

Markscheme

May 2022

Environmental systems and societies

Standard level

Paper 1

© International Baccalaureate Organization 2022

All rights reserved. No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without the prior written permission from the IB. Additionally, the license tied with this product prohibits use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, whether fee-covered or not, is prohibited and is a criminal offense.

More information on how to request written permission in the form of a license can be obtained from <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organisation du Baccalauréat International 2022

Tous droits réservés. Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite préalable de l'IB. De plus, la licence associée à ce produit interdit toute utilisation de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, moyennant paiement ou non, est interdite et constitue une infraction pénale.

Pour plus d'informations sur la procédure à suivre pour obtenir une autorisation écrite sous la forme d'une licence, rendez-vous à l'adresse <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

© Organización del Bachillerato Internacional, 2022

Todos los derechos reservados. No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin la previa autorización por escrito del IB. Además, la licencia vinculada a este producto prohíbe el uso de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales—, ya sea incluido en tasas o no, está prohibido y constituye un delito.

En este enlace encontrará más información sobre cómo solicitar una autorización por escrito en forma de licencia: <https://ibo.org/become-an-ib-school/ib-publishing/licensing/applying-for-a-license/>.

General marking Instructions

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. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor 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.
4. Personal codes/notations are unacceptable.
5. 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.
6. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers. RM™ Assessor will only award the highest mark or marks in line with the rubric.
7. 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.
8. 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 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. temperatures over 24 °C;
rainfall between 1000 and 3000 mm (eg 1501–2000 mm) / rainfall below 2000/3000 mm; [2]

Note: Do not accept only high/low annual rainfall or high annual temperatures.
Do not accept only 'over 28 °C/up to 28 °C'.

2. (a) $\left(\frac{70}{NIR} = \frac{70}{1.05}\right)$
= 66.67/66.7/67 (years); [1]

Note: Accept where there is a dot or dash above the last '6' in 66.6/66.66 as this shows that the '6' is recurring.
Do not accept only '66.6' or other incorrect rounding of the answer.

- (b) reduction in births due to greater use of contraception/improved family planning/sex education;
reduction in births due to women having children later/access to education/access to employment/improved status /increase in affluence (more personal choice);
growth in urbanization leading to fewer children required to work in agriculture to support parents / reduction in births because of increasing cost of bringing up children;
reduction in children/births due to improvements in welfare system/pensions
reducing reliance on children to support parents;
increase in more elderly population/longer life expectancy/reduction in death rate due to improvement in health care/sanitation;
reduction in infant mortality, so parents can expect most members of a family will survive to adulthood;
reduction in child mortality due to improved nutrition/access to healthcare/immunizations;
government policy/legislation that encourages a reduction in birth rates; [3 max]

Note: For credit both change observed and associated cause must be given, eg do not accept only 'decrease in birth rate / increase in life expectancy' or only 'use of contraception / improved health care'.

Do not accept 'increase in life expectancy due to better living conditions/better quality of life'.

Do not accept 'increase in working age people due to migration'.

Do not accept only 'decrease in birth rates due to education', for credit needs to also specify either sex education/family planning education or education of women.

3. (a) shortage of expertise/taxonomy skills to identify species;
shortage of finances to employ experts to classify species;
not all areas have been fully explored / access to remote forest/mountainous areas difficult;
some species are hard to find;
can be difficult to distinguish between some species/sub-species; **[1 max]**

Note: Do not accept ‘due to migration/high biodiversity/present in protected areas’

- (b) protected areas may prohibit human activities which damage the habitat/threaten species (eg urban development/hunting) / protected areas provide a safe place/habitat for species to live;
increase in size/number/coverage of protected areas may lead to:
more habitats protected/covered / more species are conserved;
better support for higher trophic levels/top carnivores;
increased distance from human activities/impacts / reduced edge effects;
more genetic mixing/formation of corridors / increased chance of connecting corridors between the protected areas;
(more people living close to protected areas leading to) greater engagement in conservation efforts / more local communities being involved in conservation / greater community involvement through education/raising awareness/greater familiarity;
more opportunity for ecotourism which encourages continued/further conservation/financial investment into conservation;
more financial support for conservation; **[3 max]**

Note: Do not credit ‘increasing habitat size for species could reduce limiting factors’.

4. (a) population size / number of mature individuals;
reduction in population size;
distribution / geographic range / number of locations species is found;
degree of fragmentation;
quality of habitat / loss of habitat / habitat degradation;
probability/risk of extinction;
trophic level; **[1]**

Note: Do not accept ‘reproduction rates / habitat distribution / degree of specialization / number of species / habitat is under threat’.

- (b) **Keystone species: [1 max]**
apex/top predator / integral to the food web/ecosystem;
Flagship species: [1 max]
popular/charismatic image / by protecting it, will help to protect the ecosystems/habitat/other species / used to raise funds for conservation; **[2]**

Note: Do not accept descriptions of just predators eg ‘controls population of primary consumers / eats organisms below it in the food web’.
Do not accept ‘top of food chain / balances the food chain’.

- (c) cost of acquiring/managing large areas;
the large areas covered by wildlife corridors can make it difficult to manage;
policing against poaching / greater vulnerability to poaching / corridors are narrow and more affected by edge effect / corridors may pass near or over roads resulting in some roadkill;
displacement of human settlement/industry / may create conflict with people's use of land eg for agriculture;
difficult to determine where to site wildlife corridors / land which is suitable must be available;
challenges of international collaboration;
spread of disease/invasive species from one region to another;

[2 max]

5. (a) *initial decrease/deforestation due to: [1 max]*
land clearance for agriculture (growth of cash crops eg coffee/sugar/palm oil or for cattle);
logging for timber / demand for wood;
urban development / industrialization;
- Note:** Do not accept 'fire caused deforestation / deforestation occurred because areas were not protected / lack of education'.
Do not accept only 'need for land/resources'.
- later increase/reforestation due to: [1 max]*
forest was allowed to regenerate naturally;
plantations for timber production;
promotion of tree planting by PES;
ban on deforestation in 1996;
increase in reserve/protected areas;
carbon off-set schemes;
increased environmental awareness on importance of forested areas; [2]
- Note:** Do not accept only deforestation/reforestation without reasons.
- (b) trees/plants absorb carbon dioxide / forest acts as a carbon sink/store; [1]
6. (a) (i) intensive agriculture/monoculture results in soil nutrient depletion/reduction in organic matter;
deforestation for plantations leaves the soil bare contributing to soil erosion;
tillage/ploughing can leave soil prone to erosion;
excessive use of pesticides leading to soil toxification;
use of fertilizers increases soil productivity; [1 max]
- (ii) use of fertilizers/leaching of nutrients can lead to eutrophication/algal blooms;
use of pesticides can lead to contamination of aquatic systems/death of non-target organisms/bioaccumulation;
over-abstraction of water for agriculture use may lead to low water levels (in rivers/lakes adversely affecting fish/aquatic species);
soil erosion into lakes/rivers could increase sedimentation/reduce water clarity; [1 max]
- Note:** For credit the cause and effect needs to be linked.
- (b) (conversion of) pasture land; [1]

7. increased tourism generates more income to invest back into conservation efforts; biodiversity/wildlife may be considered as an asset to look after to maintain/increase tourism, thereby increasing conservation efforts; increase in tourism can conflict with conservation efforts by increasing competition for resources / puts greater demand on water resources competing with wildlife / increase demand for infrastructure/hotels/roads/facilities that can destroy habitats; tourism could adversely affect conservation efforts eg disturbing species during the breeding season could reduce successful mating or producing litter that threatens wildlife when consumed;

[1 max]

Note: Do not accept only 'tourism increases pollution/litter/waste that harms species / tourism leads to illegal trespassing'.

8. (a) improved/cheaper technology; change in environmental values / increase in popularity; greater awareness of benefits of using wind power; government policy / to achieve country's goal to become carbon neutral; increasing demand due to growing population

[1 max]

Note: Do not accept 'wind power is renewable/unlimited/more sustainable/a green energy source/more viable over the long term/produces less pollution'. Do not accept 'changes in wind current'. Do not accept only 'greater investment/funds available for wind power/renewables'.

- (b) **Workings: [1 max]**
total energy sources: $2399 + 584 + 15 + 826 + 84$ (ktoe) = / 3908 (ktoe);
amount from fossil fuels: $2399 + 15 + 84$ (ktoe) = / 2498 (ktoe);
% from fossil fuels = $2498/3908 \times 100$;

Final answer: [1 max]
(=) 63.92/63.9/64 (%)

[2]

- (c) greater use of public transport that reduces individual car use (and therefore overall use of oil);
use of electric/biofuel/hybrid/hydrogen vehicles/cars (instead of oil-fuelled vehicles) / subsidize electric vehicles / higher tax on petrol cars;
adopting car sharing/pooling that reduces individual use of cars/vehicles;
use of congestion charges;
adopting policy that limits the number of cars a family/household can have;
reducing use of oil-fuelled vehicles by promoting walking/use of bicycles;
use more efficient forms of transport for goods eg boats rather than planes;
promotion of 'km0 initiative' (local production and consumption) which reduces need for transportation;
use of carbon tax on oil/petrol (to deter its use) / capping/regulating amount of oil sold;
use of quotas/permits within industry to reduce overall oil consumption;
residents/industry/ agriculture encouraged to use renewable/solar/wind energy (to replace use of oil) / government incentives/subsidizes to use renewable sources of energy;
use energy efficient machinery that requires less oil;
encourage more on-line/home working so people can stay at home (reducing need for travel);

[2]

Note: Do not accept 'build new roads / subsidize green/clean energy / use legislation'.

Do not accept only 'implement laws / reduce transport / find alternative energy sources / taxes / limit air travel'.

Accept other reasonable responses.

9. EF must be lower than biocapacity to be sustainable / if EF is above biocapacity, it is not sustainable / overall sustainability declined overtime as EF increased and biocapacity declined;
until around 1990/1991 Costa Rica was sustainable as EF was lower than the biocapacity;
after 1990/1991, EF was greater than biocapacity and therefore Costa Rica was less/no longer sustainable;

[2 max]

Note: For credit, link must be made to change in sustainability.

10. Evidence for [4 max]:

- (i) carbon off-setting has increased afforestation/reforestation/tree planting / forestation has increased carbon sinks / forestation has contributed to mitigating climate change/reducing atmospheric carbon dioxide levels;
- (ii) afforestation/reforestation/increase in protected area has increased biodiversity/natural habitat for wildlife;
- (iii) afforestation/reforestation has increased natural capital/goods and services;
- (iv) most electricity comes from renewable sources of energy rather than non-renewable sources (can be used up / exhaustible) / most electricity comes from renewable sources rather than fossil fuels hence produces less carbon dioxide emissions/has a lower EF;
- (v) use of electric/hybrid/biofuel/hydrogen vehicles limits carbon dioxide emissions / increase use of renewables/electric transport could improve air quality in urban areas;
- (vi) use of public transport limits individual car use and reduces overall carbon dioxide emissions/could improve urban air quality/has a lower EF;
- (vii) certified carbon neutral coffee farming may mitigate impacts of intensive (cash crops) agriculture / certified carbon neutral coffee farming may support businesses which have a smaller carbon footprint;

Note: Do not credit only 'PES results in more tree planting'.

Evidence against [4 max]:

- (viii) there are emissions of other greenhouse gases from farming (eg methane from cattle/beef production / nitrous oxide from using fertilizers or manure);
- (ix) increase in land area used for intensive agriculture (pineapples) reduces biodiversity;
- (x) there is high use of fossil fuel / transport sector depends on fossil fuels / the transportation of importing fossil fuels produces carbon dioxide;
- (xi) ecological footprint (EF) is beyond the carrying capacity / EF is greater than biocapacity;
- (xii) despite increased forestation the biocapacity has continued to decline which is not sustainable / biocapacity still appears to be declining which is not sustainable;
- (xiii) large tourism numbers may cause damage to the environment eg roads may fragment habitats / building development for tourism may lead to habitat destruction;
- (xiv) tourists that travel to Costa Rica can produce high levels of greenhouse gases/carbon dioxide emissions through plane travel;
- (xv) growth in agriculture leads to deforestation / there is still some loss of mature forest to agriculture / difficult to enforce ban on deforestation;
- (xvi) in future, the country will eventually run out of space for carbon off-setting by planting trees and therefore this is not a sustainable practice;
- (xvii) hydropower has a detrimental effect on the environment eg blocks migratory routes for fish, causes siltation behind the dam wall and reduces flow of nutrients/sediments downstream contributing to coastal erosion/lower diversity;
- (xviii) (despite carbon zero policy/efforts to reduce CO₂ levels) the levels of CO₂ emissions for Costa Rica are above the regional average;

Award [5 max] for evidence for and evidence against.

(continued)

Conclusion/opinion [1 max]

For example: Although Costa Rica produces most of its electricity from renewable sources, non-renewable resources are still used eg oil which is a finite resource and is not sustainable for the future;

Despite reducing loss of forest/increasing sinks for carbon, the biocapacity continues to decline and hence overall Costa Rica is not sustainable;

While Costa Rica still has some issues relating to emissions of GHGs through agriculture/transport, it is moving in the right direction towards environmental sustainability with its tree planting campaigns/increase in protected areas and cleaner air due to renewable energy sources;

A valid conclusion should be credited if it is explicit, balanced (addresses both sides of the argument) and supported by evidence. 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.

[6 max]
