



# **MARKSCHEME**

**May 2014**

## **ENVIRONMENTAL SYSTEMS AND SOCIETIES**

**Standard Level**

**Paper 2**

21 pages

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## General Marking Instructions

*Assistant Examiners (AEs) will be contacted by their team leader (TL) through Scoris™, by e-mail or telephone – if through Scoris™ or by e-mail, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this initial contact is to allow AEs to raise any queries they have regarding the markscheme and its interpretation. AEs should contact their team leader through Scoris™ or by e-mail at any time if they have any problems/queries regarding marking. For any queries regarding the use of Scoris™, please contact [emarking@ibo.org](mailto:emarking@ibo.org).*

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.
2. Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.
3. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**
4. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use Scoris™ annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.
5. Personal codes/notations are unacceptable.
6. Where an answer to a part question is worth no marks but the candidate has attempted the part question, enter a zero in the mark panel on the right-hand side of the screen. Where an answer to a part question is worth no marks because the candidate has not attempted the part question, enter an “NR” in the mark panel on the right-hand side of the screen.
7. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. Scoris™ will only award the highest mark or marks in line with the rubric.
8. Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp “seen” on any page that contains no other annotation.
9. Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have got wrong. However, a mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the “CON” stamp.

## Subject Details: Environmental Systems and Societies SLP2 Markscheme

### Mark Allocation

Candidates are required to answer **ALL** questions in Section A [*25 marks*] and **TWO** questions in Section B [*40 marks*]. Maximum total = [*65 marks*].

1. A markscheme often has more marking points than the total allows. This is intentional.
2. Each marking point has a separate line and the end is shown by means of a semicolon (;).
3. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.
4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.
5. Words that are underlined are essential for the mark.
6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by **WTTE** (or words to that effect).
8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. When marking, indicate this by adding **ECF** (error carried forward) on the script.
10. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

**SECTION A**

1. (a) (i) *Advantages: Any two of:*  
high/efficient energy source /  
easy to transport /  
easy to store /  
can be refined for different energy uses /  
already have technology dependent on it/infrastructure in place /  
lots available/more being found /  
provides high employment/revenue /  
provides energy security to those with resource /  
cheap when found in abundance/locally available;

*Disadvantages: Any two of:*  
extraction is difficult/dangerous/expensive /  
extraction damages/pollutes habitats/ecosystems /  
use produces pollutants/carbon emissions/global warming /  
spillages damage/pollute ecosystems /  
non-renewable;

*N.B. Award [1 mark] for every TWO correct entries, (two advantages, two disadvantages or one of each). One correct entry will score zero, and three correct entries will score only 1 mark.*

**[2 max]**

- (ii)  $\frac{200}{12200} = 1.6\%$  (allow 1.0 – 2.0%);  
Or, if hydroelectricity is included:  $4200/12200 = 35\%$  (allow 33-37%)

*N.B. Working and % sign are not necessary for credit in this question.  
So award 1 mark for any value between 1-2 or 33-37.*

**[1 max]**

- (iii) *Any two of: Asia Pacific / North America / Europe & Eurasia;*

**[1 max]**

- (iv) increase production of energy from renewable resources/ wind /solar/tidal/nuclear;  
increase efficiency of energy usage through technological development;  
increase awareness of energy-saving practice through education/campaigns;  
address issues of energy distribution through import/export;  
promote exploitation of locally appropriate/available energy sources to reduce need for import/export;  
seek new reserves of non-renewable energy resources/fossil fuels;  
provide technical support/economic subsidy for renewable/clean/efficient energy supply;  
imposing legislated caps/taxes/limitations to energy consumption/C production;  
anti-natalist policies reduce population growth and energy consumption;  
reducing energy consumption through recycling/reusing resources (recycling uses energy but less);

*Accept reasonable alternative responses.*

**[3 max]**

*Question addresses **strategies** of global application Credit should be given for broad approaches and not specific actions.*

*Eg “use public transport” is not acceptable, but “promoting/raising awareness of/subsidising public transport” would be acceptable.*

*Eg “switching off lights” is not acceptable, but “raising awareness/promoting energy conservation” would be acceptable.*

- (b) (i) carry out a baseline study before mining starts;  
 ...recording abiotic conditions/biodiversity/key species/habitats/resources;  
 survey opinion/value systems/perspectives/social & economic interests of  
 local population;  
 research/evaluate potential impacts on ecosystems/biodiversity/key species;  
 research/evaluate potential social/economic impacts on communities;  
 monitor changes during and after development;  
 make recommendations regarding continuance/discontinuance of project /  
 mitigation of impact / reclamation actions after the mining; [3 max]
- (ii) toxic waste from tailing ponds may leak/evaporate & precipitate into nearby  
 rivers or marshes;  
 leaks from Keystone pipeline may pollute freshwater systems (eg Ogallala  
 aquifer);  
 extraction of water from the rivers (to pump underground) may deplete  
 freshwater resources/only 10 % of the extracted water is returned;  
 extraction involves deforestation that may lead to increase run-off/input to  
 freshwater bodies causing flooding / deplete input to underground aquifers;  
 deforestation may increase soil erosion and input of sediment to freshwater  
 resources;  
 thermal pollution/pumping steam underground may melt permafrost raising  
 water table;  
*Do not credit impacts from the USE of fossil fuels, only those that relate  
 directly to exploitation/extraction.* [3 max]
- (iii) *Any two of:*  
 low temperature (will limit productivity/population sizes/regeneration);  
 short growing season (will limit productivity/population sizes/regeneration);  
 its short/simple food chains (will be more vulnerable if species are lost);  
 habitat will contain highly specialised/less adaptable species (prone to  
 extinction);  
 permafrost inhibits drainage/provides unstable substrate on melting (so  
 vegetation more vulnerable);  
 located in mining locality (so prone to pollution/habitat destruction);  
 water table close to surface (so easily polluted from leakage/spills);  
 reduced water supply (due to extraction for mining); [2 max]
- (iv) raise public awareness of the impacts through campaigns/protests/direct  
 action/social media;  
 lobby governments to legislate/control/monitor/stop mining companies;  
 research effects of the industry on local environment/communities;  
 participate in EIA to ensure reliability;  
 pressurise companies to fund local compensatory environmental projects;  
 sue/take legal action against infringements/offenders;  
 work with industry in clean-up/restorative activities;  
*Accept any three reasonable suggestions.* [3 max]



- (c) (i) *Award 1 max for general principle of dynamic nature to resources:*  
human abilities to exploit materials/processes change over time;  
so their identification/value as 'resources' is dynamic/changing;  
ability to exploit materials/processes as resources may be limited by  
technology/economics/value systems;

tar sands may become identified/more valued as a resource through...  
...technological developments making their extraction possible/easier;  
...rising price/scarcity of alternatives/oil;  
...societies prioritising development/energy security over environment;  
...technological development to mitigate C emissions;

tar sands may become less valued/lose status of resource through...  
...rise in ecocentric values;  
...advances in renewable technologies;  
...changing economic advice to investors;  
...more rigorous carbon targets;

[3 max]

- (ii) Wealthier regions will consume more energy *per capita* to support their lifestyles/cultures/more cars/consumerism (eg USA/Canada/Europe);  
Industrialised regions of heavy transport and commercialised agriculture will tend to have high per capita consumption;  
Regions where there is ample local supply (eg Gulf States) may consume more energy because it is cheaper;  
Regions with low populations but high industrial needs (eg Russia) will tend to have higher per capita consumption;  
Developing regions may give energy conservation low priority in pursuit of economic development (eg China);  
very hot/cold climates may increase per capita energy consumption for cooling/heating (eg Saudi/Canada);

*Note to markers: Question asks about energy consumption, NOT specifically the use of oil, so do not credit answers that just give reasons for using oil (rather than other sources). It also asks for WHY consumption is high, so do not credit responses that just indicate where it is high. It also addresses per capita consumption so do not credit high or dense populations as a reason.*

[1 max]

- (iii) *Award [1 max] for identifying a value system for both writers:*  
writer A could be ecocentric/soft ecologist/deep ecologist and writer B could be /technocentric/cornucopian;

*Award [2 max] for linking value system with aspects of the texts:*  
writer A focuses on negative aspects of mining suggesting an ecocentric perspective;  
writer A seems opposed to large scale technology/corporate business suggesting an ecocentric/soft-ecologist approach;  
cartoon in A implies a moral/evil component to mining suggesting a deep ecologist's appeal to rights of the environment;  
writer B seems in favour of exploiting non-renewable resources suggesting a cornucopian/technocentric value system;  
writer B appears to dismiss a loss of some forest habitat suggesting an cornucopian/technocentric perspective;  
illustration in B implies a technical solution of underground carbon capture/storage suggesting a technocentric approach;

*Do not allow anthropocentric/eco-manager (no evidence in text)*

*Award 1 max for response that justifies A as being against mining and B in favour of mining without correctly identifying any value systems.*

*Allow credit for any points of similar validity, relevance and significance. [3 max]*

**General Essay Markscheme**

Each essay is marked out of [20] of which [2] are for clarity of expression, structure and development of ideas.

[0] Quality of expression, structure and development is poor.

[1] Quality of expression, structure and development is limited.

[2] Quality of expression is clear, structure is good and ideas are well developed.

*Do not penalize candidates for writing in bullet pointed lists – if this technique is used appropriately ie to summarize or outline a list of points within an essay at an appropriate point. However, a candidate who has not shown **any** evidence of being able to write a paragraph with a developed, logical line of reasoning would not be able to achieve maximum marks.*

**SECTION B**

2. (a) (i) *Definition:*  
 NSP = the gain by consumers in energy/biomass after deducting/allowing for respiratory losses; [1 max]
- N.B. Do not credit the simple formula  $NSP = GSP - R$ , unless GSP is also defined in words ie food/biomass/energy absorbed/assimilated by consumer. Definition must include reference to “consumers” to gain credit.*
- (ii) *Data required:*  
 (rate of) food eaten - faecal loss;  
 (rate of) food absorption / gross secondary production;  
 (rate of) respiration;  
 per unit area, per time;  
 biomass/weight at time t+1 minus biomass/weight at time t; [3 max]
- No mark to be given for named consumer, but award [2 max] if population is unnamed or not an appropriate consumer.  
 Accept a generic name e.g. mouse, but not eg ‘mammal’ or ‘herbivore’.*

- (b) first law is law of conservation of energy / in transformations energy is conserved / energy is not created or destroyed;  
... demonstrated in that all chemical energy comes from light energy / is converted by photosynthesis;  
but no new energy is “created”/chemical energy is converted to heat energy but not “destroyed”;  
energy entering producers is equal to energy stored + energy dissipated as heat;
- second law states that in an isolated system entropy tends to increase spontaneously / in any transformation there is a net increase in entropy/dissipation of energy;  
... demonstrated in that while some energy is stored as chemical energy in producer;  
... there is a net dissipation of energy / lost as heat through respiration/to environment;  
(as for all transformations) efficiency of photosynthesis/conversion of solar to chemical energy is less than 100 % / (often) only 10 % is passed on / 90 % is lost before next trophic level;  
producers maintain order/low entropy through this dissipation of high entropy/heat energy/the continuous input of solar energy;

[6 max]

*Award [4 max] for responses that only address one law.*

- (c) *Arguments for terrestrial systems having greater potential:*  
terrestrial systems tend to harvest food at lower trophic levels than aquatic systems;  
... so that there is less energy loss along food chain;  
... so larger areas/volumes are necessary to produce same total harvest;  
aquatic systems tend to be less efficient at trapping/fixing solar energy;  
... due to greater reflection/absorption of light by water;  
harvesting may be more efficient/easier in terrestrial systems than marine fisheries (e.g. distance travelled by fishing vehicles);  
(inland) populations may find efficiency of terrestrial food supply more efficient in terms of convenience/transportation involved;  
inland aquacultural systems may have even greater demand on water supply than equivalent irrigated farmland;  
there is a far greater variety of producers suitable for farming/harvesting in terrestrial systems;

*Arguments for aquatic systems having greater potential:*  
aquatic systems tend to have more efficient energy conversions along food chains; ie lower respiratory losses than terrestrial systems;  
terrestrial systems require considerable inputs of water/irrigation;  
... which may deplete local resources/require energy subsidy;  
arable land is becoming limited due to increasing urbanisation/human settlement;  
global productivity of marine systems is greater than global productivity of arable land offering greater potential harvest overall;  
soils can become degraded through intensive terrestrial farming;  
... whereas marine systems tend to be more resilient/readily replenished;  
aquatic animal species tend to have higher reproductive rates than terrestrial animals;

[8 max]

*Alternative points of equivalent validity, significance and relevance to those given, should be credited.*

*Award [1 max] for an explicit and valid conclusion.*

*Note to examiners: An isolated statement e.g. “terrestrial systems show the greatest potential for food production” or an unjustified opinion e.g. “I think aquatic systems are best for food production” should not be considered as a valid conclusion. The conclusion must be **supported/justified** by points raised that must have at least addressed both sides of argument. A valid conclusion may, however, be stated within the body of the response rather than at the end, and may involve some balanced decision:*

e.g. while terrestrial systems provide the greatest potential for food production in terms of quantity, aquatic systems will make a valuable contribution to providing full dietary/feeding needs/quality; [1 max]

*Award [5 max] for responses that only explore one side of argument.*

*Otherwise, award [7 max] for marking points above, and [1 max] for a clear conclusion that is justified by points raised.*

*Expression of ideas: [2 max]*

*Total: [20]*

3. (a) Award [2 max] for factors affecting Red List status:
- population size;
  - reduction in population;
  - numbers of mature individuals;
  - geographic range/fragmentation;
  - quality of habitat;
  - area of occupancy;
  - location prone to natural disaster;
  - species characteristics (eg life-history, reproductive behaviour etc);
  - probability of extinction;

[2 max]

Award [2 max] for the following human activities appropriately linked to factors given above (eg deforestation may lead to fragmentation of larger forest populations):

- deforestation;
- harvesting/hunting;
- urbanisation/infrastructure;
- pollution;
- trade in rare species;
- introduction of non-native species;
- unfavourable climate change due to anthropogenic global warming;
- conservation/protection management;
- poor land management/fracking (leading to earthquakes/landslides);

Do not credit human impacts that not linked to specific Red List factors.  
Same human activity can be used for two factors if appropriate

[2 max]

- (b) The ecological footprint is essentially the area of land required to sustainably provide all the resources required and assimilate the wastes produced (by a population);

Technological development may decrease the EF/area of land required through...

- ...agricultural technologies for irrigation/fertilisers/pesticides increasing productivity (per unit area);
- ...increased productivity of genetically engineered crops;
- ...technology for hydroponic agriculture requiring less resources;
- ...increased energy efficiency reducing CO<sub>2</sub> waste;
- ...alternative energy sources (eg wind/solar/ etc) reducing CO<sub>2</sub> waste;
- ...hybrid/H-fuel vehicles reducing CO<sub>2</sub> waste;
- ...technology to harvest energy/recycle materials from waste;
- ...technology to capture/store C waste;

Technological development may increase the EF/area of land required through...

- ...fossil fuel dependent technology increasing CO<sub>2</sub> waste in use/production;
- ...increasing demands for resources used in manufacture of technology;
- ...pollution produced by use/manufacture of technology requiring more waste assimilation;
- ...reducing limits to population growth thereby increasing demand for resources/waste assimilation;
- ...promoting rapid turnover of technologies/consumer market that increase rate of resource consumption/waste production;

*N.B. Award credit only for those factors for which it is explicitly indicated in the context of the response whether it will lead to either an **increase** or a **decrease** of EF.*

[6 max]

- (c) *N.B. Question addresses effect of Global Warming on carrying capacity, so do not credit responses that focus on direct effects of CO<sub>2</sub> (eg ocean acidification) or other **causes** of GW.*

*Global Warming may **increase** carrying capacities due to:*

- increasing crop yields through higher temps/increased precipitation;
- melting of permafrost releasing more arable land;
- increasing available freshwater supplies through increased precipitation/ice melts;
- creating more favourable/healthy climate for some human populations;
- technological developments that mitigate its negative impacts while exploiting its benefits;
- human ingenuity has reversed major threats in the past / turned them to human advantage;
- impacts of global warming may promote environmental concern/values that lead to more sustainable lifestyles;

*Global Warming may **decrease** carrying capacities due to:*

- increasing spread of tropical diseases/pests to new regions;
- destroying coastal habitats/settlements/available land through sea rise;
- changing oceanic currents reducing productivity of fisheries;
- reducing crop yields through higher temps/reduced precipitation;

reducing available water supplies through increased evaporation/reduced precipitation;  
loss of habitats/biodiversity may deplete natural capital available to human populations;  
increasing natural hazards through extreme weather patterns/hurricanes/flooding;  
speed at which change is happening will not allow time for human populations to adapt;  
phenomenon involves positive feedback mechanisms that will increase impacts further;

*Award [1 max] for an explicit and valid conclusion.*

*Note to examiners: An isolated statement e.g. “global warming will increase carrying capacity” or an unjustified opinion e.g. “I think carrying capacity will decrease” should not be considered as a valid conclusion. The conclusion must be **supported/justified** by points raised that must have at least addressed both sides of argument. A valid conclusion may, however, be stated within the body of the response rather than at the end, and may be tenuous, involving a balance of factors and provisos, or distinguish between local and global capacities:*

*eg Global warming may lead to increase in local carrying capacities in some parts of the world, but is likely to lead to an overall decrease in global capacity;*

*[1 max]*

*Alternative points of equivalent validity, significance and relevance to those given, should be credited.*

*Award [5 max] for responses that only explore one side of argument.*

*Otherwise, award [7 max] for marking points above, and [1 max] for a clear conclusion that is justified by points raised.*

*[8 max]*

*Expression of ideas: [2 max]*

*Total: [20]*



4. (a) *Distinction [2 max]:*  
 “Goods” are marketable commodities/storages/materials/energy exploited by humans;  
 whereas “Services” are natural processes that provide a benefit to the human environment;

Do not credit purely economic understanding of services (i.e. human labour/financial input)

*Examples – Award [2 max] for an example from each column:*

<i>Goods [1 max]:</i>	<i>Services [1 max]:</i>
timber/wood; plants/animals for food; plant extracts/medicines;	vegetation/trees prevent soil erosion; absorption of CO <sub>2</sub> /carbon sink; aesthetic quality/value;

**[4 max]**

*Alternative examples of equivalent validity, significance and relevance to those given, should be credited.*

- (b) natural capital is the sum of a natural resource in a given environment;  
 natural income is the growth/increase/interest on that capital over time;  
 for resource exploitation to be sustainable, it must not reduce the potential for future exploitation;  
 ... hence natural income is a measure of (maximum) sustainable yield;  
 provided rate of harvest is below/equal to natural income/only natural income is harvested, the capital remains;  
 ... which will have potential to provide the same income in the future;  
 if harvest is greater than natural income, natural capital is reduced;  
 ...and reduction in capital will reduce potential for future harvesting/income;

*Credit may be awarded for each of these marking points if they are conveyed through use of an example eg. sustainable fishing.*

**[6 max]**

(c) Award [3 max] for general points of *distinction* between two value systems:

*Ecocentrism* gives intrinsic value to natural resources/systems;  
it argues that any exploitation must be sustainable/respect the biorights of species and landscapes;  
centralised/state management/large scale technology should be avoided in the use/extraction of resources;

*Technocentrism* claims all resources can be justifiably exploited/controlled for human benefit;  
it argues technology will provide solutions to all environmental problems / replace depleted resources;  
resource exploitation should be limited only by scientific/technological development/economic needs/benefits;

*Ecocentrism would appropriately argue to reduce or stop fossil fuel use because:*  
fossil fuels are a non-renewable resource and so cannot be exploited sustainably;  
their exploitation often leads to significant habitat destruction eg oil spills/mining;  
...this environmental impact has aesthetic/moral/spiritual implications addressed by ecocentrism;  
their use contributes to global warming – so further disturbance to natural systems/species;  
their exploitation and use involves large scale technology;  
their use tends to be managed by central state authorities rather than local communities;  
investing in fossil fuels hinders development/use of renewable alternatives;  
dependence on fossil fuels can lead to international conflicts;

*Technocentrism would appropriately argue to maintain or increase fossil fuel use because:*  
fossil fuels are still abundantly available;  
the technology is already well-developed (and developing) for their extraction;  
much of modern technology is geared toward/dependent on their use;  
they can provide significant economic benefits to countries owning the resources;  
technology is being developed for coping with environmental disturbances/oil spills etc;  
oil extraction is one of the largest capital projects providing mass employment globally;  
use of fossil fuels is essential in interim while renewable technology is being developed;  
fossil fuels have been very effective in promoting economic development;  
fossil fuels (esp natural gas) are very cost-effective sources of energy;

Award [1 max] for an explicit and valid conclusion.

Note to examiners: An isolated statement e.g. “the ecocentric approach is best” or an unjustified opinion e.g. “I’m an ecocentric, so I think this is best” should not be considered as a valid conclusion. The conclusion must be **supported/justified** by points raised that must have at least addressed both sides of argument. A valid conclusion may, however, be stated within the body of the response rather than at the end, and may suggest some combination/compromise of the two value systems:

*eg* In the short term a technocentric value system has some merit, but in the longer term ecocentric values are most appropriate in managing the use of fossil fuels;  
**[1 max]**

*Alternative points of equivalent validity, significance and relevance to those given, should be credited.*

*Wording of question does allow for other value systems than those addressed above, and these can be credited along similar lines.*

*Award [5 max] for responses that do not explicitly link to the named value systems. Wording of question does allow for other value systems than those addressed above, and these can be credited along similar lines.*

*Otherwise, award [7 max] for marking points above, and [1 max] for a clear conclusion.*

**[8 max]**

*Expression of ideas: [2 max]*

**Total: [20]**

5. (a) *Conditions for photochemical smog [2 max]:*  
local topography/valleys/lack of wind reducing dispersal of pollutants;;  
temperature inversion;  
high population density/fossil fuel use/traffic density;  
high amounts/intensity of solar radiation / sunny;

*Processes forming photochemical smog [3 max]:*  
largely photochemical reactions / reactions increased by sunlight;  
use of fossil fuels releases hydrocarbons through evaporation / nitrogen oxide/NO  
through combustion;  
emission of suspended particles catalyse photochemical reactions;  
NO reacts with oxygen to form NO<sub>2</sub>;  
Sunlight promotes the formation of O atoms from NO<sub>2</sub>;  
... that combine with O<sub>2</sub> to form ozone (the main secondary pollutant in  
photochemical smog);  
hydrocarbons react with NO<sub>2</sub>, O<sub>2</sub> and light to form aldehydes & PAN;

[4 max]

- (b) *Award 1 max for distinguishing biotic indices and direct methods.*  
biotic indices measure the quality of ecosystem rather than quantity of pollutant /  
biotic indices are dependent on the tolerance/diversity/abundance of organisms,  
not concentration/toxicity/identity of pollutant;

*They are advantageous in that:*  
they measure the widespread effects/impacts of pollutants on the system;  
...which is more significant than the quantity/concentration/nature of the  
pollutant;  
they are specific to the characteristics of a given habitat;  
they will address the combined/integrated impact of many pollutants/human  
activities;  
Avoids use of expensive instrumentation;

*They are disadvantageous in that:*  
they do not identify the specific pollutants;  
... leaving the possible source of pollution unclear;  
the quality of a given community may vary for reasons other than pollution /  
initial quality may not be known;  
may require counting/identification of organisms which are difficult to  
collect/identify (eg lichen, invertebrates) / prone to human error;

[6 max]

*Award [4 max] for responses that give only advantages, or only disadvantages.*

- (c) **Level of “producing”**. Award [1 max] for outlining such management: relevant to acid rain:

Eg management can be applied at level of producing by reducing use of fossil fuels/ switching to alternative energy sources;

*political advantages/disadvantages:*

it may not be popular to impose limits on use of fossil fuels in certain societies;  
but it does address root cause of problem;  
and political factors have the advantage of generating laws/incentives;  
in democratic societies such management may have strong influence on voting/political support;  
may gain international support for an issue that often crosses national boundaries;

*economic advantages/disadvantages:*

it may be very costly to switch to alternative energy sources;  
could be long-term economic benefit in this for countries importing fuel;  
would be economically beneficial in context of international C-trading;  
may gain volunteer support from community/NGOs that make management more cost effective;

**Level of “impact”**. Award [1 max] for outlining such management:

Eg. management can be applied at level of impact by liming of water bodies/ restoration of natural communities;

*political advantages/disadvantages:*

it may be popular because it allows use of fossil fuels to continue;  
and restores aesthetic qualities of environment;  
but may conflict with the increasing “green”/ecocentric sector of many societies;

*economic advantages/disadvantages:*

avoids cost of switching from fossil fuel technologies;  
liming and restoration may be very costly;  
could be mitigating benefits eg sustainable goods/services of restored systems;  
provides for environmental projects attractive to local community/NGO voluntary support;

[8 max]

*Alternative points of equivalent validity, significance and relevance to those given, should be credited.*

*Award [5 max] for responses that address only one level of management, or only political, or only economic, factors.*

*Expression of ideas: [2 max]*

*Total: [20]*