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(2 marks)

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

2 (d) (i) intensive production systems

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(4 marks)

2 (d) (ii) sustainable yield.

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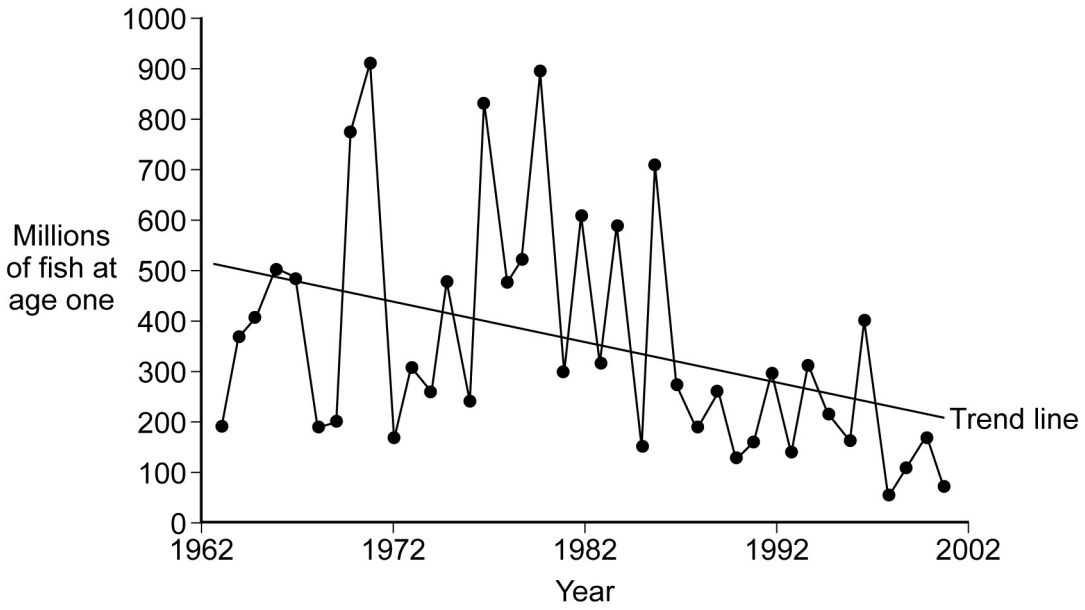
(3 marks)

15

3 (a) The graph shows estimates of the population of one-year-old cod in the North Sea. Cod reach sexual maturity at four years.



What is the significance of this trend in terms of fisheries management?

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(1 mark)

3 (b) Between 2000 and 2003, cod quotas were reduced annually, mesh sizes were increased and closed areas were introduced.

Outline the principle behind:

3 (b) (i) the reduced quotas

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(1 mark)

3 (b) (ii) an increase in mesh size

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(1 mark)

3 (b) (iii) the introduction of closed areas.

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(1 mark)

3 (c) Scientists estimate that the minimum sustainable biomass for cod in the North Sea is 150 000 tonnes. Quotas were set that would result in the stock of mature cod increasing by 30 % per year towards this target biomass.

State **two** pieces of population data that the scientists would need to know to set such quotas.

1 .....

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2 .....

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(2 marks)

3 (d) Fish farms may help to reduce pressure on wild fish stocks.

Outline **four** ways by which fish farms provide a controlled environment in order to maximise productivity.

1 .....

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2 .....

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3 .....

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4 .....

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(4 marks)

10

Aquaculture

4 Intensive fish farming may involve the use of live low-value fish as feed for the developing high-value fish.

4 (a) Suggest **two** possible harmful environmental effects of this practice.

1 .....

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2 .....

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(2 marks)

4 (b) Suggest **two** commercial advantages of this form of fish production.

1 .....

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2 .....

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(2 marks)

4

5 Economists conducted a cost–benefit analysis to evaluate the desirability of a proposed shrimp farm development in mangrove forests in the coastal wetlands of Cambodia. The tables show the expected costs and benefits of the development up to the end of year 1 and up to the end of year 5.

	Costs and benefits (000 Aus $) from start of project to the end of year 1				
	Shrimp production	Loss of fuelwood and construction timber	Loss of coastline protection	Habitat loss	Total
Costs	–	321	195	123	639
Benefits	1370	–	–	–	1370

	Costs and benefits (000 Aus $) from start of project to the end of year 5				
	Shrimp production	Loss of fuelwood and construction timber	Loss of coastline protection	Habitat loss	Total
Costs	–	2110	4900	5015	12025
Benefits	4190	–	–	–	4190

5 (a) Suggest **one** factor that determines the monetary value of a habitat such as the mangroves.

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(1 mark)

5 (b) With reference to the data, state and explain what the cost-benefit analysis suggests about the economic viability of the shrimp farm proposal.

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(3 marks)

4

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

1 .....

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2 .....

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3 .....

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(3 marks)

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

6 (b) (i) The control of day length

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6 (b) (ii) The application of pesticides

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

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

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(4 marks)

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Mark scheme – Topic 3: Aquatic Food Production Systems

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Fishing

Question 1

Need for management – overfishing, economic importance, pollution
fishing quotas
net size/shape/structure
closed seasons
fish size
fleet reduction
MSY
control of stock on farms
pest control
nutrients
waste control
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 2

2 (a) Correct ref to repeat sampling**;**
declining catch**;**
declining average fish size/age**;**
changes to eggs/larvae**;**
ref to (sexual) maturity**;** MAX 2

2 (b) Net energy use/unsustainable**;**
[**A** ref to figures but not verbatim (from text)]
catching/processing uses fossil fuels**;**
increased CO_2/NO_x/enhanced greenhouse effect**;**
correct ref to effects on food chains/wild stocks**;** MAX 2

2 (c) (i) Escape**;**
breed with wild fish**;** 2

2 (c) (ii) Could become predator**;**
could compete for food**;**
pollution effects from fish farms/fish may spread disease/
faeces/waste/sea lice**;** MAX 2

2 (d) (i) High inputs**;**
temperature**;**
named example of inputs
eg control of food = pellets/concentrates**;**
pesticides/antibiotics/growth hormones**;**
capital**;**
fossil fuels**;**
controlled environments**;**
O_2**;**
high stocking density**;**
ref battery farms/restrict movement**;** MAX 4

2 (d) (ii) Yield which can be obtained indefinitely/will not harm
future yields**;**
where growth and replacement (birth) equals/balances mortality
and harvesting/catch = birth**;**
where population structure maintained**;**
leaves enough for breeding**;**
can't rely on fossil fuels/finite**;**
ref to fishmeal/over-exploitation of wildfish for feed/oil**;**
MAX 3

Total marks = 15

Question 3

3	(a)		Number of fish reaching maturity is declining/population will fall below MSY/over fished/be unable to maintain itself without management**;**	1
3	(b)	(i)	Catch reduced so helping stocks to recover**;**	1
3	(b)	(ii)	Smaller/immature fish escape**;**	1
3	(b)	(iii)	Safe from catch allows breeding/acts as nursery**;**	1
3	(c)		Existing biomass/stock/spawning stock biomass**;** mortality rate**;** birth rate/recruitment**;** migration**;**	MAX 2
3	(d)		Control species**;** food/nutrition/vitamins**;** water temperature**;** daylight/artificial lighting**;** predators**;** antibiotics/pesticides**;** growth enhancers/regulators/hormones**;** oxygen levels**;** water/current speed**;** pH control/named example**;** pollution control/named example**;** assist spawning/reproduction**;** limit movement/respiration**;**	MAX 4

Total marks = 10

Aquaculture

Question 4

4 (a) Introduction of disease/parasites/sea lice**;**
eutrophication/waste/OM accumulating**;**
effect on food chain/population of low value fish**;**
bioaccumulation/biomagnification**;** MAX 2

4 (b) Control of supply/size/species of fish**;**
optimum growth rates/efficient energy conversion/high yield**;**
cheap/uses a waste or by-product/less waste fish**;** MAX 2

Total marks = 4

Question 5

5 (a) Value of pollinators/traded species/food species/tourism**;** 1
[**R** C > profits/ref to profit]

5 (b) Not viable/sustainable**;**
costs > benefits**;**
ref to declining shrimp productivity/accelerating costs**;** 3

Total marks = 4

Question 6

6 (a) Control size/health/disease/age optimum growth rates/ref to maximum sustainable yield/year-round supply**;**
control of species/genotype**;**
ease of harvest**;**
[**A** converse]
wild stocks depleted/preserve wildstocks/overfishing/
facing extinction**;**
quotas**;**
ref energy ratio**;** MAX 3
[**R** control quality = vague]
[**R** more efficient/cheaper/cost-effective]

6 (b) (i) (Daylength/photoperiod determines) spawning/breeding/ reproduction**;** 1

6 (b) (ii) Kill lice/parasites/fungus/worms/nematodes/leeches/bacteria**;** 1
[**R** disease/pest]

6 (b) (iii) Aeration/reduce supersaturation of eg nitrogen/add O_2/ prevent stagnation**;** 1

6 (b) (iv) Reduce energy/respiration loss by fish trying to maintain position/reduces food being washed out before it's eaten/ remove waste products**;** 1
[**A** maintain correct amount of nutrients in H_2O]
[**R** reduce damage to fish/fry]
[**R** mimic nature]

Total marks = 7

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Topic 4: Forestry

1 Read the following passage.

Despite their luxuriant growth, humid tropical forests generally occur on soils of low fertility. Most of the nutrients are in the biomass; litter is rapidly recycled. Harvesting of the biomass depletes essential nutrients and promotes erosion, compaction and weed infestation. Even if introduced forage crops are planted straight away, they can rarely compete against native weeds. Tropical deforestation disrupts global biogeochemical cycles and, ultimately, climate. The popular conception of the Amazon forest as the world's 'lungs', which generate the oxygen we breathe, has been rejected, but at least half of the rainfall in the Amazon Basin comes from water evapotranspired from the forest itself. Moreover, humid tropical forests contain approximately 35 % of the world's living terrestrial carbon pool; release of this pool through felling and burning will contribute substantially to global warming. However, perhaps the greatest danger of tropical deforestation is the loss of genetic diversity – the humid tropical forests contain 40 – 50 % of the Earth's species. At a stroke, this provides aesthetic, economic and scientific justification for conservation.

The underlying causes of deforestation are complex. One persistent myth is that tropical deforestation is caused by overpopulation, but, excluding the Amazon forest, Brazil has a population density of 23 people/km^2, about the same as the US, the world's greatest food exporter. If all potential farmland outside of the Amazon were equally distributed, each Brazilian would have 4 ha. Instead, 4.5 % of Brazilian landowners own 81% of the farmland and 70 % of rural households are landless. With insufficient land, the rural poor become shifting cultivators. Cattle production on cleared rainforests is uneconomic without government subsidy, but clearing continues because of the speculative value of land.

Ecologists have investigated methods of encouraging the recolonisation of abandoned areas of shifting cultivation. Shifting cultivators cut and burn an area of forest and grow subsistence crops such as cassava, plantains, rice, beans and fruit for two to three years. The site is then abandoned. Eventually, herbs replace the woody species. Slash and burn clearings are usually small (less than one hectare) and this allows efficient seed dispersal by native trees at the edge of the clearing. Whilst the site is being farmed, repeated weeding is necessary to remove reinvading woody pioneers. It has also been discovered that high densities of native colonisers appear under any isolated fruit trees that are left when the cultivators move on.

Use information from the passage and your own knowledge to answer the following questions.

1 (a) What is the significance to farmers of recycling rates in humid tropical forests? (line 2)

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(3 marks)

1 (b) Outline **four** ways in which deforestation can affect climate. (line 5)

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(4 marks)

1 (c) Explain how humid tropical biodiversity justifies conversation:

1 (c) (i) aesthetically (line 14)

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(1 mark)

1 (c) (ii) economically (line 14)

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(1 mark)

1 (c) (iii) scientifically. (line 14)

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(1 mark)

1 (d) Suggest how the Brazilian Government could decrease rainforest destruction through the reform of land ownership.

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(2 marks)

1 (e) Explain why native weeds outcompete introduced forage crops. (lines 4-5)

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(2 marks)

1 (f) Use information in the text to explain:

1 (f) (i) the term *deflected succession*

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(3 marks)

1 (f) (ii) why forest regeneration of abandoned plots is most likely in small clearings which contain fruit trees. (lines 30 – 32)

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(3 marks)

20

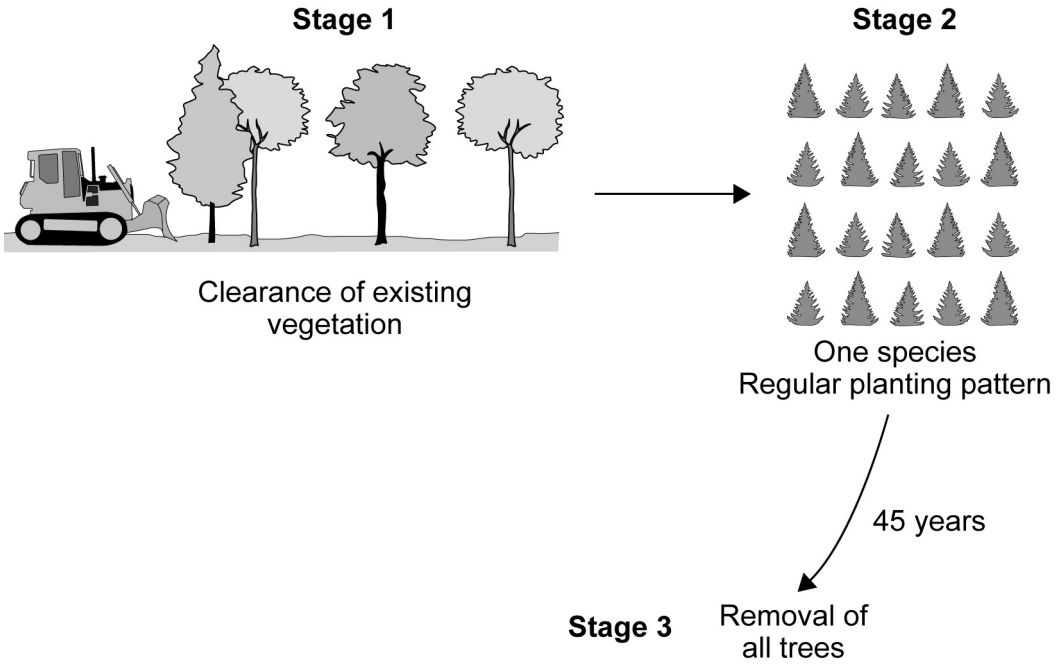
2 Outline the role of multipurpose forest management in More Economically Developed Countries.

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 for grammar, punctuation and spelling.

(20 marks)

20

3 The diagram shows stages in the development of a pine tree plantation in Australia.



3 (a) Outline the advantages of growing trees in plantations.

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(2 marks)

3 (b) Explain the impact of **Stage 3** on:

3 (b) (i) forest hydrology;

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(2 marks)

3 (b) (ii) soil stability.

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(2 marks)

6

4 Discuss the environmental and economic importance of forests.

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 for grammar, punctuation and spelling.

(20 marks)

20

5 The table summarises some of the characteristics of wild and plantation-grown teak. Teak is a valuable timber species used to make high-value furniture. In 2002, 70 % of the teak harvested in the wild was exported to richer countries. Plantations are seen as one way of helping to slow tropical forest destruction.

	Wild	**Plantation**
Growing time/years	Up to 200	20-80
Species mix	Usually hundreds of different species per hectare	Usually a monoculture
Resistance to fungal and beetle attack	High	Low

5 (a) Suggest why plantation-grown teak is ready for harvest faster than wild-grown teak.

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(1 mark)

5 (b) Using the information in the table and your own knowledge of production systems, outline how teak plantations may:

5 (b) (i) conserve tropical biodiversity

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(2 marks)

5 (b) (ii) reduce tropical biodiversity.

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(3 marks)

5 (c) Suggest how genetic engineering may help to improve the quality of plantation teak.

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(2 marks)

8

6 Read the article and then answer the questions that follow.

Saving the rainforests: Who should pay?

Forest destruction leads to local floods and landslides. Imagine that the cleaning up operation costs $20 million. This means that it could have been worth paying the government of the country $20 million to conserve the forest. The only people who suffer from the floods and landslides are locals; does this mean that they should have to pay the $20 million?

No, because tropical forest destruction also leads to global climate change, which affects people all over the planet.

Forests have other broad functions.

1 Watershed protection

30 % of the world's largest cities depend on forests for their water. Industries downstream of the forest, hydroelectric plants, irrigation systems and municipal water systems all benefit from the forest. In Costa Rica, landowners in critical watershed areas are paid $30 per hectare by these industries to maintain the forest.

2 Biodiversity protection

Landowners are paid to conserve habitats and species of insects and birds that are crucial for agriculture. They are also paid to develop ecotourism and eco-labelled products such as shade-grown coffee and herbal medicines.

3 Carbon absorption

In an effort to encourage forest conservation and creation, the Kyoto Protocol offers countries $10 per tonne of carbon absorbed. This aspect of the protocol is expected to raise $300 million per year for afforestation and reforestation.

However, the poor countries of the tropics argue that, whilst they are doing the hard work, it is the whole planet that is getting the benefit. If, for example, Malaysia protects its forests, maintains biodiversity and reduces global climate change, it will lose a fortune in income from timber sales. Many far richer countries, regions, cities and individuals will benefit. So who should pay Malaysia for its efforts?

6 (a) Explain:

6 (a) (i) how forest destruction can cause flooding and landslides (line 1)

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(4 marks)

6 (a) (ii) the statement that *'30 % of the world's largest cities depend on forests for their water'* (line 10)

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(3 marks)

6 (a) (iii) why conservation of insects and birds is considered crucial. (lines 15-16)

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(2 marks)

6 (b) Calculate the mass of carbon that tropical forests are expected to capture annually in this aspect of the Kyoto Protocol. (lines 19-21)

Answer.....

(1 mark)

6 (c) Suggest a scientific basis for each of the following scenarios.

6 (c) (i) The UK Government could pay Malaysia for helping to protect the UK coastline.

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(3 marks)

6 (c) (ii) The US Department for Agriculture could pay Malaysia for plant genetic material.

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(2 marks)

15

Mark scheme – Topic 4: Forestry

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

1	(a)			Most nutrients in biomass/soil low in nutrients**;** crop removal/deforestation removes nutrients**;** crop growth poor/poor yield**;**	3
1	(b)			Increases CO_2/C leading to global warming**;** decreases transpiration/evaporation hence rainfall/becomes drier**;** decrease cloudiness, so increase insolation/warmer**;** increases soil erosion/particulates/condensation nuclei, so increases rainfall**;** (qualified) desertification so gets warmer/drier**;**	MAX 4
1	(c)	(i)		Reference to beauty/landscape/pleasure**;**	1
1	(c)	(ii)		Reference to products/leisure/tourism/ref to avoiding negative effect**;**	1
1	(c)	(iii)		Reference to genetic information/ecological study/medical**;** environmental monitoring/undiscovered species**;**	MAX 1
1	(d)			Provide sufficient land for people to grow crops/government provides land**;** decrease shifting cultivation/decrease pressure on rainforest**;**	2
1	(e)			Better adapted/greater vigour/greater tolerance/specialised/ acclimatised**;** more efficient at capturing water/nutrients/ref to root formation (qualified explanation of tolerance)**;**	2
1	(f)	(i)		Normal pattern of species change/succession prevented**;** crop/cropping deflects succession**;** weed/weeding removes woody species**;** and allows herbs to dominate**;**	MAX 3
1	(f)	(ii)		Large edge : area ratio**;** short dispersal distance/easy to disperse seeds**;** fruit trees attract bats/birds/monkeys etc**;** important seed dispersers/faeces**;**	MAX 3

Total marks = 20

Question 2

Reference can be made to renewable source of timber, fuel, food and fibre. The forest also provides atmospheric regulation, habitat, shelter and is important in regulation of the water cycle, soil conservation and for recreation and amenity. Reference to employment and multiplier effects.
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 3

3 (a) Feature: all same age/species/genotype/high density/can control age, species etc**;**
Advantage: mature at same time/less weeding/less branching/ straighter stems/faster return/high yield/profit/easier marketing/easier management**;** MAX 2

3 (b) (i) Decreased interception**;**
increased runoff/overland flow/increased flooding/ decreased infiltration/water logging**;**
decreased (evapo)transpiration/humidity**;** MAX 2

3 (b) (ii) Increased rainsplash/raindrop impact**;**
decreased root binding/decreased OM/increased erosion/ soil becomes dust**;** MAX 2

Total marks = 6

Question 4

Wood and timber products
foodstuffs
firewood
paper
scientific/medicinal products
microclimatic effect
biodiversity/habitat/wildlife
soil conservation
role in helping economic development
recreation/amenity
catchment protection
atmospheric regulation
regulation of water cycle
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 5

5	(a)		Closer planting distance/effect of competition/pesticides/ fertilisers**;**	1
5	(b)	(i)	Less disturbance/destruction of habitat**;** less damage to non-target species**;** less hydrological/microclimate effect**;** faster production of timber/markets/demand can be satisfied easier**;**	MAX 2
5	(b)	(ii)	Plantations grown on cleared rainforest**;** may lead to soil erosion/exhaustion**;** only one tree species**;** much simpler ecosystems/unstable/fewer niches**;** may need more pesticide/fungicide**;** may stimulate demand so encourage felling wild trees**;** GM contamination**;** reservoir of disease**;**	MAX 3
5	(c)		Some factors controlled by genes**;** eg colour/grain/density/pest resistance/fibre length**;** ref to tissue culture/cloning**;**	MAX 2

Total marks = 8

Question 6

6	(a)	(i)	Loss of interception/cover/increases raindrop impact/ compaction**;** loss of absorption/evapotranspiration**;** increased runoff/overland flow**;** reduced lag time**;** reduced root binding/OM**;** weaker soil structure**;** erosion/rills/gullies/soilwash/sheetwash**;** sedimentation of rivers**;**	MAX 4
6	(a)	(ii)	Ref interception/condensation/precipitation harvesting**;** stem flow**;** ref to groundwater storage**;** prevents runoff/loss to oceans/increased infiltration**;** regulates river regimes**;** increased evaporation/transpiration**;** increases inland/downwind precipitation**;**	MAX 3
6	(a)	(iii)	Pollinators**;** seed dispersal**;** needed for crop growth**;** ref to biological control of pests**;** insects as detrivores**;**	MAX 2
6	(b)		30 million tonnes**;**	1
6	(c)	(i)	Forests maintained/afforestation/reforestation/ stop deforestation**;** carbon sinks/photosynthesis/reduced carbon dioxide**;** reduced warming/eghe/gh gasses/global climate change**;** reduced thermal expansion/sea level rise**;** reduced storms**;** reduced erosion/flooding**;** [**R** ice melt]	MAX 3
6	(c)	(ii)	Genes for pest resistance/growth traits/medicines**;** discovered/grow in forests**;**	2

Total marks = 15

Topic 5: Sustainability

1 'The environmental problems associated with agriculture, forestry and fishing are the result of simplified ecosystems'. Discuss this statement.

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 for grammar, punctuation and spelling.

(20 marks)

20

2 Discuss the ways in which modern farming systems can be made more sustainable.

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 for grammar, punctuation and spelling.

(20 marks)

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Mark scheme – Topic 5: Sustainability

Instructions: ; = 1 mark / = alternative response A = accept R = reject

Question 1

Agriculture uses simple food chains
uses few genotypes/species
forests often monocultures
easier management
fishing is simple exploitation
little attempt to manage
little knowledge of food chains/webs
problems of calculating MSY
exotic species in forestry
eradicates pests/parasites and biological control
reduces decomposition
removal of crop removes nutrients
complete harvest/clearfelling leaves soil bare
erosion
dependent upon external inputs
fertilisers
pesticides
inputs all based on fossil fuels
polluting
finite
energy ratio may be < 1
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20

Question 2

Less intensive
reduced reliance on artificial inputs
eg agrochemicals/fertilisers/pesticides/herbicides/hormones/FFs/antibiotics
EU nitrates directive
legumes
natural/green fertilisers
organic systems
EU agri-environment payments for organic farms
stewardship
mixed farming
outputs recycled as inputs
crop rotation
soil conservation techniques
re-establish hedges/Hedgerow Incentive Scheme
Farm Woodland Scheme
biological control
FWAG
Biodiv Action Plan UK
grow crops in season
reduce food miles/local Farmers' markets
farming at a lower trophic level
ban GM
GM crops require less agrochemicals
(Refer to guidance on essay questions from Topic 1 Q1)

Total marks = 20