

Environmental systems and societies

These subject guidelines should be read in conjunction with the “Introduction”, “Outline” and “Details—all essays” sections of this guide.

Overview

Environmental issues are occupying a position of increasing significance on the world agenda, and an extended essay in environmental systems and societies provides students with an opportunity to explore an environmental topic or issue of particular interest or relevance to themselves and their localities. Since the subject is a multidisciplinary one, the student will need to select and integrate theoretical contexts and methodologies from those academic disciplines appropriate to the chosen topic. In this respect, a systems approach is considered particularly effective, and students will be expected to show some employment of this approach in the analysis and interpretation of the data gathered.

Choice of topic

Environmental systems and societies focuses upon the interaction and integration of “natural” environmental systems and human societies. An essay in this subject should likewise focus on this relationship. It should not deal exclusively with ecological processes or with societal activities, but instead should give significant (though not necessarily equal) weight to both these dimensions. A topic should be chosen that allows the student to demonstrate some grasp of how **both** environmental systems **and** societies function in the relationship under study. For example, while the environmental systems and societies syllabus includes a study of pure ecological principles, in an extended essay it would have to be explored within the context of some human interaction with the environmental system. Similarly, while the syllabus includes a range of philosophical approaches to the environment, in the extended essay, these would need to be addressed in relation to specific natural systems. Great care should be taken, therefore, to ensure that the topic chosen would not be better submitted under one of the more specialized subject areas of either the experimental or the human sciences. This would invariably apply, for example, to topics focusing exclusively on human health, disease or politics.

A crucial feature of any suitable topic is that it must be open to analytical argument. If the topic chosen fails in this regard, and lends itself only to a descriptive or narrative treatment, then the student will be denied a large proportion of the available credit according to the assessment criteria. For example, it would be of minimal value simply to **describe** a given nature reserve; it would be necessary to **evaluate** its relationship with a local community possibly, or **compare** its achievement with original objectives or with a similar initiative elsewhere. The topic must, in some way, leave room for an argument that students themselves construct and support from their own analysis of the information, rather than simply reporting analysed data obtained from other sources.

There are also some topics that should be considered unsuitable for ethical or safety reasons. For example, experiments likely to inflict pain on living organisms, cause unwarranted environmental damage or put pressure on others to behave unethically must be avoided. Similarly, experiments that pose a threat to health, possibly using toxic or dangerous chemicals, or putting oneself at physical risk during fieldwork, should be avoided unless adequate safety apparatus and qualified supervision are available.

A further critical feature of a successful topic is the sharpness of its focus. If a topic is too broad, it will inevitably lead to a relatively superficial treatment that, again, is likely to penalize the student right from the start. In topics that are too broad, it is unlikely that students will be able to produce any significantly fresh analysis, arguments or meaningful conclusions of their own. To clarify the distinction between a broad and a sharply focused topic, the following examples of titles for environmental systems and societies extended essays are intended as guidance only. The pairings illustrate that focused topics (indicated by the first title) should be encouraged rather than the broad topics (indicated by the second title).

- “The ecological recovery of worked-out bauxite quarries in Jarrahdale, Western Australia” **is better than** “Environmental effects of mining”.
- “A comparison of the energy efficiency of grain production in The Netherlands and Swaziland” **is better than** “Efficiency of world food production”.
- “The comparative significance of different sources of carbon dioxide pollution in New York and Sacramento” **is better than** “Impacts of global warming”.
- “Managing the environmental impact of paper use at a Welsh college” **is better than** “Paper recycling”.

It may further assist a student in refining the focus of their research if, beyond the topic and research question, he or she also produces a succinct statement outlining the overall approach of the investigation. Some examples of this might be the following.

Topic	Impact of exotic plants on herbivore diversity in Tanzania
Research question	To what extent does the length of time after an exotic plant has been introduced to an area, and the latitude from which it originates, affect the diversity of herbivores found feeding on it?
Approach	A fieldwork investigation into the diversity of epiphytic herbivores on a range of exotic plants in the Kilimanjaro region, linked to a brief historical study of each plant’s introduction.
Topic	Evaluating the philosophical aims and achievement in local conservation
Research question	To what extent are the philosophical principles and objectives of a local conservation group being fulfilled in protecting the local environment?
Approach	An analysis of literature and attitudes from a conservation group, along with a quantitative analysis of records of environmental quality.
Topic	The ecological footprint of the school canteen
Research question	From the major inputs and outputs of the school canteen, what overall estimate of its environmental impact can be made in terms of an ecological footprint?
Approach	An analysis of records and practical measurements assessing the inputs and outputs of the canteen, and a synthesis of data into a holistic model indicating the environmental impact.

For some investigations, particularly those that are experimental, a clearly stated hypothesis may be just as acceptable as, and possibly better than, a research question.

Treatment of the topic

An extended essay in environmental systems and societies may be investigated either through primary data collection (from fieldwork, laboratory experimentation, surveys or interviews) or, alternatively, through secondary data collection (from literature or other media). It may even involve a combination of the two, although, given the limited time available and word limit for the essay, the emphasis should be clearly with one or the other to avoid the danger of both becoming rather superficial.

If the essay is focused largely on the collection of primary data, the student needs to exercise great care in selecting appropriate methods of data collection and carrying them out effectively. Before commencing the investigation, students should explore literature relating to their methodology, and also any pertinent research that may give them guidelines and useful points of theoretical comparison. Hence, even in an investigation based exclusively on primary data, the bibliography should indicate at least some recognition of secondary sources, perhaps supporting the choice and implementation of methods or providing an academic context for the conclusions.

If the essay is focused on secondary data, the student needs to take great care in selecting sources, ensuring that there is a sufficient quantity and range, and that they are all reliable. There is a great mass of populist, journalistic, partisan and unfounded claims available through the Internet and other media. The student must take on the task of sorting through these and using only those sources that have some academic credibility. An essay of this type would normally be expected to produce a substantial bibliography and not be limited to just a few sources.

From whatever sources the data has been collected, it is vital that students are involved in producing their own analysis of the data and arguing their own conclusions. This will happen more naturally if the essay is based on primary data since the data will not have been previously analysed. A source of secondary data, however, may come with its own analysis and conclusions. In this case, it is essential that students further manipulate this data, or possibly synthesize it with other sources, so that there is clear evidence in the essay of the student's personal involvement in analysis and drawing of conclusions. Whether using primary or secondary data, students should construct their own critical arguments by using and evaluating the sources available to them.

Finally, a central theme in the environmental systems and societies syllabus is the systems approach, and this should be reflected to some degree in the extended essay. The essay should include an attempt to model, at least partially, the system or systems in question. The term "model" in this context is intended in its broadest sense to include, for example, mathematical formulae, maps, graphical representations and flow diagrams. Systems terminology should also be used where appropriate.

Interpreting the assessment criteria

Criterion A: research question

To meet this criterion, a sharply focused research question defining the purpose of the essay must be stated clearly within the introduction. It is not sufficient simply to include it on the title page or in the abstract. To make "effective treatment possible", first, it must not be too broad, which will lead to superficial treatment. Second, it must allow for critical argument, and not simply require a descriptive or narrative treatment. For example, "To what extent is X like Y?" allows for argument, whereas "What is X like?" only invites simple description.

In this subject, it can be quite acceptable to formulate the research question as a clearly stated hypothesis. This may be particularly appropriate, for example, in experimental investigations. A hypothesis, as the starting point of an experimental investigation, will always lead to the implicit critical argument concerning the extent to which the results support or refute it.

Criterion B: introduction

The introduction should set the research question or hypothesis in context. For example, it might outline necessary theoretical principles on which the topic depends, summarize other related research conclusions, or give a brief history or geographical location of the issue under discussion. The introduction should also indicate the significance of the question being researched—Why is it important to answer it? What value might it have to others? What implications could the findings have?

It is also important that the introduction does not become too long. Material should only be included where it is directly required in order to follow the overall argument of the essay.

Criterion C: investigation

Where the study involves experimentation or practical fieldwork, a detailed description of the procedures used, possibly with diagrams or photographs, should be given, such that an independent worker could effectively repeat the study. Careful attention should be given to the design of experiments to include use of, for example, quantification, controls, replication and random sampling, where appropriate. The selection of techniques should be explained and justified, and any assumptions upon which they depend should be clearly stated.

If the study is based on the research of secondary data, students need to ensure that the selection of sources is sufficiently wide and reliable. Where Internet-based sources are used, for example, students should be particularly aware of their potential unreliability. Their process of selecting sources and data should be described and justified, and, in cases where there is a variety of relevant perspectives held, the selection of sources should reflect this. Where appropriate, there should be an indication of the methods by which the secondary data has been generated or the evidence upon which it is founded.

Criterion D: knowledge and understanding of the topic studied

Students are expected to have a sound knowledge and understanding of environmental systems and societies, as detailed in the current *Environmental systems and societies guide*. For many topics, this knowledge will need to be supplemented through independent study. Ultimately, the student should possess sufficient knowledge of the topic to handle the issues and arguments effectively. To score highly on this criterion, a student would also need to show clear and perceptive links between their own study and the body of theoretical knowledge associated with this subject.

Criterion E: reasoned argument

There should be a clear step-by-step logical argument linking the raw data to the final conclusions. Each step or proposition on the way should be defended against any plausible alternatives and potential criticisms with clear evidence. Personal opinions are acceptable, but again should be convincingly substantiated by the available evidence. The argument must directly answer the research question in the precise way that it has been formulated.

Criterion F: application of analytical and evaluative skills appropriate to the subject

Analytical skills can be demonstrated in the selection, manipulation and presentation of quantitative or qualitative data gathered from either primary or secondary sources. They will be most obviously apparent in the employment of such things as graphical representations, mathematical manipulations or flow diagrams. Analytical skills may also be evident in the student's ability to select specific data from sources, identifying their relevance and relationships to one another, and reorganizing them into an effective verbal argument.

Evaluative skills will be apparent in the students' reflections on the reliability and validity of the data gathered, and their subsequent interpretations. For essays concerned largely with collecting primary data, this will involve discussing inadequacies in the experimental design, the validity of assumptions made, limitations of the investigation, and any systematic errors and how they might have been avoided. For essays concerned largely with collecting secondary data, similar considerations should be applied to the sources that were accessed.

Criterion G: use of language appropriate to the subject

Students are expected to use appropriate scientific and systems terminology, as employed in the current *Environmental systems and societies guide*.

Criterion H: conclusion

It is highly recommended that this aspect of the essay is given a separate section with its own heading. It should contain a brief, concise statement of the conclusion that is in direct response to the research question or hypothesis. This should not involve new information or arguments, but should be a summary of what can be concluded from, and is supported by, the evidence and argument already presented.

In addition to the concluding statement, students should identify outstanding gaps in their research or new questions that have emerged and deserve further attention.

Criterion I: formal presentation

This criterion relates to the extent to which the essay conforms to academic standards about the way in which research papers should be presented. The presentation of essays that omit a bibliography or that do not give references for quotations is deemed unacceptable (level 0). Essays that omit one of the required elements—title page, table of contents, page numbers—are deemed no better than satisfactory (maximum level 2), while essays that omit two of them are deemed poor at best (maximum level 1).

Particular attention should be paid to the use of graphs, diagrams, illustrations and tables of data. These should all be appropriately labelled with a figure or table number, a title, a citation where appropriate, and be located in the body of the essay, as close as possible to their first reference. Any downloaded or photocopied material included should be clearly legible.

Criterion J: abstract

The abstract is judged on the clarity with which it presents an overview of the research and the essay, not on the quality of the research question itself, nor on the quality of the argument or the conclusions.

Criterion K: holistic judgment

This criterion invariably favours those students who have some direct involvement or personal contact with the environmental issue under study, and this should be encouraged wherever possible. It is more challenging for a student to clearly demonstrate personal engagement, initiative and insight in a topic with which their sole contact has been through the Internet or library bookshelves.

“Intellectual initiative” may be apparent in the formulation of a novel and penetrating research question, or in the design or inventive modification of an experimental procedure, or in a creative identification and selection of secondary source material, for example. A major theme of this subject is the interrelatedness of systems and components within them, and many common principles can be applied to a wide variety of systems. An essay that overtly recognizes these underlying principles and the interrelatedness of components will most clearly demonstrate an element of the “insight and depth of understanding” referred to in this criterion.