

# Markscheme

**May 2021**

**Environmental systems and societies**

**Standard level**

**Paper 1**

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**Subject details: Environmental systems and societies SLP1 markscheme****Mark allocation**

Candidates are required to answer **ALL** questions. Total = **[35]**.

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 **OWTTE** (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.

1. (a) taiga/boreal; [1]  
(b) logging/forestry/timber/lumbering; [1]

2. higher temperatures in taiga which contribute to more plant growth/photosynthesis / lower temperatures in tundra which restrict photosynthesis/plant growth; more sunlight in taiga contributes to more plant growth/photosynthesis/longer growing season / fewer hours of sunlight in tundra which restricts photosynthesis/plant growth/contributes to shorter growing season in tundra; [2 max]

*Do not accept only 'more precipitation/higher temperatures/more sunlight in taiga results in greater productivity/biomass'.*

*Do not accept 'low temperatures in tundra make it more difficult for plants to survive / plants are adapted to warmer conditions'.*

*Do not accept more sunlight/rainfall increases nutrients for plant productivity.*

*Do not accept 'growth of organisms/species' instead of 'growth of plants'.*

3. the yaranga uses fewer materials/resources/wood to construct than a modern city house;  
the yaranga is made of entirely renewable materials, (the city house is not);  
all yaranga materials are biodegradable/naturally recyclable, (some city house materials are not);  
the city house has associated infrastructure roads/utility supplies etc, the yaranga does not;  
production of concrete used in city house produces waste and chemical pollution;  
the yaranga is mobile so no permanent destruction of habitat, (city house is not);  
yaranga has smaller size;  
yaranga is made from local materials, therefore less energy used in transport;  
yaranga is made from local materials that are used sustainably;  
yaranga may be better insulated/less heat loss; [1 max]

*Do not accept only 'yaranga has a smaller ecological footprint'.*

*Do not accept only 'yaranga made of wood/local/natural materials'.*

*Do not accept only 'modern city houses use concrete/bricks/ man-made materials'.*

*For credit a reason much be given to why the materials used are more/less sustainable.*

4. (a) introduction of scrubbers / use of pollution reduction equipment / reduced use of smelters / cleaner energy source / stricter legislation on emissions / use of a lower-sulphur ore/coal;

[1]

*Do not accept 'opening of third/new smelter'.*

*Do not accept 'closure of smelters / control/limit number of smelters'.*

*Do not accept 'only reduction in mining activity'.*

*Do not accept use of 'catalytic converters'.*

*Do not accept only 'a reduction in use of fossil fuels'.*

- (b) prevailing/NW winds carry pollutants / winds drive acid deposition/particulates towards SE;  
dilution effect of pollutants by wind / concentration of particulates declines with distance away from the source;  
acid deposition declines with distance away from the source / acid deposition is greatest near the source of pollution;  
higher concentration of pollutants corresponds to a greater level of damage;  
transport/deposition rates dependent on nature of particulates;  
different pollutants produce different damaging effects;  
wind is funnelled along valleys (indicated by lakes) ...;  
...therefore pollutants carried along valleys...;  
water in rivers/lakes spreads the pollutants;

[3 max]

*Do not credit descriptions of the vegetation damage.*

5. (a) identify sampling sites upstream **and** downstream of plant/town / sample before **and** after effluent is released;  
sample invertebrate populations / eg using kick samples/nets;  
identify and count numbers of each species;  
determine the absence/presence of indicator species;  
calculate from this data the biotic index for each site / eg use BMWP/Simpson's Diversity Index/Trent Biotic Index;  
repeat sampling throughout the year;

[3 max]

*Do not accept 'use of fish'.*

*Do not accept only 'measure biodiversity'.*

- (b) (i) measures actual impact on living organisms/ecosystem;  
can see if pollution has occurred in the past/in the lifespan of the indicator species even if the water is clean now;  
records seasonal changes in the impact of pollutants;  
does not require complex chemical analysis;  
does not require expensive equipment / is relatively cheap;

[1]

*Do not accept 'using a biotic index is quicker than measuring pollutants directly'.*

*Do not accept 'provides a numerical value for the level of pollution'.*

*Do not accept 'can be used as a reference for future monitoring'.*

- (ii) does not identify pollutant causing impacts / does not measure the level of the actual pollutant;  
does not directly measure the level of pollution;  
does not help identify source responsible for impacts;  
inaccurate as populations change naturally (during the season) / impacts could be due to natural changes in environment/other factors;  
requires knowledge of/ability in identification of organisms for area;  
requires existence of identification keys;

[1]

*Do not accept only 'it is not exact/precise'.*

*Do not accept 'method kills organisms'.*

6. (a) provides habitat for animals/birds;  
(photosynthesis) acts as a carbon sink/absorbs CO<sub>2</sub> reducing greenhouse emissions;  
(photosynthesis) releases O<sub>2</sub> necessary for living organisms;  
filters water / maintains water table;  
cools/moistens climate through evapotranspiration / source of moisture for precipitation;  
vegetation prevents soil erosion;  
increases/maintains biodiversity (increasing/maintaining resilience of biosphere);  
pollination of plants/crops; **[1 max]**

*Do not accept only 'photosynthesis'.  
Do not accept provision of goods eg timber/food.  
Do not accept cultural, intrinsic or aesthetical benefits eg spiritual/tourism/recreation.  
For credit response must focus on ecological service/function.*

(b)  $\left( \left( \frac{34\,962}{57\,690} \right) \times 100 \right) = 60.6\% / 61\%;$  **[1]**

*Note: Units are not required for credit.*

- (c) removing vegetation increases CO<sub>2</sub> levels in atmosphere which promotes global warming / deforestation increases melting of permafrost which releases CO<sub>2</sub> and CH<sub>4</sub> which promotes global warming;  
increased CO<sub>2</sub> levels lead to ocean acidification (reduction in ocean pH) / carbon stores within oceans increase;  
ocean acidification causes the bleaching of corals/corrosion of shells/loss of marine species/diversity;  
global warming/higher temperatures cause thermal expansion which raises sea levels;  
global warming/higher temperatures cause the melting of glaciers which raises sea levels;  
higher sea water temperature causes bleaching of corals/loss of breeding grounds for marine organisms/loss of marine species;  
deforestation leads to an increase in surface runoff which raises sea levels;  
increase in freshwater input results in a reduction in seawater salinity;  
reduction in forest cover so more soil erosion (by rain), leading to sediment input to the ocean / roots no longer hold soil in place which results in soil erosion, leading to sediment input into the ocean;  
warmer waters can lead to a reduction in oxygen levels within the oceans;  
lower oxygen levels within the oceans can reduce biodiversity; **[3 max]**

*Do not accept 'the transport/exportation of timber causes ocean pollution'.  
Do not accept only 'global warming causes sea-level rise'.  
Do not accept that deforestation causes an increase in nutrient run-off that causes eutrophication (taiga soils are nutrient poor).  
Do not accept 'climate change' instead of the term 'global warming'.  
Accept other reasonable responses.*

- (d) nutrient poor soils / low temperature / low rainfall / limited growing season / limited amount of sunlight / slow growth rates / permafrost inhibits plant growth; **[1]**

*Do not accept 'wildfires / grazers/animals eat the plants/seedlings'.  
Do not accept just 'temperature/rainfall/soil fertility/time it takes for trees to grow/long mature time for trees'.*

7. (a) it is likely to lead to an increase in its prey populations/  
reindeer/hare/wolves/lemming/boar;  
...which in turn may lead to decreases in their prey/food  
populations/hares/reindeer/lemming/plants/larch/wheatgrass/bearberry;  
...causing fluctuations in population size/instability/reduced resilience throughout  
web;

[2 max]

*Do not accept 'collapse in food chain'.*

- (b) smaller population will reduce its gene pool/genetic diversity;  
...reducing its resilience / making it more vulnerable/less adaptable to changes in  
environment/disease/resource availability;  
harder to find a mate / reduce successful pairing/mating/reproduction/favourable  
gender ratios;  
increase rarity in tiger population may result in an increase in demand/market/trade value  
(increasing probability of extinction);

[2 max]

*Do not accept 'tigers do not reproduce fast'.*

8. the ban on hunting was followed by a small/triple increase in tiger population;  
...but Figure 8(e) shows poaching continued well beyond this / was still recorded until  
2005;  
the ban on trade/CITES convention was followed by very significant increase in tiger  
population;  
use of tagging and reserves showed little further increase in tiger population;  
but population was already increased before reserves were introduced / reserves may  
have helped maintain higher populations;  
the rate of increase has slowed, suggesting tigers have reached a carrying capacity;

*Conclusion: eg overall, the ban on trade seems the most successful over this period /  
the ban on hunting was the least successful;  
overall these measures have been successful since tiger numbers have increased  
during this period (from 50 to 500 between 1940 and 2009);*

[3 max]

*Note: Must include strength, weakness and conclusion for [3] marks.  
Award [2 max] if no conclusion provided.*



9. habitat will become less fragmented by the roads;  
reduced fragmentation may allow access to important resources, eg food/water / removal  
allows for regeneration of tiger habitat through succession;  
populations will be less isolated improving gene pool/diversity/resilience;  
reduces noise/disturbance/stress/pollution associated with roads/traffic;  
reduces mortality through road kill;  
makes habitats less accessible to human disturbance/poaching / it could reduce contact between  
tigers and humans which could result in fewer tigers being killed//poached; **[2 max]**

*Do not accept 'habitat size is increased / results in a larger habitat / there is more  
vegetation for prey'.*

*Do not accept only 'population is less accessible'.*

*Do not accept only 'poaching is more difficult/harder' without reason.*

*Do not accept 'tigers are better able to hide'.*

**10. Arguments that support addressing issue at global level [4 max]:**

- many of the issues generate global impacts / affect ecological services to whole planet;
- eg deforestation affects climate change / widely different ecosystems, eg oceans / trees are exported around the world, making deforestation in Siberia part of the global/importing countries ecological footprint;
- loss of habitats/local species eg tiger affect global biodiversity;
- it is a moral duty/responsibility of humans to conserve species/biodiversity globally;
- local habitats/populations are quite small/vulnerable/less resilient and so more easily lost;
- many of the impacts are stimulated by global markets/economies/demands;
- ie international demand for goods, eg timber/tiger parts/fossil fuels/metals;
- so international management is required because source/impact of problem is international;
- experts from around the world can collaborate to help tackle issues/plan for sustainable development;
- countries can help each other with resources/expertise;
- at global level there is more access to funds to implement strategies;
- countries need to collaborate to avoid tragedy of the commons, eg climate change;

**Arguments that support addressing issue at local level [4 max]:**

- some issues are more localized, eg acid deposition / cause and effect of acid deposition is local / discharge of effluent affects local river quality/biodiversity;
- implementation and enforcement needs to be done at a local level/on the ground (eg policing of poachers/reduction in emissions of NO<sub>x</sub>/SO<sub>2</sub>/CO);
- most management strategies are more successful when they engage local support / decisions at global level may not take into account local customs/needs/knowledge and alienate local people;
- at a global level it is more difficult to get everyone to agree/take action;

**Conclusion/opinion [1 max]:** eg “due to the interconnected nature of environmental systems, action needs to be taken at a global level eg through international agreements, however these then need to be implemented at a local level to be successful”;

**[6 max]**

*Note: An isolated statement/opinion, eg “Environmental issues are best addressed at a global level” should not be considered as a valid conclusion/opinion without supporting evidence.*

*Award [5 max] if there is no conclusion/opinion.*

*Accept other reasonable responses supported by information in the resource booklet.*

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