

ENVIRONMENTAL MANAGEMENT

Paper 8291/03
Centre Based Assessment

General comments

There was wide variation in the performance of candidates in this component. There were some very strong reports which were well structured, provided evidence of collected and collated primary data and often combined this with secondary data sources. Many candidates did not evidence the use of a statistical tool or provide a clear and reflective evaluation of the investigation, i.e. strengths or weaknesses of the study.

It is extremely pleasing to see that the selection of topics continues to focus on some very key and current environmental issues at a local level. Several candidates selected similar topics; however it is clear that Centres provided good guidance to candidates in order for them to avoid copying or colluding.

It is still without doubt that the best reports are derived from the collection and collation of primary data obtained from either field investigations or laboratory work. Some of the higher achieving candidates clearly demonstrated the use of combining secondary data in conjunction to their primary data, thus evidencing a very rigorous report.

Stronger candidates also tended to submit detailed sources of information in support of their environmental proposals; including the submission of a reasonably detailed and considered methodology prior to undertaking the investigation.

Some issues experienced this series in some Centres were as follows:

- A very limited number of Centres were late dispatching reports and submitting marks. The deadlines are available in our Samples Database
- Leniency, particularly in assessment criteria: **C2(a), (b) and (e); C3(a) and (b)**, was shown by some Centres. In these cases, full credit was often awarded where partial credit would be more appropriate.
- Some Centres are awarding credit for criteria not actually present in project reports, e.g. no credit can be given for the use of a statistical tool when one has not been used, nor can credit be awarded for conclusions that do not relate to the candidates' specific data.
- A small number of Centres did not check that final marks for submission to Cambridge were entered correctly; this should be a mark out of 40.
- A small number of Centres did not follow guidance on the selection of the sample for external moderation, or on which forms should be submitted with the sample. A common mistake for these Centres was to send all of their candidates' work which is not necessary for centres with over ten candidates; although extra can be requested by the external moderator.

There is good evidence of many candidates structuring their reports in a logical order, which is often: introduction, methods (justified), results and analysis, conclusion and evaluation, and many use these stages as section or chapter headings. It is extremely important that Centres, as well as candidates, recognise the difference between a research report and an extended essay, given the range of assessment criteria, and importantly **C2(c)**.

Candidates are reminded that the following questions should be considered when preparing their reports:

- Will my hypothesis or question actually yield viable results?
- Are my methods realistic, practical and relevant; do they include data recording, collation and presentational techniques?
- Are the results and analyses fully representative of the methods referred to in the previous section?
- Does my conclusion sum up and relate the results to the original hypothesis or question?
- Have I evaluated my work in terms of its successful features and its limitations and considered what can be done to improve the work?

Comments on assessment criteria

Skill C1

Most candidates performed well in this skill area.

Either as the project title or as part of an introduction, hypotheses or questions were stated by most candidates and frequently accompanied by a clear explanation of its underpinning principles. The hypothesis should be clearly written and not implicit to the introduction. This is important as a significant number of candidates will conclude that their hypothesis was correct, yet there is no evidence anywhere in the report of a research question or hypothesis.

Stating and justifying a methodology was, in the main, adequate. Good quality research requires the formulation of a plan, detailing research sites, equipment, expected data and how it will be collated and presented. Weaker reports had a methodology which was often a brief list without any explanation or justification. As a consequence it is difficult to judge whether such methodologies would be effective in testing a hypothesis or not.

Skill C2

There were a significant number of high quality research reports that clearly demonstrated skill in meeting the criteria in this section. They made excellent use of relevant collected data which was presented in a variety of ways including graphs, tables, diagrams and photographs; sometimes integrated into an analysis through the use of figure references.

A significant number of candidates did not achieve full credit for **C2(a)** as graphs and tables were poorly presented, which made them difficult to interpret. The type of graph selected to present data was also occasionally inappropriate for the type of data.

There were a very limited number of candidate reports that contained very little data presented in the form of graphs and/or tables. As a result, it was difficult to achieve credit in criteria that reference data. Often these reports were heavily reliant upon photographic evidence. It is better that photographic evidence supplements other forms of information.

The use of a statistical tool is generally only seen in the strongest reports. There is a difference between statistical methods that are used to describe data and statistical tools that are used to analyse data. The former might include bar charts or line graphs whilst the latter would include correlation, chi-squared, *t*-tests etc. For Centres to award credit for this, there should clearly be evidence of a statistical tool used to analyse the data.

The majority of candidates received full credit for the general organisation of their work and the quality of their written communication.

Skill C3

This important skill frequently forms the weakest part of reports. Often, the main weakness in **C3(a)**, the conclusion, is a lack of reference to the data presented in the report. **C3(b)** is also often limited, as only a small number of candidates referred to related environmental management principles. This element also needs reference to the data within this section of the report.

Some Centres need to provide guidance to their candidates that the evaluation needs to be a brief summary of those things that went well and not so well, i.e. success and limitations. Some candidates demonstrate confusion between an evaluation and a conclusion and evaluate their secondary data, instead of appraising their methodology (success and limitations of the methodology). A relatively small number still did not include an evaluation.

Concluding comments

These reports demonstrate a clear and enthusiastic engagement with this element of the environmental management syllabus. It is pleasing to see that when candidates are given the opportunity to research a topic of their choice, their selection often focuses on key and current environmental issues.

It is important that candidates are given guidance in the selection of their project title as sometimes the title can be too broad in scope. A significant number of candidates try to review global data which is extremely challenging given the assessment criteria and word count.

In addition to the topic, there is the opportunity to learn some research techniques and put them into practice. As in previous sessions, the better topics and strongest final reports tend to be derived from locally based research and utilise primary data.

ENVIRONMENTAL MANAGEMENT

Paper 8291/11
Paper 11

Key messages

- Candidates need to be aware of the equal balance between **Section A** and **Section B** of the paper and plan their time accordingly.
- In **Section A**, candidates should note the credit available for each part question as this provides an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates should ensure that they are familiar with the differences in meaning of command words such as state, suggest, explain and describe.

General comments

There was a reasonably good response to all questions on this paper. In some cases, performance was uneven across the two sections of the paper. Some candidates found **Question 1** (global emissions) less challenging than **Question 2** (soil science). Specific issues which presented the most challenge included the characteristics of different soils and how these relate to cultivation.

Many answers showed a good understanding of key issues and an attention to detail.

The strongest answers included effective use of appropriate examples to illustrate key points along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

- (a) (i) Most candidates demonstrated a good understanding of the term *greenhouse gas* and gained full credit for this question.
- (ii) Many candidates demonstrated good skill at interpreting the data on the graph and gained full credit for this question.
- (iii) A significant proportion of candidates found it challenging to relate the generation of electricity to the burning of fossil fuels and the resultant greenhouse gas emissions.
- (iv) Many candidates demonstrated good graph drawing skills. Some candidates neglected to correctly label their axes.
- (b) Candidates made good use of the data from the table and were able to compare the contribution of the two gases.
- (c) (i) Most candidates made good use of the data and effectively highlighted the significant contribution of China and the USA. Weaker responses simply listed the countries and their associated percentages without further description or explanations. Stronger answers often provided details about likely population size and industrialisation of the country. An area of concern is the

misunderstanding that some candidates showed about the levels of economic development in different countries, especially the emerging nations.

- (ii) Some candidates found this question challenging and demonstrated similar issues in their answers to this question as were seen in (c)(i). These candidates did not have an understanding of the likely status of newly industrialised countries and the need to use fossil fuels for power generation to rapidly grow their economies.

Question 2

- (a) (i) Most candidates understood the use of a triangular graph and gained full credit.
 - (ii) Most candidates were able to read the correct figures from the triangular graph.
 - (iii) Candidates found this question challenging with some candidates unable to relate the characteristics and properties of soils to their value in cultivation. Stronger answers understood that sandy soils held little water and that a clayey soil had poor aeration.
- (b) (i) Candidates showed good understanding of biotic and abiotic factors and many gained full credit.
 - (ii) Stronger candidates provided descriptions of the interaction between soil components and chose a wide range from the diagram, though plant roots and water was the most popular pairing.
 - (iii) Candidates had a good understanding of the ways in which agricultural practices could damage soils and particularly good responses were about irrigation and loss of fertility through overuse or monoculture. Some candidates referred to the American dust bowl. Weaker responses often contained errors in the description of the causes of the damage.
- (c) Most candidates showed a good understanding of the management techniques of planting trees, terracing hillsides and contour ploughing. A weaker understanding of applying green manure, building earth dams and fencing in animals was apparent.

Section B

Question 3

- (a) This question was well answered in general with candidates able to describe the likely impacts of climatic change. The main focus was on rising sea levels but the strongest answers also included suggestions of increasing storm activity and the potential salinisation of the soil.
- (b) There was a good understanding of the causes and effects of global warming shown by most candidates. Weaker answers included reference to CFC release and ozone depletion and often confused the effects with those of global warming. The strongest responses were those that offered specific examples from different parts of the world to support their assessment.

Question 4

- (a) The stronger responses commented on the likely effects and impacts of the claims made in the article. Weaker answers didn't develop or explore the information provided and so these candidates were unable to offer evaluative comments.
- (b) Strong answers to this question referred to the pressure on resources posed by people being concentrated in cities and also demonstrated an understanding of the potential for efficiencies in the management of resources. However, many candidates showed a lack of depth in their responses and focussed only on the disadvantages for the sustainable management of resources. Because of this, many candidates did not present a balanced response.

Question 5

- (a) For many candidates, there was good understanding of the techniques for monitoring volcanic activity and an appreciation of how these methods were able to help predict volcanic eruptions. Some weaker answers referred to the information that was shown in the diagram only without

additional detail to outline how the methods worked. These candidates therefore couldn't effectively link monitoring to prediction.

- (b)** There was a very good understanding of the issues faced from a tectonic hazard event, and many candidates used a wide range of different examples from countries with different levels of economic development. Weaker answers only focused on volcanoes and were therefore limited in the examples that they could utilise.

ENVIRONMENTAL MANAGEMENT

Paper 8291/12
Paper 12

Key messages

- Candidates need to be aware of the equal credit available for **Section A** and **Section B** of the paper and plan their time accordingly.
- For **Section A**, candidates should note the credit available for each part question as this provides an indication of the amount of content and detail expected.
- It is important that instructions are followed carefully. Candidates should ensure that they are familiar with the differences in meaning of command words such as state, suggest, explain and describe.

General comments

There was a reasonably good response to all questions on this paper. In some cases performance was uneven across the two sections of the paper. Some candidates found **Question 1** more challenging than **Question 2**.

Many answers showed a good understanding of key issues and attention to detail.

The strongest answers included effective use of appropriate examples to illustrate key points along with supporting details using appropriate terminology.

Comments on specific questions

Section A

Question 1

- (a) (i) Most candidates gained full credit.
- (ii) Some candidates found the description of the pattern of air circulation at the equator challenging. The strongest candidates correctly described the rise at the equator of the warm air, the direction of the flow and the sinking at the tropics.
- (b) (i) The effect on climate by relief was generally explained more successfully than that of ocean currents. The stronger answers tended to use the terms relief rainfall and rain shadow. Stronger answers also clearly understood that the cold ocean currents cooled the air and meant that little moisture could be collected.
- (c) (i) Many candidates found stating the differences between daytime and night-time patterns of air movement challenging. Weaker answers tended to describe the reverse arguments of the same points, such as rises over land by day and sinks by night.
- (ii) Successful answers understood that the land heated quicker than the sea and the resultant rising air cools and water vapour condenses to form the clouds. Weaker responses described generic cloud formation without reference to the coastal conditions.

- (d) Many candidates found this question challenging and the link between daily wind speed forecasts and the people and activities which would find them useful was only made in the strongest answers.

Question 2

- (a) (i) The types of plate boundary were identified successfully by nearly all candidates.
- (ii) Candidates were able to correctly perform the calculation.
- (b) (i) The term earthquake magnitude was well understood. Some candidates confused earthquake frequency with wavelength and referred to the wavelength of seismic waves
- (ii) Destructive plate was the most popular choice with many good reasons given.
- (iii) Many candidates provided good explanations of most factors, with time of day being the most popular choice. Population density and distribution was a factor that drew weaker responses which referred to cities only and did not contrast these with rural areas. The role of underlying rocks was not well understood by some candidates with weaker responses referring to landslides rather than the nature of the rock.

Question 3

- (a) The environmental problems of major building projects were well understood by many candidates with strong answers giving detailed examples of the problems suggested. Weaker answers tended to list problems without demonstrating an understanding of why they arise.
- (b) Some candidates have problems with understanding the nature of the resources of the lithosphere and can drift into discussing examples from the biosphere and hydrosphere. More successful answers referred to mining, quarrying and the intensification of farming with valid supporting views about damage. Weaker answers often avoided including the lithosphere in their discussion.

Question 4

- (a) Many candidates were able to give good descriptions of the weather patterns shown on the diagram. Weaker answers did not refer to satellite imagery. Successful answers referred to satellite imagery with a few of the strongest answers linking this well to monitoring long-term climate change.
- (b) The answers to this question demonstrated that most candidates have a very good understanding of global warming. A minority of candidates showed a weaker understanding by erroneously linking CFC release and the depletion of the ozone layer directly to global warming. Many students gave fine assessments of the role of carbon dioxide, with a few of the very strongest answers showing a good understanding of the role methane.

Question 5

- (a) The most successful answers were able to describe the stages of ozone depletion and then provide well explained links between the additional UV rays and the health and environmental problems created. Weaker answers described what was shown in the diagram without attempting to explain the links.
- (b) Many candidates provided a wide range of detailed approaches, including international agreements, alternative energy sources or local initiatives. Weaker answers tended to confuse the issues of climate change resulting from the greenhouse effect and global warming and the depletion of the ozone layer causing increased UV radiation to enter the atmosphere. A small number of the strongest responses referred to examples from different areas of the world.

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Paper 8291/21
Paper 21

Key messages

- In **Section A**, when considering source material candidates should analyse and use specific information and data to support statements made in answers.
- Candidates should ensure that they are familiar with the differences in meaning of command words such as state, suggest, explain and describe.
- In **Section B**, candidates should use specific examples to allow for relevant evaluations of the strategies and methods used in environmental management.

General comments

In **Section A**, many candidates performed equally well in both questions. There was good use of information from source material and in the strongest answers numerical data was appropriately interpreted and manipulated. In **Section B** there was some effective use of examples to illustrate the key points and there was accurate use of subject specific vocabulary.

Comments on specific questions

Section A

Question 1

- (a) (i) In excellent answers, trends were fully described. These answers highlighted the overall differences between evaporation and infiltration before urban development and at 100% impervious surfaces. In most answers the decreasing trend in both evaporation and infiltration was stated and supported by some data from **Fig. 1.1**. In some weaker answers, no data was used to support observations of the trends. There was occasionally some misinterpretation of the question, where either an explanation of the data or definitions of evaporation and infiltration were provided.
- (ii) For many candidates, a calculation of percentage increase in run-off was not fully completed. A difference in the run-off was often calculated but this was not used by many candidates to complete a calculation of the percentage increase in run-off.
- (iii) This question was well answered. In most answers, more run-off because of less infiltration due to less water being absorbed by the ground was stated. In good answers this was further developed by explaining the reasons for this reduction in infiltration.

- (iv) Two effects of run-off on the river environment were often stated, most usually flooding and the uptake of polluting chemicals by the run-off. The direct effect of contaminated water on the river environment was outlined in good answers. In less effective answers the effect of the run-off wasn't explained. Where eutrophication was mentioned this was often not clearly linked to nutrients in run-off from urban sources.
- (b) Excellent answers used the information in **Fig. 1.2** to describe and explain how the vegetation system reduces the negative impact of human activity on the river environment. These answers clearly linked the vegetation type to how the specific benefits could be achieved. In less effective answers, differences in the role of the different type of vegetation were not stressed.

Question 2

- (a) (i) Many answers showed a good understanding of the basic principles of food chains and food webs. Correct answers were usually achieved by candidates who selected organisms that were directly linked in the food chain of a coral reef ecosystem. When organisms that were not directly linked in a food chain were chosen, mistakes were made by some candidates with a minority of candidates confusing the first and third trophic levels.
- (ii) Good answers recognised the importance of photosynthesis and applied a basic knowledge of photosynthesis to this unfamiliar situation. Weaker answers focused on indirect benefits to other components of the food chain.
- (iii) This question proved challenging to some candidates. In good answers a predator-prey relationship was recognised and considered. In weaker answers, organisms other than the coral were discussed.
- (iv) In better answers the impact of overfishing on the delicate balance of a coral reef ecosystem was exemplified with precise explanation. In weaker answers an explanation of a specific disruption to the food web by overfishing was explained.
- (b) (i) This question was well answered. In excellent answers there was good use of the data that was suitably manipulated to compare threats to coral reefs and the impact of human activity. Some weaker answers made simplistic statements with very limited interpretation of the data.
- (ii) There were many good responses to this question. A variety of appropriate management strategies to preserve and conserve coral reefs were suggested and explained in good responses. In some less precise answers, suggestions to prevent or reduce each of the threats listed in **Fig. 2.2** characterised answers.

Section B

Question 3

- (a) There were some very strong responses to this question with candidates showing a good understanding of the energy and nutrient flows in an ecosystem through well exemplified and detailed descriptions. Typically, descriptions focussed on the energy flows more than the nutrient recycling so there was some imbalance in the responses. In less effective answers, information in **Fig. 3.1** was described without expansion or exemplification.
- (b) In good responses a balance between the impact of deforestation and strategies to reduce pressures on forest ecosystems were discussed. Both ecological and environmental impacts of deforestation were clearly described. Strategies were assessed most effectively though the use of examples.

Question 4

- (a) This was generally well answered. In strong answers, changes in the sources of water for the city were described and supported with data and a variety of reasons were suggested to explain these changes. In more basic answers, changes were described but reasons for the changes were not considered.

- (b) The better responses considered both sources of supplying water from groundwater and desalination and advantages and disadvantages of both. In these answers there was reference to specific examples of countries using these sources and the responses were very well balanced. In particularly good essays an example of an arid country in which water was supplied from each of the two sources enabled a direct comparison and assessment of the two methods in terms advantages and disadvantages of a variety of factors. Less effective answers provided no examples and no assessment and sometimes only referred to one of the designated sources.

Question 5

- (a) Effective answers described an overall trend in global crop production and also highlighted the years when there were significant variations. Reasons for the increase were attributed to a well explained increasing demand and the ways in which large increases in production had been achieved were also discussed. The variations in crop production were also very well explained with appropriate reasons suggested. Less strong answers described the overall trend but did not consider the variation in crop production.
- (b) There were some excellent responses to this question. These responses explored the ways in which increasing food production would be sustainable even with a global population continuing to increase. An argument was presented which suggested that as new technologies are developed the global population can be supported. A contrasting view was also discussed which considered a limit to food production. Examples of the impact of population growth and of population policies were provided in these excellent essays. Weaker essays tended to lack a balanced argument and assessment focused solely on the negative impact of human population growth on food resources.

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Paper 8291/22
Paper 22

Key messages

- In **Section A**, when considering source material candidates should analyse and use specific information and data to support statements made in answers.
- Candidates should ensure that they are familiar with the differences in meaning of command words such as state, suggest, explain and describe.
- In **Section B**, candidates should use specific examples to allow for relevant evaluations of the strategies and methods used in environmental management.

General comments

In **Section A**, candidates performed equally well in **Question 1** and in **Question 2**. There was good use of information from source material and in the strongest answers numerical data was appropriately interpreted and manipulated. Overall candidates performed equally well in **Section A** and **Section B**. In **Section B** there was accurate use of subject specific vocabulary and some effective use of appropriate examples.

Comments on specific questions

Section A

Question 1

- (a) (i) A definition of a *biome* was often correctly stated. Some weaker answers provided a definition for an *ecosystem*.
- (ii) This question was well answered with all three biomes being correctly named. Occasional errors were made when there was a misinterpretation of the diagram and labels from the adjacent named biomes given in **Fig. 1.1** were used to name **A**, **B** and **C**.
- (iii) This question was also answered well with the ranges correctly stated by many candidates. Some candidates failed to gain credit when they stated the range shown by the entire graph axes rather than the temperate deciduous forest biome.
- (iv) Candidates found this question challenging.
- (v) This question proved challenging for many candidates. Stronger answers often illustrated their answer with an example to highlight the transition from one biome to another.
- (b) (i) This question was approached in a variety of ways. The best answers demonstrated understanding of the way in which the nutrient balance of a tropical rainforest ecosystem is maintained by the balance between the inputs and outputs, with the relative proportions of the different gains and losses considered. Less strong answers focused on the size of the biomass store and a description of the gains and losses without considering the relative size of the flows.
- (ii) Candidates showed a very good understanding of the impact of human activity on tropical rainforest ecosystems. Good answers identified the different types of human activity taking place, often dividing their answer into three sections and then explaining the specific impacts of each

different human activity on a tropical rainforest ecosystem. In other answers, general ecological impacts on the tropical rainforest ecosystem were considered.

Question 2

- (a) (i) This question was answered well. Inputs and outputs to the local water cycle were correctly stated.
- (ii) This question was successfully answered. Candidates effectively described how the level of the water table was determined by changes to the inputs and outputs of the hydrological cycle. These changes were well explained by candidates.
- (iii) This was generally well answered. In excellent responses, the relationship between the decrease in vegetation or soil cover/increase in impermeable surfaces and corresponding decrease in infiltration and increase in run-off was explained and linked to an increase in the chance of flooding.
- (iv) This question was also well answered with most candidates linking agricultural activity to pollution of the river water through the input of agrochemicals, increasing the input of nutrients into the river resulting in eutrophication. However, there were some inaccuracies in the explanation of eutrophication and oxygen depletion.
- (b) In good answers, of which there were many, the changes resulting from the organic pollution event in the river were well described and the relationship between the input of organic matter, the activity of decomposer organisms and the changing oxygen levels were explained. In very good answers the explanation was detailed and considered and discussed many of the factors.

Section B

Question 3

- (a) Observations relating to the method for managing wildlife in each protected area, together with some assessment of their effectiveness giving an advantage and disadvantage of each approach, characterised good answers. In many responses, the number and extent of the different types of protected areas and the degree of protection of the wildlife from the impact of named human activities were considered. The location of the protected areas in relation to the distribution of anti-poaching units was also considered. Less successful answers tended to either focus either solely on the positive aspects of conservation or illegal hunting from the negative perspective.
- (b) Candidates chose a wide range of methods of managing the natural environment for wildlife. The most effective answers used specific examples to illustrate each of the two methods chosen. Other successful answers selected one area and illustrated the application of two different methods of managing the natural environment for wildlife within the same area. This approach facilitated effective evaluation and demonstration the importance of applying a range of methods of conservation. Weaker answers tended to lack examples of the application of the chosen methods. This made evaluation more difficult to achieve.

Question 4

- (a) This was generally well answered. In good answers the changes in the number of large free-flowing rivers that were dammed in each decade were described. Candidates highlighted the decades in which there was more/less dam construction and the main trends were identified. Data was often used well to support the statements made. Reasons for the specific changes were well considered by many candidates and these reasons were carefully linked to the specific time periods. In less successful answers the description was more simplistic with key decades identified but trends not described. The reasons were generalised and not linked to specific time periods and reasons for decreases were often omitted.
- (b) Very good answers were characterised by the use of well-chosen specific examples. The pertinent use of examples for specific advantages and disadvantages exemplified excellent answers to this question as this facilitated very good assessment. Advantages were varied and disadvantages wide ranging. Discerning candidates drew an overall balanced conclusion considering the concern for the negative implications of dams and the positives of constructing dams. In less strong answers there was some imbalance with either the advantages featuring more strongly than

disadvantages or vice versa. These answers tended to lack examples and generated limited assessment.

Question 5

- (a) In very good answers, in addition to the overall trends of the global use of all resources, the main trends for each resource were described to highlight the differences between resources. Data was accurately extracted from the graph and manipulated to support these observations. Good answers explained the variation in the increasing trends for each resource. Less strong answers considered the overall trend in the global use of all resources collectively and did not identify the variations in the use of each resource type. Thus explanation was limited to reference to an increasing population with increasing demand for all resources in these answers.
- (b) Excellent essays considered ways in which it was possible to solve the problems of overpopulation through the sustainable management of resources. There was appropriate use of examples to illustrate different approaches to achieving sustainability for different resources. Methods of controlling population growth through the implementation of population policies were also explored using appropriate examples. Both approaches were considered and an appropriate conclusion stated. Less strong answers lacked balance by considering only population policies and dismissing the sustainable use of resources, or the essay may have only addressed the sustainability aspect. These answers tended to lack examples. In general the sustainable management of resources was less well addressed than population policies.