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EDEXCEL INTERNATIONAL GCSE GEOGRAPHY: QUESTIONS BY TOPIC

Fragile Environments and Climate Change (Topic 7)

International GCSE Geography Topic 7

16 questions · 560 marks · Mark schemes included

Pearson Edexcel International GCSE (9–1) Geography 4GE1, Papers 1, 1R, 2 & 2R, June 2019 - June 2025

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HOW TO USE THIS BOOKLET

Questions are grouped by sub-topic (exam questions, then fieldwork), oldest paper first.

Click any heading or question row below to jump straight to it.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
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3. Q7	Paper 2 November 2020	35	15
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QUESTIONS

16 questions · 560 marks · grouped by sub-topic



SUB-TOPIC

FRAGILE ENVIRONMENTS AND CLIMATE CHANGE: EXAM QUESTIONS

16 questions in this booklet



7 Fragile environments and climate change.(a) (i) State **one** example of a greenhouse gas.

(1)

(ii) Identify the meaning of the term **enhanced greenhouse effect**.

(1)

☐	A cooling of the Earth's atmosphere resulting from human activities
☐	B warming of the Earth's atmosphere resulting from human activities
☐	C additional heat trapped in the Earth's atmosphere as a result of natural effects
☐	D greenhouse gases naturally present in the Earth's atmosphere causing warming

(iii) Identify the meaning of the term **Milankovitch cycle**.

(1)

☐	A cyclical movement of the Earth's orbit around the Sun
☐	B differences in the amount of energy emitted from the Sun
☐	C additional heat trapped in the Earth's atmosphere
☐	D seasonal movement of the Sun in different orbits

(b) (i) Study Figure 7a in the Resource Booklet.

Identify the **two** countries labelled in Figure 7a with the most and least CO₂ emissions.

(2)

Most

.....

Least

.....

(ii) Suggest **two** reasons for the pattern shown on Figure 7a.

(4)

1

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2

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(c) Explain **two** negative effects of deforestation on people in fragile environments.

(4)

1

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2



(d) Study Figure 7b in the Resource Booklet.

(i) Calculate the range in CO₂ emissions in **India** between 1960 and 2015.

You must show all your workings in the space below.

(2)

(ii) Identify the trends in CO₂ emissions in China, 1960-2015.

(2)

(e) Study Figure 7c in the Resource Booklet.

Assess the different human factors that cause climate change.

(6)



(f) Discuss the view:

“Those people contributing the most to climate change will experience the greatest impact”.

Use Figures 7a, 7b and 7c from the Resource Booklet and your own knowledge and understanding to support your answer.

(12)

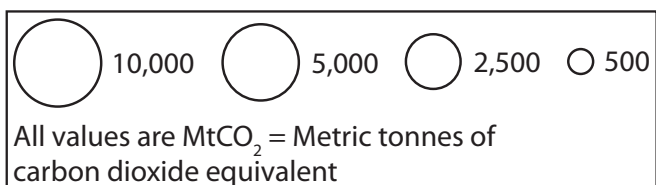
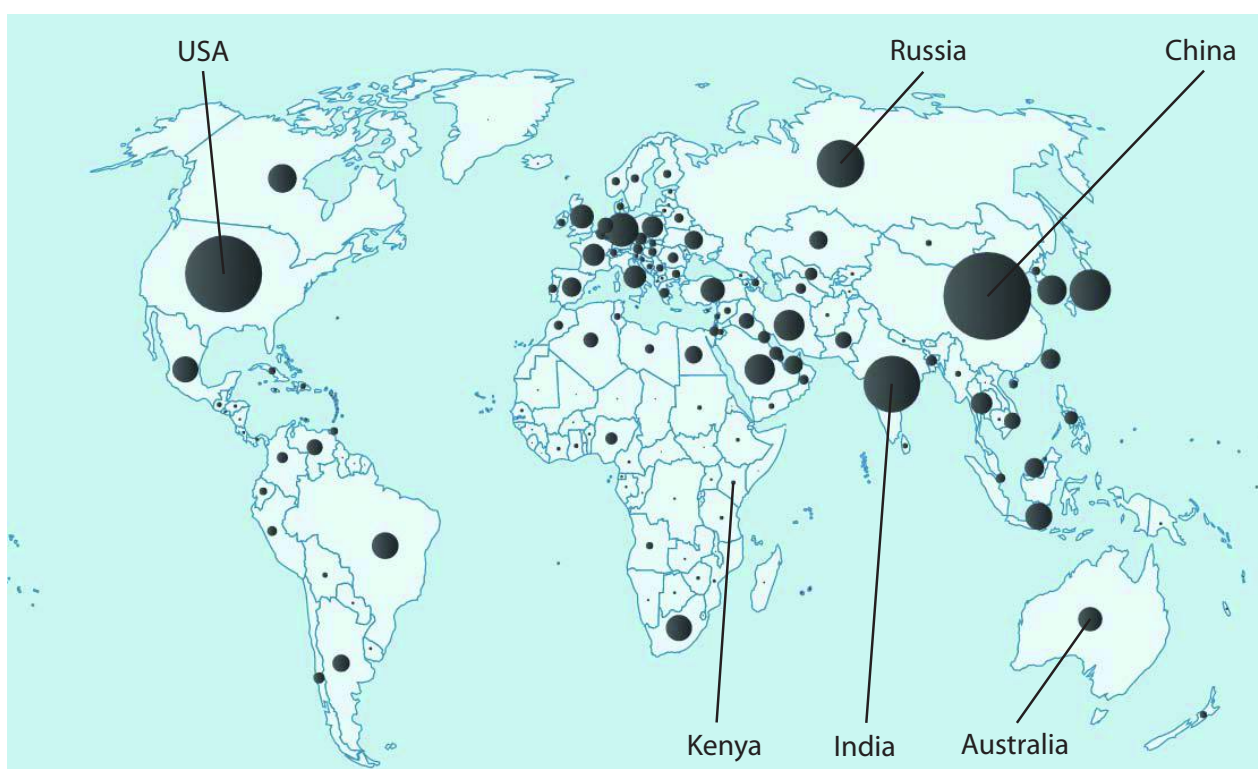
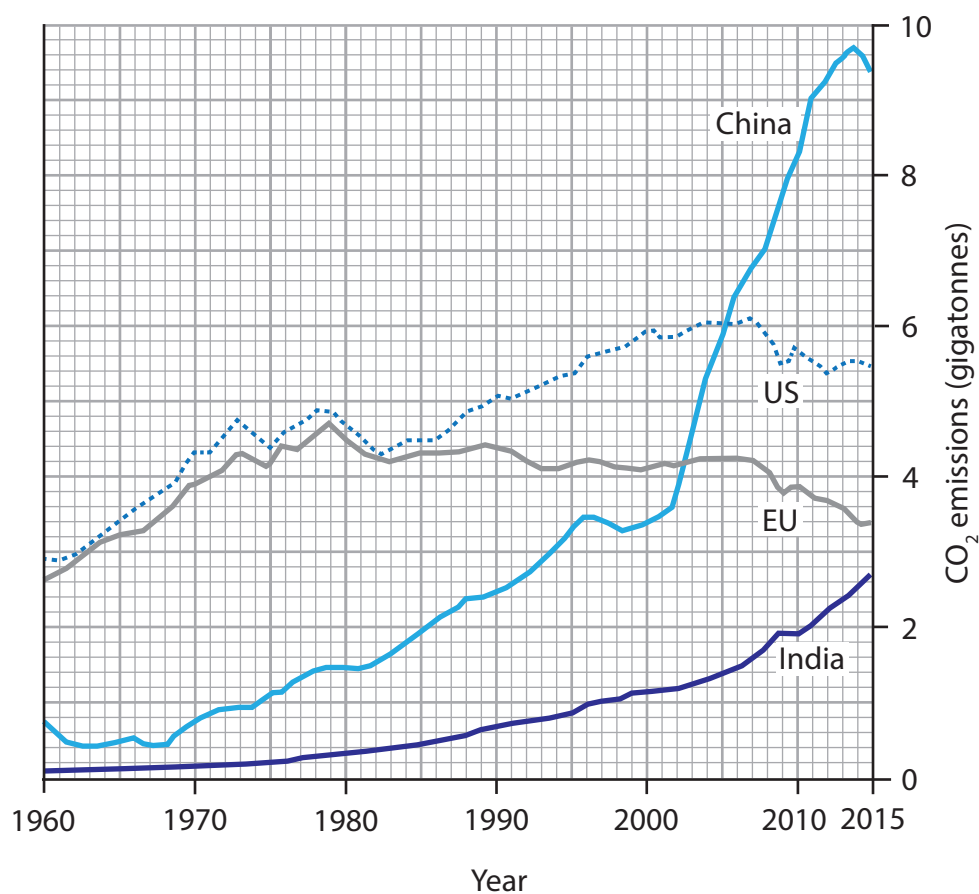


Figure 7a

Map of global CO₂ emissions per country in 2016 (carbon footprint)

(Source: from <http://www.globalcarbonatlas.org/en/CO2-emissions>)

**Figure 7b**

CO₂ emissions (gigatonnes) for selected countries and regions, 1960 - 2015

(Source: from <https://www.economist.com/blogs/graphicdetail/2015/12/climate-change>)

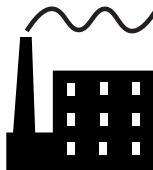
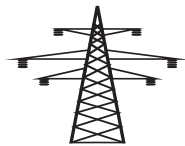
Human activities		Drivers (causes) of climate change
	Air travel	Fossil fuel combustion from increasing global air travel produces CO ₂ and nitrous dioxide.
	Livestock farming	Cows and sheep produce large amounts of methane when they digest their food.
	Industry	Energy is used in both the making and distribution of manufactured goods. These have a high global carbon footprint.
	Electrical energy consumption	Global electricity consumption has risen from increasing wealth and changes in people's lifestyles. A high proportion of electricity is produced from non-renewable sources.
	Deforestation	Forests help balance gases in the atmosphere. Deforestation upsets this process, releasing more CO ₂ into the atmosphere.

Figure 7c**Selected human activities as drivers of climate change**

7 Fragile environments and climate change.(a) (i) Identify **one** natural cause of climate change.

(1)

☐	A industry
☐	B transport
☐	C volcanoes
☐	D intensive farming

(ii) Identify the meaning of the term **enhanced greenhouse effect**.

(1)

☐	A cooling of the Earth's atmosphere from human activities
☐	B less heat trapped in the Earth's atmosphere
☐	C additional heat trapped as a result of natural effects
☐	D additional heat trapped as a result of human activities

(b) (i) Define the term **deforestation**.

(1)

.....

.....

(ii) Study Figure 7a in the Resource Booklet.

Identify **two** countries labelled in Figure 7a with a net loss in forest cover of greater than 5,000 km²/year.

(2)

1

2



(iii) Suggest **two** possible reasons for the pattern shown on Figure 7a.

(4)

1

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.....

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2

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.....

(c) Explain **two** negative effects climate change is having on people.

(4)

1

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2



(d) Study Figure 7b in the Resource Booklet.

(i) Calculate the range in **total deforestation** loss between 2004 and 2012.

You must show all your workings in the space below.

(2)

(ii) Describe the extent to which deforestation rates have changed from 2004-2012 in Figure 7b.

(2)

(e) Study Figure 7c in the Resource Booklet.

Assess the different factors that have caused deforestation.

(6)



(f) Discuss the view:

"It is possible to manage the global rates of deforestation in a more sustainable way".

Use Figures 7a, 7b and 7c from the Resource Booklet and your own knowledge and understanding to support your answer.

(12)

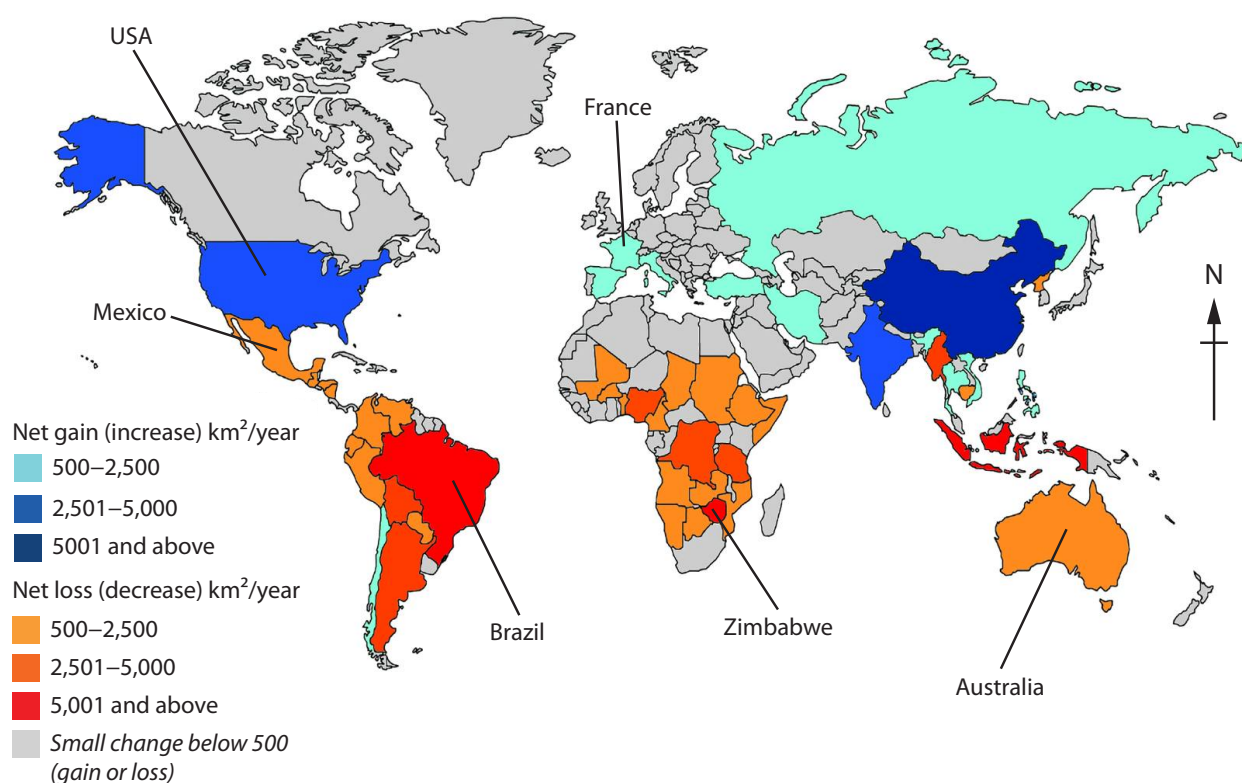
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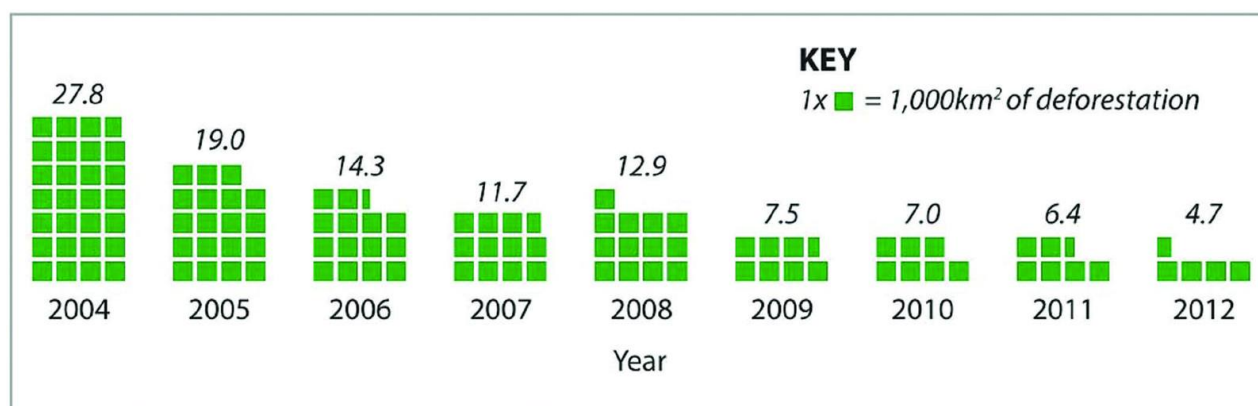
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(Source: <http://www.dw.com/en/amazon-deforestation-ticks-tragically-up/a-36597538>)

Figure 7a

Annual net change in global forest area 1990-2015



(Source: http://wwf.panda.org/_core/general.cfc?method=getOriginalImage&ulmgID=%26%2ARX%2E%21NS%3F%0A)

Figure 7b

Estimate of annual deforestation rate in Brazilian Amazon, 2004-2012

	Cause	Description
	Conversion of forests	For other land uses, including pulp, palm and soy plantations, pastures, settlements and infrastructure, e.g. roads.
	Forest fires	Each year, fires burn millions of hectares of forest worldwide. Fires are usually a natural process and fragile forests are particularly vulnerable.
	Illegal logging	Illegal logging occurs in all types of forests across all continents – destroying nature and wildlife, taking away community livelihoods and distorting trade.
	Mining	The impact of mining on tropical forests is growing due to rising demand and high mineral prices. Mining projects are often accompanied by major infrastructure construction.

(Source: http://wwf.panda.org/_core/general.cfc?method=getOriginalImage&ulmgID=%26%2ARX%2E%21NS%3F%0A)

Figure 7c

Some causes of deforestation and loss of environmental quality

7 Fragile environments and climate change

(a) (i) Identify **one** human cause of **climate change**.

(1)

☐	A Milankovitch cycles
☐	B intensive farming
☐	C volcanoes
☐	D sun-spot cycles

(ii) Identify **one** cause of **deforestation**.

(1)

☐	A planting of trees
☐	B sustainable forest management
☐	C lowering of sea levels
☐	D significant increase in mining

(b) (i) Define the term **global climate change**.

(1)

(ii) Study Figure 7a in the Resource Booklet.

Identify **two** countries labelled in Figure 7a, **one** with the highest and **one** with the lowest total carbon emissions.

(2)

Highest

Lowest

(iii) Suggest **two** possible reasons for the pattern shown in Figure 7a.

(4)

1

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2

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(c) Explain **two** causes of desertification.

(4)

1

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2



(d) Study Figure 7b in the Resource Booklet.

(i) Calculate the mean change in global forest area, 1990–2015.

You must show all your workings in the space below.

Give your answer to one decimal place.

(2)

(ii) Describe the differences in the changes in global forest area for Europe and Central Asia, and Latin America.

(2)

(e) Study Figure 7c in the Resource Booklet.

Assess the different climate change impacts.

(6)

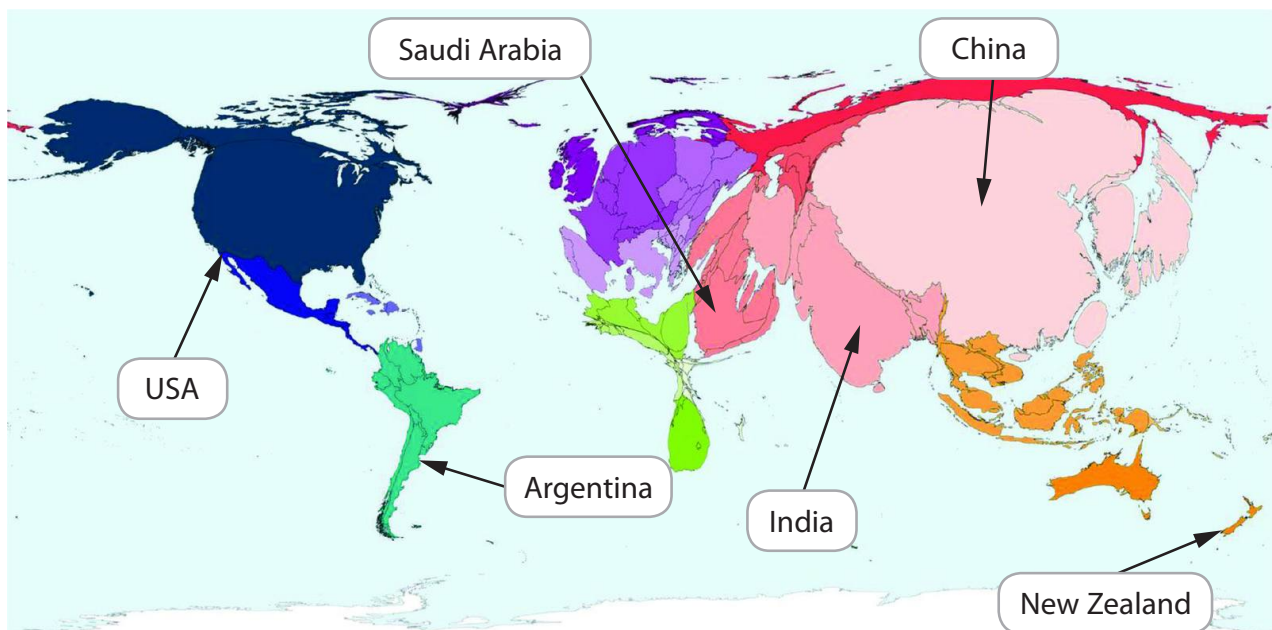


(f) Discuss the view:

'The places which contribute the most to climate change will be the places that suffer the least from climate change.'

Use Figures 7a and 7c from the Resource Booklet and your own knowledge and understanding to support your answer.

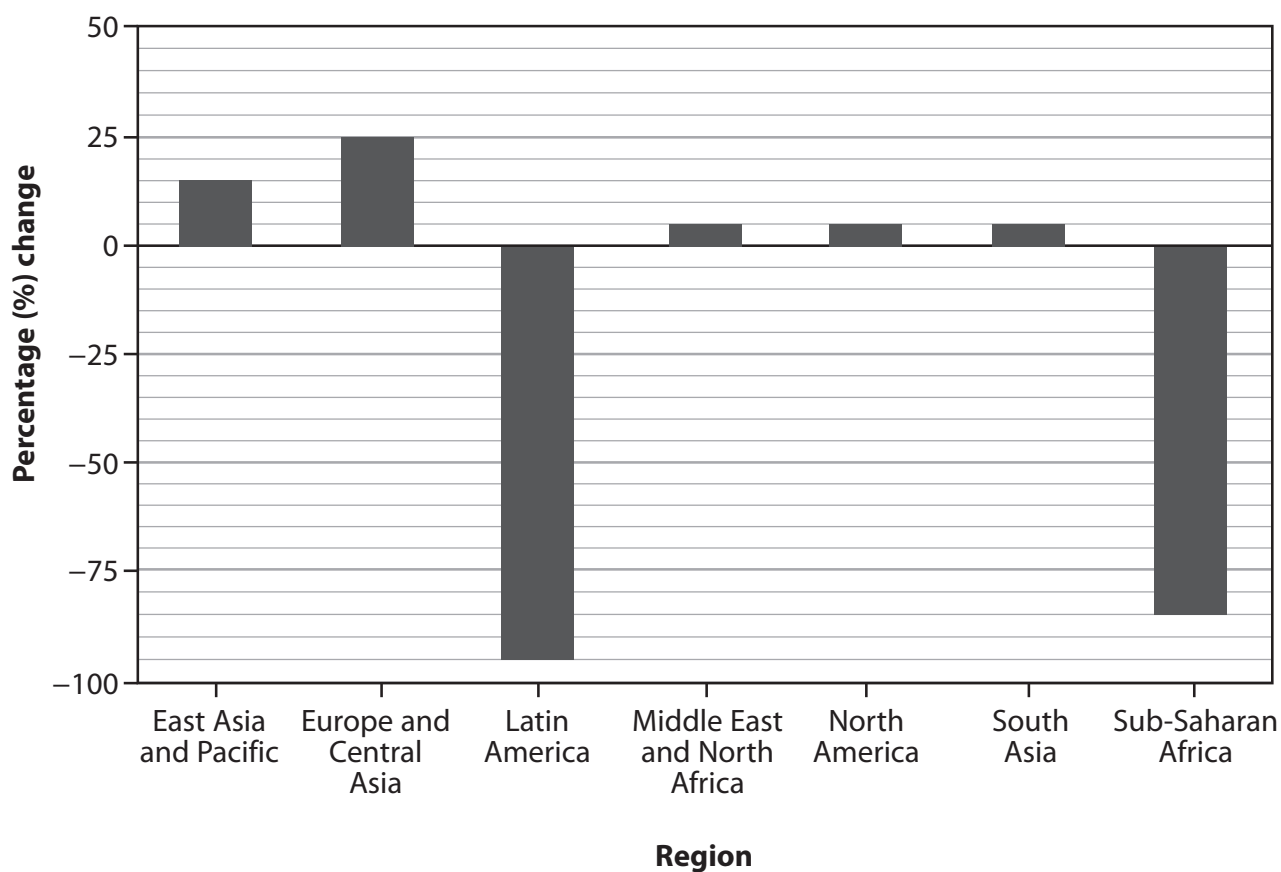
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(Source: © Worldmapper.org)

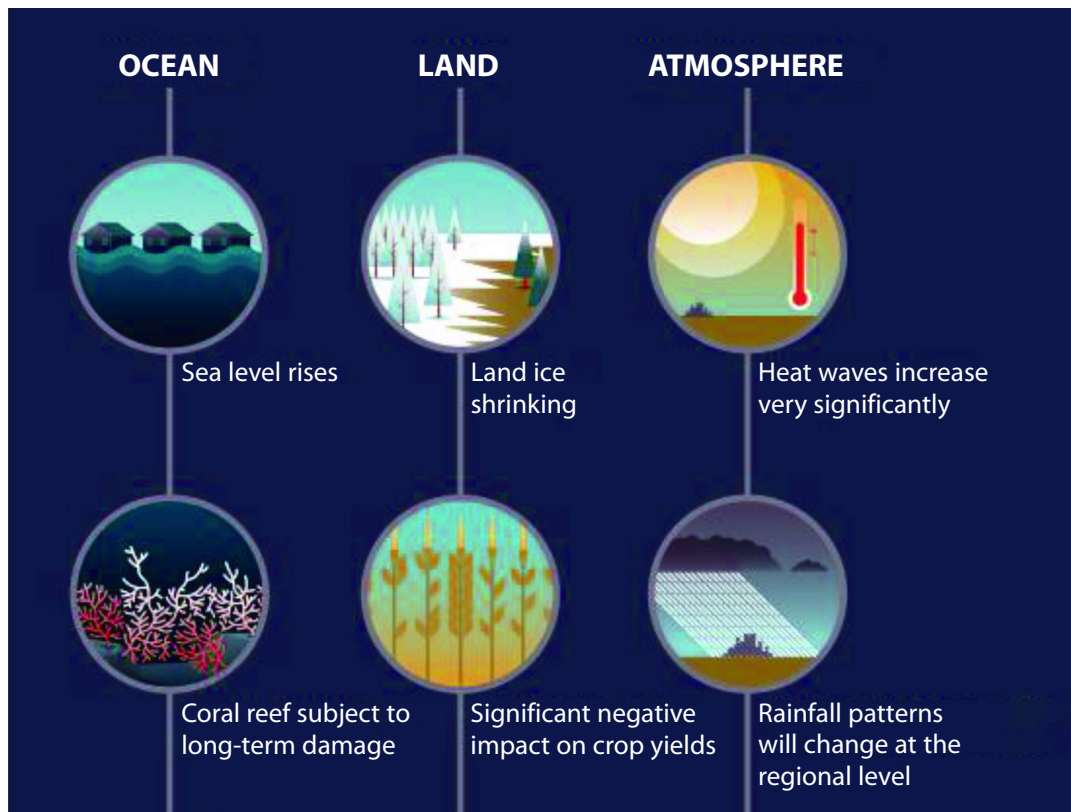
Figure 7a

Carbon emissions (2015) by colour-coded region, where each country is scaled (sized) proportionally to its total emissions



(Sourced from: <https://openknowledge.worldbank.org/bitstream/handle/10986/23969/9781464806834.pdf>)

Figure 7b
Percentage change in global forest area, 1990–2015



(Source: Today's Choice, Tomorrow's Impact © Global Carbon Atlas)

Figure 7c
Selected climate change impacts

7 Fragile environments and climate change(a) (i) Identify the meaning of the term **malnutrition**.

(1)

☐	A a diet that is high in sugar
☐	B a diet with too many nutrients
☐	C a diet with too few nutrients
☐	D a diet associated with scarcity of food

(ii) Identify **one** characteristic of a fragile environment.

(1)

☐	A a place that is suffering deforestation
☐	B a place that has a high biodiversity
☐	C a place that is being managed sustainably
☐	D a place threatened by human and physical factors

(b) (i) State **one** economic cause of deforestation.

(1)

.....

.....

(ii) Study Figure 7a in the Resource Booklet.

Identify **two** areas labelled A–F in Figure 7a with a predicted –15% to –50% loss in agricultural productivity.

(2)

1

2

(iii) Suggest **two** possible reasons for the pattern shown in Figure 7a.

(4)

1

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2

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(c) Explain **two** economic impacts climate change is having on people.

(4)

1

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2



- (d) Study Figure 7b in the Resource Booklet.
- (i) Calculate the range in loss between the countries shown.
- You must show all your workings in the space below.

(2)

..... millions of hectares

- (ii) Describe the amount of tree cover loss shown in Figure 7b.

(2)

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- (e) Study Figure 7c in the Resource Booklet.
- Assess the fragile environments at risk from increasing temperatures.

(6)

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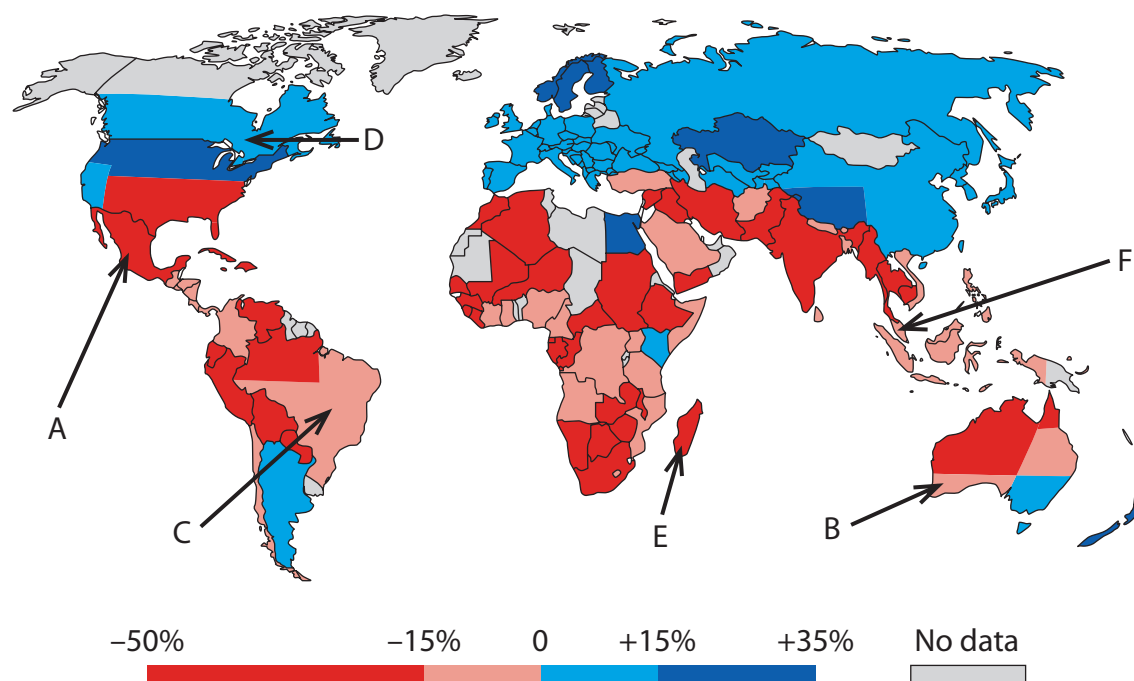
(f) Discuss the view:

'Climate change will have a bigger impact on agricultural food productivity than on fragile environments.'

Use Figures 7a and 7c from the Resource Booklet and your own knowledge and understanding to support your answer.

(12)



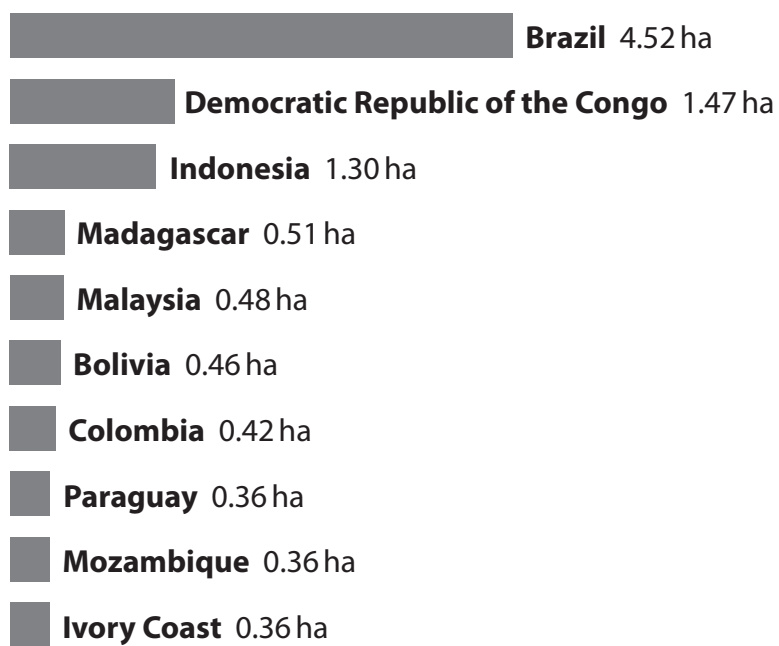


KEY:

- A – Mexico
- B – South west Australia
- C – Brazil
- D – Southern Canada
- E – Madagascar
- F – Malaysia

Figure 7a

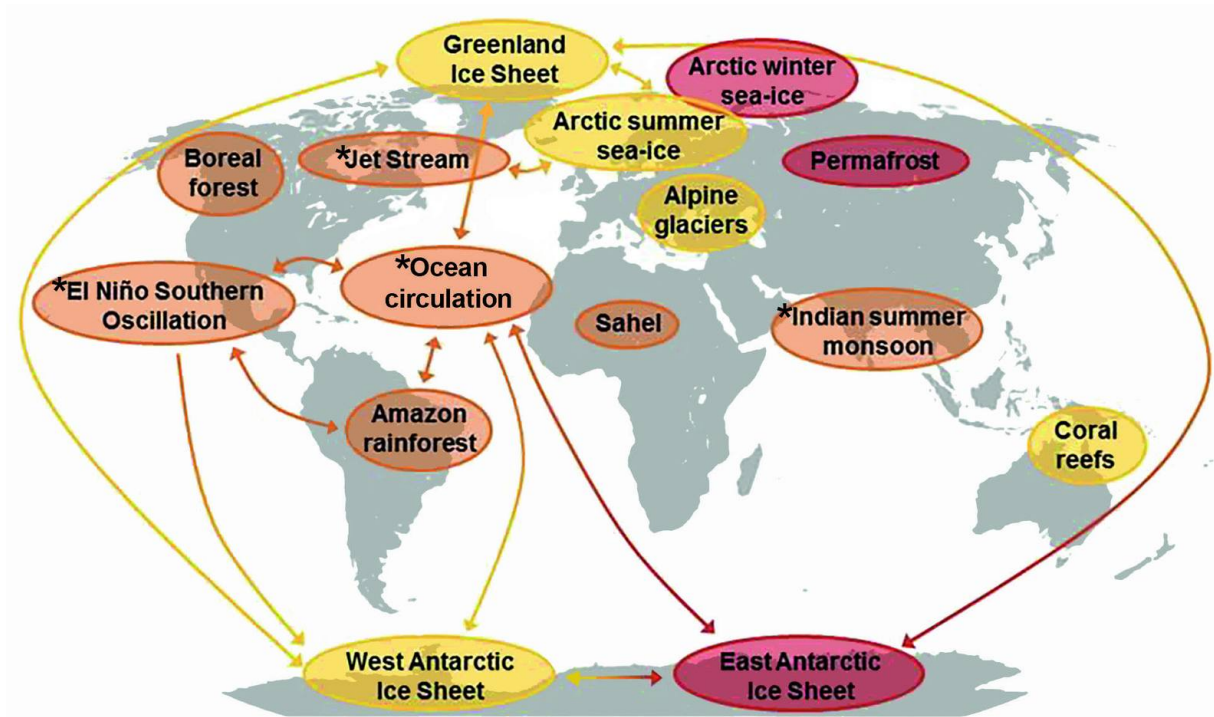
Predicted changes in agricultural productivity in 2080, as a result of climate change



(Source: <https://www.wri.org/blog/2018/06/2017-was-second-worst-year-record-tropical-tree-cover-loss>)

Figure 7b

Top ten countries for tree cover loss in 2017 (millions of hectares)



KEY:

* Earth's natural systems at risk

Temperature tipping points which will put fragile environments and natural systems at risk

● 1 °C – 3 °C

● 3.1 °C – 5 °C

● >5 °C

(Source: <http://www.stockholmresilience.org/research/research-news/2018-08-06-planet-at-risk-of-heading-towards-hothouse-earth-state.html>)

Figure 7c

Fragile environments and natural systems at risk from increasing temperatures

7 Fragile environments and climate change(a) (i) Identify the meaning of the term **Milankovitch cycles**.

(1)

☐	A Variations in ocean circulation movements.
☐	B Variations in the length of time it takes for the earth to orbit the sun.
☐	C Variations in the movement of air in the atmosphere.
☐	D Variations in the tilt and/or orbit of the earth around the sun.

(ii) Explain what is meant by the term **drought**.

(2)

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(iii) Identify **one** source leading to a significant increase of methane (CH₄) in the atmosphere.

(1)

☐	A Burning wood as fuel.
☐	B Decaying organic matter.
☐	C Use of artificial fertilisers.
☐	D Use of aerosols.

(b) Study Figure 7a in the Resource Booklet.

(i) Identify which month had the highest average rainfall in 1991–2016.

(1)

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(ii) Compare the temperature profile for 1901–1931 with the temperature profile for 1991–2016.

(2)

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(iii) Identify **one** human cause of climate change.

(2)

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(iv) Suggest **one** reason why the data in Figure 7a could create an inaccurate interpretation of global climate change trends.

(2)

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(c) State **two** impacts of deforestation.

(2)

1

2



- (d) Explain **two** different approaches to managing deforestation in a named developing or emerging country.

(4)

Named developing or emerging country

1

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2

- (e) Study Figure 7b in the Resource Booklet.

Assess the reasons for the global variation in the vulnerability to desertification.

(6)

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- (f) Discuss the view:

'Deforestation represents the most significant threat to fragile environments.'

Use Figures 7b and 7c in the Resource Booklet, and your own knowledge and understanding to support your answer.

(12)

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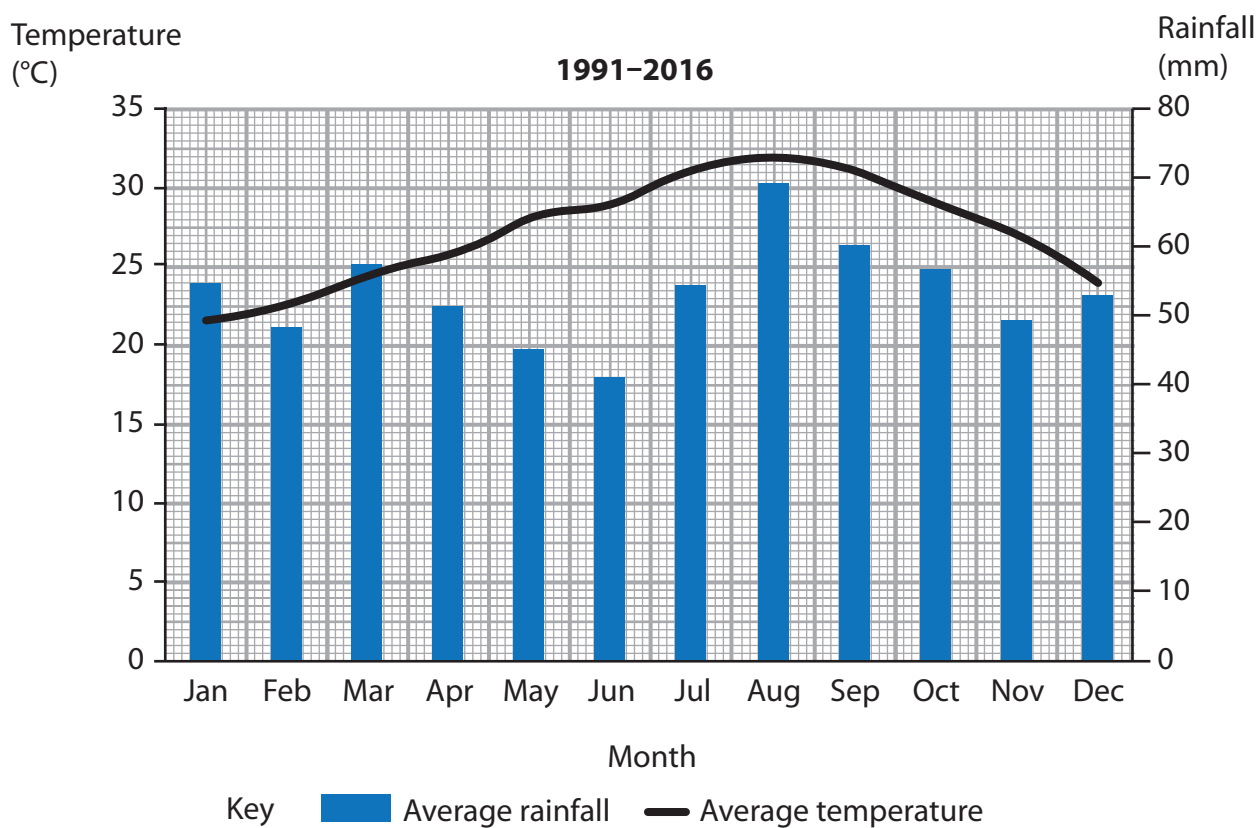
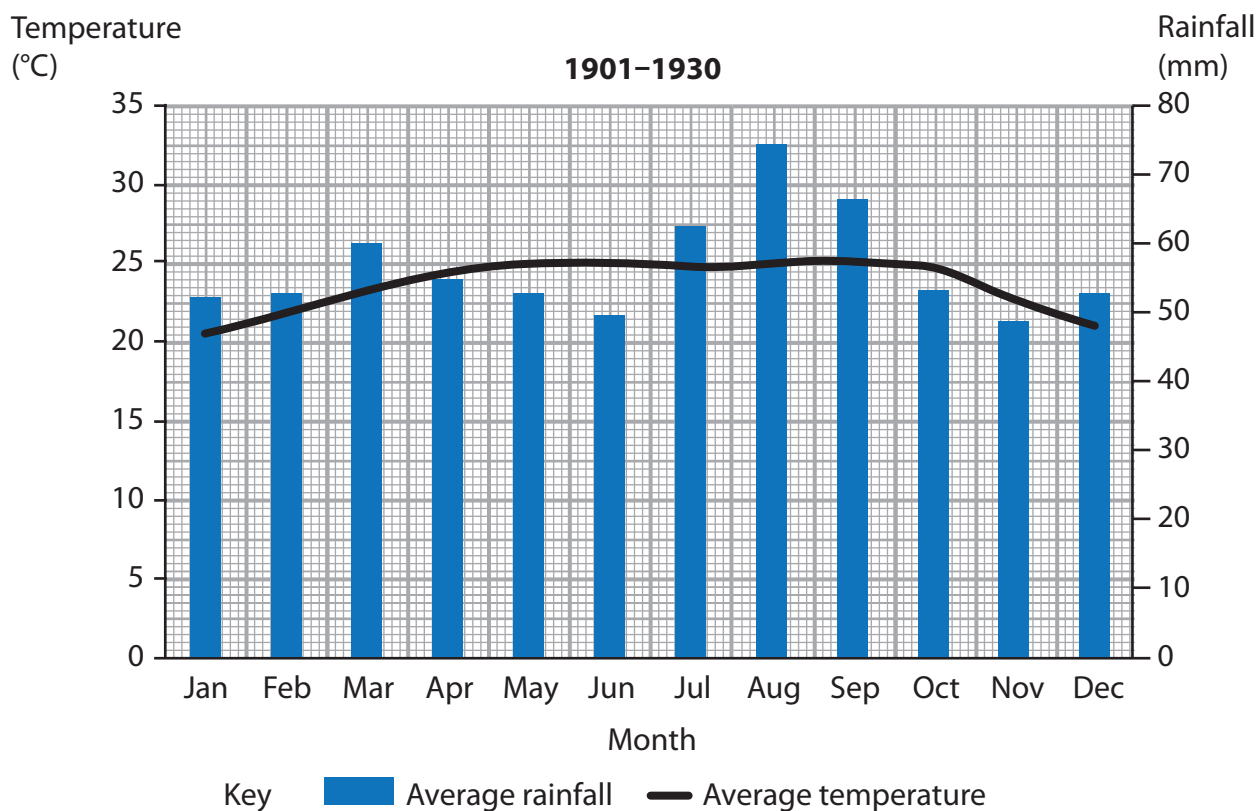
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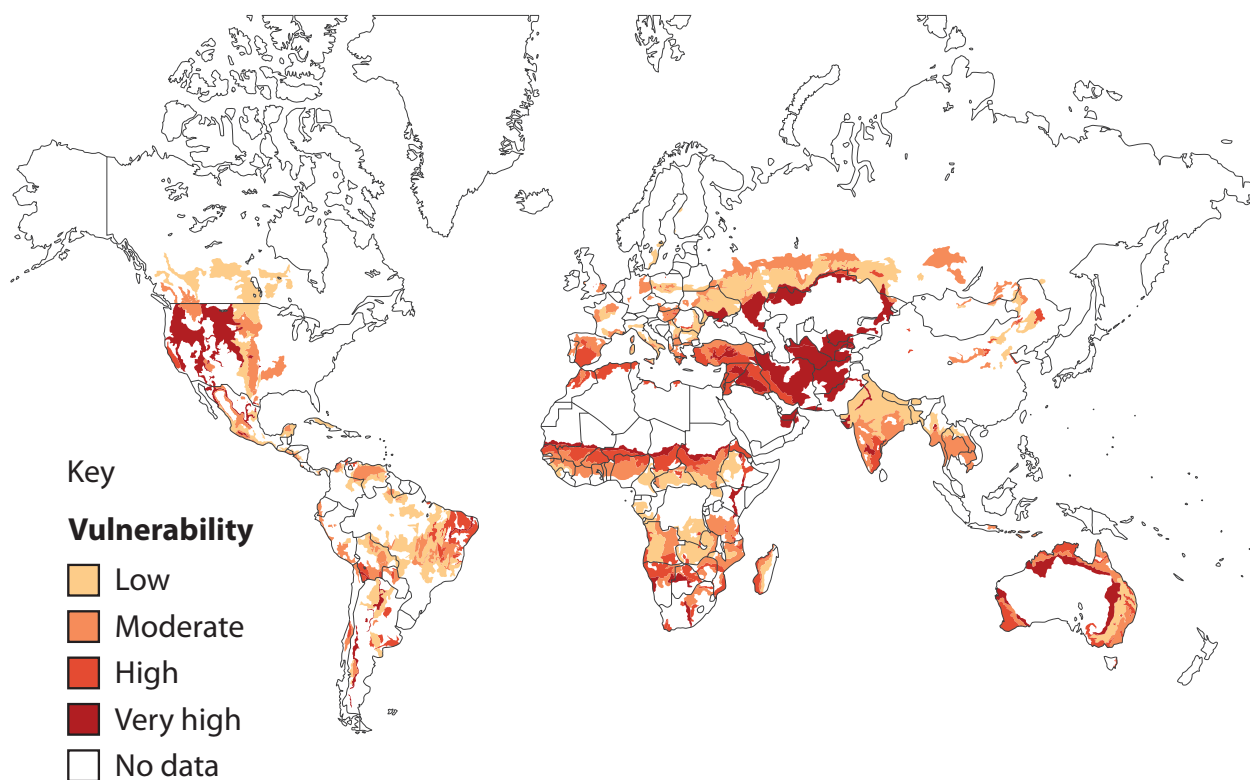
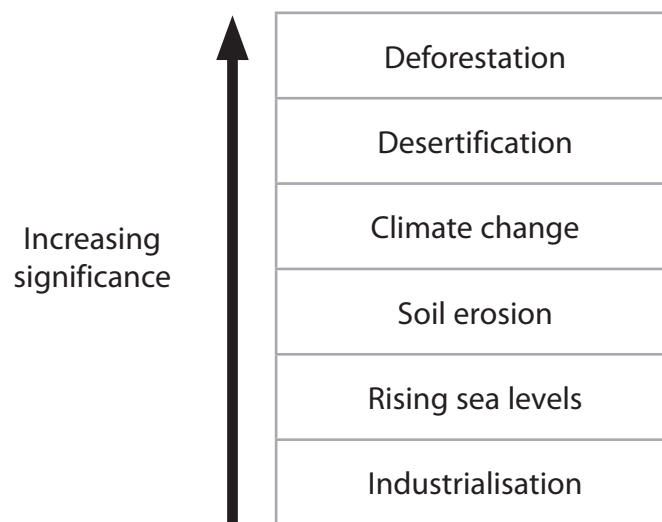
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**Figure 7a****Climate graphs for Africa, 1901–1930 and 1991–2016**

**Figure 7b****A global map of vulnerability to desertification****Figure 7c****Selected threats to fragile environments**

7 Fragile environments and climate change(a) (i) Identify the meaning of the term **drought**.

(1)

☐	A A period of time with abnormally low rainfall.
☐	B A period of time with high rainfall.
☐	C A period of time with high temperatures.
☐	D A period of time with abnormally low humidity.

(ii) Define the term **desertification**.

(2)

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(iii) Identify **one** method to manage the impacts of desertification.

(1)

☐	A Removing trees in affected areas
☐	B Install solar panels
☐	C Install water storage devices
☐	D Increase cattle farming

(b) Study Figure 7a in the Resource Booklet.

(i) Identify a decade where global temperature variation goes above zero.

(1)

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(ii) Compare the patterns of CO₂ and global temperature variation.

(2)

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(iii) Identify **two** reasons for the increased CO₂ emissions.

(2)

1

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2

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(iv) Suggest **one** reason why the data may not show global climate change accurately.

(2)

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(c) State **two** characteristics of a rainforest.

(2)

1

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2

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(d) Explain **two** different ways rainforests can be managed in a named region.

(4)

Named region

1

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2

(e) Study Figure 7b in the Resource Booklet.

Assess the potential variation in economic impact from predicted sea level rise.

(6)

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(f) Discuss the view:

'Global sea level rise presents the greatest threat from global climate change'.

Use Figures 7b and 7c in the Resource Booklet, and your own knowledge and understanding, to support your answer.

(12)

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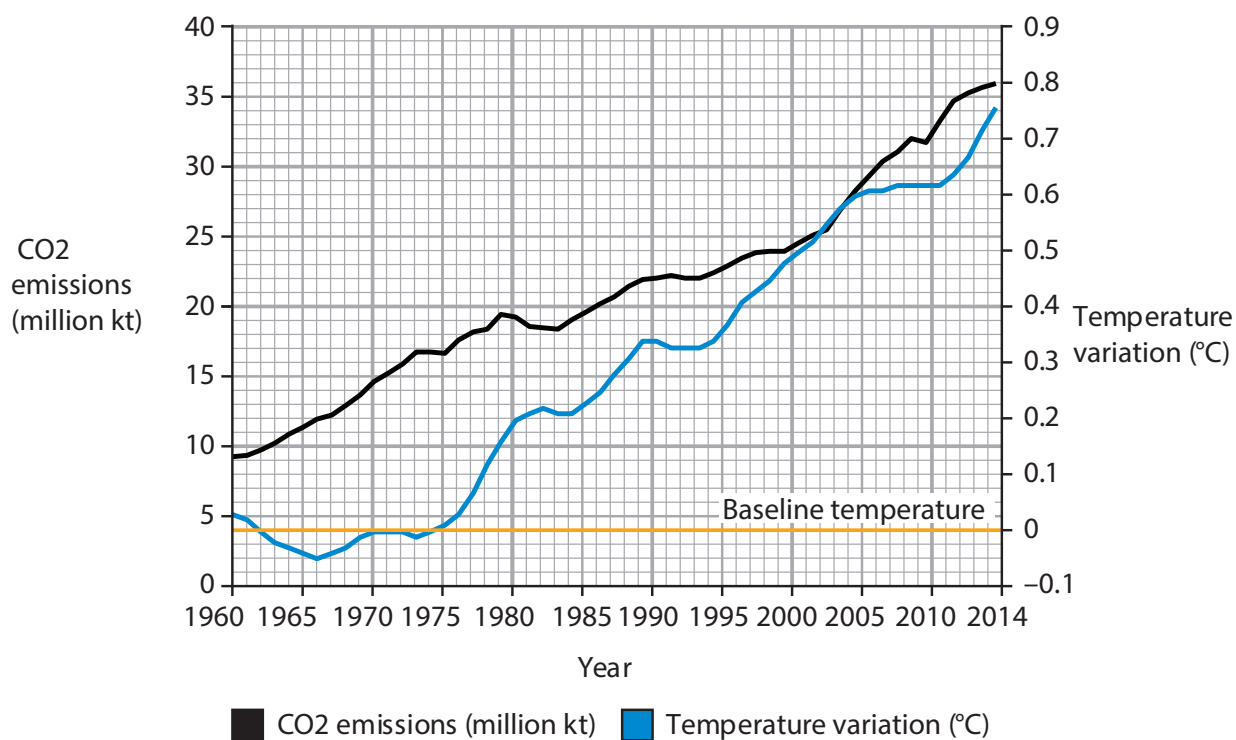
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**Figure 7a**

CO2 emissions and global temperature variation taken from a baseline of 1960

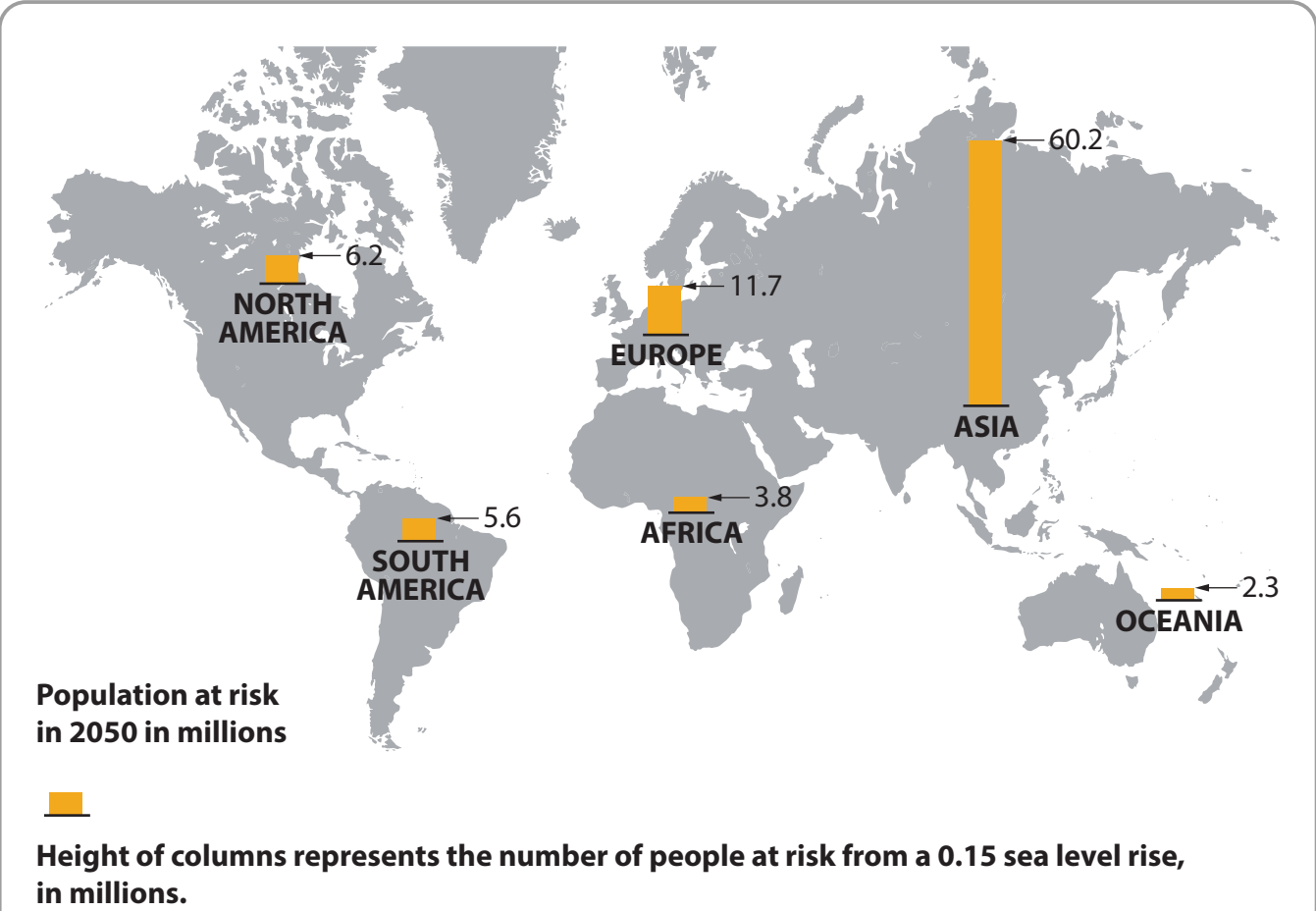


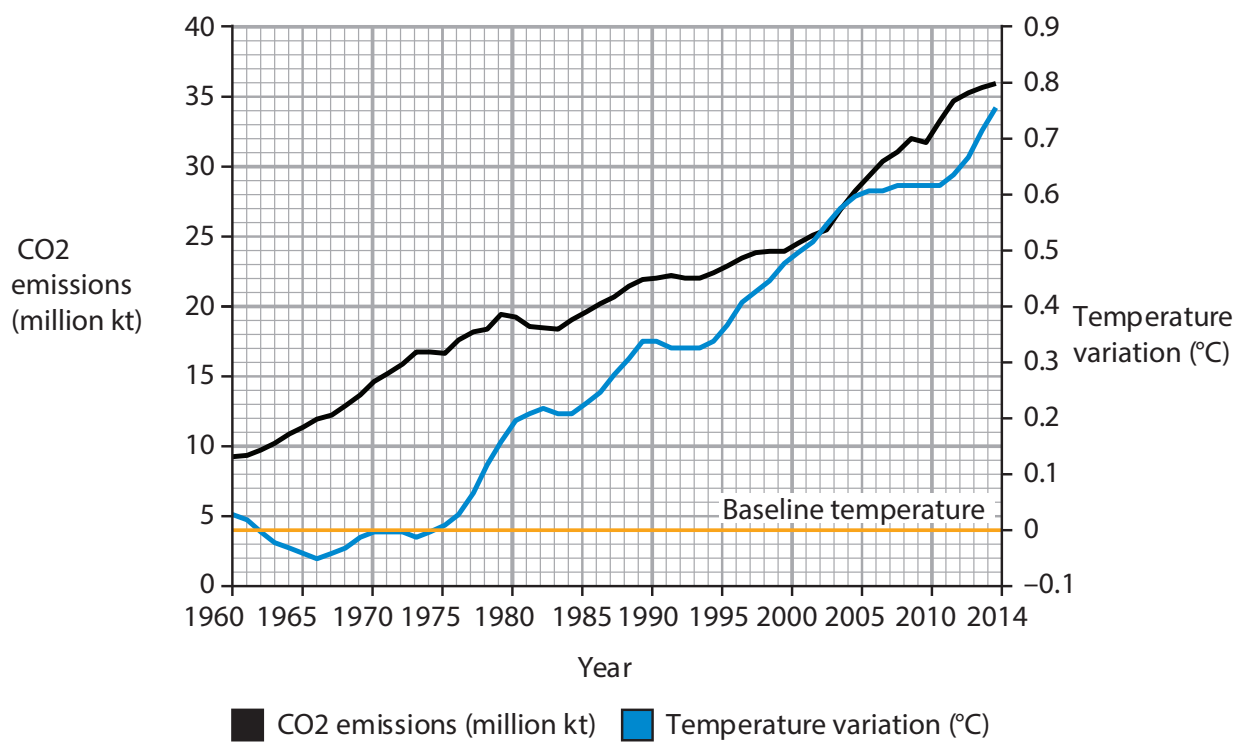
Figure 7b

Global map of populations at risk from 0.15m sea level rise due to climate change

Greatest threat ↓ Least threat	Global sea level rise
	Desertification
	Changing weather patterns
	Ecosystem changes
	Health challenges
	Changing pattern of food production

Figure 7c

Selected potential threats from global climate change

**Figure 7a**

CO2 emissions and global temperature variation taken from a baseline of 1960

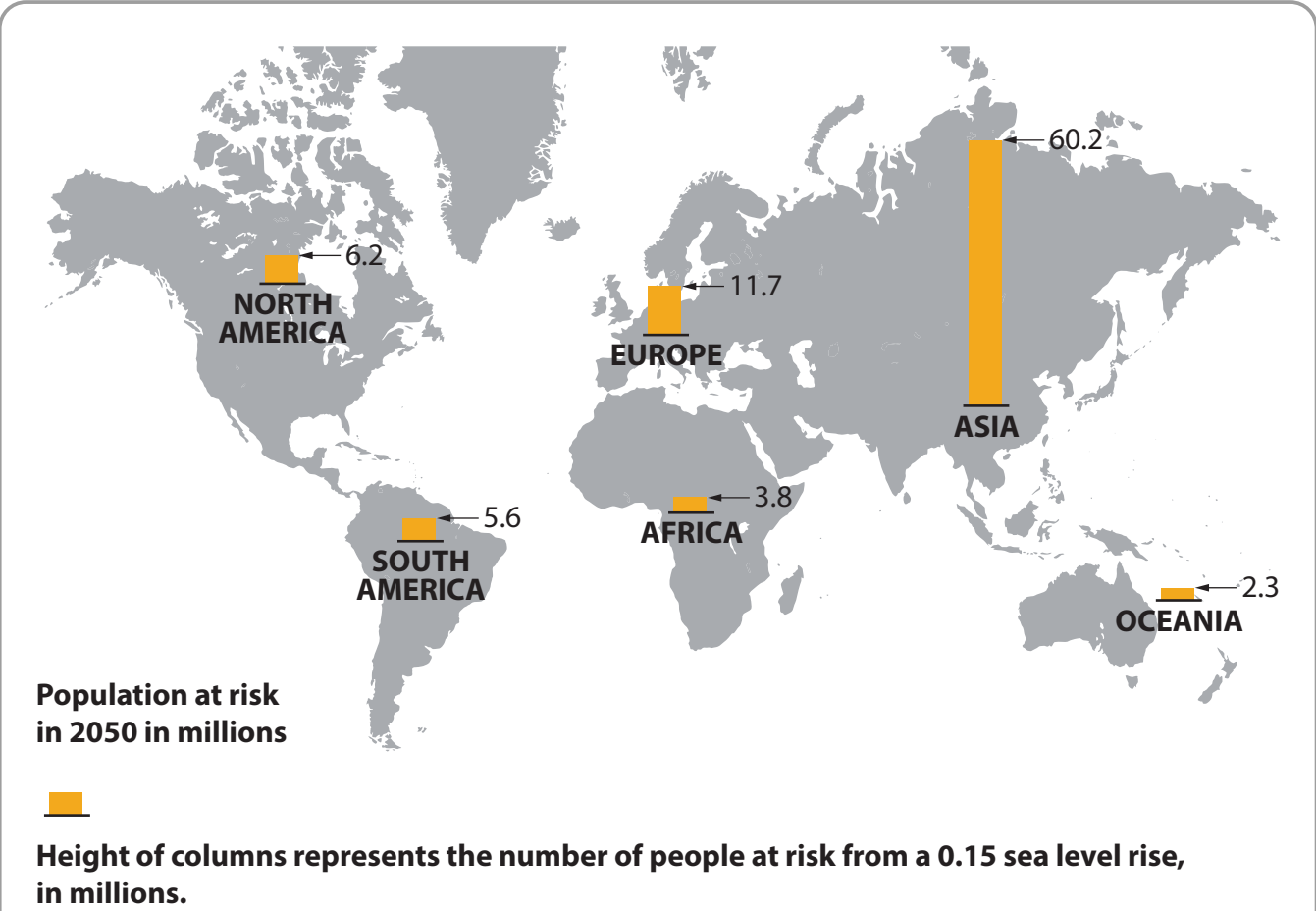


Figure 7b

Global map of populations at risk from 0.15m sea level rise due to climate change

Greatest threat ↓ Least threat	Global sea level rise
	Desertification
	Changing weather patterns
	Ecosystem changes
	Health challenges
	Changing pattern of food production

Figure 7c

Selected potential threats from global climate change

7 Fragile environments and climate change

(a) (i) Identify the correct word to complete the sentence below.

Greenhouse gases allow ... radiation through the atmosphere to warm the Earth's surface.

(1)

- ☐ A nuclear
- ☐ B light
- ☐ C temperature
- ☐ D solar

(ii) Identify the meaning of the term **Milankovitch cycle**.

(1)

- ☐ A changes in the shape of the Earth's orbit
- ☐ B changes to rainfall patterns
- ☐ C changes to the carbon cycle
- ☐ D changes in the composition of the atmosphere

(b) State **one** human cause of climate change.

(1)



(c) Study Figure 7a in the Resource Booklet.

(i) Name **two** countries labelled in Figure 7a at 'Very High' risk of desertification.

(2)

1

2

(ii) Suggest **two** possible reasons for the distribution of countries at risk of desertification.

(4)

1

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2

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(d) Explain **two** strategies for sustainable rainforest management.

(4)

1

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2



(e) Study Figure 7b in the Resource Booklet.

(i) Calculate the range in the number of tropical storms for 2019.

You must show all your workings in the space below.

Give your answer to one decimal place.

(2)

(ii) Describe **one** difference in the number of tropical storms between 2010 and 2019.

(2)

(f) Study Figure 7c in the Resource Booklet.

Assess the potential impacts of deforestation.

(6)



(g) Discuss the view

'The most significant impact of climate change will be the increased frequency of extreme weather events.'

Use Figures 7a and 7b from the Resource Booklet, and your own knowledge and understanding to support your answer.

(12)

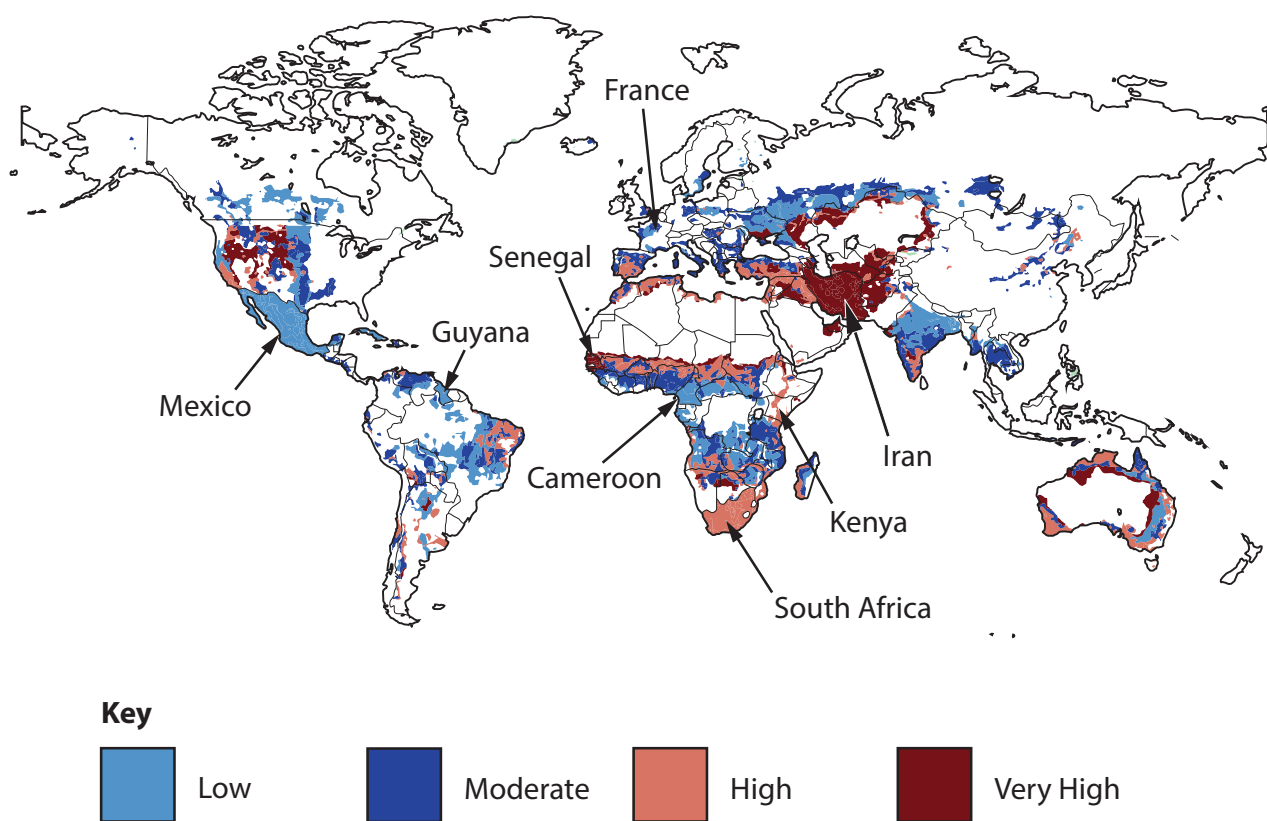


Figure 7a

Levels of global desertification risk

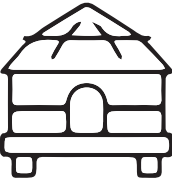
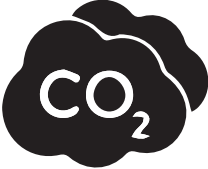
Physical	Human
 Loss of biodiversity	 Loss of goods provided by the forest
 Soil erosion	 Local communities forced to move
 Increased CO₂ in the atmosphere	 Money made from deforestation can support economic development

Figure 7c**Selected impacts of deforestation**

7 Fragile environments and climate change

(a) Identify the correct word to complete the sentence below.

Climate change is the long-term changes in conditions.

(1)

- ☐ **A** atmospheric
- ☐ **B** aerobic
- ☐ **C** evaporation
- ☐ **D** forest

(b) Identify **one** environmental impact of deforestation.

(1)

- ☐ **A** increased exports of timber
- ☐ **B** loss of species diversity
- ☐ **C** local communities forced to move
- ☐ **D** extra space for cattle ranching

(c) State **one** cause of the enhanced greenhouse effect.

(1)

.....

.....



(d) (i) Study Figure 7a in the Resource Booklet.

Identify the countries labelled in Figure 7a with the highest net percentage decrease and lowest net percentage decrease in forest cover.

(2)

Highest net percentage (%) decrease

.....

Lowest net percentage (%) decrease

.....

(ii) Suggest **two** reasons for this pattern of change.

(4)

1

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2

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(e) Explain **two** strategies to manage water shortages in fragile environments.

(4)

1

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.....

.....

2



(f) Study Figure 7b in the Resource Booklet.

(i) Calculate the mean amount of money spent on responding to climate change.

You must show all your workings in the space below.

Give your answer to one decimal place.

(2)

\$

(ii) Describe the trends shown in Figure 7b.

(2)

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(g) Study Figure 7c in the Resource Booklet.

Assess the potential impacts of desertification.

(6)

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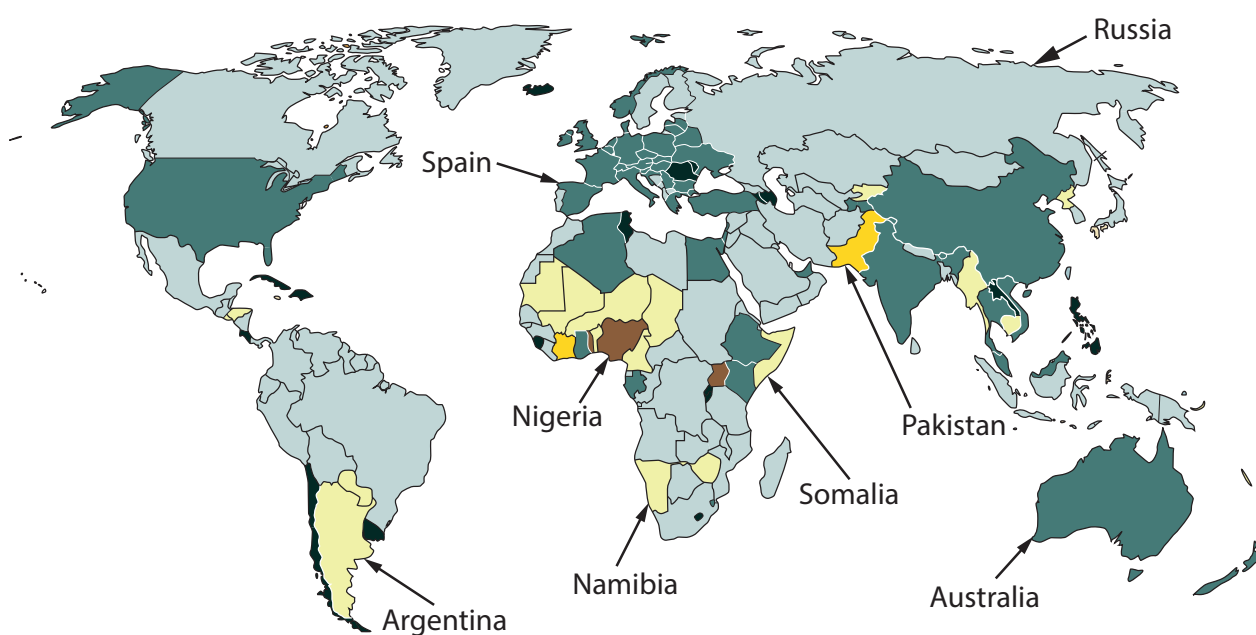
.....

(h) Discuss the view

'The environmental impacts of climate change will be greater in the future than the economic impacts.'

Use Figures 7b and 7c from the Resource Booklet, and your own knowledge and understanding to support your answer.

(12)



Key: Net percentage (%) change in forest cover

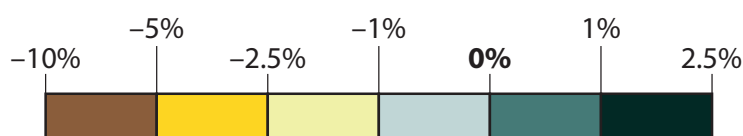
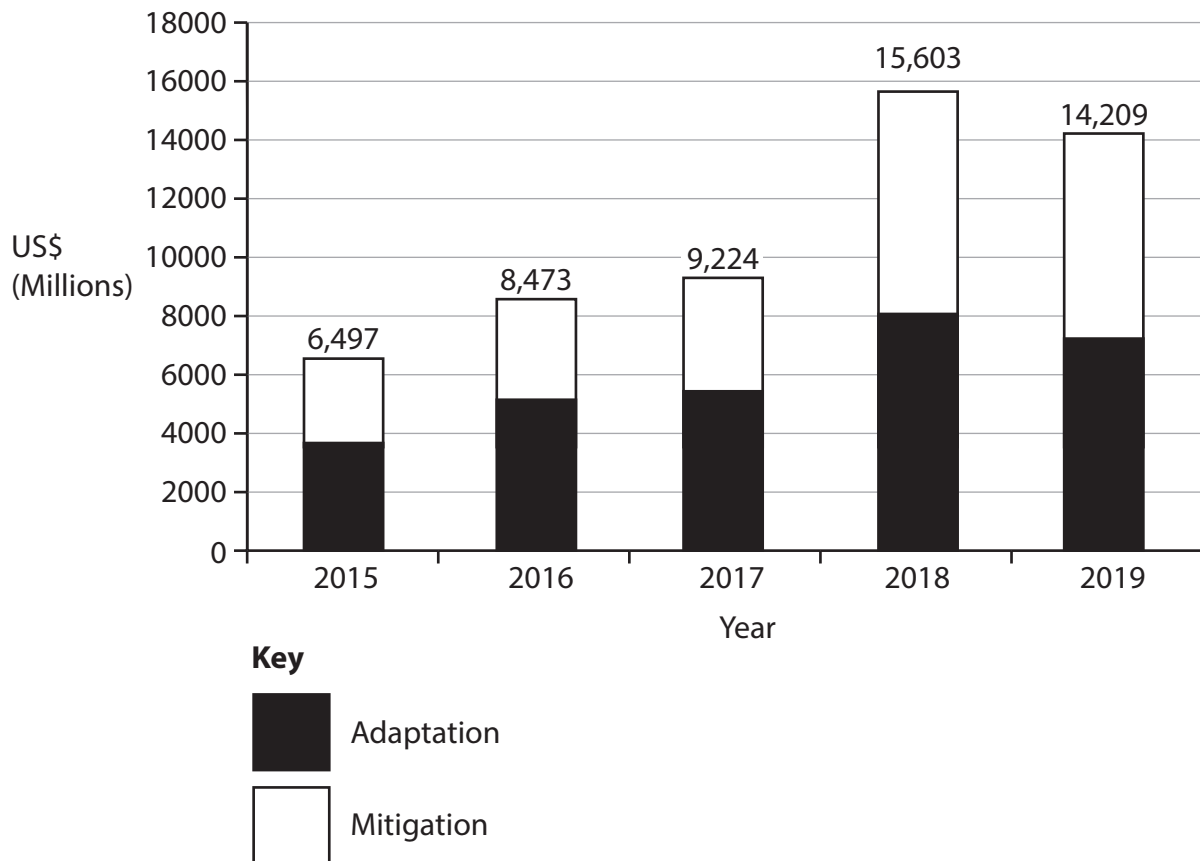
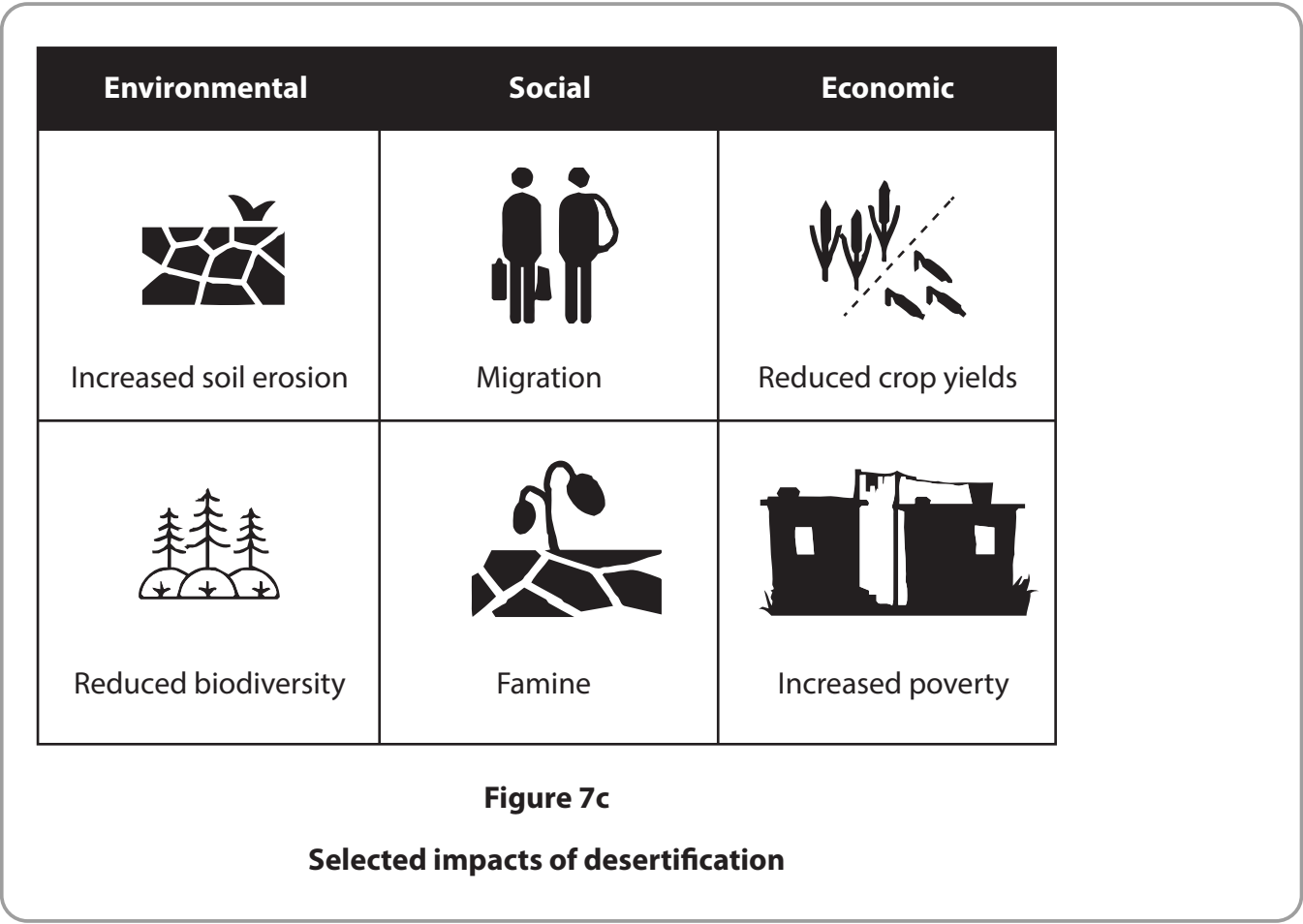


Figure 7a

Annual net percentage (%) change in forest cover, 2019–2020

**Figure 7b****Money spent by the World Bank on responding to climate change, 2015–2019**



7 Fragile environments and climate change

(a) Identify a cause of desertification.

(1)

- ☐ A hydroelectric power
- ☐ B increased rainfall
- ☐ C international trade
- ☐ D overgrazing

(b) Identify an impact of desertification.

(1)

- ☐ A increased exports
- ☐ B increase of species diversity
- ☐ C reduced crop yields
- ☐ D reduced energy production

(c) Explain **one** natural cause of climate change.

(2)

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.....

(d) Study Figure 7a in the Resource Booklet.

(i) Identify the labelled country most at risk from sea level rise.

(1)

.....

(ii) Compare the level of risk for Asia and North America.

(2)

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.....

(iii) Suggest **one** reason for the pattern shown.

(2)

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.....

(iv) Explain why the data shown is useful for understanding the potential impacts of climate change.

(2)

.....

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.....

(e) State **two** causes of deforestation.

(2)

1

2



(f) Explain **two** impacts of deforestation.

(4)

- 1
- 2

(g) Study Figure 7b in the Resource Booklet.

Assess strategies used to reduce threats from desertification.

Refer to the resource in your answer.

(6)

(h) Discuss the view:

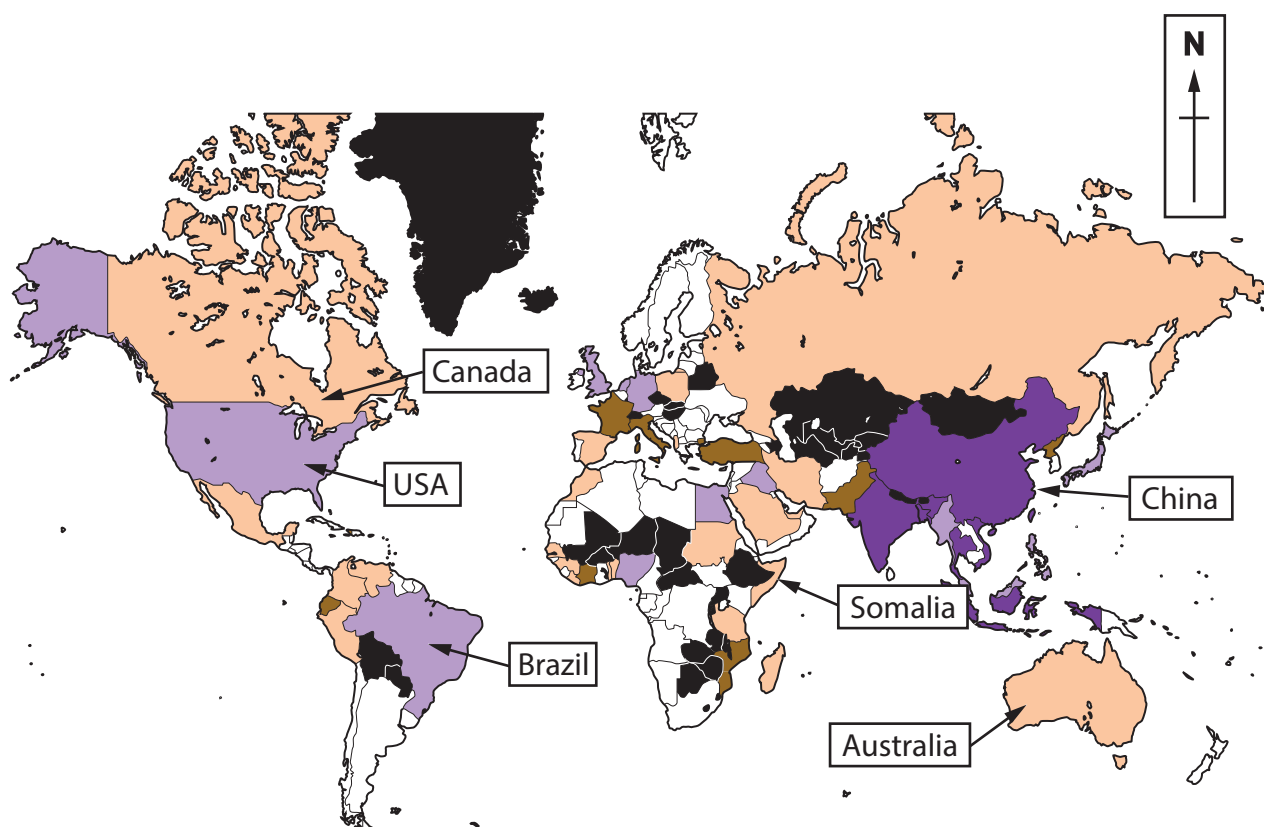
“Strategies to reduce threats to fragile environments should be led by governments.”

Use Figures 7a and 7b from the Resource Booklet, and your own knowledge and understanding to support your answer.

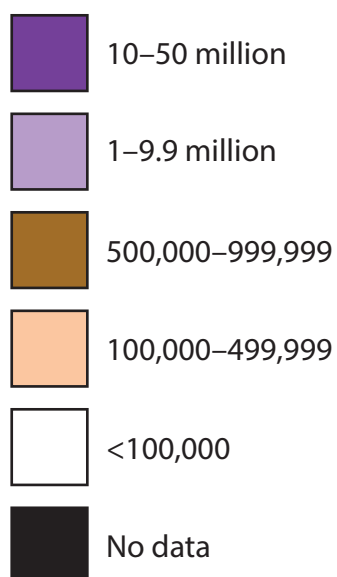
Refer to the resources in your answer.

(12)





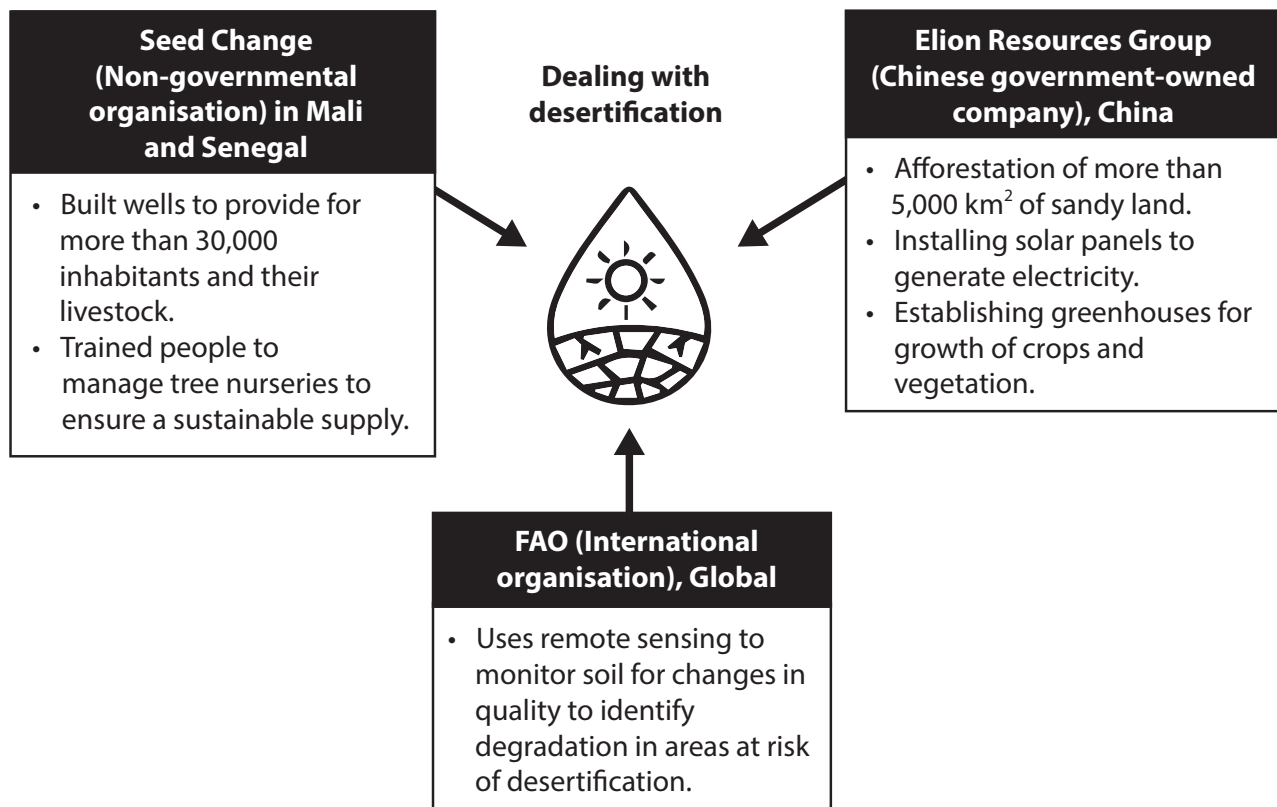
Key: Number of people per country living on land expected to be under sea level by 2100*



*assuming a rise in sea levels of 50–70 cm

Figure 7a

Map of areas predicted to be at risk of sea level rise by 2100

**Figure 7b****Information on strategies to deal with desertification**

7 Fragile environments and climate change

(a) Identify a cause of deforestation.

(1)

- ☐ A increased humidity
- ☐ B increased rainfall
- ☐ C tourism industry
- ☐ D logging industry

(b) Identify an impact of deforestation.

(1)

- ☐ A increased biodiversity
- ☐ B increased habitat for wildlife
- ☐ C increased soil erosion
- ☐ D reduced energy production

(c) State **two** causes of desertification.

(2)

1

2

(d) (i) Study Figure 7a in the Resource Booklet.

Identify the labelled country with the predicted highest decline in crop yields.

(1)

.....

(ii) Compare the predicted changes for South America and Europe.

(2)

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.....

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(iii) Suggest **one** reason for the predicted changes shown in Figure 7a.

(2)

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(iv) Suggest **one** reason why the data shown in Figure 7a might **not** be useful when considering the impact of climate change.

(2)

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(e) State **two** physical factors that affect the distribution of a named fragile environment.

(2)

Named fragile environment

.....

1

.....

2

.....



(f) Explain **two** ways to reduce water-resource shortages.

(4)

- 1
- 2

(g) Study Figure 7b in the Resource Booklet.

Assess strategies used for sustainable tropical rainforest management.

Refer to the resource in your answer.

(6)

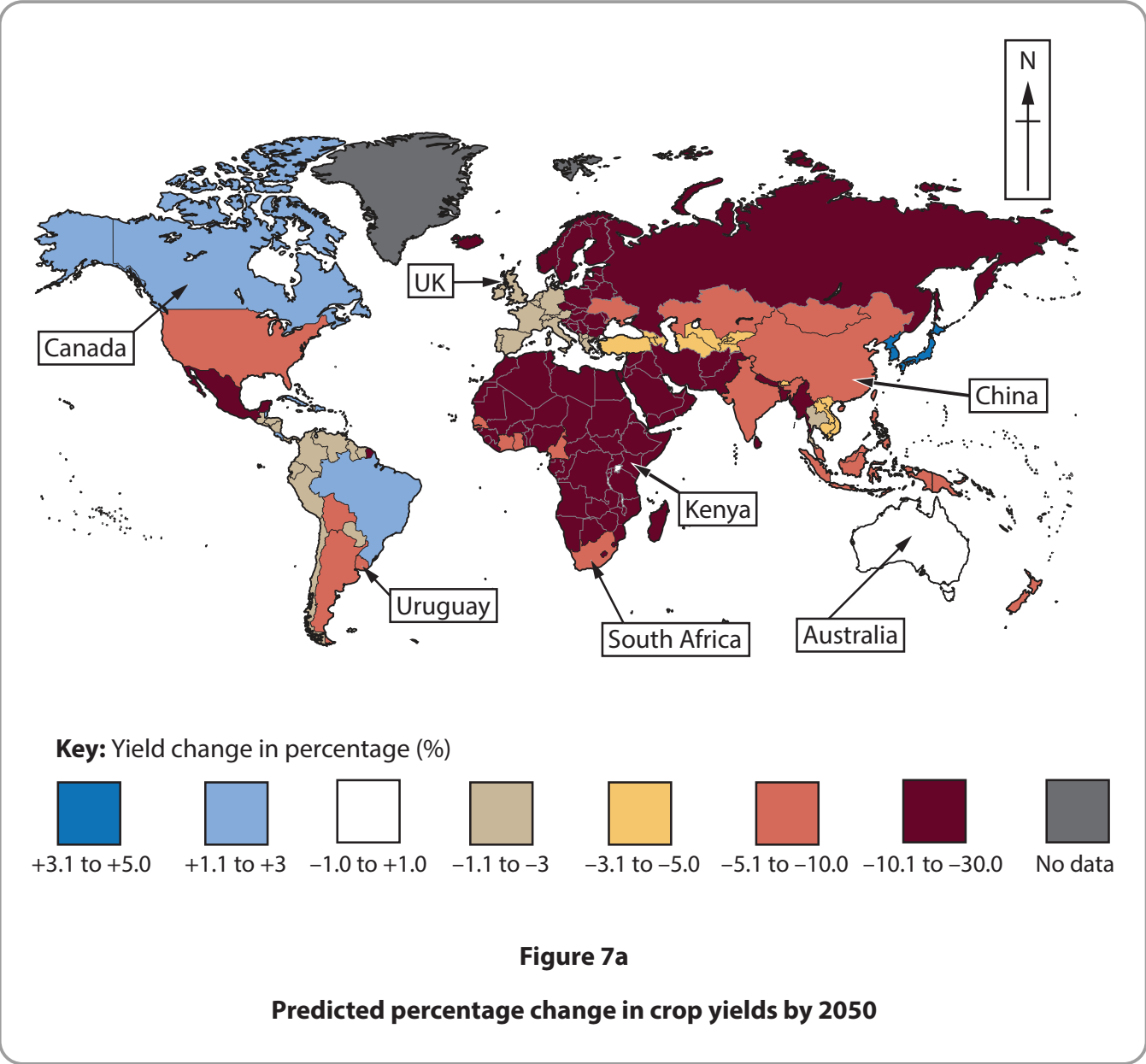
(h) Discuss the view:

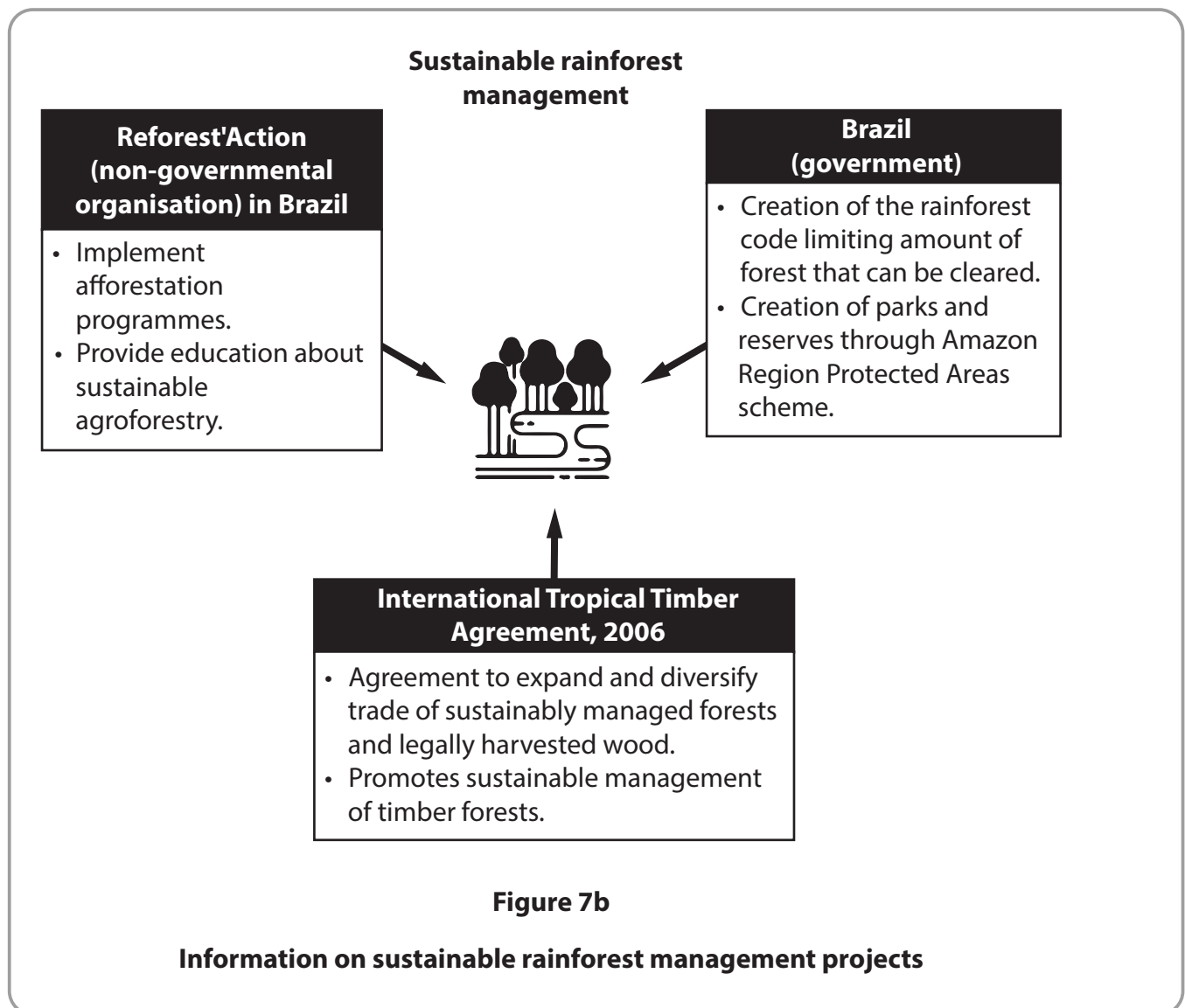
“Responses to climate change may be more effective if led by international organisations.”

Use Figures 7a and 7b from the Resource Booklet, and your own knowledge and understanding to support your answer.

Refer to the resources in your answer.

(12)





7 Fragile environments and climate change

(a) Identify **one** natural cause of climate change.

(1)

- ☐ A glacial melt
- ☐ B air travel
- ☐ C renewable energy
- ☐ D solar variations

(b) Identify which statement best explains how volcanoes can affect climate change.

(1)

- ☐ A eruptions release greenhouses gases
- ☐ B eruptions release volcanic bombs
- ☐ C eruptions lead to damaged houses
- ☐ D eruptions lead to damaged pipes

(c) State **two** human causes of global climate change.

(2)

- 1
- 2



(d) (i) Study Figure 7a in the Resource Booklet.

Identify the labelled country with the highest reduction in CO₂ emissions per capita.

(1)

(ii) Compare the pattern shown for Africa and North America.

(2)

(iii) Suggest **one** reason for the pattern shown in Figure 7a.

(2)

(iv) Suggest **one** other type of data which could be used to understand the causes of climate change.

(2)

(e) State **two** characteristics of a desert environment.

(2)

1

2



(f) Explain **two** causes of desertification.

(4)

1

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2

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(g) Study Figure 7b in the Resource Booklet.

Assess strategies that could be used to try and resolve water resource shortages.

(6)

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(h) Discuss the view:

"The most effective way to protect fragile environments is through international agreements."

Use Figures **7a** and **7b** from the Resource Booklet, and your own knowledge and understanding to support your answer.

Refer to the resources in your answer.

(12)

.....

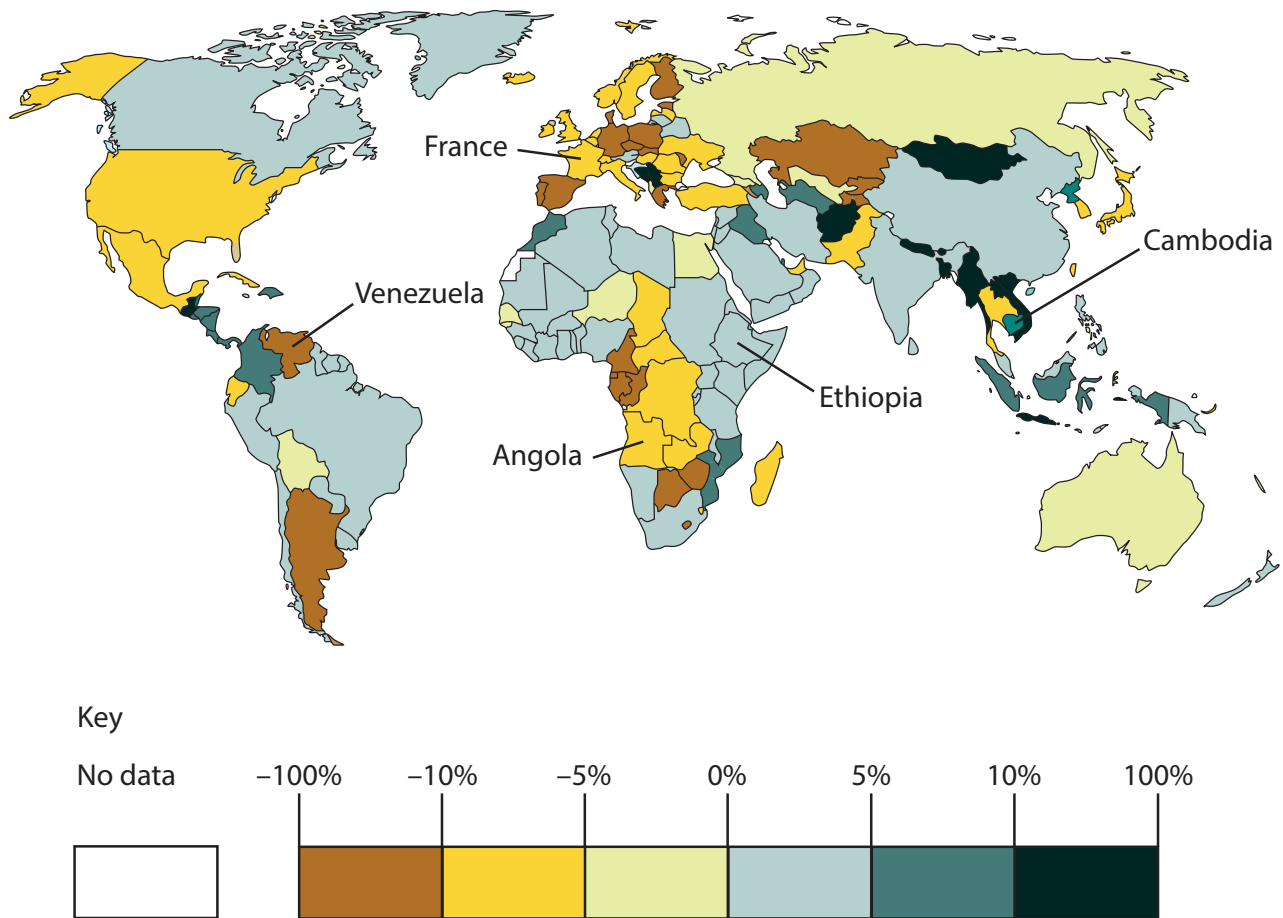
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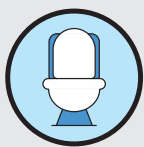


Promoting sustainable water use

- People are setting water-saving examples at home, school, and work, including:



Taking shorter
showers



Installing low-flow
toilets



Collecting
rainwater



Reusing greywater
(waste water)



Fixing leaks
quickly



Investing in sustainable
energy and water
reduction initiatives



Figure 7b

Strategies for reducing water shortage

7 Fragile environments and climate change

(a) (i) Name **one** greenhouse gas.

(1)

(ii) Identify a strategy to try and reduce the impacts of climate change.

(1)

- ☐ **A** use of low yield seed varieties
- ☐ **B** use more timber from forests
- ☐ **C** use more fossil fuels
- ☐ **D** use more renewable energy

(iii) Identify which statement best describes a way of adapting to climate change.

(1)

- ☐ **A** increase in cattle farming
- ☐ **B** increase in flood protection
- ☐ **C** increase in number of airports
- ☐ **D** increase in use of coal

(b) (i) Study Figure 7a in the Resource Booklet.

Identify **two** labelled countries with the highest risk of drought.

(2)

1

2



(ii) Suggest **two** reasons for the pattern shown in Figure 7a.

(4)

1

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2

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(c) Explain **two** potential impacts of climate change.

(4)

1

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.....

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2



(d) (i) Study Figure 7b in the Resource Booklet.

Calculate the range in total forest loss, 2001–2015.

You **must** show all your workings in the space below.

(2)

..... Mha

(ii) Describe a variation in forest loss shown for 2001–2015.

(2)

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(e) Study Figure 7c in the Resource Booklet.

Assess the potential impacts of deforestation.

You **must** refer to the resource in your answer.

(6)

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(f) Discuss the view:

“Deforestation is the greatest threat to fragile environments.”

Use Figures 7b and 7c from the Resource Booklet, and your own knowledge and understanding to support your answer.

You **must** refer to the resources in your answer.

(12)

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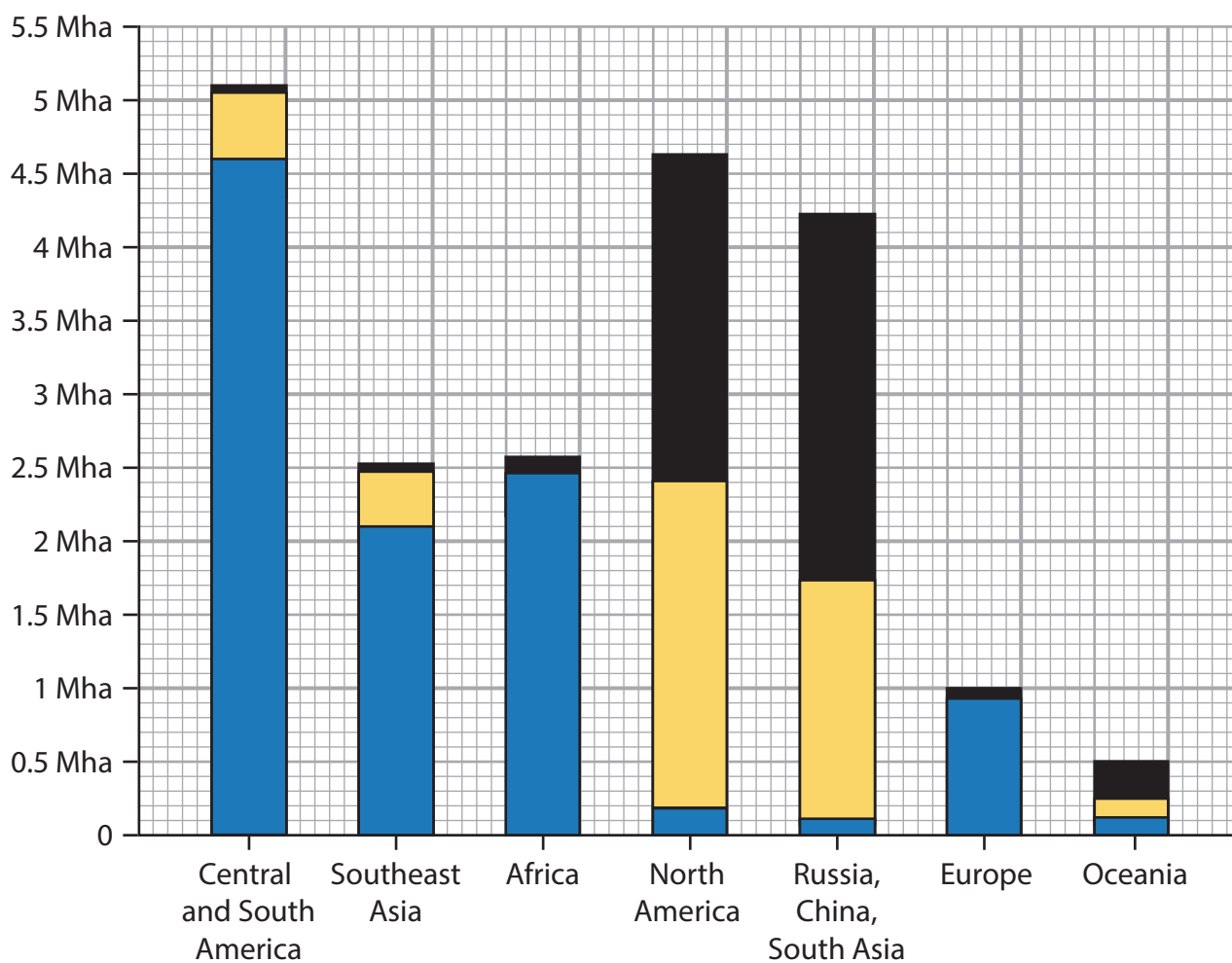
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Total forest loss
(millions hectares)



Key: Cause of forest loss



Wildfires



Deforestation for logging to make paper and pulp



Deforestation from agriculture, mining and urbanisation

Figure 7b

Information on global forest loss, 2001–2015

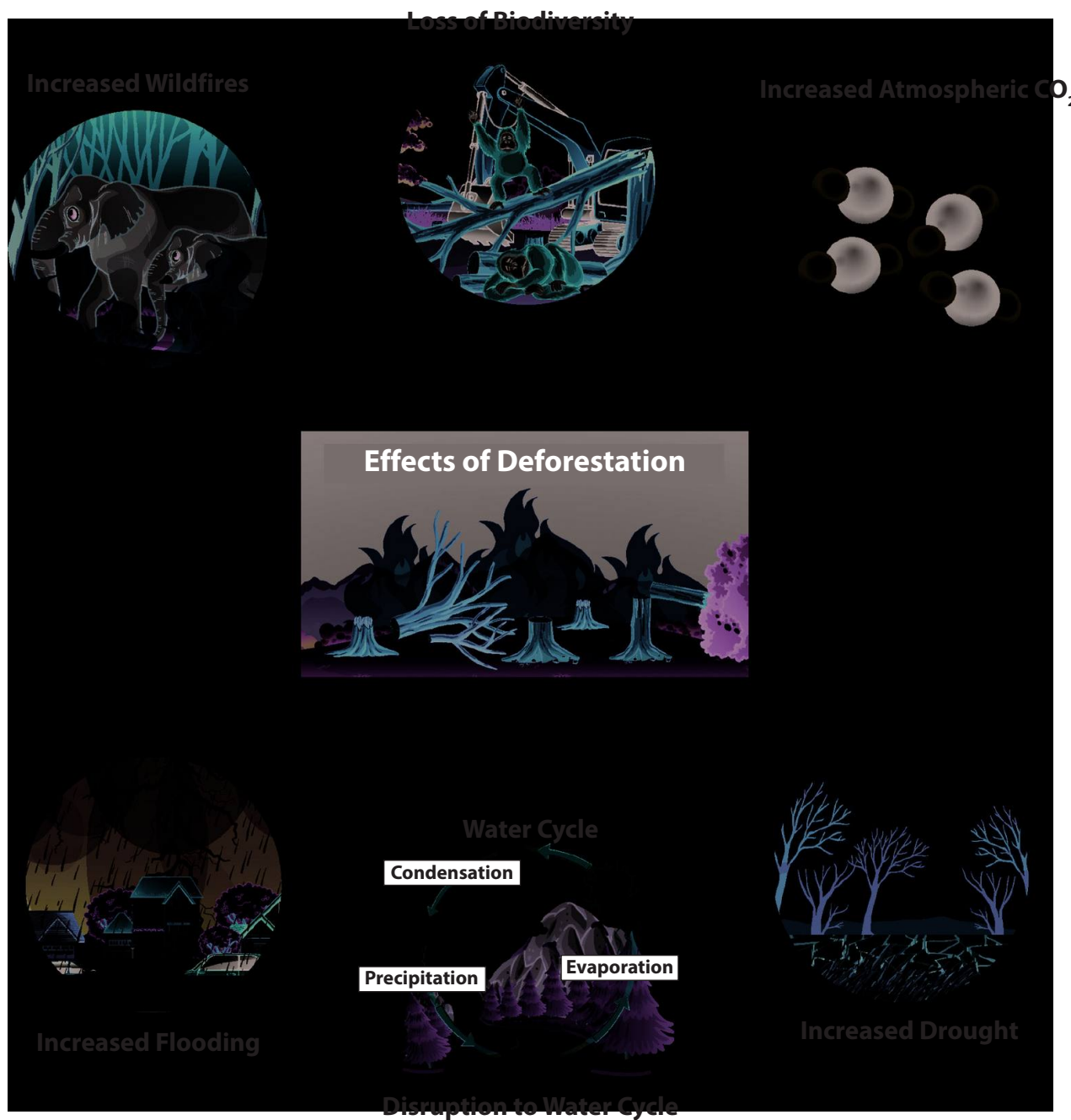


Figure 7c
Selected impacts of deforestation

7 Fragile environments and climate change

(a) Name **one** location of a fragile environment.

(1)

(b) (i) Identify **one** impact of desertification.

(1)

- ☐ **A** heavy rainfall
- ☐ **B** population increase
- ☐ **C** soil erosion
- ☐ **D** tree logging

(ii) Identify **one** potential strategy to reduce desertification.

(1)

- ☐ **A** more pastoral farming
- ☐ **B** more wood harvesting
- ☐ **C** water spreading weirs
- ☐ **D** water purification systems

(c) (i) Study Figure 7a in the Resource Booklet.

Identify the **two** labelled countries with the highest forest loss.

(2)

1

2

(ii) Suggest **two** reasons for the pattern shown in Figure 7a.

(4)

1

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2

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(d) Explain **two** sustainable rainforest management strategies.

(4)

1

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2

(e) (i) Study Figure 7b in the Resource Booklet.

Calculate the range in sea level change between 1920 and 2000.

You **must** show all your workings in the space below.

(2)

..... mm

(ii) Describe the trend in sea level change shown.

(2)

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(f) Study Figure 7c in the Resource Booklet.

Assess the potential impacts of climate change.

You **must** refer to the resource in your answer.

(6)

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(g) Discuss the view:

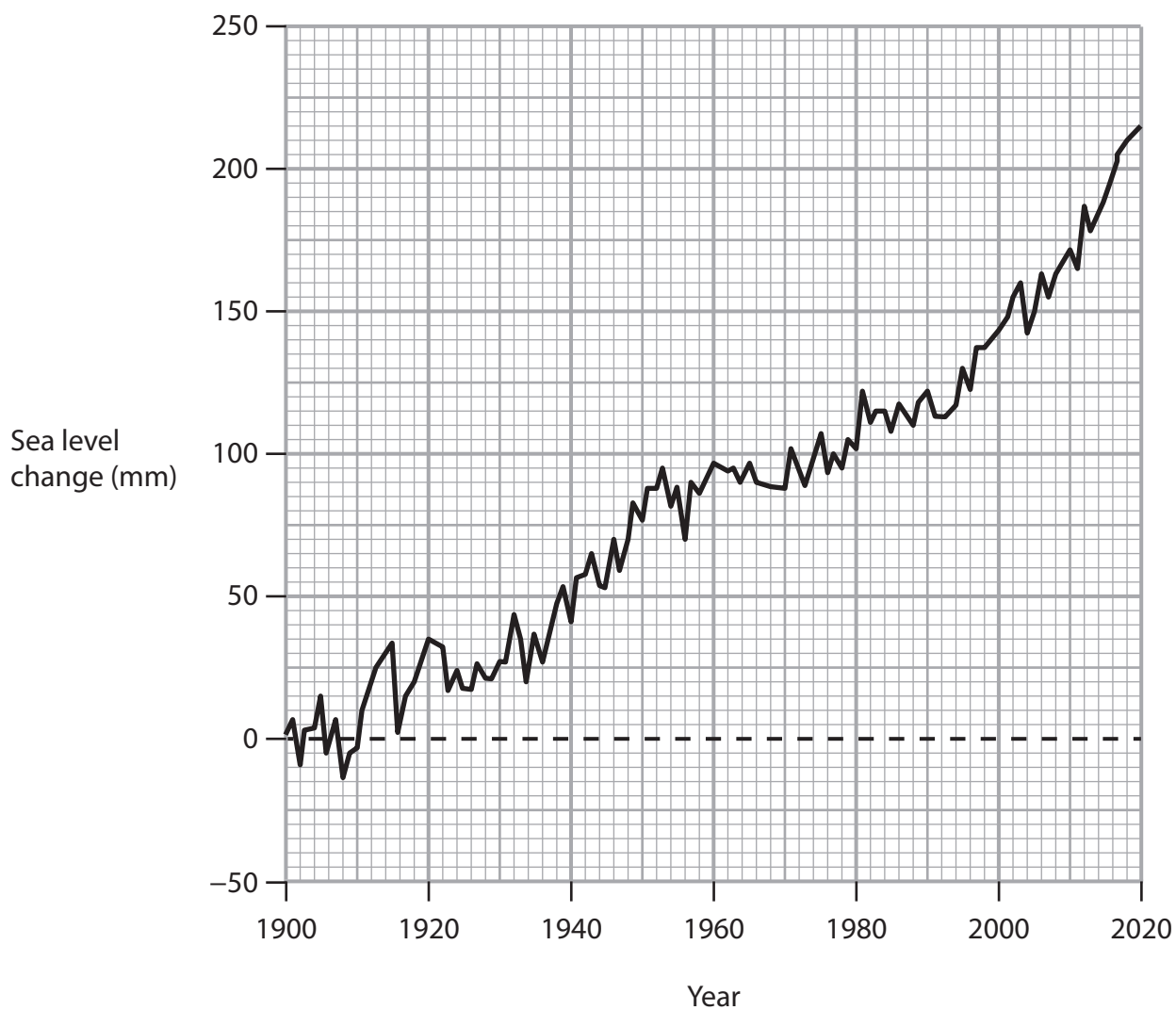
“Climate change is the greatest threat to fragile environments.”

Use Figures 7b and 7c from the Resource Booklet, and your own knowledge and understanding to support your answer.

You **must** refer to the resources in your answer.

(12)



**Figure 7b****Sea level change, 1900–2020**

	Food insecurity
	Increased flooding
	Increased risk of fires
	Changes in growing seasons
	Migration
	Heat stress

Figure 7c

Potential impacts of climate change

7 Fragile environments and climate change

(a) (i) Define the term **fragile environment**.

(1)

(ii) Identify **one** factor that affects the distribution of coral reefs.

(1)

- ☐ **A** soil pH
- ☐ **B** water biodiversity
- ☐ **C** water salinity
- ☐ **D** wind speed

(iii) Identify **one** feature of a coral reef.

(1)

- ☐ **A** algae
- ☐ **B** buttress roots
- ☐ **C** river delta
- ☐ **D** permafrost

(b) (i) Study Figure 7a in the Resource Booklet.

Identify **two** cities at greatest risk of desertification.

(2)

1

2

(ii) Suggest **two** reasons for the pattern shown in Figure 7a.

(4)

1

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2

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(c) Explain **two** approaches to reducing water shortages.

(4)

1

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2



(d) (i) Study Figure 7b in the Resource Booklet.

Calculate the mean deforestation rate for the countries shown.

You **must** show all your workings in the spaces below.

(2)

.....Mha

(ii) Describe **one** difference shown in Figure 7b.

(2)

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(e) Study Figure 7c in the Resource Booklet.

Assess the importance of the causes of climate change shown.

You **must** refer to the resource in your answer.

(6)

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(f) Discuss the view:

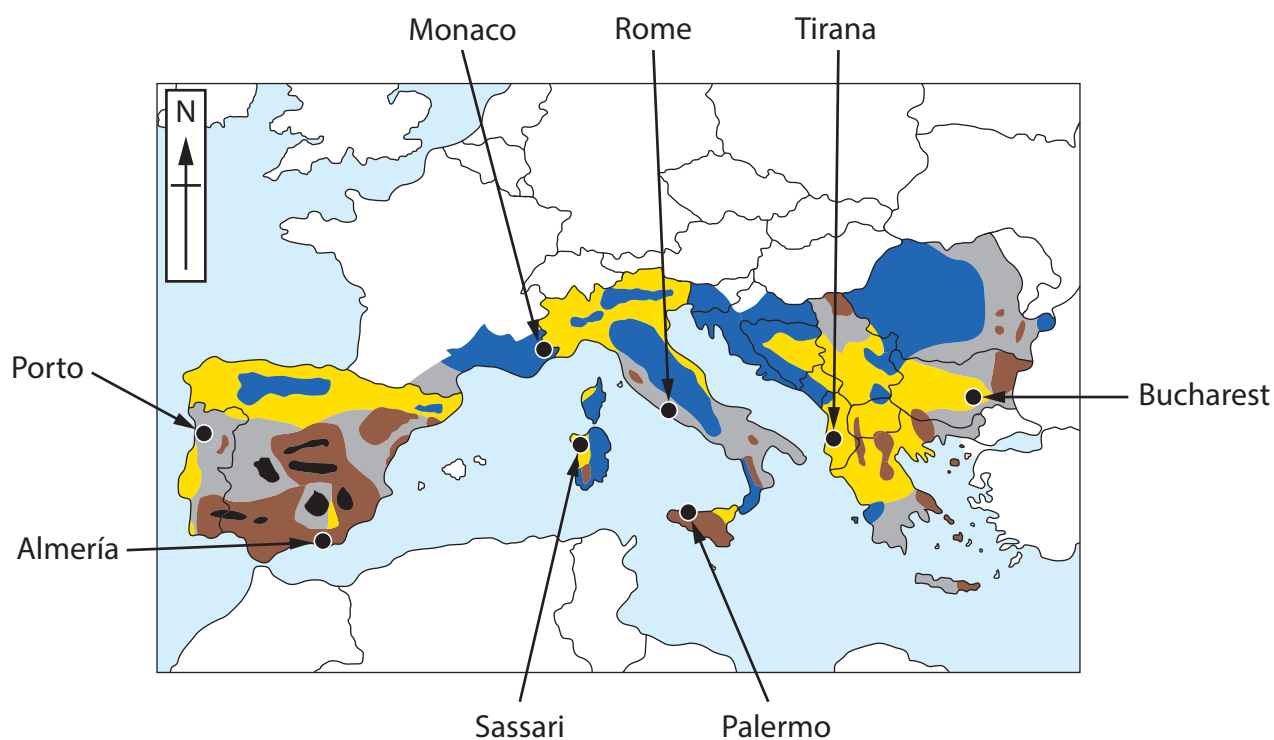
“Countries which have contributed the most to climate change should be responsible for leading the actions to combat climate change.”

Use Figures 7b and 7c from the Resource Booklet, and your own knowledge and understanding to support your answer.

You **must** refer to the resources in your answer.

(12)



**Key**

	1.2 and below	Non affected areas or very low risk of desertification
	1.21–1.3	Low risk of desertification
	1.31–1.4	Medium risk of desertification
	1.41–1.6	High risk of desertification
	1.61 and above	Very high risk of desertification

Figure 7a**Distribution of desertification risk in Southern Europe**

Country	Deforestation rate in million hectares per year (Mha) 2015–2020	Reforestation rate in thousand hectares per year (Kha) 2015–2020
Brazil	66.1	945
Canada	48.9	427
United States of America	46.5	691
Indonesia	29.4	867

Figure 7b

Deforestation and reforestation rates for selected countries

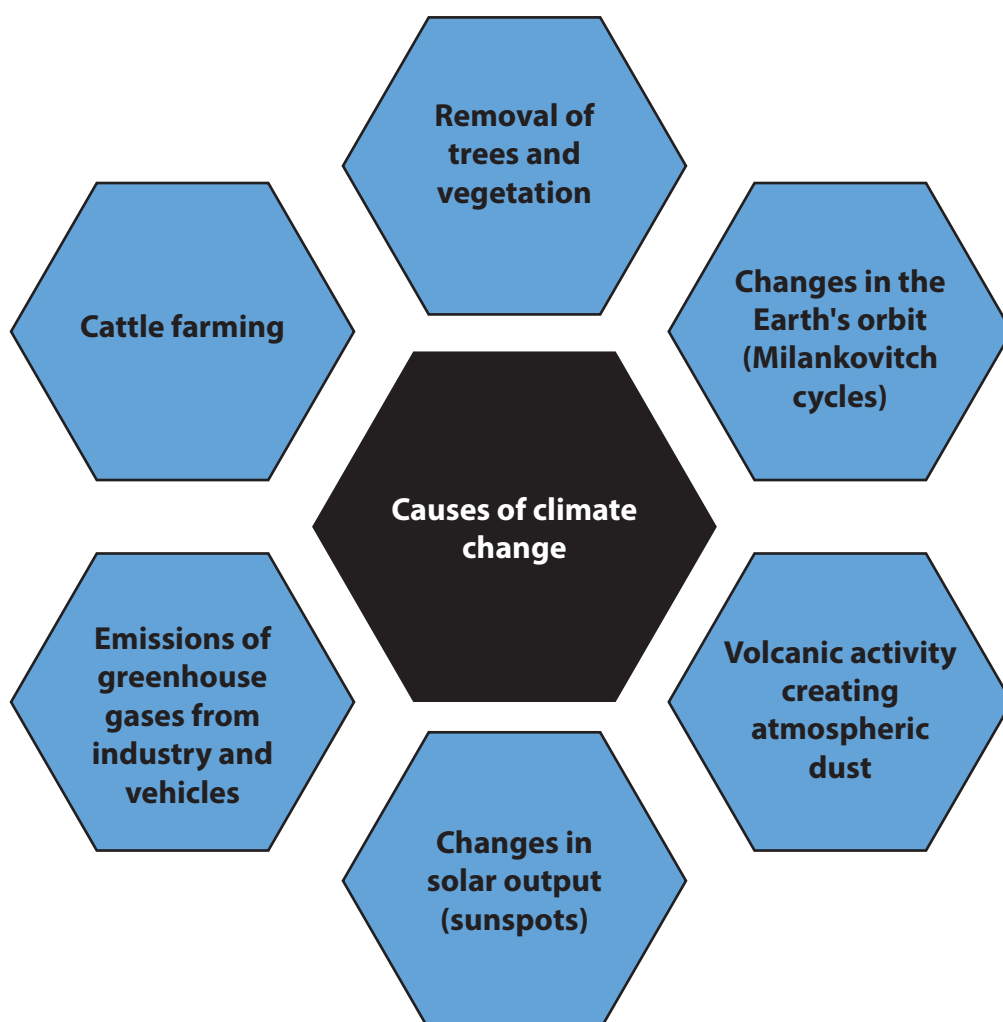


Figure 7c

Selected causes of climate change

7 Fragile environments and climate change

(a) (i) Identify **one** characteristic associated with tropical rainforests.

(1)

- ☐ **A** high humidity
- ☐ **B** high latitude
- ☐ **C** low biodiversity
- ☐ **D** low rainfall

(ii) Identify **one** reason why tropical rainforests are considered fragile.

(1)

- ☐ **A** dense canopy of trees
- ☐ **B** infertile soils
- ☐ **C** moderate temperatures
- ☐ **D** water surplus

(iii) State **two** impacts of deforestation.

(2)

1

2



(b) (i) Study Figure 7a in the Resource Booklet.

Identify **one** labelled country with the most people at risk from sea level rise.

(1)

.....

(ii) Describe the pattern of risk in South America.

You **must** refer to the resource in your answer.

(2)

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(iii) Suggest **one** reason for the pattern shown.

You **must** refer to the resource in your answer.

(2)

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(iv) Suggest **one** way this data could be used by international organisations.

(2)

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.....

(c) Sea level rise is one impact of climate change.

State **two other** impacts of climate change.

(2)

1

2



(d) Explain how solar variations and farming contribute to climate change.

(4)

solar variations

.....

.....

.....

farming

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(e) Study Figure 7b in the Resource Booklet.

Assess the importance of biodiversity loss as a cause of desertification.

You **must** refer to the resource in your answer.

(6)

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(f) Discuss the view:

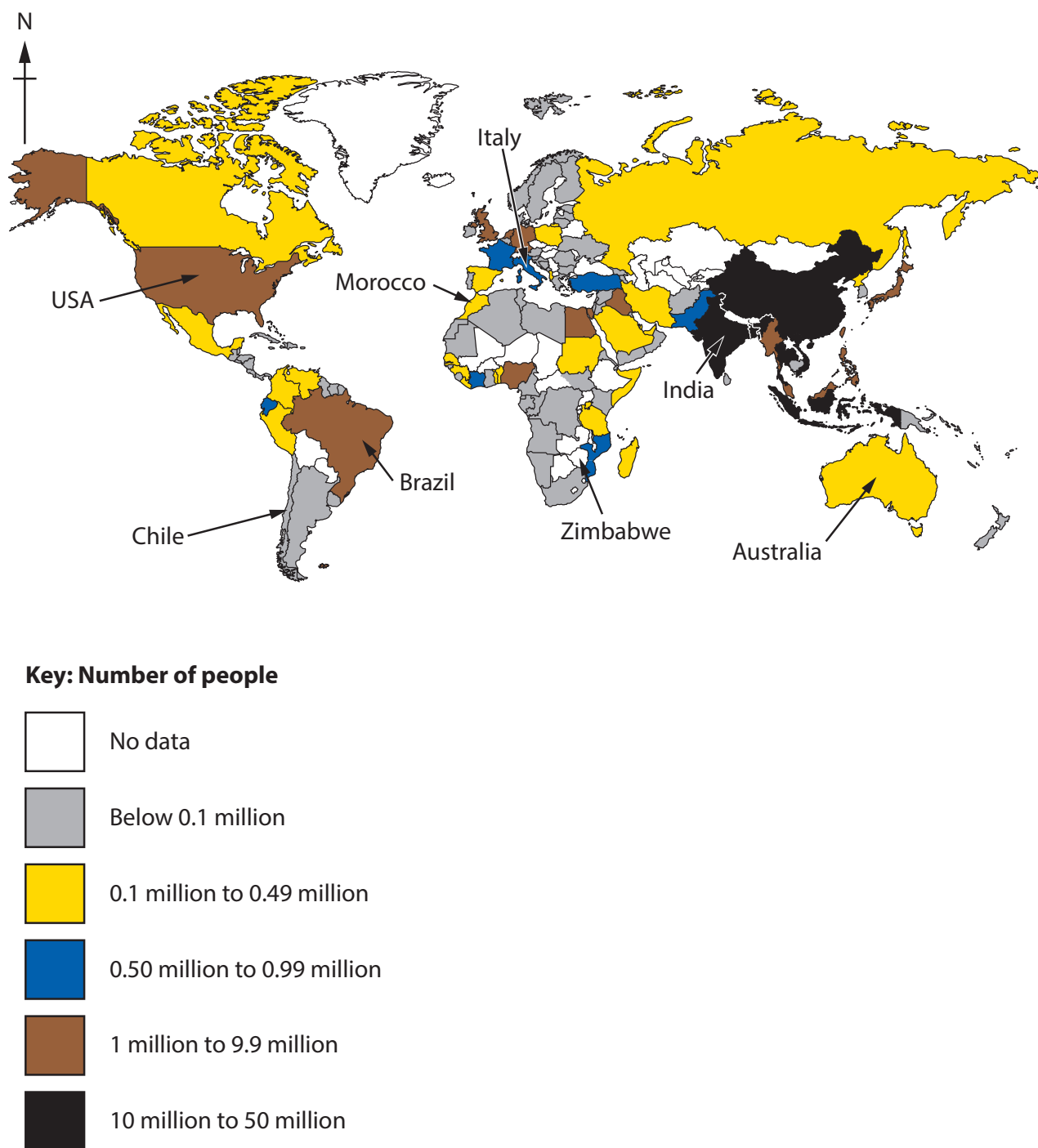
“The greatest impacts of climate change will be linked to sea level rise.”

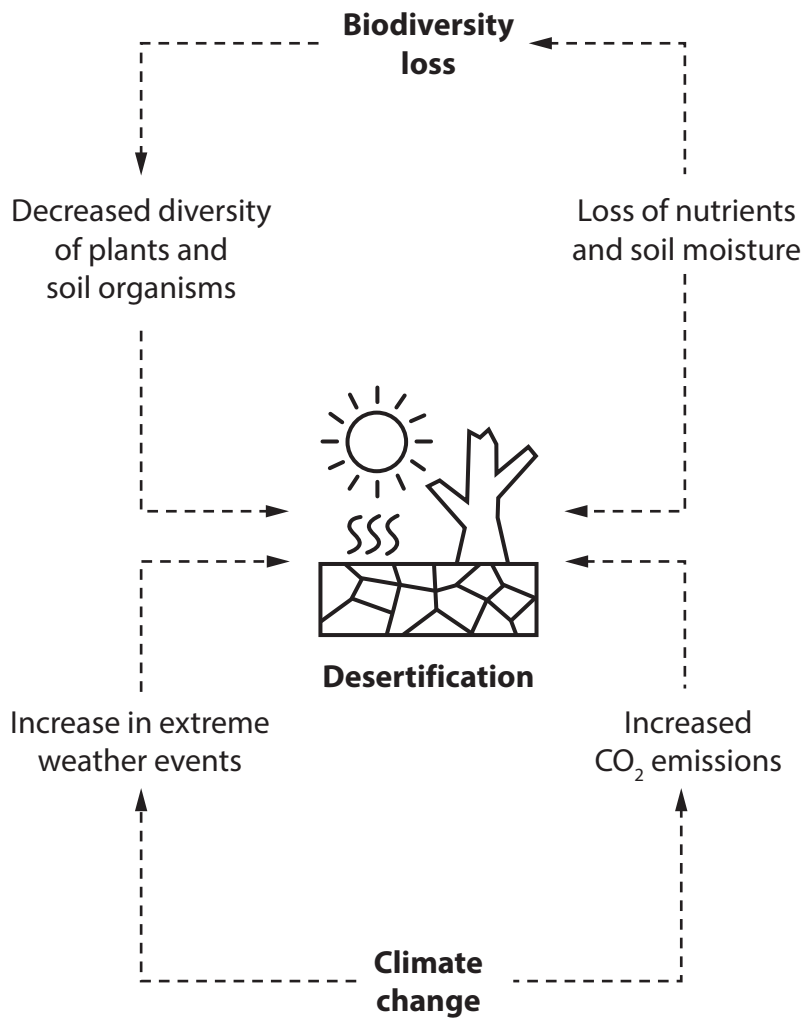
Use Figures 7a and 7b from the Resource Booklet, and your own knowledge and understanding to support your answer.

You **must** refer to the resources in your answer.

(12)



**Figure 7a****Number of people per country at risk from predicted sea level rise by 2100**

**Figure 7b****Causes and impacts of desertification**

7 Fragile environments and climate change

(a) (i) Identify **one** cause of deforestation.

(1)

- ☐ **A** cattle ranching
- ☐ **B** frozen soils
- ☐ **C** planting trees
- ☐ **D** shallow soils

(ii) Explain **one** impact of deforestation.

(2)

.....

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.....

.....

(iii) Identify **one** strategy used to slow down deforestation.

(1)

- ☐ **A** improved infrastructure
- ☐ **B** increased farming
- ☐ **C** promotion of logging
- ☐ **D** providing logging permits

(b) Study Figure 7a in the Resource Booklet.

(i) Identify **one** labelled country with the highest average wildfires per month.

(1)

(ii) Describe the pattern of wildfires in South America.

You **must** refer to the resource in your answer.

(2)

(iii) Suggest **one** reason for the pattern shown.

You **must** refer to the resource in your answer.

(2)

(iv) Suggest **one other** piece of evidence that could be used with Figure 7a to understand the impacts of climate change.

(2)



(c) State **one** human and **one** natural cause of climate change.

(2)

human

natural

(d) Explain **two** ways that governments can respond to climate change.

(4)

1

2

(e) Study Figure 7b in the Resource Booklet.

Assess the role of agriculture as a cause of desertification.

You **must** refer to the resource in your answer.

(6)



(f) Discuss the view:

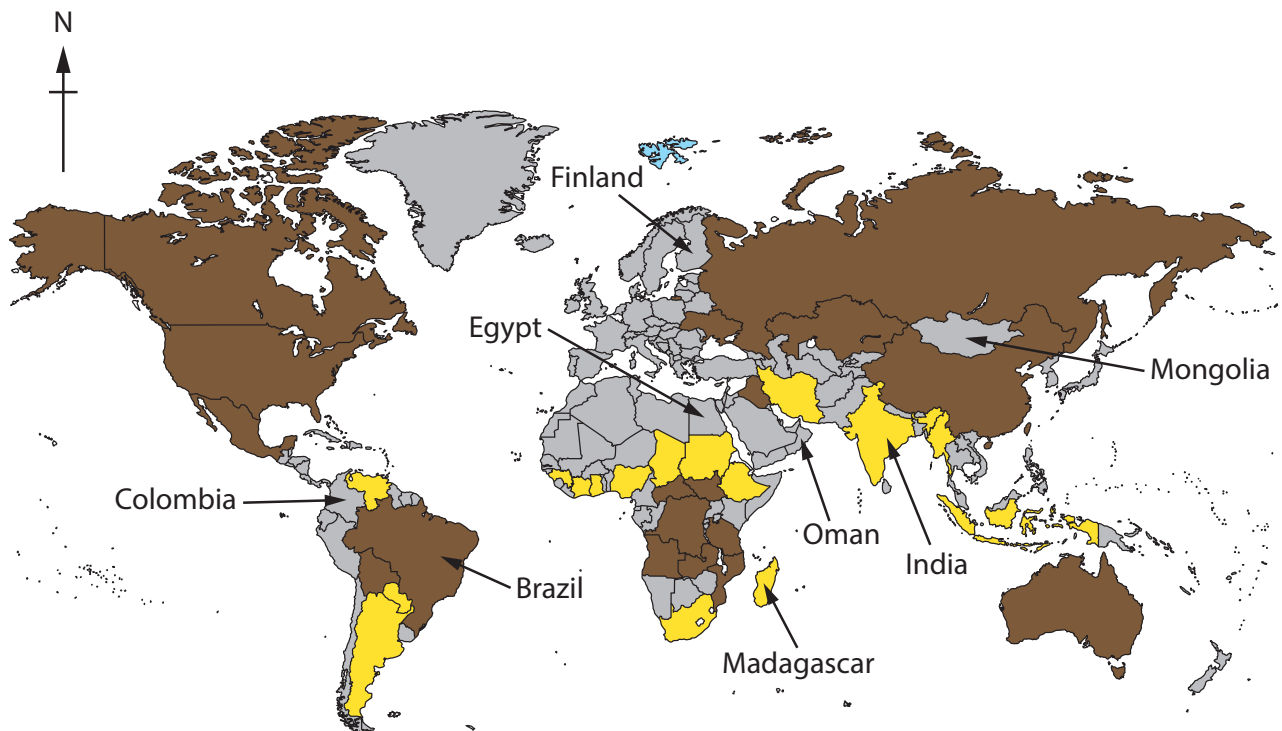
“Climate change is the greatest threat to fragile environments.”

Use Figures 7a and 7b from the Resource Booklet, and your own knowledge and understanding to support your answer.

You **must** refer to the resources in your answer.

(12)





Key: Average number of wildfires per month



0



Less than 500



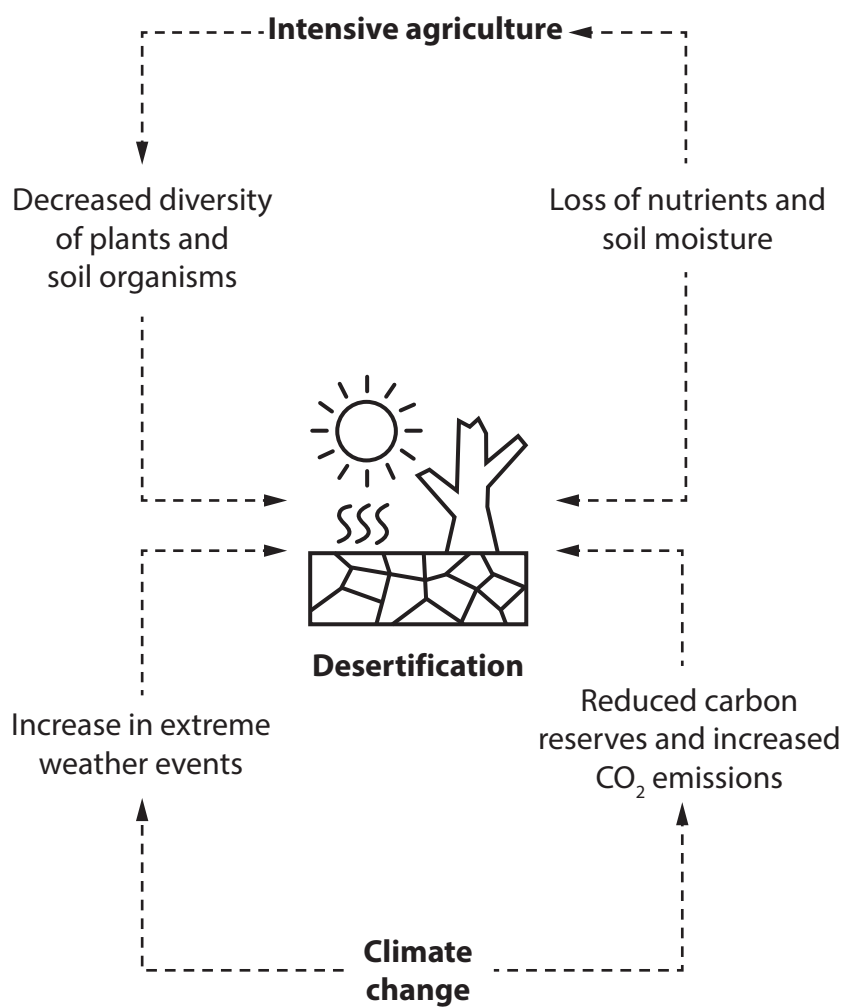
500 to 1,000



More than 1,000

Figure 7a

Global distribution of wildfires

**Figure 7b****Information on desertification**

MARK SCHEMES

official Pearson Edexcel mark schemes



7(a)(i)	AO1 (1 mark) • Water vapour • Carbon dioxide / CO₂ • Methane / CH₄ • Nitrous oxide / NO • Ozone / O₃ • Chlorofluorocarbons (CFCs) • Hydrofluorocarbons (incl. HCFCs and HFCs) Reject burning fossil fuels with no gas stated. Reject carbon monoxide as it is not considered a greenhouse gas.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) B warming of the Earth's atmosphere resulting from human activities B is the correct answer as the other options do not have the correct meanings of the term.	(1)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) A cyclical movement of the Earth's orbit around the sun A is the correct answer as the other options do not have the correct meanings of the term.	(1)

Question number	Answer	Mark
7(b)(i)	A03 (2 marks) Award 1 mark for any of the following, up to a maximum of 2 marks. Most = China (1) Least = Kenya (1)	(2)

Question number	Answer	Mark
7(b)(ii)	A02 (2 marks) / A03 (2 marks) Award 1 mark for the identification of a possible reason for the pattern shown on Figure 7a (A03) and a further mark for an explanation of the reason (A02), up to a maximum of 2 marks per idea. • Energy consumption can be linked to development (1) so countries which are rich and developed, e.g. USA have greater energy demands (1). • Low population densities mean that there is least energy consumed (1) so smaller amount of total emissions (1). • Manufacturing in places like China (1) helps explain the countries high total carbon footprint (1). • Cheap availability of oil, e.g. Middle East creates demand for carbon-based energy (1) as the fuel is lower cost and affordable (1) Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(c)	A01 (2 marks) / A02 (2 marks) Award 1 mark (A01) for identification of effect and a further mark (A02) for an explanation of the reason, up to a maximum of 2 marks per idea: • Loss of species richness from increased heat and heatwaves (1) so this means increased temperatures will greatly affect places where ecosystems are already under stress (1). • Sea level rise affecting many low lying coastal areas and world cities (1). Linked effects of salinization and loss of biodiversity (1).	



	- Droughts, and prolonged drought for some areas (1) leading to loss of health and ecosystem stress (1). - Knock-on effects may be increased tensions over natural resources at risk from climate change (1) and even greater risk of conflict in areas with fragile environments (1). Accept any other appropriate response, e.g. can be linked effects on people through environmental degradation.	(4)
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Question number	Answer	Mark
7(d)(i)	(AO4) 2 marks Award 1 mark for a correct answer and one mark for working: 1960 = 0.1 and 2015 = 2.7 (1) or working out with similar numbers, i.e. understands idea of difference / subtraction (highest and lowest values). Range = 2.6 (1) Allow 2.4-2.8 as correct. Note units not required.	(2)

Question number	Answer	Mark
7(d)(ii)	A03 (2 marks) Award 1 mark for the identification of a trend and 1 mark for further detail through evidence from the resource from the resource, up to a maximum of 2 marks. - Overall there has been a substantial increase in CO₂ emissions 0.3- just under 10 gigatonnes (1). The greatest increase was in the last 15 years (1). - Overall there has been a substantial increase in CO₂ emissions 0.3- just under 10 gigatonnes (1). The rate of increase was however slower between 1960 1995 compared to the period after that (1). Accept any other appropriate response. Must state an overall trend, i.e. increase, for credit. Data not required for credit.	(2)

Question number	Indicative content	
7(e)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 • The most important factors locally are likely to be conversion of forest to agriculture, illegal logging and mining. But the impacts of these will vary spatially and will depend on the geo-political arrangements in that country / region. • Longer term climate-change is a worrying factor because of its scale of impacts and the positive feedback / amplification mechanism so, conversion of forest to livestock farming is an example • Development and globalisation are underlying factors that drive air travel, and increasing demand for energy. These are linked to population growth in some parts of the world so play a significant role. • Drivers are often interlinked and there can be a chain of effects that increase the likelihood of climate change. AO4 • Figure 7c shows a range of different drivers which are all linked to human activity and climate change. • Figure 7c shows drivers that can operate at different geographical scales and have very different root causes. • Figure 7c shows that deforestation has an indirect impact, whereas the others are more direct causes and rivers. • Figure 7c indicates that there is only a limited number of drivers, but for some places there may be more which are not on the diagram.	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	• Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3)

		• Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
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Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Responses to climate change are many and varied. • Responses can be shorter-term as well as longer term and they can be mitigate (reduce cause) or adaptation (live with impacts) • Responses can be localised, e.g. managing traffic, more sustainable buildings and heating systems. • Responses can be based round “polluter pays” principle or more of an incentivised solution, e.g. FITs to encourage green energy technology. AO3 • Countries, places and regions which have the greatest carbon footprints do not always have the most robust solutions in terms of responses. • Cutting of CO₂ emissions is complex, controversial and politically difficult, especially taken as a long-term objective where growth and development might be at risk. • In order for mitigation responses to be effective, many would argue that they need to be global, rather than country or even regionally-based. • Some places might see adaptation as the best responses as they have the resources and technical capability to withstand shorter and longer-term climate change shocks and impacts. • The development pathways to secure money for climate change responses going from the richest nations to the poorest to counter the most significant drivers is seen as a good approach. AO4 • Figure 7a shows “hotspots” in China, India and USA especially as well as much of Europe if taken as a region in itself. • Figure 7a shows some countries and regions have made very little contribution to carbon emissions, e.g. parts of Sub-Saharan Africa.



Question number	Indicative content	
	- Figure 7b shows a range of different drivers which are all linked to human activity and climate change. - Figure 7b shows causes that can operate at different geographical scales. - Figure 7b shows that deforestation can be linked to agricultural land conversion e.g. livestock farming.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark) C volcanoes C is the correct answer as the other options include the impacts from people.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) D additional heat trapped as a result of human activities D is the correct answer as the other options include options not related to the enhanced greenhouse effect.	(1)

Question number	Answer	Mark
7(b)(i)	AO1 (1 mark) Award 1 mark for any of the following • Clearance / removal of a forest or stand of trees where the land is thereafter converted to a non-forest use (1) • Removal from tress into a different land use (1) • Cutting down of trees or woodland (1) • The destruction of forests or woodlands (1) Accept any other appropriate response.	(1)

Question number	Answer	Mark
7(b)(ii)	AO3 (2 marks) Award 1 mark for any of the following, up to a maximum of 2 marks. • Brazil (1) • Zimbabwe (1)	(2)

Question number	Answer	Mark
7(b)(iii)	A02 (2 marks) / A03 (2 marks) Award 1 mark for the identification of a pattern shown on the map (A03) and a further mark for an explanation of the reason (A02), up to a maximum of 2 marks per idea. • Reforestation in some places (blue), e.g. USA has been caused by government policy which has encouraged replanting of forest cover (1). • Net increase in forest in China (1) is due to Low population densities e.g. in parts of China (1). • Deforestation e.g. south America (1) is caused by land conversion to agriculture as this is a profitable use of the productive farmland in this area (1) • Poor management of the forest reserve in Zimbabwe (1) is as a result of government corruption (1). Accept any other appropriate response. Note: Pattern can refer to individual countries, data from key or regions, e.g. Europe, EU etc.	(4)

Question number	Answer	Mark
7(c)	A01 (2 marks) / A02 (2 marks) Award 1 mark (A01) for identification of effect and a further mark (A02) for an explanation of the reason, up to a maximum of 2 marks per idea: • Deaths from increased heat and heatwaves (1) so this means increased temperatures will greatly affect places like France and Spain (1). • Sea level rise affecting many low lying coastal areas and world cities (1). Linked effects of salinization and loss of agricultural productivity (1). • Droughts, and prolonged drought for some areas (1) leading to loss of health and livelihood (1). • Knock-on effects may be increased tensions over natural resources at risk from climate change (1) and even greater risk of conflict in areas of political instability (1). Accept any other appropriate response, e.g. can be linked effects on people through environmental degradation.	(4)

Question number	Answer	Mark
7(d)(i)	(AO4) 2 marks Award 1 mark for a correct answer and one mark for working: 2004 = 27.8 and 2012 = 4.7 (1) or working out with similar numbers, i.e. understands idea of difference / subtraction (highest and lowest values). Range = 23.1 (1) or 23100 (1) Note units not required.	(2)

Question number	Answer	Mark
7(d)(ii)	A03 (2 marks) Award 1 mark for the identification of a pattern and 1 mark for further detail through description, up to a maximum of 2 marks. - Overall rates of loss have decreased in the time period (1) and the slowing the rate of deforestation has been roughly even (1). - Overall rates of loss have decreased (1) but the most significant slowing of the total loss occurs between 2004 and 2005 (1). Accept any other appropriate response. Data or data manipulation can be used as part of development to support an additional point.	(2)

Question number	Indicative content
7(e)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 The most important factors locally are likely to be conversion of forest to agriculture, illegal logging and mining. But the impacts

		of these will vary spatially and will depend on the geo-political arrangements in that country / region. • Longer term climate-change is a worrying factor because of its scale of impacts and the positive feedback / amplification mechanism. • Forest fires can be localised, and in some places controlled, but with increase temperatures and aridity, this is a factor that in the future will likely be very significant. • Causes are often interlinked and there can be a chain of causes that increase the pressure on the resource. AO4 • Figure 7c shows a range of different causes which are all linked to human activity. • Figure 7c shows causes that can operate at different geographical scales. • Figure 7c shows forest fires are natural but their impact damages ecosystems. • Figure 7c indicates that there is only a limited number of causes, but for some places there may be more.
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	• Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • The term 'sustainable' can be defined in a range of ways, often to suit different arguments • Deforestation will have an impact on biodiversity, livelihoods, soil quality, hydrology etc so it is very important to consider a range of management options. • Rainforest structure will be threatened by rising sea levels caused by climate change; rainforest biodiversity could be threatened by animals migrating because they cannot adapt to the changing climate of their current habitat. AO3 • A main cause of deforestation is poor management locally. However, different groups of people have different opinions about which strategy is the best/most effective – so this is complex • The challenge of global management of the issue is that crosses international boundaries – and therefore international cooperation is crucial– but these agreements are never straight forward to arrive at, or to implement • Attempts to mitigate against climate change threats, for example through sustainable management, can vary significantly for different fragile environments (judgements will depend on case studies). • A specific ecosystem's natural ability to respond to management can vary, which means that management solutions often have to be tailored locally or regionally, so the global aspect is difficult • The development of alternative income streams for rural people may reduce deforestation, but the development of each type of strategy has its own advantages and disadvantages. AO4 • Figure 7a shows red "hotspots" of Brazil and Indonesia • Figure 7a shows some countries have had net forest gains between 1990 and 2015. • Figure 7b shows decrease in the annual rate of deforestation • Figure 7b shows the rate of deforestation slows between 2008 and 2012 • Figure 7c shows a range of different causes which are all linked to human activity.

Question number	Indicative content	
	- Figure 7c shows causes that can operate at different geographical scales. - Figure 7c shows forest fires are natural but their impact damages ecosystems.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark)	
	B intensive farming	(1)
	B is the correct answer as the other options are natural causes,	

Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark)	
	D significant increase in mining	(1)
	D is the correct answer as the other options are not direct causes,	

Question number	Answer	Mark
7(b)(i)	AO1 (1 mark)	
	Award 1 mark for a suitable definition.	
	The long-term changes in the average planetary / surface temperature of the Earth (1).	
	Accept any other appropriate response.	
		(1)

Question number	Answer	Mark
7(b)(ii)	AO3 (2 marks)	
	Award 1 mark for any of the following, up to a maximum of 2 marks.	
	- Highest = China (1) - Lowest = New Zealand (1)	
		(2)

Question number	Answer	Mark
7(b)(iii)	AO2 (2 marks) / AO3 (2 marks) Award 1 mark for the identification of a possible reason for the pattern shown on Figure 7a (AO3) and a further mark for an explanation of the pattern (AO2), up to a maximum of 2 marks per idea. • The two most populated countries have the highest CO₂, e.g. China (1) this is because more people are generating more CO₂ emissions through domestic heating and lighting (1). • Countries with lower levels of development, e.g. within sub-Saharan Africa (1) have poor energy infrastructure grids and therefore use less power (1). • Places such in the Middle East have a high CO₂ footprint as energy is comparatively cheap (oil) (1) so people will be inclined to use more (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(c)	AO1 (2 marks) / AO2 (2 marks) Award 1 mark (AO1) for identification of causes and a further mark (AO2) for an explanation of the reason, up to a maximum of 2 marks per idea. - Overgrazing through exceeding the land natural carrying capacity (1) is caused when there is pressure on the land to produce more food from livestock (1). - Deforestation of large areas of tress and woodland especially in places like Asia (1) is often caused by conversion of the forest into a farmed landscape (1). - Over exploitation of plants for domestic use (1) causes soils to be degraded or lost which puts more pressure on the vulnerable land (1). - Increasing population pressures on vulnerable land (1) cause land to become degraded as the soils are slowly exhausted over time. (1). - Changing rainfall patterns (1) leading to reduce water availability (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(d)(i)	(AO4) 2 marks Award 1 mark for a correct answer and one mark for working: Total = -125 (accept -120 to -130) / 7 Mean = -17.9 (accept -17.4 to -18.3) (1)	(2)

Question number	Answer	Mark
7(d)(ii)	A03 (2 marks) Award 1 mark for the identification of a pattern and 1 mark for further detail through description or use of supporting data from the resource, up to a maximum of 2 marks. • Latin America has the greatest loss (1) compared to Europe which has seen the largest gains of nearly 25% (1). • Latin America has the greatest loss (1) whilst all other regions have seen net gains of between 5% to nearly 25% (1). • There are big variations between Latin America and other regions (1), the first two seeing huge losses (over 75%) and the other regions all seeing modest gains (1). Accept any other appropriate response.	(2)

Question number	Indicative content
7(e)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 • The most important impacts may be systems changes in the atmosphere e.g. unreliable rainfall and extreme temperatures have a wider global reach • Climate-change is a worrying because of its scale of impacts and the positive feedback / amplification mechanism. • Local effects will also be severe on land especially crop yields affecting people's health and livelihoods. These are linked to atmosphere e.g. monsoon summer changes (reliability, amount) • Ocean degradation is important especially from a marine biodiversity point of view. • Systems are very interlinked and therefore it is actually difficult to predict the scale of impacts especially with unknown temperature increases. AO4 • Figure 7c shows six different climate change impacts. • Figure 7c shows that the climate change impacts are grouped into three categories: ocean, land and atmosphere. • Figure 7c shows a selected range of climate change impacts

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	• Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)



Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Climate change is the increasing temperatures associated with average weather conditions or longer-term average conditions. • Ecosystems and places are affected by water and drought stress linked to climate change. • Low lying places will be threatened by rising sea levels caused by climate change. • Biodiversity will be threatened by animals migrating because they cannot easily / quickly adapt to the changing climate of their current habitat. • Climate change will affect global atmospheric circulation systems thereby affecting many places. AO3 • Figure 7a shows that China, India and USA are the worse emitters, and to some extent they will suffer the effects of climate change although they may be able to adapt especially in the richest parts of those nations. • Perhaps the worst impact will be felt by the people and nations who do not emit, e.g. parts of Africa, small island states (SIDS) etc. Sea level rise for the latter is especially significant especially as they often don't have a voice on the global stage. • 7a shows emissions for a whole country; arguably a more useful measure are emission per capita. • Changes in farming, through adaptation, may mitigate against the risks of climate change. So, the evidence in Figure 7c may not be reliable and conclusions not valid. • Overall the view is likely to be broadly correct, with exceptions. AO4 • Figure 7a shows China, India and USA as the biggest emitters (total CO₂). • Figure 7a shows that a large number of nations, especially in the southern hemisphere have a low total CO₂ output.

Question number	Indicative content	
	- Figure 7a shows a good deal of variability between countries and global regions. - Figure 7c shows nine different climate change impacts. - Figure 7c shows that the climate change impacts are grouped into three categories: ocean, land and atmosphere. - Figure 7c shows a selected range of climate change impacts.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark) C a diet with too few nutrients The answer cannot be A, B or D as these are not the correct meanings for malnutrition.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) D a place threatened by human and physical factors The answer cannot be A (activity that can take place in some fragile environments), B (not all fragile environments), C (refers to sustainable management).	(1)

Question number	Answer	Mark
7(b)(i)	AO1 (1 mark) Award 1 mark for a suitable economic cause of deforestation. • Timber extraction (1) • Conversion to agriculture (1) • Mining (1) • Transport (1) • HEP (1) Accept any other appropriate response.	(1)

Question number	Answer	Mark
7(b)(ii)	AO3 (2 marks) Award 1 mark for any of the following, up to a maximum of 2 marks. • A - Mexico	

	E - Madagascar	(2)
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Question number	Answer	Mark
7(b)(iii)	AO2 (2 marks) / AO3 (2 marks) Award 1 mark for the identification of a possible reason for the pattern shown on Figure 7a (AO3) and a further mark for an explanation of the reason (AO2), up to a maximum of 2marks per idea. - Increases in productivity e.g. Canada and Scandinavia (1) might be due to warmer soils allowing more rapid germination (1). - Increases in productivity e.g. Canada and Scandinavia (1) might be due to more rapid rates of nutrient recycling with warmer climates (1). - Decreases in productivity e.g. much of central and southern Africa (1) might be due to less reliable or lower rainfall causing crop stress (1). - Decreases in productivity e.g. parts of northern and western Australia (1) might be due to increases temperatures causing crop stress and desiccation (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(c)	AO1 (2 marks) / AO2 (2 marks) Award 1 mark (AO1) for identification of effect and a further mark (AO2) for an explanation of the reason, up to a maximum of 2 marks per idea: - Deaths from increased heat and heatwaves (1) so this means increased temperatures will greatly affect places like Greece and Turkey which rely on tourism in their economy (1). - Sea level rise affecting many low-lying coastal areas and world cities (1). Linked effects of salinization and loss of agricultural productivity (1). - Droughts, and prolonged drought for some areas (1) leading to loss of health and therefore an ability to work (1). - Knock-on effects may be increased tensions over natural resources at risk from climate change (1) and even greater risk of conflict in areas of political instability, reducing GDP (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(d)(i)	(AO4) 2 marks Award 1 mark for a correct answer and one mark for working: Ivory coast = 0.36 Brazil = 4.52 Range = 4.16 (1)	(2)

Question number	Answer	Mark
7(d)(ii)	AO3 (2 marks) Award 1 mark for the identification of a pattern and 1 mark for further detail through description or use of supporting data from the resource, up to a maximum of 2 marks. • Brazil has by far the greatest loss (1) compared to the other countries, except DRC and Indonesia (1). • Ivory Coast to Madagascar have similar deforestation losses (between 0.36 to 0.51 respectively) (1) but deforestation for Indonesia and DRC is nearly 3x higher (1). • There are big variations between the top three (Brazil, DRC, Indonesia) (1), whereas the other countries all have similar rates of loss. Accept any other appropriate response.	(2)

Question number	Indicative content
7(e)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 • The most important impacts may be systems changes e.g. jet stream, El Nino which have a wider global reach. • Climate-change is a worrying factor because of its scale of impacts and the positive feedback / amplification mechanism.

	- Local effects will also be severe affecting people's health and livelihoods, e.g. monsoon summer changes (reliability, amount). - Systems are very interlinked and therefore it is actually difficult to predict impacts especially with unknown temperature increases. AO4 - Figure 7c shows vulnerability based predicted temperatures changes between 1 and >5°C. - Figure 7c shows that a number of locations and environments are at risk from 3-5°C temperature increases: the Sahel, Amazon rainforest and Boreal forest (Canada / Arctic). - Figure 7c shows especially ice areas (Greenland, Arctic, Alpine glaciers etc) are at risk from only a smaller 1-3°C temperature rise. - Figure 7c indicates that a >5°C will impact on winter sea ice, permafrost and the East Antarctic ice sheet.	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Climate change is the increasing temperatures associated with average weather conditions or longer-term average conditions. • Ecosystems are affected by water and drought stress linked to climate change. • Ecosystems will be threatened by rising sea levels caused by climate change. • Biodiversity will be threatened by animals migrating because they cannot adapt to the changing climate of their current habitat. • Climate change will affect global atmospheric circulation systems. AO3 • There is an overlap between agricultural productivity and ecosystem health, so when one is stressed the other is also affected. • Attempts to mitigate against climate change threats, for example through sustainable management, can vary significantly for different fragile environments (judgements will depend on case studies). • A specific ecosystem's natural ability to respond to management can vary, which means that management solutions often have to be tailored locally or regionally, so the global aspect is difficult. • Changes in farming, through adaptation, may mitigate against the risks of climate change. So, the evidence in Figure 7a may not be reliable.



Question number	Indicative content	
	AO4 - Figure 7a shows red “hotspots” of southern USA, much of Africa, N+W Australia as well as India and the Middle East. - Figure 7a shows some places are predicted to have an increase in agricultural productivity by 2080, but these are largely in the northern hemisphere. - Figure 7a shows a good deal of variability from -50% drop to +35% increase. - Figure 7c shows especially ice areas (Greenland, Arctic, Alpine glaciers etc) are at risk from only a smaller 1-3°C temperature rise. - Figure 7c shows several systems will be affected with a 3-5 Figure 7c shows rise: thermohaline circulation, jet stream, El Nino, monsoons. - Figure 7c indicates that a >5°C will impact on winter sea ice, permafrost and the East Antarctic ice sheet. Figure 7b shows forest fires are natural but their impact damages ecosystems.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but

Question number	Indicative content	
		not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark

7(a)(i)	AO1 (1 mark) D - Variations in the tilt and/or orbit of the earth around the sun. (1) A, B and C are all incorrect.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (2 marks) Award 2 marks for a suitable explanation. • A period of time with abnormally low rainfall (1) for an extended period of time (1). • Shortage of water (1) due to reduced rainfall (1). • Shortage of water (1) which means people cannot irrigate their crops (1). Accept any other appropriate response. Only award 1 mark for reference to lack of rainfall with no development.	(2)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) B - Decaying organic matter. (1) A, C, and D are all incorrect as they lead to increases in other greenhouse gases.	(1)

Question number	Answer	Mark
7(b)(i)	AO3 (1 mark) August (1).	(1)

Question number	Answer	Mark
7(b)(ii)	AO4 (2 marks) Award 1 mark for the comparison using Figure 7a, and a further mark for additional development, up to a maximum of 2 marks per idea. • Temperature peaks in 1991-2016 in August at 32°C (1), whereas it plateaus around 25°C in 1901-1930 (1). • Greater range in temperature in 1991-2016 (1), from 22-32, whereas 20-25 in 1901-1930 (1). • January temperatures in both months are similar (1) but 1991-2016 has a higher peak (1). Accept any other appropriate response. Use of data is not required to obtain marks.	(2)

Question number	Answer	Mark
7(b)(iii)	AO2 (2 marks) Award 1 mark (AO2) for identification of a cause and a further mark (AO2) for development or explanation up to a maximum of 2 marks. • Increased production of CO₂ from burning fossil fuels (1) which enhances the greenhouse effect. (1) • Intensive cattle farming (1) which increases the production of methane. (1) • Increased use of CFCs (1) which damages the ozone layer. (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b)(iv)	AO2 (1 mark)/AO3 (1 mark) Award 1 mark (AO3) for identification of a reason and a further mark for development of the reason (AO2), up to a maximum of 2 marks. • Data only presents patterns for two time periods. (1) which is not long enough to understand patterns of climate change. (1) • Data is only for Africa (1) and does not necessarily reflect the global experience. (1) • The data shows averages for the times periods (1) and so will not show annual variations. (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(c)	AO1 (2 marks) Award 1 mark for each impact provided: • Land degradation. (1) • Increased soil erosion. (1) • Damaged habitat for wildlife. (1) • Interruption of food chains. (1) • Increased CO₂ in the atmosphere. (1) • Loss of biodiversity. (1) • Changes to rainfall patterns. (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)	AO1 (2 marks) /AO2 (2 marks) Award 1 mark (AO1) for identification of approach and a further mark (AO2) for an explanation, up to a maximum of 2 per approach. A range of country examples could be used. • Selective logging and replanting (1) to ensure areas affected by deforestation have tree replacement programmes to reduce overall loss (1). • Agroforestry to combine using trees and crops (1) to reduce the amount of trees being removed for agriculture (1). • Increasing community involvement in forest conservation projects (1) to increase potential for sustainable management (1). • Creation of a biosphere reserve (1) in order to protect biodiversity (1). Accept any other appropriate response.	(4)

Question number	Indicative content	Mark
7(e)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include the following. A03 • Existing climatic patterns will affect where has experienced desertification processes in the past. Arid areas with large deserts are naturally areas with a higher risk e.g. Sahel.	

	• Variation in risk will also be affected by population distribution. • Variation in risk will be affected by human activities which can increase soil erosion, lower the water table or use up water sources which can all contribute to desertification. A04 • Figure 7b shows there are great differences in the level of vulnerability to future desertification. • Figure 7b shows the Middle East and borders of the Sahel region are very vulnerable to future desertification. • Figure 7b shows that desertification has the potential to impact wide areas of the globe. • Figure 7b indicates that there remains several humid areas that are less vulnerable to desertification, particularly in the Amazon basin and Europe.	(6)
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)
Level 2	4–6	• Applies understanding to deconstruct information but understanding and connections are flawed. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain information that supports some aspects of the argument. (A04)

Question number	Indicative content
7(f)	A02 (4 marks)/AO3 (4 marks) /AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include the following. A02 • Deforestation has a range of negative effects on fragile environments including loss of biodiversity, contribution to climate change, increased soil erosion. • Rising global temperatures have the potential to have wide ranging impacts on fragile ecosystems. • Rising global temperatures are likely to increase risk of desertification for areas of the globe, introducing desertification into some areas, and making it worse in others. • Increased desertification has the potential to impact livelihoods across the globe in terms of the availability of land for agriculture. AO3 • Changes in temperatures are likely to have more wide-ranging impacts on the globe than just deforestation. • Changing rainfall patterns will not only affect forests processes, but a wider range of areas with many facing increased rainfall and hazards associated with this. • Global temperatures have the potential to contribute to sea level rise which many would argue poses a greater threat to fragile environments. • The variation in patterns of surface water will affect humidity and therefore rainfall patterns and as a consequence risk of desertification. AO4 • Figure 7b shows how many regions of the world are vulnerable to desertification for example the Middle East or large area of sub-Saharan Africa. • Figure 7c indicates a series of threats that are posed to fragile environments indicating a proposed order of significance,

		including deforestation, desertification, climate change, soil erosion, rising sea levels, industrialisation.
		•
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–4	• Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information but understanding and connections are flawed. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark) A period of time with abnormally low rainfall (1). B, C, and D are all incorrect as they are not referring to the meaning of drought.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (2 marks) - The spread of desert conditions (1) and decline of soil quality (1). - Degradation of land/drying out of land (1) as a result of human activities/climate change (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) C Install water storage devices. A, B and D are all incorrect as they are not methods to manage the impacts of desertification.	(1)

Question number	Answer	Mark
7(b)(i)	AO3 (1 mark) 1970s, 1980s, 1990, 2000s, 2010s (1). Allow a range for example 1970-1980.	(1)

Question number	Answer	Mark
7(b)(ii)	AO3 (2 marks) Award 1 mark for the comparison using data Figure 7a and a further mark for additional development, up to a maximum of 2 marks per idea. - Global temperatures and CO₂ emissions continue to rise at fast rates (1) at times following similar growth trajectories (1). - Global temperatures have varied more than CO₂ emissions, with greater fluctuation in the 1970s (1), but with a more steady trajectory since 1995 (1). - CO₂ emissions have tripled since 1960 (1), while global	

	temperature anomalies have risen up to 0.725-0.8oC (1). Accept any other appropriate response.	(2)
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Question number	Answer	Mark
7(b)(iii)	AO2 (2 marks) Award 1 mark (AO2) for identification of each reason up to a maximum of two marks. • Increased use of cars burning fossil fuels (1) • Burning coal to produce energy (1) • Deforestation (1) • Volcanic eruptions (1) • Industrialisation (1) • Population increase (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b)(iv)	AO2 (1 mark)/AO3 (1 mark) Award 1 mark (AO3) for identification of a reason and a further mark for development of the reason (AO2), up to a maximum of 2 marks. • Data only presents patterns for a limited time period (1) which is not long enough to understand patterns of climate change (1). • The data does not show actual temperatures, but variations from a particular temperature (1) so not an accurate picture of actual changing climatic conditions (1). • The data does not show the fluctuations in temperatures that happen during the year (1) so may hide important variations in the pattern (1). • The data does not show other aspects of climate (1) such as rainfall patterns (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(c)	A01 (2 marks) Award 1 mark for each characteristic identified: • High annual rainfall (1) • High average temperature (1) • Nutrient poor soil (1) • High levels of biodiversity (1) • Dense shrub layer and canopy (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)	A01 (2 marks) / A02 (2 marks) Award 1 mark (AO1) for identification of ways to manage rainforests and a further mark (AO2) for an explanation, up to a maximum of 2 for each way explained. • Selective logging and replanting (1) to ensure areas affected by deforestation have tree replacement programmes to reduce overall loss (1). • Agroforestry to combine using trees and crops (1) to reduce the number of trees being removed for agriculture (1). • Increasing community involvement in forest conservation projects (1) to increase potential for sustainable management (1). • Creation of a biosphere reserve (1) in order to protect biodiversity (1). • Government regulations to conserve rainforest (1) limiting activities that can take place there (1). Accept any other appropriate response.	(4)

Question number	Indicative content	Mark
7(e)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below.	

	Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include the following. A03 - Global warming is thought to be contributing to sea level rise, with predictions of how much this going to be over future decades varying significantly. Whichever scenario takes place any amount of sea level rise has the potential to cause damage to the economic development of many countries. - Sea level rise will not only damage many coastal environments, and increase flooding and erosion, it has the potential to damage human lives for those in affected areas. - Those countries such as Bangladesh which are low lying have the greatest potential to have their economies damaged as rising waters would not only damage buildings and infrastructure but disrupt agricultural systems and ability to produce food for consumption and exports. A04 - Figure 7b shows how Asia will be the continent that is most affected by either 0.15m sea level rise potentially affecting 60.2 million people. - Figure 7b shows in terms of total numbers Oceania has the lowest number at risk. - Figure 7b shows how North and South America have a similar level of risk ranging from 5.6-6.2 million people.		(6)
Level	Mark	Descriptor	
	0	No rewardable material.	
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (A03) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)	
Level 2	4–6	- Applies understanding to deconstruct information but understanding and connections are flawed. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (A03) - Uses geographical skills to obtain information that supports some aspects of the argument. (A04)	

Question number	Indicative content
7(f)	A02 (4 marks)/A03 (4 marks) /A04 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include the following. A02 • Sea level rise poses a significant threat to the many countries around the world, particularly those with high populations living on coastal or low lying areas. • There are different scenarios for the potential level of sea level rise but even the smallest of these is likely to damage coastlines and cause greater flooding along coast and river courses. • Some of the worlds largest cities are at risk from sea level rise including New York and Tokyo which represent significant global financial centres. Damage in these locations would have a global effect. • There are a range of threats links to global climate change including sea level rise, desertification, changing weather patterns, ecosystem challenges, health challenges and changing patterns of food production. A03 • Rising global temperatures as an indicator of global climate change will have wider impacts than just sea level rise. • Atmospheric systems are likely to be altered as temperatures will have changed, and a different level of moisture in the air, which has the potential to cause more frequent and extreme weather events. • Rising global temperatures are likely to increase risk of desertification for areas of the globe, introducing desertification into some areas, and making it worse in others. Increased desertification has the potential to impact livelihoods across the globe in terms of the availability of land for agriculture. • Global climate change will lead to a range of threats which will have various social, economic and environmental impacts. • Changing global temperatures may have an impact on the prevalence of insects, bacteria, and viruses which can affect animal and food crops in other countries. • Many of the threats from global climate change are interconnected and cannot be seen independently.



		AO4 - Figure 7b shows the varied levels of population at risk from different levels of sea level rise. - Figure 7b shows how Asia will be the continent the most affected by either 0.15m sea level rise potentially affecting 60.2 million people. - Figure 7b presents a range of threats from global climate change in a rank order suggesting that global sea level rise is the greatest, but covers other economic, social and environmental threats. - Figure 7c shows how there a range of potential threats from climate change.
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information but understanding and connections are flawed. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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Question Number	Answer	Mark
7(a)(i)	AO1 (1 mark) D solar (1). The answer cannot be A, B or C as these are all incorrect.	(1)

Question Number	Answer	Mark
7(a)(ii)	AO1 (1 mark) A Changes in the shape of the earth's orbit (1). The answer cannot be B, C, D as these are all incorrect.	(1)

Question Number	Answer	Mark
7(b)	AO1 (1 mark) • Burning fossil fuels (1). • Deforestation (1). • Farming livestock (1). Accept any other appropriate response.	(1)

Question Number	Answer	Mark
7(c)(i)	AO3 (2 marks) Award 1 mark for any of the following, up to a maximum of 2 marks. • Iran (1). • Senegal (1).	(2)

Question Number	Answer	Mark
7(c)(ii)	AO2 (2 marks) / AO3 (2 marks) Award 1 mark for the identification of a possible reason for the pattern shown on Figure 7a (AO3) and a further mark for an explanation of the pattern (AO2), up to a maximum of 2 marks per idea. • Countries most at risk of desertification experience arid condition including high temperatures (1) this leads to high evaporation of water (1). • Places such as the Middle East have climates with high temperature and low rainfall (1) which mean they have the conditions that are more susceptible to desertification (1). • Some countries such as those on the edge of the Sahara Desert (1) may have been overgrazing the land increasing the risk of desertification (1). • More developed countries have the resources to respond to desertification (1) with strategies to try and reduce the risk of soil erosion in areas that are considered at risk (1). Accept any other appropriate response.	(4)



Question Number	Answer	Mark
7(d)	AO1 (2 marks) / AO2 (2 marks) Award 1 mark (AO1) for identification of a management method and a further mark (AO2) for an explanation, up to a maximum of 2 marks per method. • Selective logging (1) which involves strict planning of which trees can be cut down, and involves replacing trees cut down (1). • International agreements (1) to ensure particular areas of rainforests are protected from logging or construction (1). • Increased education about rainforests (1) to ensure people recognise their value and therefore are less likely to cause damage (1). • Ecotourism (1) to increase awareness of the rainforest and how it needs to be protected (1). Accept any other appropriate response.	(4)

Question Number	Answer	Mark
7(e)(i)	(AO4) 2 marks Award 1 mark for correct figures used, and one mark for correct answer: Highest = 52 Lowest = 12 (1). Range= 40.0 (1). Accept answers from 39.0-41.0	(2)

Question Number	Answer	Mark
7(e)(ii)	AO3 (2 marks) Award 1 mark for the identification of a pattern and 1 mark for further detail through description or use of supporting data from the resource, up to a maximum of 2 marks. • For many regions there are few differences between 2010 and 2019 (1) except Western Pacific where there are almost double the number of storms (1). • All regions have a higher number of storms in 2019 than in 2010 except Australia (1). The greatest increase has been in the Western Pacific region (1). • In 2010 the regions with the highest number of storms was the Atlantic and Western Pacific (1), but in 2019 it was Western Pacific and Eastern Pacific (1). Accept any other appropriate response.	(2)

Question Number	Indicative content
7(f)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 • There are a range of economic, social and environmental impacts of deforestation. Many of the impacts are interlinked. • Most of the impacts are negative, however, for many countries the economic benefits outweigh the negative which is why deforestation continues even if these benefits are short-lived compared to the long-term impacts. • Physical impacts: ○ Loss of biodiversity: Amazon rainforest thought to be home for over 60,000 species of plant, more than 1,000 species of birds and over 300 species of mammals. ○ Soil erosion: removal of trees for cattle ranching exposes the soil and makes it more prone to erosion. ○ Increased CO₂ in the atmosphere as there are less trees to absorb it, contributing to climate change in the long term. • Human impacts: ○ Loss of goods provided by the rainforest, for example many rainforest plants are used for medicines. ○ Native tribes forced to move e.g. Kayapo tribe Brazil forced to move due to logging activity. ○ Money made: cattle ranching in areas of Brazil formerly part of the rainforest generated US\$6.7 billion in exports. AO4 • Figure 7c shows a series of physical and human impacts of deforestation. • Figure 7c indicates how human impacts can include a loss of services provided by the forest, movement of native tribes and money made from deforestation can support economic development.

	- Figure 7c indicates physical impact of deforestation include loss of biodiversity, soil erosion and increased CO₂ in the atmosphere. - Figure 7c indicates there are some potential positive impacts of deforestation for people (money).
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Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (g)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Climate change is the increasing temperatures associated with average weather conditions or longer-term average conditions. • There are a range of potential impacts of climate change including: increased temperatures, sea level risk, increased frequency of extreme weather events. • Climate change will affect global atmospheric circulation systems thereby affecting many places. AO3 • Figure 7a shows how arid regions of the world are particularly at risk of desertification, and therefore if climate change continues this process will get worse. • Figure 7b how there has already been an increase in the number of tropical storms over a decade, if climate change continues and this trajectory continues some regions of the world will be at great risk of a high number of tropical storms each year. • Rising sea levels due to climate change has the potential to impact a much larger number of people. Every year the sea rises by around 3mm but this could increase if temperatures continue to rise too, with up to 150 million people being affected by 2050. AO4 • Figure 7a shows the regions at risk of desertification, particularly around the edge of the Sahara desert and the middle east, and the edge of Australia. • Figure 7a shows that a large number of nations are affected by some level of risk of desertification.

	• Figure 7a shows a significant level of variability between countries and global regions. • Figure 7b shows how there has been an increase in the number of tropical storms across all regions with the lowest increase seen around Australia. • Figure 7b shows how the Western Pacific region has experienced the greatest increase in the number of tropical storms. • Figure 7b shows how there is significant variability in the risk of tropical storms, although there are many regions at risk.
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Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	• Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading

		to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)
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7(a)	AO1 (1 mark) A atmospheric (1) The answer cannot be B, C or D as these are not relevant for climate change.	(1)
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Question number	Answer	Mark
7(b)	AO1 (1 mark) B Loss of species diversity (1) The answer cannot be A (economic), C (social) or D (economic)	(1)

Question number	Answer	Mark
7(c)	AO1 (1 mark) - Increased greenhouses gases/CO₂/methane/water vapour in the atmosphere (1). - Burning fossil fuels such as coal (1). Accept any other appropriate response.	(1)

Question number	Answer	Mark
7(d) (i)	AO3 (2 marks) Award 1 mark for any of the following, up to a maximum of 2 marks. - Highest = Nigeria (1) - Lowest = Russia(1)	(2)

Question number	Answer	Mark
7(d)(ii)	AO2 (2 marks) / AO3 (2 marks) Award 1 mark for the identification of a possible reason for the pattern shown on Figure 7a (AO3) and a further mark for an explanation of the pattern (AO2), up to a maximum of 2 marks per idea. • Deforestation (1) to create income from exports of timber (1). • Afforestation (1) due to efforts to mitigate against climate change (1). • Countries with a large area of forest still remaining in 2020 e.g. Brazil have economies that rely on deforestation (1) as they need to clear the land for timber and cattle ranching (1). • Some countries have recognised the negative impacts of deforestation (1) and have made efforts to reforest areas where possible (1). • Some countries use the forest as a natural resource to fuel economic development e.g. those in central Africa (1) and therefore continue to deforest areas at a high rate (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(e)	AO1 (2 marks) / AO2 (2 marks) Award 1 mark (AO1) for identification of strategy and a further mark (AO2) for an explanation of the reason, up to a maximum of 2 marks per idea: • Installing rainwater harvesting devices (1) to capture rainwater to reduce demand on other supplies (1). • Create an earth dam/stone lines (1) to retain water during the rainy season (1). • Install drip irrigation for crops (1) to minimise water loss (1).	

	Build a dam (1) to increase water storage that can be released when needed (1) Accept any other appropriate response.	(4)
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Question number	Answer	Mark
7(f)(i)	(AO4) 2 marks Award 1 mark for the calculation method and one mark for the correct answer: $\frac{6497 + 8473 + 9224 + 15603 + 14209}{5} = 10801.2$ Mean = 10,801.2 (1)	(2)

Question number	Answer	Mark
7(f)(ii)	AO3 (2 marks) Award 1 mark for the identification of a pattern and 1 mark for further detail through description or use of supporting data from the resource, up to a maximum of 2 marks. - There has been a significant increase in spending on adaptation and mitigation (1) with almost twice as much spent on mitigation between 2015 and 2019 (1). - Spending increases gradually between 2015-2017 (1) but remains higher in 2018-2019, over double the amount spent in 2015 (1). Accept any other appropriate response.	(2)

Question number	Indicative content	
7(g)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 • The impacts of desertification will vary in severity by location, and the scale of the impact will vary too. • Countries around the Sahel region in Africa have been experiencing increased desertification for decades which has led to increased drought and crop failures since the 1970s, leading to over 1 million deaths. • Desertification leads to soil erosion as it becomes left bare and crops become more difficult to grow, this leads problems for those who rely on incomes from crops grown demonstrating how many of these impacts are linked. • It is possible for some people to migrate to other areas to respond to these impacts, whereas loss of biodiversity and soil erosion are more difficult to address. AO4 • Figure 7c shows six different impacts from desertification. • Figure 7c shows that the impacts of desertification can be categorised as environmental, social and economic. • Figure 7c shows a selected range of desertification impacts with others not shown (e.g. deaths, changing farming practices).	
Level	Mark	Descriptor
	0	No rewardable material.

Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (h)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 - Climate change is the increasing temperatures associated with average weather conditions or longer-term average conditions. - Ecosystems and places are affected by water and drought stress linked to climate change. - Climate change is a key cause of desertification - Climate change will have a range of impacts from flooding in low lying places due to sea level rise to changes in regions where crops can grow.

Question number	Indicative content	
	- Climate change will affect global atmospheric circulation systems thereby affecting many places. AO3 - Figure 7b shows how as well as the environmental impacts of climate change such as desertification or sea level rise, there will be serious economic impacts too. - Figure 7b shows how spending from the World Bank for adaptation and mitigation strategies to address climate change have over doubled in three years, and this is only spending from the World Bank, not from individual nations. - While sea level rise does have the potential to create serious issues for coastal regions around the globe, other impacts such as increasing temperatures and changing global atmospheric circulation systems have the potential to change whole ecosystems, with the potential to change them irreversibly so they cannot sustain the current levels of biodiversity which will have serious environmental impacts. - Many of the impacts of climate change are interlinked and will have further impacts themselves i.e coastal flooding will affect ability to grow crops in these areas, affecting long-term quality of life. The likely rise in the number of climate refugees will have economic impacts for the countries they belong to. AO4 - Figure 7b shows how the amount of money spent on addressing issues of climate change has increased since 2015. - Figure 7b shows how there was a large rise in spending from the World Bank on climate change between 2017 and 2018. - Figure 7b indicates that the World Bank spends more money on mitigation of climate change impacts than adaptation. - Figure 7c shows six different impacts from desertification. - Figure 7c shows that the impacts of desertification can be categorised as environmental, social and economic. - Figure 7c shows a selected range of desertification impacts with others not shown (e.g. deaths, changing farming practices).	
Level	Mark	Descriptor
	0	No acceptable response.

Question number	Indicative content	
Level 1	1–4	• Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)	AO1 (1 mark) D overgrazing (1) The answer cannot be A, B or C as they are not causes of desertification.	(1)
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Question number	Answer	Mark
7(b)	AO1 (1 mark) C reduced crop yields (1) The answer cannot be A, B or D as these are not impacts of desertification.	(1)

Question number	Answer	Mark
7(c)	AO1 (2 marks) Award one mark for a suitable natural cause, and a further mark for development. • Milankovitch cycles/earth's tilt (1) which leads to natural warming and cooling periods of the earth (1). • Volcanic activity (1) with large eruptions causing ash/dust clouds which can warm or cool the earth's surface (1). • Changes in solar output (1) where increases in the sun's output lead to higher temperatures (1). • Natural greenhouse effect (1) where heat is trapped by greenhouse gases and radiate heat back toward earth (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d) (i)	AO3 (1 mark) Award 1 mark for: • China (1)	(1)

Question number	Answer	Mark
7(d)(ii)	AO4 (2 marks) Award 1 mark for comparative statement, and a further mark for development, up to a maximum of 2 marks per idea. • Risk is greater in Asia than in North America (1) there are several countries where the number of people that are expected to be under sea level of between 10-50 million (1). • There are more countries with 10-50 million people at risk of the impacts of sea level rise in Asia (1) whereas only 1 country in North America has 1-9 million people at risk (1). • Lower risk in North America than in Asia (1) e.g. more countries with 1-9.9million compared to more with 10-50 million (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)(iii)	AO2 (2 marks) Award 1 mark for identification of reason, and a further mark for an explanation or development, up to a maximum of 2 marks. • Large number of coastal cities in China (1) lead to high populations at risk from sea level rise caused by climate change (1). • Low lying coastlines in South East Asia (1) mean they will be more heavily affected by sea level rise caused by climate change (1). • Countries that are not low lying (1) such as South Africa and New Zealand which are under <100,000 people at risk (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)(iv)	A02 (1 mark) / A03 1 mark Award 1 mark for initial point, and further mark for explanation or development, up to a maximum of 2 marks. • Map demonstrates how huge numbers of people will be affected by sea level rise (1), which may prompt international action to respond to climate change (1). • Data suggests there will be global impacts of climate change (1) and gives an indication of amount of people it will affect (1).	(2)

Question number	Answer	Mark
7(e)	A01 (2 marks) Award 1 mark for each cause identified, up a maximum of 2 marks: • Cattle ranching (1) • Farming/agriculture/palm oil plantations (1) • Population growth (1) • Logging (1) • Urbanisation (1) • Forests fires/wildfires (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(f)	A01 (2 marks)/ A02 (2 marks) Award 1 mark for the identification of each impact and 1 mark for further detail through explanation, up to a maximum of 2 marks for each impact. • Loss of plants and animals/biodiversity (1) due to clearing of forests destroying habitats (1). • Loss of soil/soil nutrients (1) due to removal trees which leaves soil bare (1). • Increased CO₂ in the atmosphere (1) which contributes to climate change (1). • Increased flooding (1) due to less trees to intercept rainfall (1). Accept any other appropriate response.	(4)

Question number	Indicative content	
7(g)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 - The impacts of desertification will vary in severity by location, and as a consequence the strategies used will vary. - Countries around the Sahel region in Africa have been experiencing increased desertification for decades which has led to increased drought and crop failures since the 1970s, and over 1 million people have died. A combination of government led, international organisation led, and NGO led strategies have been used. - Strategies can include: - Education around sustainable farming practices. - Reducing soil erosion through planting trees and perennial plants. - Water conservation techniques such as water spreading weirs. - Technology plays a key role in monitoring desertification the impacts of any strategies used to deal with it. - While some strategies can be actioned at the local level, others are at a much larger scale and need large sums of investment to be effective. AO4 - Figure 7b shows three different strategies used to deal with desertification. - Figure 7b shows how a range of stakeholders can be involved in strategies to deal with desertification. - Figure 7b shows how strategies to deal with desertification can be at different scales from building small wells to large scale afforestation programmes.	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)

Level 2	4–6	• Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
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Question number	Indicative content
7 (h)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Fragile environments such as forests and deserts are at risk of damage and destruction through a range of human and natural causes. • Climate change has the potential to increase desertification, as well as deforestation (through changes in growing conditions but also wildfires). • Strategies to address sea level rise lend themselves to governmental and inter-government action such as the Paris Accord. • Strategies to address expanding deserts including: afforestation; sustainable farming practices; water spreading weirs. AO3 • The nature of the threats to fragile environments spans across national borders so often requires co-operation with international organisations such as the World Bank or UN organisations, or with smaller scale NGOs who can tackle issues on the ground. • Strategies to tackle these threats are often very expensive, for example land reclamation to tackle desertification can cost millions, and so many NGOs alone cannot fund this work, so require the financial backing of governments. • Successful examples of projects to tackle deforestation and desertification have relied on collaboration between international organisations, governments, companies and NGOs. For example, the Elion Resource Group have successfully restored areas of land experiencing desertification in the northern China. AO4 • Figure 7a indicates that large populations are at risk of sea level rise by 2100. • Figure 7a indicates that the highest number of people likely to be at risk of sea level rise are in South East Asia.

Question number	Indicative content	
	- Figure 7b shows three different strategies to try and deal with desertification. - Figure 7b shows how different stakeholders can be involved in strategies to deal with desertification. - Figure 7b shows how strategies can be used at different scales from local to global.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)	AO1 (1 mark) D logging industry (1) The answer cannot be A, B or C as they are not causes of deforestation.	(1)
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Question number	Answer	Mark
7(b)	AO1 (1 mark) C increased soil erosion (1) The answer cannot be A, B or D as these are not impacts of deforestation.	(1)

Question number	Answer	Mark
7(c)	AO1 (2 marks) Award 1 mark for each suitable cause up to a max of 2 marks. • Climate change/global warming (1) • Overgrazing (1) • Soil erosion (1) • Population growth (1) • Removal of wood for cooking (1) • Drought (1) • Deforestation (1) If makes reference to rainfall, it needs to be extended periods of low rainfall, not low rainfall or changing rainfall. Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d) (i)	AO3 (1 mark) Award 1 mark for: • Kenya (1)	(1)

Question number	Answer	Mark
7(d)(ii)	AO4 (2 marks) Award 1 mark for initial comparative statement, and a further mark for development or use of suitable data, up to a maximum of 2 marks per idea. • South America for significant variation in crop yield (1) while Europe is predicted to mainly experience -3 to -1% change (1). • Both South America and Europe have some countries which have the potential to change -3 to -1 %(1) although there are some counties in South America which may experience some increases (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)(iii)	AO2 (2 marks) Award 1 mark for identification of reason, and a further mark for an explanation or development, up to a maximum of 2 marks. • Climate change will lead to widespread changes in temperatures (1) which will affect growing seasons and therefore crop yields (1). • There are some countries in the northern hemisphere which may experience increases in temperatures (1) which could lead to some increases in the ability to grow some crops (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)(iv)	AO2 (1 mark) /AO3 1 mark Award 1 mark for initial point, and further mark for explanation or development, up to a maximum of 2 marks. - The map does not show the different potential crop yields for different crops (1) which may have different impacts to climate change (1). - The data only provides patterns at a large scale (1) when crop yields are often affected at the local level depending on different human and physical factors (1). - The predictions might not be accurate as the impacts of climate change may be more severe (1) meaning the potential increases in yields that are predicted for some countries will not happen (1).	(2)

Question number	Answer	Mark
7(e)	AO1 (2 marks) Award 1 mark for each factor associated with a suitable fragile environment identified, up a maximum of 2 marks: [Coral reefs]: - Warm water temperature (23-29°C)(1) - Latitude 30N and 30S (1) [Mangrove]: - Intertidal zone / saline water (1) - Warm water (1) Accept any other appropriate response. Credit any plausible fragile environment from arctic through to tropical rainforests.	(2)

Question number	Answer	Mark
7(f)	AO1 (2 marks)/ AO2 (2 marks) Award 1 mark for each identification of suitable way to resolve water-resource shortage, and 1 mark for further detail through explanation, up to a maximum of 2 marks for each way. - Water conservation such as collecting rainwater (1) in order to not reduce the use of groundwater supplies (1). - Water-spreading weirs (1) which can help store and distribute water for agriculture to grow crops all year (1). - Construction of dams (1) to store water in a reservoir and control its release to other areas (1). Accept any other appropriate response.	(4)

Question number	Indicative content	
7(g)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 • There a range of strategies used to prevent loss of tropical rainforests, that operate at a range of scales. • Sustainable rainforest management is based around the key concepts of respecting the environment and the cultures of local people, using appropriate technology, generate income for local communities as well as protect diversity. • Sustainable rainforest management can include: ◦ Protection of forests (sometimes via National Parks or reserves) to limit development. ◦ Planned and controlled logging, as well as restricting licences. ◦ Selective logging, leaving some trees untouched. ◦ Reafforestation to try and restore areas of forest. • There are a range of national and international programmes to try and protect forest. For example the Forest Code in Brazil which restricts activity in the rainforest, or the Amazon Region Protected Areas programmes which led to 45 million hectares of forest being made into parks and reserves. International programmes that try to support sustainable forest management include the UN-REDD and United Nations Forum on Forests. A04 • Figure 7b shows three different strategies used as part of sustainable rainforest management. • Figure 7b shows how a range of stakeholders can be involved in strategies to deal with sustainable rainforest management. • Figure 7b shows how strategies to deal with deforestation can be at different scales from local/regional reafforestation programmes to international agreements.	
Level	Mark	Descriptor
	0	No rewardable material.

Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

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Question number	Indicative content
7 (h)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 - Climate change has both natural and human causes, but it is widely acknowledged that human activities have led to the enhanced greenhouse effect and climate change with global surface temperatures rising faster since 1970 than any other 50 year period in the past 2,000 years. It is predicted for temperatures to rise 1.5°C by 2040 in all scenarios. - The 2021 IPCC report highlighted that climate change has the potential to be a catastrophe for the entire planet, but that working together could avoid a climate catastrophe. - Raised awareness is often done better at local level – challenges to get the connect between international and local level. - COP26 AO3 - Figure 7a shows how the scale of potential changes are global, although varied across different continents, suggesting the potential impacts of climate change will be varied too.



Question number	Indicative content	
	- Climate change is primarily driven by human activities, often related to economic development, either as part of fuelling the economy or urbanisation. Given the ties with economic development, governments should take responsibility to address threats to these fragile environments, and should work together through international organisations to coordinate activities. - The nature of the threats to fragile environments from climate change span across national borders so often requires co-operation with international organisations such as the World Bank or UN organisations, or with smaller scale NGOs who can tackle issues on the ground. - Successful examples of projects to tackle deforestation and desertification (impacts of climate change) have relied on collaboration between international organisations, governments, companies and NGOs. For example, the Elion Resource Group have successfully restored areas of land experiencing desertification in the northern China. Such examples suggest that while international examples are important, it is important to have actions taking place at different scales. AO4 - Figure 7a shows how there is the potential for many areas of the world to have serious declines in crop yields by 2050 due to climate change. - Figure 7a shows how the changes to crop yields will be uneven across the globe, significant declines in the global south, with some potential increases in the global north. - Figure 7b shows three different strategies used as part of sustainable rainforest management. - Figure 7b shows how a range of stakeholders can be involved in strategies to deal with sustainable rainforest management. - Figure 7b shows how strategies to deal with can be at different scales from local/regional reforestation programmes to international agreements.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3)

Question number	Indicative content	
		• Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)	AO1 (1 mark) D solar variations (1) The answer cannot be A, B or C as they are not natural causes of climate change.	(1)
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Question number	Answer	Mark
7(b)	AO1 (1 mark) A eruptions release greenhouse gases (1) The answer cannot be B, C or D as these are not considered contributors to climate change.	(1)

Question number	Answer	Mark
7(c)	AO1 (2 marks) Award 1 mark for each cause up to a maximum of 2 marks. • Burning fossil fuels (1) • Increased greenhouse gases (1) • Commercial livestock farming (1) • Deforestation (1) • Industrialisation (1) • High amounts of traffic (1) Accept any other valid response.	(2)

Question number	Answer	Mark
7(d) (i)	AO3 (1 mark) Award 1 mark for the following answer. Venezuela (1)	(1)

Question number	Answer	Mark
7(d)(ii)	AO4 (2 marks) Award 1 mark for initial point of difference identified, and a further mark for development which could be further description or the use of data to support, up to a maximum of 2 marks per idea. - There is a greater variation in CO2 emissions in Africa (1). Many countries in Africa have positive change of between 1-5% (1). - There are more countries in Africa that have negative change than North America (1) Just 3 in North American but over 6 in Africa (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)(iii)	AO2 (1 mark) /AO3 1 mark Award 1 mark for an initial reason, and further mark for explanation or development, up to a maximum of 2 marks. • Reductions of CO₂ in Europe (1) due to government policies to reduce carbon emissions to combat climate change (1). • Countries at different stages of industrialisation can lead to different abilities to reduce carbon emissions (1). Whereas countries in the post-industrial stage may have more ability/resources to reduce carbon emissions (1). • Variation in carbon emission reduction in many continents (1) due to different government commitments to achieve carbon reduction targets (1).	(2)

Question number	Answer	Mark
7(d)(iv)	AO2 (1 mark) /AO3 1 mark Award 1 mark for initial point, and further mark for explanation or development, up to a maximum of 2 marks. • Carbon emissions over time (1) so if a country has been a big contributor to carbon emissions compared to other countries (1). • Rates of deforestation (1) as this reduces the ability for carbon to be absorbed by trees (1). • Analysis of gas composition from ice cores (1) to be able to monitor CO₂ levels (1). • Emissions of volcanic eruptions (1) and impacts on global temperatures (1).	(2)

Question number	Answer	Mark
7(e)	AO1 (2 marks) Award 1 mark for each characteristic identified, up a maximum of 2 marks: • Arid / dry / little rain/ less than 25cm of rain a year (1) • Hot temperatures (1) • Temperatures fall rapidly/cold during the night (1) • Little /sparse vegetation (1) • Sandy (soil) (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(f)	AO1 (2 marks)/ AO2 (2 marks) Award 1 mark for the identification of each cause and 1 mark for further detail through explanation, up to a maximum of 2 marks for each impact. • Deforestation (1) which means soils can be exposed and lead to erosion (1) • Drought (1) due to significant lack of rainfall (1). • Intensive agriculture (1) which reduces the quality of the soil (1) • Overgrazing (1) which can lead to soil being more easily eroded (1). • Climate change (1) as higher temperatures can lead to more areas being at risk of desertification (1). • Over population (1) leading to exploitation of resources on the edge of deserts such as wood for fires (1). Accept any other appropriate response.	(4)

Question number	Indicative content	
7(g)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 • There are various strategies that can be used to resolve water shortages some which can be addressed at the household level, while other require greater investment. • The idea for water conservation can be effective if lots of people are involved. But given levels of rainfall are low in areas experiencing desertification, rainwater harvesting may not be effective in addressing water shortages. • Given many of the causes of desertification are made worse by farming practices, it could be more effective to tackle some of these issues. Technology to make more efficient use of the limited water supplies, and reduced water, through irrigation could be more effective. • While some strategies can be actioned at the local level, others are at a much larger scale and need large sums of investment to be effective. A04 • Figure 7b shows six different strategies that are used as part of efforts to save water. • Figure 7b shows how some of these strategies can involve basic changes in behaviour (taking shorter showers). • Figure 7b shows how some strategies involve investments to make changes to how water is used (systems for collecting rainwater, eradicating leaks, investing in sustainable energy).	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (A03) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)

Level 2	4–6	Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
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Question number	Indicative content
7 (h)	A02 (4 marks), A03 (4 marks), A04 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A02 - Fragile environments such as forests and deserts are at risk of damage and destruction through a range of human and natural causes. - Climate change has the potential to increase desertification, as well as deforestation (through changes in growing conditions but also wildfires). - Strategies to address threats and to protect forests/deserts include: sustainable forestry/farming programmes; afforestation; regulation to stop illegal logging as well as international agreements to address these issues, but more generally to address climate change. - International agreements such as the Paris agreement provided legally binding targets for many countries, and this prompted many countries to make changes to try and reach these targets. A03 - Figure 7b shows how in many areas of the world there have been significant reductions in carbon emissions, which have often been driven by the targets set by international agreements. - To protect fragile environments more localised responses may be needed. For example an area experiencing increased desertification on the edge of the Sahel may benefit more from a tree planting program than an international agreement about deforestation more generally. This suggests that to protect fragile environments more generally there needs to be approaches taking place at different scales. - Successful examples of projects to tackle deforestation and desertification have relied on collaboration between international

Question number	Indicative content	
	organisations, governments, companies and NGOs. This may sometimes require international agreements, but more often may rely on local investment and action. - The scale of efforts to protect fragile environments varies. While international agreements can often feel unsuccessful their targets are often much higher i.e. reducing sea level rise, compared to smaller scale desertification reclamation projects which have a smaller area as focus. AO4 - Figure 7a shows how there is a varied global pattern of reductions in carbon emissions in 2019. - Figure 7a how there is significant variation in reductions across the development stages with economic development not necessarily corresponding to particular levels of carbon emission reduction. - Figure 7b indicates how the rates of carbon emission reduction have varied from to over 10% increases to -10% decreases. - Figure 7b shows how some of these strategies can involve basic changes in behaviour (taking shorter showers). - Figure 7b shows how some strategies involve investments to make changes to how water is used (systems for collecting rainwater, eradicating leaks, investing in sustainable energy).	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)

Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark) Award 1 mark for a greenhouse gas provided: • carbon dioxide/CO₂ (1) • carbon monoxide (1) • methane/CH₄ (1) • nitrous oxide/N₂O (1) • sulphur dioxide (1) • CFCs (1) • water vapour (1)	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) D using more renewable energy (1) The answer cannot be A, B, or C as these are not responses to reduce climate change.	(1)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) B increase in flood protection (1) The answer cannot be A, C or D as these are not descriptions of climate change adaptation, they would all contribute to climate change.	(1)

Question number	Answer	Mark
7(b)(i)	AO3 (2 marks) Award 1 mark for each of the following answers. • France (1) • India (1)	(2)

Question number	Answer	Mark
7(b)(ii)	AO2/AO3 (4 marks) Award 1 mark for identification of a pattern shown on the resource, and a further mark for a reason for this pattern, up to a maximum of 2 marks per idea. • There is widespread risk of drought across the globe (1) which could be due to the effects of climate change (1). • The majority of countries in south-east Asia, including China and India are at medium to high risk of drought (1) which could be due to their proximity to the equator where temperatures tend to be higher (1). • South America mostly medium risk (0.41-0.6) (1) due some areas close to the equator/ due to changing rainfall patterns (1). Accept any other appropriate response. Do not accept ideas about areas with no data because this does not give an idea of a pattern of drought risk. Accept a pattern to be a reference to more than one country.	(4)

Question number	Answer	Mark
7(c)	AO2 (4 marks) Award 1 mark for identification of potential impact of climate change and a further mark for an explanation or development, up to a maximum of 2 marks. • Increased sea levels (1) which could cause flooding to many coastal areas which are low lying e.g. much of Bangladesh coastline (1). • Increased temperatures (1) which could alter growing conditions for crops/increased risk of wildfires (1). • Changing weather patterns (1) due to variations in temperatures which affect atmospheric circulation (1). • Increased risk of drought/desertification (1) due to changing rainfall patterns (1). • Changes to habitat conditions (1) which leads to migration of animals/people (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(d)(i)	AO4 2 marks Award 1 mark for correct answer, and 1 mark for method. 5.1 – 0.5 (1) = 4.6 (1)	(2)

Question number	Answer	Mark
7(d)(ii)	AO2 (1 mark) /AO3 1 mark Award 1 mark for initial point, and further mark for further description which could include the use of data, up to a maximum of 2 marks. - Deforestation accounts for most of the forest loss in tropical regions (1) with nearly 3.5 MhA (1). - In temperate regions wildfires have been responsible for much of the forest loss (1) over 2 mhA in North America (1). - In Africa most of the deforestation is from agriculture, mining and urbanisation (1) compared to Russia China and South Asia where it is mostly wildfires (1). - Significant differences between regions (1) with North America having lots of wildfires and Africa lots of deforestation (1). Accept any other appropriate response.	(2)

Question number	Indicative content
7(e)	AO3 (3 marks)/AO4 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO3 - Deforestation is the process of clearing forested land, often for forestry, agriculture, mining, settlement or transport route building. Although there can also be loss of forests from wildfires. - Since 1990 around 420mha of forest have been lost due to human activities. Although the rate of deforestation has decreased in recent years it is still nearly around 10 million ha a year.

		- Forest loss contributes around 5 billion tonnes of CO₂ into the atmosphere every year. - There are a range of impacts of deforestation that affect the immediate environment (e.g. soil erosion) but also there is the potential for impacts to affect global environments. For example through increased CO₂ which can contribute to climate change. AO4 - Figure 7c shows six potential effects of deforestation: loss of biodiversity; increased atmospheric CO₂; increased drought; disruptions to water cycle; increased flooding; increased wildfires. - Figure 7c demonstrates how deforestation has immediate and long terms impacts. - Figure 7c demonstrates how deforestation can have effects beyond the forest ecosystem.
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 - Deforestation has a range of negative effects on fragile environments including loss of biodiversity, contribution to climate change, increased soil erosion. - Rising global temperatures have the potential to have wide ranging impacts on fragile ecosystems. - Rising global temperatures are likely to increase risk of desertification for areas of the globe, introducing desertification into some areas, and making it worse in others. - Increased desertification has the potential to impact livelihoods across the globe in terms of the availability of land for agriculture. AO3 - Changes in temperatures are likely to have more wide-ranging impacts on the globe than just deforestation. - Changing rainfall patterns will not only affect forests processes, but a wider range of areas with many facing increased rainfall and hazards associated with this. - Global temperatures have the potential to contribute to sea level rise which many would argue poses a greater threat to fragile environments. - The variation in patterns of surface water will affect humidity and therefore rainfall patterns and as a consequence risk of desertification. AO4 - Figure 7b shows there is variation in the causes of deforestation between tropical and temperate regions. - Figure 7b shows how agriculture contributes to deforestation in all global regions, although to different extents. - Figure 7b shows how wildfires have contributed to over half of deforestation in North America and Russia, China and South Asia. - Figure 7c shows potential effects of deforestation: loss of biodiversity; increased atmospheric CO₂; increased drought; disruptions to water cycle; increased flooding; increased wildfires. - Figure 7c demonstrates how deforestation has immediate and long terms impacts. - Figure 7c demonstrates how deforestation can have effects beyond the forest ecosystem.

Question number	Indicative content	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	• Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)	AO1 (1 mark) Award 1 mark for a suitable location of a fragile environment: • Amazon (rainforest) (1) • Sahara/Sahel (desert) (1) • Great barrier reef (1) Accept any other appropriate response. This could be a specific local region or a larger region such as the Amazon. Do not accept just the name of the fragile environment.	(1)
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Question number	Answer	Mark
7(b)(i)	AO1 (1 mark) C soil erosion (1) The answer cannot be A, B or D as these are all causes of desertification.	(1)

Question number	Answer	Mark
7(b)(ii)	AO1 (1 mark) C water spreading weirs (1) The answer cannot be A, B or D as these are not strategies that can be used to reduce the risk of desertification.	(1)

Question number	Answer	Mark
7(c)(i)	A03 (2 marks) Award 1 mark each of the following answers. • Nicaragua (1) • Egypt (1)	(2)

Question number	Answer	Mark
7(c)(ii)	A02/A03 (4 marks) Award 1 mark for pattern identified, and a further mark for explanation of the reason, up to a maximum of 2 marks per idea. • Most of Europe is experiencing increases in forest cover (1) as many governments seeking to plant more trees to combat rising CO2 emissions (1). • Many African and South American Countries are experiencing loss of 0 to -2% (1) as trees are an important natural commodity that can support their economies (1). • Large amount of LICs have loss (1) due to rising populations/need to clear forest for farmland (1). • Many HICs have a gain in forest (1) as government encourage afforestation (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(d)	A01/A02 (4 marks) Award 1 mark for identification of a suitable management strategy, and a further mark for an explanation or development, up to a maximum of 2 marks each. • Requirement for logging permits (1) to reduce illegal logging (1). • Afforestation schemes (1) to try and reduce overall loss of forests (1). • Legal protection of some areas (1) to try and reduce the rates of deforestation (1). • Ecotourism (1) designed to support local incomes without damaging the forest (1). • Selective logging (1) which ensures whole forest areas are not cleared (1). • Sustainability certifications (1) designed to raise awareness/protect forest areas (1). • Agroforestry (1) which mixes farming and trees/which maintains soil structure (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(e)(i)	A04 2 marks Award 1 mark for the correct method, and 1 mark for the correct answer. • 145-16 (1) Larger number – small number • 129 (1) Accept answers that answers that range from 126-32.	(2)

Question number	Answer	Mark
7(e)(ii)	A02 (1 mark) / A03 1 mark Award 1 mark for initial point, and further mark for further description which could include the use of data, up to a maximum of 2 marks. • Rise in sea level (1) 215 mm (1) • General rising trend (1) but with some fluctuations between years (1). • Sea level increases (1) from around 0mm to 215mm (1) Accept any other appropriate response.	(2)

Question number	Indicative content
7(f)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 • The potential impacts of climate change are wide ranging. While some of the most discussed impacts are increased temperatures related to global warming, and rising sea levels due to melting of the ice caps there are many more which have potential to impact the environment, people and economies. • Climate change, linked with changes in temperatures but also differences in extreme weather events can mean that the ability to grow some crops is becoming more challenging. This creates issues of food security but also creates problems for ensuring secure livelihoods. • It is estimate there could be 1.2 billion climate refugees by 2050, with many being forced to move from coastal areas that experience flooding, or more hazardous weather events (from flooding to wildfires). • Many of these impacts are interrelated, the increased flooding can link to food insecurity, the changing growing seasons links to food insecurity. Depending on the location on the planet, the severity of these potential impacts will differ.

	A04 - Figure 7c shows there are 6 potential impacts of climate change. - Figure 7c shows how there are a range of potential impacts which could affect both people and the environment. - Figure 7c shows how climate change may lead to environmental hazards.	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7(g)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • Fragile environments such as forests and deserts are at risk of damage and destruction through a range of human and natural causes. • Climate change has the potential to affect such fragile environments in various ways including: increased desertification, wildfires, changing habits conditions, increased extreme weather events, flooding. • Deforestation by human activity has had considerable impact on the tropical rainforests of Brazil. An area equivalent to the size of Qatar was cleared between 2021 -2022. AO3 • Figure 7b shows how there has been continued sea level rise over previous decades and the impacts of this are already being experienced. If this is to continue as a result of climate change then these impacts will continue and potentially worsen. • Fragile environments are affected by human activity directly through practices such as deforestation (for mining, agriculture, settlement/infrastructure building), agriculture and tourism. Human activity can lead to increased pollution of water, air and land. • Given the global nature of climate change it may be considered the greatest threat because it has such a wide range of impacts on different environments. AO4 • Figure 7b shows how there has been continued sea level rise since 1900. • Figure 7b shows how there are fluctuations in sea levels. • Figure 7b shows how sea levels have continued to rise despite efforts to curb the impact of climate change. • Figure 7c shows there are 6 potential impacts of climate change. • Figure 7c shows how there are a range of potential impacts which could affect both people and the environment. • Figure 7c shows how climate change may lead to environmental hazards.

Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	• Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark) Award 1 mark for a suitable cause definition. • An environment vulnerable to change by human or physical activities (1). • An environment that is easily disturbed / difficult to restore as they are sensitive to changes (1). Accept any other appropriate response.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) C water salinity (1) The answer cannot be A, B or D as these are not factors that can affect the distribution of coral reefs.	(1)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) A algae (1) The answer cannot be B, C or D as these are not features of coral reefs.	(1)

Question number	Answer	Mark
7(b)(i)	AO3 (2 marks) Award 1 mark for each of the following answer. • Palermo (1) • Almería (1)	(2)

Question number	Answer	Mark
7(b)(ii)	AO2/AO3 (4 marks) Award 1 mark for identification of a pattern shown on the resource, and a further mark for a reason for this pattern, up to a maximum of 2 marks per idea. • There are a lot of areas that are very sensitive to desertification in the south of Europe (1) this is likely to be due to higher temperatures experienced in this region (1). • There are large sections of central southern Europe that have low sensitivity to desertification (1) because they have greater water supplies and river networks (1). • High risk in the south (1) due to lack of rainfall (1). • Varied risk across Europe (1) due to conditions associated with climate change (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(c)	AO2 (4 marks) Award 1 mark for identification of an approach to reduce water shortage a further mark for an explanation or development, up to a maximum of 2 marks. • Dams (1) can store water in a reservoir to be released at intervals to reduce shortages (1). • Rainwater harvesting / storage (1) which can capture rainwater to be used at a later date for irrigation (1). • Desalination (1) which removes salt from sea water and therefore increasing freshwater supplies (1). • Improving maintenance of water pipes (1) to ensure reduced leakages (1). • Drip irrigation (1) directs water to plants/roots (to avoid wasting water) (1). • Water recycling (1) to reduce consumption (of fresh water supplies (1). Accept any other appropriate response.	(4)

Question number	Answer	Mark
7(d)(i)	AO4 2 marks Award 1 mark for correct answer, and 1 mark for method. • $(66.1 + 48.9 + 46.5 + 29.4) / 4$ OR $190.9 / 4$ (1) • $47.725 / 47.73 / 47.7 / 48$ (1)	(2)

Question number	Answer	Mark
7(d)(ii)	A02 (1 mark) /A03 (1 mark) Award 1 mark for initial point, and further mark for further description which could include the use of data, up to a maximum of 2 marks. - The deforestation rate is much higher in Brazil than in Indonesia (1) over double the amount of hectares / 36.7 higher (1). - Countries with the highest deforestation rates are not necessarily those with the highest reforestation rates (1) for example the United States which has a much lower deforestation rate than Brazil but is reforesting a much larger area (1). Accept any other appropriate response.	(2)

Question number	Indicative content
7(e)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 - Climate change is complex and is caused by a mixture of natural and human induced factors. - Evidence and modelling suggests that human activities have increased the rate of climate change that would have been experienced. - There are a range of natural causes of climate change: - Changes in the earth's orbit or Milankovitch cycles which can affect the amount of solar energy reaching the earth. - Solar activity including solar flares/sunspots are thought to lead to increased solar energy which could increase temperatures. - Volcanic eruptions can release dust in the atmosphere which can lead to reduced temperature if it blocks solar energy. - There are a range of human induced causes of climate change: - Some of these causes are interlinked and interrelated, for example the increase greenhouse gas emissions from industry linked to the enhanced greenhouse effect.

	AO4	- Figure 7c shows six potential causes of climate change: some human and some natural. - Figure 7c show three human causes of climate change including: removal of trees and vegetation; enhance greenhouse effect and emissions of greenhouse gases. - Figure 7c shows three natural causes of climate change including changes in the earth's orbit, volcanic activity and changes in solar output.
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	- Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 - The impacts of climate change are varied and wide ranging, in addition to changing temperature patterns there are changes sea levels, prolonged heatwaves, desertification, acidification of the sea, more extreme weather events, species extinction and crop failures. - While countries from across the globe contribute to climate change some are seen to be greater contributors The top 10 countries for CO₂ emissions include China, USA, India, Russia, Japan, Germany,

Question number	Indicative content	
	Iran, South Korea, Saudi Arabia and Indonesia. This is a mix of emerging and developed economies. - There are various actions being taken to combat climate change at a range of scales. - International efforts have been made to combat climate change through international agreements such as the Paris Agreement, or commitments made to emission reductions at meetings such as COP26/28. - There are various mitigation strategies used to combat the impacts of climate change including finding ways to reduce emissions and enhancing carbon sinks (such as forests). AO3 - The impacts of climate change are uneven, and have been argued to disproportionately affect countries that have not historically been those that have contributed to the increased carbon emissions. - It is expected that developed countries lead and contribute to funds to deal with loss and damage from climate change. - The United Nations Environment Program (UNEP) has shown that adaptation is often not enough to be resilient to climate change, and therefore financial support should be made available to deal with loss and damage and that this needs to be supported by a wide range of countries. - There is significant debate about the role of developed countries in supporting economies that are more affected by climate change due to their involvement in the causes. AO4 - Figure 7b shows that countries from across the world have significant deforestation rates ranging with the highest being Brazil (66.1 Mha per year). - Figure 7b shows how the countries with the highest rate of deforestation are not necessarily those with the highest rates of reforestation. USA has a relatively high deforestation rate but a reforestation rate higher than some other countries shown. - Figure 7c show three human causes of climate change including: removal of trees and vegetation; enhance greenhouse effect and emissions of greenhouse gases. - Figure 7c shows three natural causes of climate change including changes in the earth's orbit, volcanic activity and changes in solar output.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3)



Question number	Indicative content	
		• Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)
Level 2	5–8	• Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) • Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	• Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) • Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) • Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark)	
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	A high humidity (1) The answer cannot be B, C or D as these are not characteristics associated with tropical rainforests.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (1 mark) B infertile soils (1) The answer cannot be A, C or D as these are not reasons why they would be considered fragile, they are more strengths of the ecosystem.	(1)

Question number	Answer	Mark
7(a)(iii)	AO1 (2 marks) Award 1 mark for each suitable impact, up to a maximum of 2 marks. • Loss of biodiversity (1) • Soil erosion (1) • Reduced climate regulation (1) • Increased CO₂ in the atmosphere (1) • Desertification (1) • Increase flood risk (1) • Loss of nutrients (1) • Climate change (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b) (i)	AO3 (1 mark) Award 1 mark for each of the following answer. • India (1)	(1)

Question number	Answer	Mark
7(b)(ii)	A02/A03 (2 marks) Award 1 mark for identification of a feature shown on the resource, and a further mark for a reason for this pattern, up to a maximum of 2 marks per idea. • There is significant variation in the risk of sea level rise (1) from less than 100,000 people to up to 9.9m (1). • Generally the risk of sea level rise is low compared to other areas of the world (1) with the highest number at risk remaining under 10 million (1). • Brazil is at the highest level of risk on the north/east coast (1) whereas Chile/landlocked Bolivia on the west/south coast is at less/no risk of flooding (1) Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b)(iii)	A02/A03 (2 marks) Award 1 mark for a relevant description of the distribution shown on the resource, and a further mark for a suitable reason up to a maximum of 2 marks per idea. • Population (density) (1) as many countries with a high number of cities in coastal areas will have high risk (1). • There is a global risk as sea level rise will affect all countries (1) as sea levels are predicted to rise considerably due to global climate change (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b)(iv)	A02/A03 (2 marks) Award 1 mark for identification of a suitable way, with a further mark for development, up to a maximum of 2 marks per idea. • The data could be used to decide where greater adaptation methods are implemented (1) and ensure that suitable funding is made available (1). • It could be used as evidence for international agreements on climate change (1) to show the importance of taking action (1).	

	Accept any other appropriate response.	(2)
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Question number	Answer	Mark
7(c)	A02 (2 marks) Award 1 mark for identification of each impact of climate change, up to a maximum of 2 marks. • Increased temperatures/global warming (1) • Disrupted food chains/ecosystems (1) • Changing weather patterns/seasonal shift (1) • Increased frequency of extreme weather events (1) • Increased drought (1) • Changing crop growth patterns (1) • Displacement of people/climate refugees (1) • Melting icecaps (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(d)	A01(2 marks)/A02 (2 mark) Award 1 mark for initial point for solar variations and farming, and further mark for further development, up to a maximum of 2 marks. Solar Variations: • Increased sunspot activity (1) leads to changes in the amount of solar radiation received by the earth (1). • Milankovitch cycles/precession/axial tilt/elliptical orbit/obliquity/eccentricity (1) influence the amount of solar radiation reaching the earth (1) Farming: • Cattle farming can lead to increased methane produced (1) which can contribute to the enhanced greenhouse effect (1). • Deforestation for plantations/cattle ranching (1) can lead to reduced CO₂ being absorbed by trees (1). Accept any other appropriate response.	(4)

Question number	Indicative content	
7(e)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 - Desertification is defined by the United Nations as 'land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic factors and human activities'. It is more than just the expansion of deserts but more a process of land degradation in water scarce areas of the world. - There are a range of causes of desertification including drought, population pressure, fuel supply, overgrazing and migration, with many of these being interlinked. - Biodiversity loss is an impact of desertification caused by loss of vegetation and habitats for plants and animals. However, this in turn creates more sparse areas which become at greater risk of soil erosion and therefore land degradation. A04 - Figure 7b shows how desertification can lead to increased CO₂ emissions and increase in extreme events. - Figure 7b shows how desertification can lead to loss of nutrients and moisture in the soil. - Figure 7b shows how desertification can lead to a loss of biodiversity. - Figure 7b demonstrates how the causes of desertification operate as a feedback loop with the impacts make desertification worse.	
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	- Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (A03) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (A04)
Level 2	4–6	Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to

		judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
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Question number	Indicative content
7 (f)	AO2 (4 marks), AO3 (4 marks), AO4 (4 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 • There are a range of impacts linked to climate change including sea level rise. Sea level rise has risen by around 21cm since 1880. Predictions for sea level rise vary based on different projections but could be as much as 2m by 2100 and 3.9m by 2150 depending on future emissions. • Other impacts of climate change include increased temperature, increased frequency of extreme weather events, drought, loss of species, crop failure and food shortages. AO3 • The impacts of climate change are likely to be uneven, with those living in coastal communities exposed to more risks from sea level rise than those living further inland. Although those living in areas in desert biomes may experience water shortages and crop failures due to lack of water. • The impacts of climate change are interrelated and also uncertain to what extent they may take place. There are predictions about how changing temperatures may shift the areas that certain crops may grow in but this is uncertain. AO4 • Figure 7a shows there is variation in the risk of sea level rise. • Figure 7a shows how southeast Asia has a high number of people at risk of sea level rise by 2100, with 10-50m people in China and India. • Figure 7a shows how Africa has many countries which have relatively low numbers of people at risk of sea level rise by 2100. • Figure 7b shows how desertification can lead to increased CO₂ emissions and increase in extreme events. • Figure 7b shows how desertification can lead to loss of nutrients and moisture in the soil, and how this can lead to a loss of biodiversity



Question number	Indicative content	
	Figure 7b demonstrates how the causes of desertification operate as a feedback loop with the impacts make desertification worse.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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7(a)(i)	AO1 (1 mark)	
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	A cattle ranching (1) The answer cannot be B, C or D as these are not causes of deforestation.	(1)
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Question number	Answer	Mark
7(a)(ii)	AO1 (2 marks) Award 1 mark for a suitable impact, up to a maximum of 2 marks. • Lack of roots to hold soil together (1) which leads to soil erosion (1) • Loss of vegetation cover (1) which leads to reduced habitat animals (1). • Reduced trees to absorb CO₂ (1) which can lead to the increased enhanced greenhouse effect (1). • Less evapotranspiration (1) results in less precipitation (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(a)(iii)	AO1 (1 mark) D providing logging permits (1) The answer cannot be A, B or C as these are not strategies that would be used to manage deforestation.	(1)

Question number	Answer	Mark
7(b) (i)	AO3 (1 mark) Award 1 mark for the following answer. • Brazil (1)	(1)

Question number	Answer	Mark
7(b)(ii)	AO2/AO3 (2 marks)	

	Award 1 mark for identification of a pattern shown on the resource, and a further mark for a description or use of data, up to a maximum of 2 marks per idea. • There is a lot of variation of risk in South America (1) with the western coast having the lowest risk (1). • The highest risk is experienced in central and eastern countries of South America (1) with more than 1,000 fires per month (1). Accept any other appropriate response.	(2)
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Question number	Answer	Mark
7(b)(iii)	AO2/AO3 (2 marks) Award 1 mark for identification of a pattern shown on the resource, and a further mark for a reason for this pattern or use of data, up to a maximum of 2 marks per idea. • Increased temperatures/climate change (1) which has meant some areas have longer dry conditions (1). • Some areas may have greater water resources available to reduce the risk of wildfires (1) for example the UK has less than 500 wildfires per month (1) . Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(b)(iv)	AO2/AO3 (2 marks) Award 1 mark for identification of a suitable piece of evidence and a further mark for development, up to a maximum of 2 marks per idea. • Temperature changes (1) to understand where the highest temperatures are being experienced (1). • Data on extreme weather events (1) to understand if there is an increase in frequency due to climate change (1). Accept any other appropriate response.	(2)

Question number	Answer	Mark
7(c)	AO2 (2 marks)	

	Award 1 mark for identification of a human cause and 1 mark for a natural cause of climate change, up to a maximum of 2 marks. Human • Cattle farming (1) • Urbanisation (1) • Vehicle emissions (1) Natural • Solar variations (1) • Milankovitch cycles (1) • Volcanic eruptions (1) Accept any other appropriate response.	(2)
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Question number	Answer	Mark
7(d)	A01(2 marks)/A02 (2 mark) Award 1 mark for each government response provided, and further mark for further description which could include the use of data, up to a maximum of 2 marks. • Commitment to international agreements (1) which aim to reduce overall country carbon emissions (1). • Invest in green energy (1) to reduce CO2 emissions/ carbon footprint (1). • To enable laws and regulations (1) to encourage businesses and individuals to reduce use of fossil fuels (1). • Some governments have leaders who do not believe in climate change (1) leading to less participation in international agreements. Accept any other appropriate response.	(4)

Question number	Indicative content
7(e)	A03 (3 marks)/A04 (3 marks) Marking instructions Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: A03 • Desertification is defined by the United Nations as 'land degradation in arid, semi-arid and dry sub-humid areas resulting from various

		factors, including climatic factors and human activities'. It is more than just the expansion of deserts but more a process of land degradation in water scarce areas of the world. • There are a range of causes of desertification including drought, population pressure, fuel supply, overgrazing and migration, with many of these being interlinked. • These causes are both human and climate related with the relative contribution depending on the specific context. In some cases land degradation has been caused by intensive agriculture/cattle farming which is exacerbated by climatic changes. AO4 • Figure 7b shows how desertification can lead to increased CO₂ emissions and increase in extreme events. • Figure 7b shows how desertification can lead to loss of nutrients and moisture in the soil. • Figure 7b shows how desertification can lead to a loss of biodiversity. • Figure 7b demonstrates how the causes of desertification operate as a feedback loop with the impacts make desertification worse.
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–3	• Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements that are supported by limited evidence. (AO3) • Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	4–6	• Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) • Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)

Question number	Indicative content
7 (f)	A02 (4 marks), A03 (4 marks), A04 (4 marks)

Question number	Indicative content
	Marking instructions - Markers must apply the descriptors in line with the general marking guidance and the qualities outlined in the levels-based mark scheme below. Indicative content guidance - The indicative content below is not prescriptive and candidates are not required to include all of it. Other relevant material not suggested below must also be credited. Relevant points may include: AO2 - Fragile environments such as rainforests, deserts and coral reefs are at risk of damage. A fragile environment is considered an area that is vulnerable to change and may struggle to recover from the changes. - Rising global temperatures caused by climate change have the potential to have wide ranging impacts on fragile ecosystems. There are various scenarios for predicted change depending on emissions in the future. Optimistic scenarios predicted a warming of 1.5°C by 2050. - Rising global temperatures are likely to increase risk of desertification for areas of the globe, introducing desertification into some areas, and making it worse in others. This may also increase risk of wildfires. - Climate change has a range of impacts (and potential future impacts) from temperature increases through to sea level rise. - Other threats to fragile environments include deforestation, urbanisation, and the growth of mass tourism. AO3 - Climate change is likely to have more wide-ranging impacts on the globe than just other more specific threats such as deforestation. - Global temperature changes as a result of climate change have the potential to contribute to sea level rise which many would argue poses a greater threat to fragile environments and extreme weather events which can be more localised. Many of the threats to fragile environments are interlinked. Deforestation is a contributor to climate change which in turn can increase the risk of wildfire which can damage more forested areas. AO4 - Figure 7a shows how there is significant variation of the global distribution of wildfires. - Figure 7a shows how wildfire risk is significant for many countries across the world. - Figure 7a shows how wildfire risks affect both developed and developing countries in the northern and southern hemisphere. - Figure 7b shows how desertification can lead to increased CO₂ emissions and increase in extreme events. - Figure 7b shows how desertification can lead to loss of nutrients and moisture in the soil, and how this can lead to a loss of biodiversity.

Question number	Indicative content	
	Figure 7b demonstrates how the causes of desertification operate as a feedback loop with the impacts make desertification worse.	
Level	Mark	Descriptor
	0	No acceptable response.
Level 1	1–4	- Demonstrates isolated elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Attempts to apply understanding to deconstruct information but understanding and connections are flawed. An unbalanced or incomplete argument that provides limited synthesis of understanding. Judgements are supported by limited evidence. (AO3) - Uses some geographical skills to obtain information with limited relevance and accuracy, which supports few aspects of the argument. (AO4)
Level 2	5–8	- Demonstrates elements of understanding of concepts and the interrelationship between places, environments and processes. (AO2) - Applies understanding to deconstruct information and provide some logical connections between concepts. An imbalanced argument that synthesises mostly relevant understanding, but not entirely coherently, leading to judgements that are supported by evidence occasionally. (AO3) - Uses geographical skills to obtain accurate information that supports some aspects of the argument. (AO4)
Level 3	9–12	- Demonstrates accurate understanding of concepts and the interrelationship of places, environments and processes. (AO2) - Applies understanding to deconstruct information and provides logical connections between concepts throughout. A balanced, well-developed argument that synthesises relevant understanding coherently, leading to judgements that are supported by evidence throughout. (AO3) - Uses geographical skills to obtain accurate information that supports all aspects of the argument. (AO4)

Question number	Answer	Mark
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