

# 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(c)**, identify **one** type of vegetation that is found on the North Island but not on the South Island but not on the South Island. [1]

Subtropical rainforest/shrub steppe;

*Do not accept only “rainforest/subtropical forest/steppe/shrub”.*  
*Only mark the first response if more than one answer is given.*

2. (a) Outline two factors that may have contributed to the large number of species only found within New Zealand. [2]

- a. Geographical isolation/isolation from other land masses (leading to speciation);
- b. Process of natural selection/evolution/species evolve (leading to speciation);
- c. Diverse geographical conditions / variation in altitude / variation in presence of water;
- d. Diverse climate allowing for development of different habitats/ecosystems/biomes / presence of different habitats/ecosystems/biomes (lead to large variety of species);
- e. Adaptive radiation to the distinctive New Zealand environment (e.g. complete absence of indigenous terrestrial ground predators);

*Do not accept only “species have adapted to absence of terrestrial predators”.*  
*Do not accept reference to only one biome e.g. rainforest.*  
*Do not accept only “different types of vegetation”.*

- (b) With reference to **Figure 2(c)**, identify the group of species most ‘at risk of becoming threatened’. [1]

Reptiles;

*Only mark the first response if more than one answer is given.*

- (c) Suggest **one** reason why there is insufficient data available to categorise the conservation status of a large proportion of marine mammals, as shown in **Figure 2(c)**. [1]

- a. Lack of expertise / lack of technology for underwater research;
- b. Lack of existing relevant keys/identification resources;
- c. Difficulty in identifying/sampling species in the water (due to turbidity /reduced visibility);
- d. Species can be difficult to find in deep water / difficult to find species hiding on seabed/under rocks/within vegetation;
- e. Large size of oceans so difficult to explore;
- f. Species migrate making them difficult to find at certain times of the year / species are motile moving from one location to another and therefore difficult to identify;
- g. Insufficient human resources;

*Do not accept only “difficult to access the water” or “some areas are inaccessible”.*  
*Do not accept “difficult to explore/find” without giving reason.*  
*Do not accept only “migration”.*

3. (a) State **one** factor which could have contributed to the Black stilt being classified as ‘critically endangered’ on the IUCN Red List. [1]
- a. Low population numbers / low population size / low number of mature individuals;
  - b. Reduction in population size;
  - c. Low distribution / limited/decreased geographical range / low number of locations species is found;
  - d. High/increased degree of fragmentation / high fragmentation of distribution;
  - e. Reduced quality of habitat / loss of habitat / habitat degradation;
  - f. High/increased probability/risk of extinction;

*Do not accept only “population size”.*

*Do not accept “low population density”.*

*Do not accept “human interference/disturbance/hunting/introduced predator”.*

- (b) With reference to Figure 3(b), calculate the percentage increase in the number of Black stilt from 1981 to 2023 [1]

578 / 578.26 / 578.3 (%);

*Note: The working out:  $((156 - 23) / 23) \times 100$  is not required for the mark.*

*Do not accept incorrect rounding of the answer.*

(c) Evaluate the management strategy used to conserve the Black stilt.

[3]

**Pros [2 max]:**

- a. Strategy is successful because the population has increased (since 1981 when there were only 23 birds) / large number of hatchlings survive when raised in captivity;
- b. Predator eradication programme also benefits other (native/endemic) species;
- c. Habitat restoration (of the Waitaki Basin) benefits other (native/endemic) species / restoration of wetland will help with flood mitigation;
- d. Strategy adopts a variety of approaches increasing its chances of success;
- e. Whilst birds are in captivity it allows for research/education activities / strategy adopted allows for opportunities for increase revenue from tourism;

**Cons [2 max]:**

- f. The small number of Black stilt (23 in 1981) has resulted in a small gene pool which can result in increase in genetic disorders/low breeding rates/reduced fertility/decrease in resilience;
- g. Removal of predators may impact other species adversely / removal of predators may disrupt the ecosystem;
- h. Removal/killing of predators could be considered ethically wrong;
- i. Separation of eggs/young from parent could be considered ethically wrong;
- j. This intervention program is very expensive/costly;
- k. Successful incubation of eggs/rearing of young appears to be highly dependent on intervention by humans;
- l. Birds raised in captivity may struggle to survive when released into the wild;
- m. Increase in Black stilt may decrease its prey species (which disrupts the ecosystem);
- n. Maintenance of predator free areas is difficult to achieve/enforce;
- o. Restoration of habitats may take a long time to achieve;

*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 the number of Black stilts has increased over time, predators continue to be a threat to the eggs limiting growth of the population without continuing human intervention;*

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

*Do not accept factors that cause predators to die.*

4. Describe two ecological impacts of the change in forest cover in New Zealand as shown in Figure 4. [2]
- a. Reduction in trees results in less primary productivity/loss of habitat/loss of food for some species;
  - b. \*Loss of habitat/food source for some species results in reduction in population/species/biodiversity;
  - c. Loss of trees/root systems can lead to soil erosion;
  - d. Removal of forests can result in reduction in organic matter in soils;
  - e. Loss of forest can cause habitat fragmentation/isolation;
  - f. \*Habitat fragmentation/isolation can limit gene flow;
  - g. Loss of trees/deforestation results in reduced carbon sequestration;
  - h. Loss of trees could change microclimate resulting in reduced rainfall;
  - i. Loss of trees can lead to increase in flooding/landslides;

**Note to examiners:** *With the exception of marking points \*b and \*f, for credit it must be recognized that there has been a loss of trees at least once in the overall response. E.g. do not accept only “loss of carbon sink/sequestration”.*

*Do not accept “deforestation” only without description of an ecological impact.*

*Do not accept “loss of habitat results in reduction of species niche”.*

*Do not accept only “loss of habitat/biodiversity”.*

*Accept other reasonable responses.*

5. (a) Explain three ways farming within the Canterbury Plains could impact nearby rivers. [3]
- a. Water abstracted for irrigation from rivers could lead to a reduction in river flow;
  - b. Pesticides used in farming may enter rivers may bioaccumulate within organisms/resulting in death of fish/invertebrates;
  - c. Fertilizers applied to land may enter rivers causing eutrophication;
  - d. Run off manure/organic matter into the rivers can result in a reduction in oxygen due to decomposition;
  - e. Cattle-rearing may result in nutrients (from manure/faeces/urine) entering rivers causing eutrophication;
  - f. Cattle-rearing may result in sediments (from manure) entering rivers, increasing turbidity/reducing clarity of the water;
  - g. Cattle-rearing may result in an increase in sediments (from manure) entering rivers that smother/kill riverbed organisms;
  - h. Presence of cattle may increase microscopic pathogens (from manure) entering rivers;
  - i. Presence of cattle may cause trampling along riverbanks increasing erosion and sediment loading into rivers (and reducing overall water quality) / overgrazing may lead to soil prone to erosion which increases silting/turbidity/sedimentation in the river / overgrazing may increase soil degradation/compaction and lead to increase in surface runoff entering the river;
  - j. Ploughing of soils/harvesting could contribute to soil erosion and sediment loading into rivers;
  - k. Use of heavy machinery in farming can compact the soil leading to an increase in surface run-off entering the river;

*For credit reference must be made to the impact on the river.*

*Do not credit responses that refer to impacts on lakes/oceans or acid rain.*

*Do not accept “pollutants” only without an explanation of how the pollutant is linked to farming.*

(b) (i) Describe a method that could be used to monitor biochemical oxygen demand (BOD) on the Selwyn (Waikirikiri) River within the Canterbury Plains. [3]

- a. Water samples could be taken at various points along the river;
- b. Water could be tested for BOD by taking samples and measuring oxygen concentration at start / initial oxygen concentration is measured in the sample;
- c. Incubate samples for (5 days at 20 °C) in the dark;
- d. Measure reduction in oxygen concentration after 5 days;
- e. *Example of method e.g.* dissolved oxygen can be measured using an oxygen probe/test kit/titration;
- f. Testing could be repeated at different time intervals (and compared to previous results);

(ii) Outline one disadvantage of using BOD measurements as an assessment of pollution. [1]

- a. Takes minimum of 5 days to get results / long time lag for results;
- b. Measures only (biodegradable) organic pollution (indirectly);
- c. Not all water pollution impacts BOD;
- d. Toxic substances can kill micro-organisms which affects results;
- e. It is an indirect measure of pollution rather than measuring pollutants directly/damage caused to species;
- f. Does not identify/measure actual/specific pollutant eg pathogens/heavy metals;
- g. Snapshot in time / only represents the moment the sample was taken;

*Do not accept "it is not accurate".*

*Do not accept "it does not identify the source of pollution".*

*Do not accept "it is expensive".*

(c) Suggest two ways water pollution from agricultural activity can be reduced within the Canterbury Plains. [2]

- a. Reduce use of pesticides/fertilizers;
- b. Do not apply pesticides/fertilizers/slurry to land during wet weather conditions;
- c. Do not apply pesticides/fertilizers/slurry near a river;
- d. Apply fertilizer in a form that ensures it is released at a rate at which it is needed by crops;
- e. Only apply fertilizers during periods of crop growth;
- f. Keep livestock away from rivers / farm (further) away from the rivers;
- g. Collect and appropriately manage manure/animal waste;
- h. Use cover crops/buffer strips/swales/bunds/sediment traps/ponds/ditches/wetlands to intercept/collect (and treat) run-off;
- i. Change irrigation practices to reduce runoff e.g. use drip irrigation;
- j. Reduce frequency of ploughing (e.g. minimum-tillage/zero-tillage) to reduce sediments/nutrients levels in run-off;
- k. Reduction in agriculture/growing crops/ reduction in number of livestock/cattle;

*Do not accept "use of terracing/contour farming to reduce run-off" as the Canterbury Plains are flat.*

*Do not accept use of "regulations/legislation/education".*

6. (a) With reference to **Figure 6**, state which stage New Zealand would be on the Demographic Transition Model (DTM). [1]
- Stage 4/5;
- (b) Outline one limitation of using the Demographic Transition Model (DTM) in predicting the growth of the population of New Zealand. [1]
- a. It does not account for migration;
  - b. It does not account for impacts of natural disasters/pandemics/war;
  - c. It does not predict how long each country will be in each stage;
  - d. It is based on approximations/is simplified (and therefore may not be accurate);
7. (a) With reference to **Figure 7(a)**, identify the sector which contributed the most to greenhouse gas emissions in New Zealand in 2019. [1]
- Agriculture;
- (b) Suggest two ways in which the use of renewable energy sources could be encouraged within New Zealand. [2]
- a. Economic incentives/subsidies/government investments/government provision of solar panels/wind turbines/renewable energy;
  - b. Subsidies for batteries to store renewable energy / improved battery technology for storing renewable energy;
  - c. Making it easier to obtain planning permits for wind farms/solar farms / reduced bureaucracy in obtaining planning permission to build renewable energy sources;
  - d. Better rates for electricity generated through renewable sources rather than via fossil fuels;
  - e. Increase subsidies/incentives for electric cars/vehicles;
  - f. Increase recharging sites/network for electric cars/vehicles;
  - g. Impose higher taxes on importation/use of fossil fuels/carbon emissions;
  - h. Public awareness/education campaign (to encourage people to change to renewable energy sources);

*Do not credit only “implement legislation/regulations to reduce use of fossil fuels or increase in use of renewable sources of energy”.*

(c) Outline one possible disadvantage of New Zealand adopting the emission trading scheme (ETS). [1]

- a. Buying emission credits may be cheaper than converting to cleaner technologies/resources/changing behaviour;
- b. Some companies may only focus on forestry/planting trees (to gain credit) rather than changing behaviour/reducing sources of carbon emissions;
- c. Allowable levels of emissions set by the government may be high and not be an incentive for companies to change behaviour/reduce emissions;
- d. Penalties for exceeding emissions levels may be low and not encourage a change to reduce emissions;
- e. It may increase the price of goods and services/may cause public dissatisfaction;
- f. It may increase cost of production and therefore limit economic growth / increase cost of production reduces economic competitiveness within the international market;
- g. Industries reliant on use of fossil fuels/non-renewable energies may relocate and this will cause loss in jobs/decrease in economy in New Zealand;

*Do not accept “rich companies will not be impacted by ETS and will continue to use fossil fuels/emit CO<sub>2</sub>”.*

*Do not accept only “ETS limits economic growth”.*

*Do not accept “ETS leads to wealth inequalities”.*

*Do not accept “ETS is expensive”.*

*Do not accept “it is difficult to determine the amount of carbon emissions”.*

*Do not accept “does not reduce overall CO<sub>2</sub> emissions”.*

8. With reference to Figure 8, outline how biocapacity and ecological footprint (EF) may influence the current and future sustainability of New Zealand. [2]

- a. Currently New Zealand is sustainable as biocapacity exceeds ecological footprint (EF);
- b. If trends continue, New Zealand will become unsustainable when biocapacity falls below EF;
- c. New Zealand may continue to be sustainable if biocapacity is increased through forestation/habitat restoration etc / New Zealand may become unsustainable if biocapacity decreases reducing biological productive land available for agriculture;
- d. New Zealand may continue to be sustainable if EF is reduced, through recycling, reduced consumption etc;

9. With reference to the information in the resource booklet, to what extent can New Zealand be considered to be effectively addressing the issue of climate change.

[6]

**Pros [4 max]:**

- a. NZ has pledged to cut GHG emissions by 30% below 2005 levels by 2030 (Paris Agreement) / NZ is aiming to reach net zero carbon emissions by 2050;
- b. New Zealand is aiming to increase its use of renewable sources of energy which should reduce (use of fossil fuel and) production of CO<sub>2</sub> / New Zealand aims to produce all its electricity from renewable energy which should reduce (fossil use and) production of CO<sub>2</sub>;
- c. Plan to improve energy efficiency should reduce the (amount of fossil fuels used and) generation of GHG emissions;
- d. Emission trading scheme should reduce the amount of CO<sub>2</sub> emissions from industry over time;
- e. Emission trading scheme should encourage planting of trees/forest that remove CO<sub>2</sub> from the atmosphere/acts as carbon sinks;
- f. EF has declined over time suggesting reduction in use of resources and generation of CO<sub>2</sub> (per person);

**Cons [4 max]:**

- g. Agricultural sector is the largest/main source of GHGs in New Zealand (and these levels have remained high/no evidence of plans to reduce these levels) / agriculture sector produces over 30 (to 40) million tonnes of CO<sub>2</sub> (equivalent);
- h. Cattle are a large source of methane/GHG and numbers remain high;
- i. Arable farming is a major industry in New Zealand and use of fertilizers releases GHGs;
- j. New Zealand imports oil which when used releases CO<sub>2</sub>;
- k. GHGs/CO<sub>2</sub> emissions from the energy sector continues to rise;
- l. New Zealand has a high level of car ownership which produces CO<sub>2</sub>;
- m. New Zealand has lost large areas of forest and therefore its carbon sinks / loss of large forest areas contributes to carbon emissions;
- n. Penalties for exceeding emission targets may not be a deterrent, and some companies may continue to emit large amounts of GHGs;
- o. Biocapacity has declined over time suggesting reduction in carbon absorption (from biological productive land);
- p. Development of hydroelectric power has led to an increase in GHG emissions due to loss of forest/loss of carbon sink;

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

**Conclusion [1 max]:**

*For example:* Although New Zealand is reducing the generation of GHG by switching from using fossil fuels to renewable energy, the emissions from agriculture continue to be high and therefore New Zealand is not effectively addressing climate change;

**Note to examiners:** 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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