

# Markscheme

**May 2025**

**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
- The maximum total = **[35]**.

1. Environmental systems and societies uses marking points and markbands (only Paper 2) to determine the achievement of candidates

*When using marking points:*

- i. A markscheme often has more marking points than the total allows. This is intentional
  - ii. Each marking point has a separate line and the end is shown by means of a semi-colon (;)
  - iii. 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**
  - iv. The order of marking points does not have to be as in the markscheme, unless stated otherwise.
2. An alternative answer or wording is indicated in the markscheme by a slash (/). Either wording can be accepted.
  3. Words in brackets ( ) in the markscheme are not necessary to gain the mark.
  4. Words that are underlined are essential for the mark.
  5. 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).
  6. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
  7. 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.
  8. Do **not** penalize candidates for errors in units or significant figures, **unless** it is specifically referred to in the markscheme.

1. With reference to **Figure 1(b)**, identify which type of vegetation is found on the South Island but not on the North Island. [1]

Temperate broadleaf forest;

2. (a) Outline why 100 % of reptile, frog and bat species are unique to New Zealand, shown in **Figure 2(b)**. [2]

- a. The land mass of New Zealand has been separated from other land masses for a long period;
- b. Geographical separation has caused isolation of species/prevented migration/exchange of genetic information/allopatric speciation;
- c. Natural selection has contributed to evolution of new species/speciation/species have adapted to suit the environment;
- d. These species have evolved independently/in isolation/conform to the theory of island biogeography;
- e. Limited resources on the island required specialization to reduce competition;

**Note to examiners:** Do not accept “New Zealand is an isolated/geographically isolated system” without explanation.

- (b) With reference to **Figure 2(c)**, identify the group of species which has the highest percentage in the ‘not threatened’ category. [1]

(vascular) plants;

- (c) Outline **two** ways in which climate change may impact the reptile populations in New Zealand. [2]

- a. Move further to the south/higher up (altitude) to maintain appropriate temperature band;
- b. Extreme high/low temperatures may cause death/increase threat to species extinction;
- c. Habitat loss reducing space and resources/reduction in geographical range;
- d. A warming atmosphere would reduce water availability for reptiles;
- e. Difficult to regulate body temperature (ectothermic)/changing temperature can influence the sex of offspring/may lead to egg development issues;
- f. Climate change may alter prey numbers/food availability resulting in reduced/increased food sources and risk of death (for higher trophic levels);
- g. Climate change may increase invasive species which out compete/prey on specific species reducing their numbers;
- h. Climate change may contribute to increase (range of) pathogens which kill reptile species;
- i. Climate change may increase risk of wildfires/floods which kill individuals and increase risk of their extinction;
- j. Some species may adapt to changing climate conditions (leading to speciation over time);
- k. Climate change may increase global temperatures that could increase plant productivity, which would make more food available for many reptiles/prey.

**Note to examiners:** Do not accept links to sea level rise impacting reptile populations

3. (a) State **one** way different species of kiwi could be identified. [1]

- a. Using DNA/protein analysis;
- b. Using dichotomous (identification) key/species identification apps;
- c. Looking at differences in physical traits (spots/colour)/behaviour;
- d. Looking at differences in habitat/location/distribution/area of habitation;

**Note to examiners:** Do not accept “location” without link to differences.

(b) Outline **one** advantage of using kiwi as a flagship species. [1]

- a. Charismatic species that is well recognised/represents iconic symbol for the country/national bird (icon) of New Zealand;
- b. Conservation efforts will help protect other species in the same region;
- c. Can be used to raise funds for conservation;
- d. Raises cultural awareness for the indigenous people of NZ (Maori);

(c) With reference to **Figure 3(c)**, calculate the percentage decrease in the number of Southern brown kiwi between 2008 and 2018. [1]

$$(29\,800 - 24\,850 / 29\,800 \times 100 =) 16.61, 16.6, 17$$

**Note to examiners:** Accept correct answer with minus sign.

(d) Evaluate the strategy used to conserve kiwi species.

[3]

**Pros [2 max]:**

- a. Population of Little spotted kiwi/Okarito/two species of kiwi are increasing suggesting program is having a positive impact;
- b. Predator eradication/control programme also benefits other native/endemic species/provides safer habitat for kiwis;
- c. Working together with a large range of stakeholders (eg local groups/volunteers/government groups/NGOs), provides ownership of the project and increases its chances of success;
- d. Sanctuaries can provide a safe/protected place for kiwi populations;
- e. Operation Nest Egg (ONE) has increased success rates of Okarito/one species of kiwi birds reaching adulthood from the egg stage;
- f. Program adopts a variety of approaches increasing its chances of success;

**Cons [2 max]:**

- g. Program does not address habitat loss/deforestation;
- h. Populations are fragmented/isolated limiting the gene pool/genetic diversity and this is not being addressed by current conservation efforts;
- i. Population of North Island brown kiwi/Great spotted kiwi/Southern brown kiwi are decreasing suggesting the program is not successful;
- j. Control/removal of predators may impact other species adversely;
- k. Removal/killing of predators could be considered ethically wrong;
- l. This intervention program is very expensive/costly;
- m. Successful breeding (e.g. ONE project) appears to be highly dependent on intervention by humans/has only been successful for Okarito kiwi birds;

**Note to examiners:** Do not accept responses that refer to the difficulties of reintroduction of kiwi into the wild (ONE project).

**Note to examiners:** Conclusion [1 max] needs to be balanced considering both sides of the argument for credit and makes a clear value judgement e.g. Although Operation Nest Egg has increased the survival rates of the Okarito kiwi and contributed to an increase in its overall population, populations of other kiwi birds such as the North Island brown kiwi are still declining hence the strategy cannot be considered entirely successful./ has only been successful

*Conclusion is not mandatory and 3 marks can be achieved through consideration of both cons and pros.*

4. Describe an impact of the change in forest cover shown in Figure 4 on the hydrological system. [1]
- a. With less trees, less interception of rainfall and increased surface run-off/risk of flooding;
  - b. With less trees, increase risk of water causing soil erosion and increasing input of sediments/nutrients into water courses/rivers/coastal waters;
  - c. With less trees/plants, less interception of rainfall and therefore less infiltration into groundwater/reduces groundwater storage;
  - d. With less trees, less evapotranspiration, decreasing water vapour in atmosphere;
  - e. Fewer trees/plants so less organic matter in soil, so water retention lowered;
  - f. With less trees, there will be less moisture in the air, less rainfall, leading to dry soil/alteration of the water cycle;
  - g. With less trees, there will be an increase in evaporation directly from the soil causing the soil to dry out;

5. (a) Suggest **one** possible reason why the number of sheep farmed in the Canterbury region has changed as shown in **Figure 5(d)(i)**. [1]
- a. Sheep numbers have decreased because value of lamb/mutton/meat/wool has declined/sheep numbers have fallen because it is less profitable to farm sheep;
  - b. Farmers may want to switch to other types of more profitable farming (e.g. cattle/arable/forestry) resulting in the decline in sheep being farmed;
  - c. Farmers may want to diversify to improve resilience to changes in global market/climate change resulting in decline in sheep farming;
  - d. Possible change in agricultural subsidies;
  - e. Changes in cultural attitudes towards lamb/mutton consumption/increase in vegetarian/vegan diets causing less demand for lamb/mutton;

**Note to examiners:** Award mark only if associated with a decline in the number of sheep farmed.

- (b) Explain how the change in cattle numbers since 1990 shown in **Figure 5(d)(ii)** may impact soil properties. [2]
- a. Increase in cattle number can increase compaction of the soil (via trampling);
  - b. Compaction of soil reduces soil porosity/infiltration rates/plant coverage which removes nutrients from the soil;
  - c. Movement of cattle hooves can help to aerate the soil/increase porosity of the soil;
  - d. Increase in waste/manure from cattle can increase organic matter/nutrients of the soil;
  - e. Continual grazing of grass removes nutrients/soil carbon/nitrogen compounds from the soil/removes the O horizon from the soil (leading to erosion);
  - f. Increased grazing can lead to barren areas of soil contributing to soil erosion (by wind/water which degrades the soil);

**Note to examiners:** Response must be linked to an increase in cattle.

- (c) Outline a possible impact of growing wheat and barley on soils in the Canterbury Plains. [1]
- a. Use of pesticides may result in accumulation of metals/toxic substances within the soil;
  - b. Pesticides may kill/cause loss of biodiversity of/organisms (soil invertebrates, soil micro-organisms) within the soil;
  - c. Monoculture/intensive farming may result in loss/leaching of soil nutrients/minerals/fertility;
  - d. Monocultures are more vulnerable to a disease/pest threat;
  - e. Excessive irrigation may lead to soil salination;
  - f. Tillage of the soil can lead to soil erosion (by wind/water);
  - g. (The added coverage) decreases the level of wind/water erosion in the plains;
  - h. Use of chemical fertilizers increases soil productivity;
  - i. Use of chemical fertilizers can lead to soil acidification/reduction in natural nutrients and organic matter;
- (d) Describe **two** conservation strategies that could be used to prevent soil degradation from farming in the Canterbury Plains. [2]
- a. Use of crop rotation to prevent exhaustion of specific nutrients/minerals from the soil /use of crop rotation to prevent build-up of specific pests in the soil;
  - b. Allowing fields to go fallow/rest/not getting planted/grazed to recover for a year;
  - c. No-till technique to reduce soil erosion;
  - d. Limited use of pesticides/herbicides/fungicides to prevent build up in soil/effect on soil organisms;
  - e. Use of integrated pest management (IPM)/encouraging natural predators to limit use of pesticides;
  - f. Use of wind reduction techniques eg wind breaks/shelter beds to limit soil erosion/ use of terracing/contour ploughing/strip cultivation to limit soil erosion;
  - g. Use of fencing to restrict/control movement/implement nomadic grazing of animals to avoid over grazing leading to soil degradation;
  - h. Avoid continuous use of heavy machinery which compacts the soil;
  - i. Avoid cultivating marginal lands (which cannot support farming) which can cause desertification;
  - j. Use of agroforestry/mixed cropping/use of cover crops/polyculture farming to maintain nutrients/prevent soil erosion;
  - k. Reduce the use of inorganic fertilizers to prevent soil salinization;
  - l. Use of drip irrigation/improved irrigation to prevent runoff but still support productivity;

6. (a) With reference to **Figure 6**, calculate the crude death rate (CDR) per 1000 people for the year 2022. [1]

(38 574 / 5 157 100 × 1000 =) 7.48; 7.5 (/1000/year);

**Note to examiners:** Do not accept improper rounding/no rounding.

- (b) Outline how the total fertility rate of New Zealand shown in **Figure 6** will influence its future population. [1]
- a. Value/TFR (1.66) is below population replacement levels/needed to sustain population levels;
  - b. Will lead to long-term population decline;
  - c. Will lead to less working population to support elderly population/a smaller working population will be supporting a higher non-working/retired population;
  - d. This will require immigration of workforce/younger working-age people;

7. (a) State the name of **one** greenhouse gas produced by dairy cattle. [1]

Methane (CH<sub>4</sub>) / carbon dioxide (CO<sub>2</sub>);

- (b) With reference to **Figure 7(c)**, identify which sector is predicted to reduce its energy use between 2020 and 2050. [1]

Transport;

- (c) With reference to **Figures 7(a), 7(b) and 7(c)**, evaluate New Zealand's approach to mitigating climate change.

**[4]**

**Pros [3 max]:**

- a. New Zealand aims to reduce overall energy consumption which could reduce use of fossil fuels/GHG/carbon emissions;
- b. New Zealand aims to increase use of renewable energy and reduce use of fossil fuels reducing GHG/carbon emissions;
- c. New Zealand aims to reduce GHG/carbon emissions from transport by using electricity generated from renewable sources (instead of fossil fuels);
- d. Improving energy efficiency can reduce the amount of fossil fuels used and associated GHG/carbon emissions;
- e. Carbon emissions trading schemes (ETS) can encourage industry to reduce their GHG/carbon emissions (by changing practices/behaviour);

**Note to examiners:** Do not accept "aim to reach net zero by 2050" without a clear approach.

**Cons [3 max]:**

- f. Making pledges to reduce carbon emissions/GHG emissions/become carbon neutral is not always followed by appropriate action;
- g. Main source of GHG is agriculture which does not appear to be addressed/tackled;
- h. Electricity only contributes 5.7 % of GHG emissions and therefore sourcing all electricity from renewable sources will not have a significant overall impact to emissions;
- i. Production of biofuel may compete with the growing of food and cause problems with cost/availability of some foods;
- j. Cost of changing over to renewable energy can be costly/it can be expensive for industry to change technology to reduce emissions;
- k. Fossil fuels will continue to be used in 2050 resulting in GHG/carbon emissions;
- l. Some industries may buy more permits to continue emitting the same levels of GHGs/some industries may find it cheaper to pay fines than makes changes to reduce emissions;

**Note to examiners:** Conclusion [1 max] needs to be balanced considering both sides of the argument for credit and makes a clear value judgement e.g: although ETS can help encourage to use methods which produce less GHG emissions, some may be prepared to pay for more permits rather than reduce their emissions and therefore having little/no effect;

Conclusion is not mandatory and 4 marks can be achieved through consideration of both cons and pros.

8. (a) Suggest **one** possible reason for why the biocapacity of New Zealand has changed between 1961 and 2022, as shown in **Figure 8**. [1]
- a. clearing of productive land/deforestation for building homes/urbanisation/industry/infrastructure expansion/roads/mining/logging (wood harvesting);
  - b. degradation of productive land/forest by pollution;
  - c. deforestation due to intensive farming;
  - d. loss of productive land/forest due to wildfires;
  - e. increase in the production of waste/increase in industrialization/increase in the emissions of GHGs from burning fossil fuels.
- (b) Outline a reason why the ecological footprint of New Zealand has changed between 1961 and 2022, as shown in **Figure 8**. [1]
- a. EF has declined due to reduction in consumption of goods/materials/extraction of virgin materials/fossil fuels;
  - b. EF has declined due to reduction in waste production due to waste minimization/recycling materials/reusing materials;
  - c. EF has declined due to reduction in pollution/CO<sub>2</sub> emissions due to more efficient manufacture methods/transport/more stringent legislation/reduction in use of fossil fuels/incorporation of more sustainable agricultural practices;
  - d. EF has declined due to an increase in renewable energy sources;
  - e. EF has declined due to people switching to diets with a lower impact on GHG emissions;

9. With reference to the information in the resource booklet, to what extent is New Zealand managing its resources sustainably?

[6]

**Pros [4 max]:**

- a. There are various schemes/approaches/investments in protecting the species/kiwi which is helping increase population numbers;
- b. EF is below biocapacity and therefore is sustainable;
- c. Farming produces enough food for New Zealand's population as well as for exports;
- d. New Zealand is aiming to replace a significant proportion of fossil fuel, a finite resource, with renewable energy sources/replacement of fossil fuels with renewable energy sources will reduce GHG emissions;
- e. Established sanctuaries for conservation of wildlife/kiwi in partnership with NGOs/groups of local volunteers;
- f. Policies/legislation/Paris 2015 Agreement/ETS in place to reduce GHG emissions/achieve net zero by 2050;

**Note to examiners:** *Accept any other reasonable response that connects EF to supporting sustainable examples.*

**Cons [4 max]:**

- g. The large number of species under threat of extinction suggests that New Zealand is not managing its resources well;
- h. Despite human intervention some species numbers continue to decline;
- i. Protected kiwi populations are in decline due to habitat loss/habitat fragmentation/invasive predators;
- j. Large scale deforestation has occurred leading to loss of habitats/carbon sinks/resources;
- k. Intensive agriculture uses fertilizers which can cause run-off into rivers causing eutrophication;
- l. Intensive agriculture uses pesticides which may kill non-target species/cause accumulation in soils/biota;
- m. Intensive agriculture uses machinery that combusts fossil fuels increasing GHG emissions;
- n. Intensive agriculture with monoculture (of wheat and barley) leads to nutrient-depleted soil;
- o. Large number of livestock/cattle/sheep contributes significantly to GHG emissions;
- p. Intensive farming can use large amounts of water leading to low river levels having a detrimental effect on river biota/other species;
- q. The biocapacity is declining and in the future could be less than the EF which is not sustainable;
- r. Fertility rate is below the replacement level and thus population will be declining/unsustainable;
- s. Many exported agricultural products need to be transported long distances increasing food miles and carbon footprint;
- t. Production of biofuel is projected to increase by 2050, which may compete with the growing of food and cause problems with cost/availability of some foods;
- u. Projections for 2050 estimate that gas and coal will still be used as sources of energy;

**Note to examiners:** *Award [5 max] for both pros and cons.*

**Conclusion [1 max]**

For example: EF is currently below biocapacity which is sustainable but if the trend in the decline of biocapacity continues, it will become less than the EF which is not sustainable and hence indicates that New Zealand is not currently managing its resources sustainably;

*A valid conclusion should be credited if it is explicit, balanced (addresses both sides of the argument) supported by evidence and makes a clear value judgement. Do not credit the conclusion if only one side of the argument has been considered within the overall response.*

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

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