

# Oxford Revise | AQA A Level Geography | Answers

## Chapter 6

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. 1 mark per valid point with extra marks for development.

1 AO1 = 4

- A plagioclimax is a sub-climax ecosystem area where the arresting factor is human interference (1).
- Part of the concept of succession in which ecosystems increase in complexity, diversity, and stability over time (1).
- A climatic climax is the final stage of succession in which flora and fauna have reached a state of dynamic equilibrium (1).
- A plagioclimax occurs where an ecosystem has not been able to reach the climatic climax (1).
- An example of a plagioclimax is heather moorland, where the arresting factor is yearly burning (1).

Example answer: *A plagioclimax is a sub-climax ecosystem area where the arresting factor is human interference. It is part of the concept of succession, in which ecosystems increase in complexity, diversity and stability over time. A climatic climax is the final stage of succession in which flora and fauna have reached a state of dynamic equilibrium. A plagioclimax occurs where an ecosystem has not been able to reach the climatic climax. An example of a plagioclimax is heather moorland, where the arresting factor is yearly burning.*

2 AO1 = 4

- Energy flows through ecosystems in a one-way direction, passing from producers to consumers to decomposers (1).
- Trophic levels represent the different positions within a food chain or web, indicating an organism's role in energy transfer (1).
- Energy is lost as heat at each trophic level (1).
- There are typically four trophic levels in an ecosystem: producers, primary consumers, secondary consumers, and tertiary consumers (1).

3 AO1 = 4

- Human activity is a factor that can influence change in ecosystems at a global scale through anthropogenic climate change (1).
- Factor operates through human interventions in the carbon cycle, releasing carbon dioxide from the combustion of carbon stores in the lithosphere (1).
- Carbon dioxide is a greenhouse gas, so increased emissions produce atmospheric warming which transfers warmth back to the Earth's surface (1).
- Warming leads to climate change; ecosystems are primarily influenced by climate conditions and so climate change leads to ecosystem change (1).

**4 AO1 = 4**

- Coral polyps have a symbiotic relationship with zooxanthellae (photosynthetic algae) allowing corals to thrive in nutrient-poor waters (1).
- Warm waters (23–29°C) are essential for the growth and survival of the coral polyps and their symbiotic algae (1).
- Clear and sunlit waters to support the photosynthesis of zooxanthellae, which provide the corals with essential nutrients (1) / Shallow waters, usually less than 45 m deep, as beyond that depth, insufficient light limits coral growth (1).
- Stable salinity levels, as rapid fluctuations can stress corals and disrupt their ability to maintain proper internal conditions.

**5 AO1 = 4**

- Summer temperatures average 10–18°C, winter temperatures average 2–7°C but do dip below 0°C (1).
- There is between 800 mm and 1400 mm of precipitation per year on average (1); wet all year round but typically more precipitation in winter than summer (1).
- There are four distinct seasons (spring, summer, autumn, winter). As temperatures fall and daylight hours reduce in autumn, deciduous trees shed their leaves (1).
- Temperate deciduous woodland, such as ash and oak, is the climax community for the temperate climate biome (1).

**6 AO1 = 4**

- A biome is a large-scale ecological area with plants and animals that are well-adapted to their environmental conditions (1).
- The distribution of terrestrial biomes is largely a match to the pattern of climate zones (1), with variation due to relief, continentality and, at a local scale, geology (1).
- Examples of biomes include the tropical rainforest biome and the savanna grassland biome (1).

**Questions 7–16 are level-marked.**

**7 AO3 – Analysis of the extent of terrestrial biomes to identify patterns and anomalies in the data, using data manipulation to support response.**

AO3 = 6

Level	Marks	Description
2	4–6	<ul style="list-style-type: none"> <li>• Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.</li> <li>• Clear connection(s) between different aspects of the evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.</li> <li>• Basic connection(s) between different aspects of the evidence.</li> </ul>

- There are areas considered to be intact wilderness on all the continents shown (Antarctica is not shown).
- The largest areas of wilderness are in high latitudes of the northern hemisphere. Here there are some large areas of wilderness showing no fragmentation, e.g. Greenland.
- At lower latitudes and in eastern Russia, intact wilderness areas are more fragmented, broken up by areas where the human footprint is <4.

- Areas of high damage include the east coast of China, India, central and western Europe and the east of the USA.
- Areas with lower damage correspond to areas where conditions are challenging for humans to live, such as the Sahara Desert in north Africa or the Himalaya mountain range.
- Areas of higher damage correspond to areas with dense human habitation and where human habitation and development has a long history.

Example answer: *There are areas considered to be intact wilderness on all the continents shown (Antarctica is not shown). The largest areas of wilderness are in high latitudes of the northern hemisphere. Here there are some large areas of wilderness showing no fragmentation, e.g. Greenland. At lower latitudes and in eastern Russia, intact wilderness areas are more fragmented, broken up by areas where the human footprint is <4. Areas showing high damage include the east coast of China, India, central and western Europe and the east of the USA. Areas with lower damage correspond to areas where conditions are challenging for humans to live, such as the Sahara Desert in north Africa or the Himalaya mountain range. Areas of higher damage correspond to areas with dense human habitation and where human habitation and development has a long history.*

- 8 AO3 – Analysis of the global extent of live hard coral from 1980 to 2020 to identify patterns and anomalies in the data, using data manipulation to support response.  
AO3 = 6

Level	Marks	Description
2	4–6	<ul style="list-style-type: none"> <li>• Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.</li> <li>• Clear connection(s) between different aspects of the evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.</li> <li>• Basic connection(s) between different aspects of the evidence.</li> </ul>

- The mean estimated coral cover (central blue line) shows an overall declining trend over the 40-year period from approximately 33 per cent of cover to 29 per cent of cover.
  - There appear to be specific periods where coral cover declines more sharply, e.g. in the late 1990s (drop of nearly 3 per cent cover) and around 2010 (drop of 2 per cent).
  - There are also periods of slight recovery or plateauing, e.g. in the early 2000s, the mid-2010s, where the decline in coral cover slows down or the mean estimate increases slightly, and towards 2020 where some signs of recovery are evident.
  - The improvement in confidence about survey data has significantly reduced uncertainty: it may be that the period from the late 1970s to the late 1990s showed a similar amount of variation in cover (peaks and troughs) as in the later period.
- 9 AO1 – Knowledge and understanding of the savanna grassland biome and typical development issues relating to this biome.  
AO2 – Application of knowledge and understanding to the novel situation, to assess development issues in the savanna grassland biome.  
AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</li> <li>• AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence.</li> </ul>
2	4–6	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</li> <li>• AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</li> <li>• AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.</li> </ul>

#### AO1

The nature of the savanna grassland biome to include:

- main characteristics
- ecological responses to the climate, soil, and soil moisture budget – adaptations by flora and fauna
- human activity and its impact on each biome, typical development issues in each biome to include changes in population.
- economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

#### AO2

- Figure 3's degradation spiral shows how the loss of vegetation cover can lead to soil compaction, loss of nutrients, reduced infiltration, and increased soil erosion.
- This can lead to further loss of biomass and perennial grass species.
- Managing this negative feedback loop is challenging as each step of degradation exacerbates the next.
- Crop rotations that protect soils, rotational grazing and reseeding and replanting of grasses can all help to break the downwards spiral.
- In both spirals, water influences vegetation cover and biomass/productivity. In savanna grasslands with seasonal rainfall, water availability can be highly variable. Climate change also has an effect.
- Sustainable management strategies are needed to enhance water conservation and water harvesting for development.
- Managing biomass productivity involves balancing the need for grazing and the need for resting periods to allow grasslands to recover. In addition to the factors shown in Figure 3, it is important to manage fire regimes.
- Controlled burning early in the dry season regenerates grassland growth, prevents the spread of invasive species and fertilises the soil with ash. Early-season burning also reduces the risk of extensive late-season wildfires.

- Also not included in Figure 3 is the significant challenge of population growth and economic development. Sustainable policies must balance economic development with the conservation of these ecosystems.

Example answer: *Figure 3's degradation spiral shows how the loss of vegetation cover can lead to compacting of soil, loss of soil nutrients, reduced water infiltration and increased soil erosion from accelerated runoff, which, in turn, can lead to further loss of biomass and perennial grass species.*

*Managing this negative feedback loop is a key development issue as each step of degradation exacerbates the next. Education in crop rotations that protect soils, rotational grazing and reseeding and replanting of grasses can help to break the downwards spiral.*

*In both spirals, water is a central factor influencing vegetation cover and biomass/productivity. In savanna grasslands, water availability can be highly variable due to seasonal rainfall – and climate change. Access to water is a key development issue. This shows the need for sustainable management strategies to enhance water conservation and water harvesting.*

*Managing biomass productivity is a key development issue if growing livestock populations are not to permanently degrade grassland resources. It involves balancing the need for grazing and the need for resting periods to allow grasslands to recover. It is also important to manage fire regimes (not included in Figure 3). Controlled burning early in the dry season regenerates grassland growth, prevents the spread of invasive species and fertilises the soil with ash. Early-season burning also reduces the risk of extensive late-season wildfires.*

*A significant challenge for economic development that is not included in Figure 3 is population growth. Sustainable policies must balance economic development with the conservation of these ecosystems.*

**10** AO1 – Knowledge and understanding of the tropical rainforest biome and typical development issues relating to this biome.

AO2 – Application of knowledge and understanding to assess the implications of the information in Figure 4 for tropical rainforest biomes under stress from climate change.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</li> <li>• AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence.</li> </ul>
2	4–6	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</li> <li>• AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</li> </ul>

		<ul style="list-style-type: none"> <li>• AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.</li> </ul>
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AO1

The nature of the tropical rainforest biome to include:

- main characteristics
- ecological responses to the climate, soil, and soil moisture budget – adaptations by flora and fauna
- human activity and its impact on each biome, typical development issues in each biome to include changes in population.
- economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

AO2

- Figure 4 shows three responses to climate change – temporal, spatial and body size changes in species, and their potential mismatch effects on species interactions.
- Many species have adapted to very specific conditions and are often dependent on a particular plant or food source; mismatches due to changes in phenology could lead to declines in plant reproduction and thus affect the entire food web.
- In the dense and stratified structure of tropical rainforests, a loss of specialised relationships could occur as species that are adapted to particular microhabitats shift and no longer interact with their usual partners.
- Body size changes could lead to size mismatches between species that interact, such as predators and prey or pollinators and flowers. Smaller body sizes may affect the survival and reproduction rates of species.
- Altered conditions could increase the numbers and success of invasive species, which could outcompete native species and further disrupt traditional species interactions.
- Declines in interactions like pollination can have feedback effects. For example, the loss of certain tree species due to failed pollination would have a significant knock-on effect for all the other species that depend on that particular tree species.

Changes in species interactions are likely therefore to reduce rainforest biodiversity and reduce the resilience of rainforest biomes to further stress related to climate change, e.g. droughts or wildfire.

**11** AO1 – Knowledge and understanding of the main characteristics and ecological responses to the climate, soil and soil moisture budget of a lithosere.

AO2 – Application of knowledge and understanding to analyse interconnections between climate, vegetation and soils in a lithosere.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</li> <li>• AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully</li> </ul>

		developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence.
2	4–6	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</li> <li>• AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</li> <li>• AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.</li> </ul>

#### AO1

- Concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.
- Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil, and topography which produce them. Ecosystem responses to changes in one or more of their components or environmental controls.
- Succession and climatic climax as illustrated by lithoseres and hydrosere.

#### AO2

- In the British Isles, lithoseres have been produced by glacial retreat and isostatic rebound – the uplifting of an area after the weight of glaciation has been removed. Climate change therefore has a key role in the formation of conditions under which a lithosere can begin to develop.
- Pioneer species are the first organisms that colonise the bare rock (typically mosses/lichens). They will be hardy (e.g. xerophytes) and autotrophic (do not need external nutrients except sunlight)
- Mosses/lichens, along with natural weathering, begin to break the rock down, creating soil and increased water retention. Climate conditions of freeze-thaw assist the weathering process.
- Decomposers break down dead mosses and lichens, releasing nutrients into the soil. These require periods of warmer temperatures and moisture to operate.
- As the soil develops, conditions then become favourable for grasses and ferns to colonise the area, outcompeting the mosses and lichens. In turn, flowering plants and shrubs colonise the area – climate conditions are not responsible for this change but instead the increasing depth and nutrient supply of the soil.

**12** AO1 – Knowledge and understanding of the main characteristics of the tropical rainforest biome and typical development issues in the biome.

AO2 – Application of knowledge and understanding to assess the role global governance has to play in securing a viable future for the tropical rainforest biome.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.</li> </ul>



		<ul style="list-style-type: none"> <li>• AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Evaluation is detailed and well supported with appropriate evidence.</li> </ul>
2	4–6	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.</li> <li>• AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.</li> </ul>
1	1–3	<ul style="list-style-type: none"> <li>• AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.</li> <li>• AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.</li> </ul>

#### AO1

- The nature of the tropical rainforest biome to include:
  - main characteristics
  - ecological responses to the climate, soil, and soil moisture budget – adaptations by flora and fauna
  - human activity and its impact on each biome, typical development issues in each biome to include changes in population.
- Economic development, agricultural extension, and intensification, has implications for biodiversity and sustainability.
- Case study of a specified region experiencing ecological change to illustrate and analyse the nature of the change and the reasons for it, how the economic, social, and political character of its community reflects its ecological setting and how the community is responding to change.
- The emergence and developing role of norms, laws, and institutions in regulating and reproducing global systems.
- Issues associated with attempts at global governance, including how interactions between the local, regional, national, international, and global scales are fundamental to understanding global governance.

#### AO2

- This question is synoptic: global systems and global governance. Case study information could be effectively used in answers to this question.
- Global governance mechanisms, such as the United Nations Framework Convention on Climate Change (UNFCCC), which includes the REDD+ mechanism (Reducing Emissions from Deforestation and Forest Degradation), provide frameworks for conservation efforts. They encourage countries to collaborate on reducing deforestation and forest degradation.
- Through global governance, financial mechanisms can be established to support conservation efforts: this funding can help spread the benefits of sustainable forest management to local communities who otherwise benefit more from deforestation.
- Global governance bodies can aid in the development of international policies and treaties, such as the Paris Agreement on climate change (2015) and offer platforms for sharing best practices (as REDD Plus does for sustainable forest management).



- The regulation of international trade in endangered species through agreements like CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is another example of the power of global governance.
- However, global governance has limitations and those often relate to national interests and the lack of enforcement mechanisms. Where national interests or national politics do not align with the aims of global governance then its role will be limited (e.g. deforestation in the Brazilian Amazon increased markedly under the presidency of Jair Bolsonaro).
- National interests will include the opportunities for development of forest areas: while global governance can provide mechanisms and models for spreading the benefits of sustainable forest management and conservation, these benefits can only go so far when compared with the demand for farmland from a growing population, for example.
- Key to a successful partnership of global and national governance therefore could be the identification of reasonable targets for maintaining forest areas (such as Malaysia’s 50 per cent forest cover target), mechanisms for monitoring threats to these targets and the development of benefits for as wide a range of stakeholders in forest areas as possible.

**13** AO1 – Knowledge and understanding of a distinctive local ecosystem including adaptations by flora and fauna, knowledge and understanding of challenges and opportunities presented by sustainable development of a local scale ecosystem.

AO2 – Application of knowledge and understanding to evaluate the extent to which causes of declining biodiversity have been successfully managed in a local-scale ecosystem.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	<ul style="list-style-type: none"> <li>• AO2 – Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent.</li> <li>• AO2 – Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout.</li> <li>• AO2 – Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout.</li> <li>• AO1 – Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout.</li> <li>• AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.</li> </ul>
3	11–15	<ul style="list-style-type: none"> <li>• AO2 – Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects.</li> <li>• AO2 – Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding.</li> <li>• AO2 – Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Generally clear and relevant knowledge and understanding of place(s) and environments.</li> <li>• AO1 – Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change.</li> </ul>

		<ul style="list-style-type: none"> <li>• AO1 – Generally clear awareness of scale and temporal change which is integrated where appropriate.</li> </ul>
2	6–10	<ul style="list-style-type: none"> <li>• AO2 – Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question.</li> <li>• AO2 – Interpretations are partial but do support the response in places. Some partially relevant analysis and evaluation in the application of knowledge and understanding.</li> <li>• AO2 – Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Some relevant knowledge and understanding of place(s) and environments which is partially relevant.</li> <li>• AO1 – Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies.</li> <li>• AO1 – Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies.</li> </ul>
1	1–5	<ul style="list-style-type: none"> <li>• AO2 – Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic.</li> <li>• AO2 – Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence.</li> <li>• AO2 – Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Very limited relevant knowledge and understanding of place(s) and environments.</li> <li>• AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies.</li> <li>• AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.</li> </ul>
0	0	<ul style="list-style-type: none"> <li>• Nothing worthy of credit.</li> </ul>

#### AO1

- The main characteristics of a distinctive local ecosystem (such as an area of heathland, managed parkland, pond, dune system). Ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna.
- Case study of a specified ecosystem at a local scale to illustrate and analyse the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development.

#### AO2

- Answers should relate to a case study of a specified ecosystem at a local scale: for this answer the case study is the Sefton Coast ecosystem.
- By including all major landowners and stakeholders, the Sefton Coast Landscape Partnership (SCLP) ensures that conservation measures are implemented across the ecosystem, leading to more comprehensive management of biodiversity threats.

- The active management of dune habitats, including the restoration of dune slack habitats and the removal of invasive species, is vital for the maintenance and recovery of native biodiversity, including rare species like the sand lizard and northern dune tiger beetle.
- The strategy to direct visitors away from sensitive areas and towards less vulnerable areas by upgrading walkways and providing information boards helps minimise human impact on key habitats.
- The involvement of volunteers in conservation efforts not only increases manpower for projects like habitat restoration but also raises local awareness and stewardship of the natural environment.
- Despite 75 per cent of the area being greenbelt, past development has fragmented the sand dune ecosystem. Ongoing demands for housing and other development continue to pose a threat to the integrity of the ecosystem.
- Coastal erosion and changes in deposition patterns present ongoing challenges that require adaptive management strategies. Global climate change is a persistent threat that can exacerbate these issues.
- The high demand for leisure activities like golf, which has led to many golf courses on the Sefton Coast, can conflict with conservation objectives, particularly if these activities lead to further habitat loss or degradation.
- The decline in grazing land has led to dunes becoming overgrown with vegetation, altering the habitat structure and potentially affecting the species that depend on open sandy areas.
- There is always a question of the long-term sustainability of such conservation efforts. They often require continuous funding, political will, and community support, which can fluctuate with economic and social priorities.

*Example answer: The Sefton Coast is a stretch of coastline of Merseyside, in the north-west of the UK. Close to the densely populated area of Merseyside, it is popular with visitors, creating challenges to conserve the local ecosystem while promoting the area socially and economically. To accomplish this, the Sefton Coast Landscape Partnership (SCLP) was created. It includes all major landowners and stakeholders and aims to direct visitors away from the most sensitive parts of the ecosystem towards less sensitive areas by upgrading walkways and providing information boards to educate visitors to minimise human impact on key habitats. The involvement of volunteers in conservation efforts not only increases manpower for projects like habitat restoration but also raises local awareness and stewardship of the natural environment.*

*The designation of parts of the Sefton Coast as sites of special scientific interest (SSSI) offers a high level of protection, where it is an offence to damage natural features. This legal backing is crucial for the conservation of habitats and species. The active management of dune habitats, including the restoration of dune slack habitats and the removal of invasive species, is vital for the maintenance and recovery of native biodiversity, including rare species like the sand lizard and northern dune tiger beetle.*

*Despite 75 per cent of the area being greenbelt, past development has fragmented the sand dune ecosystem. Ongoing demands for housing and other development continue to pose a threat to the integrity of the ecosystem. The decline in grazing land has led to dunes becoming overgrown with vegetation, changing the habitat structure, and potentially affecting the species that depend on open sandy areas.*

*Coastal erosion and changes in deposition patterns present ongoing challenges that require adaptive management strategies. Global climate change is a persistent threat that can exacerbate these issues. The high demand for leisure activities, which has led to many golf courses being created on the Sefton Coast, can conflict with conservation objectives, particularly if these activities lead to further habitat loss or degradation.*

*There is always a question of the long-term sustainability of such conservation efforts. They often require continuous funding, political will, and community support, which can fluctuate with economic and social priorities.*

**14** AO1 – Knowledge and understanding of the savanna grassland biome including adaptations by flora and fauna, knowledge and understanding of challenges and opportunities presented by sustainable development of a local scale ecosystem.

AO2 – Application of knowledge and understanding to evaluate the extent to which threats to biodiversity have been successfully managed in the savanna grassland biome.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	<ul style="list-style-type: none"> <li>• AO2 – Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent.</li> <li>• AO2 – Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout.</li> <li>• AO2 – Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout.</li> <li>• AO1 – Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout.</li> <li>• AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.</li> </ul>
3	11–15	<ul style="list-style-type: none"> <li>• AO2 – Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects.</li> <li>• AO2 – Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding.</li> <li>• AO2 – Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Generally clear and relevant knowledge and understanding of place(s) and environments.</li> <li>• AO1 – Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change.</li> <li>• AO1 – Generally clear awareness of scale and temporal change which is integrated where appropriate.</li> </ul>
2	6–10	<ul style="list-style-type: none"> <li>• AO2 – Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question.</li> <li>• AO2 – Interpretations are partial but do support the response in places. Some partially relevant analysis and evaluation in the application of knowledge and understanding.</li> <li>• AO2 – Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>• AO1 – Some relevant knowledge and understanding of place(s) and environments which is partially relevant.</li> <li>• AO1 – Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies.</li> <li>• AO1 – Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies.</li> </ul>

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0	0	<ul style="list-style-type: none"> <li>• Nothing worthy of credit.</li> </ul>

**AO1**

The nature of savanna grassland to include:

- the main characteristics of the biome
- ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna
- human activity and its impact on each biome
- typical development issues in each biome to include changes in population, economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

**AO2**

- Mineral nutrient cycling is an important factor in the natural development of all ecosystems. It is the slow mineral nutrient cycling of cold climates, for example, or dry climates, that determines the vegetation types that have evolved to characterise those ecosystems.
- As with all ecosystems, however, the speed of mineral nutrient cycling is dependent on other factors – temperature and precipitation being key. The availability of mineral nutrients also depends on other factors, for example underlying bedrock, the extent of leaching (linked to precipitation).
- In the case of savanna grasslands, it is precipitation that determines this ecosystem, since in the most part any increase in precipitation results in the growth of trees, since trees outcompete grasses once established as their canopies mean insufficient light reaches grasses for them to photosynthesise: regardless of mineral nutrient cycling.
- Fire is a factor in the development of savanna grassland. The adaptations to fire of savanna vegetation are evidence of the pivotal importance of fire in the development of savanna grassland: e.g. grasses have deep root systems resilient to fire; many trees and plants have adapted to be fire-resistant, some needing fire for reproduction. Fire speeds up the mineral nutrient cycle by releasing nutrients from burned vegetation into the soil.
- It is also fire that sometimes prevents grassland from being forested in areas where precipitation is high enough for tree development, but it is low precipitation in the dry season that is the principal factor for savanna grassland development, and the effect of fire in clearing non-resistant species from the grasslands is not linked to mineral nutrient cycling.
- Soil can be a factor: most savanna grasslands have quick-draining sandy soils or laterite soils. These can be nutrient-poor due to leaching.

- Human impacts also important: humans have been influencing grassland savanna landscapes in Africa for 300,000 years, especially through fires. Climate change increases the duration/severity of droughts fragmenting savanna grasslands.

**15** AO1 – Knowledge and understanding of a specified region experiencing ecological change and how the community is responding to change.

AO2 – Application of knowledge and understanding to assess the sustainability of a community’s response to ecological change in its region.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	<ul style="list-style-type: none"> <li>AO2 – Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent.</li> <li>AO2 – Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout.</li> <li>AO2 – Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.</li> <li>AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout.</li> <li>AO1 – Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout.</li> <li>AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.</li> </ul>
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#### AO1

- Case study of a specified region experiencing ecological change to illustrate and analyse the nature of the change and the reasons for it, how the economic, social and political character of its community reflects its ecological setting and how the community is responding to change.

#### AO2

- Answers should relate to a case study of a specified region experiencing ecological change: for this answer the case study is deforestation in Malaysia.
- In the period 2000–2012, Malaysia had the highest rate of deforestation in the world. The rate has since reduced, from 244,300 hectares of primary forest lost in 2012 to 73,000 in 2020.
- This suggests some success in Malaysia’s response to the extreme ecological changes resulting from deforestation.
- Malaysia has used initiatives such as licensed selective logging, replanting programmes, the establishment of national parks, nature reserves, the promotion of ecotourism, national plans and targets and membership of global schemes such as REDD Plus. Each of these responses has its own set of successes and challenges.
- The introduction of licensed selective logging has helped in minimising the impact of logging by ensuring only certain trees are removed. Together with replanting, this response has enabled Malaysia to work towards national targets of 50 per cent forest cover nationally.
- However, secondary succession in replanted or selectively logged areas often leads to a subclimax community, which may not fully replicate the biodiversity and complexity of the original rainforest. Additionally, the effectiveness of prosecution against illegal loggers varies, impacting on forest conservation efforts and reducing sustainability.
- National parks have been established with a focus on threatened ecosystems, helping to preserve biodiversity and serve as a refuge for endangered species.
- However, the creation and management of these conservation areas require continuous funding and monitoring. Conservation efforts have to be balanced with the rights and needs of local communities.



- Ecotourism in protected areas like the Sungai Yu Forest Reserve provides a sustainable income source that supports conservation efforts. It also raises awareness among visitors about the importance of rainforest conservation.
- Managing ecotourism to prevent negative impacts on the environment and local communities is essential. This limits the numbers of tourists and therefore the potential economic benefits for local communities.

**16** AO1 – Knowledge and understanding of a distinctive local ecosystem including adaptations by flora and fauna, knowledge and understanding of concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.

AO2 – Application of knowledge and understanding to assess the extent to which the properties of a specified ecosystem at a local scale reflect the climatic climax community.

AO1 = 10 AO2 = 10

Level	Marks	Description
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#### AO1

- Concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.
- The main characteristics of a distinctive local ecosystem (such as an area of heathland, managed parkland, pond, dune system). Ecological responses to the climate, soil and soil moisture budget – adaptations by flora and fauna.
- Case study of a specified ecosystem at a local scale to illustrate and analyse the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development.

#### AO2

- Answers should relate to a case study of a specified ecosystem at a local scale.
- Assessment of what the climatic climax community is for the specified ecosystem: for example, a psammosere, where bare sand is colonised by plants.
- If conservation efforts are rewilding or restoring the natural pioneer species or later seral stages for degraded parts of the local scale ecosystem, the extent to which this should still be considered an arresting factor (human interference) or the resumption of natural progression towards the climatic climax community.

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