# MARKSCHEME

# May 2005

# ECOSYSTEMS AND SOCIETIES

# Standard Level

# Paper 2

*This markscheme is **confidential** and for the exclusive use of examiners in this examination session.*

*It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of IBCA.*

# Subject Details: Ecosystems and Societies SLP2 Markscheme

**General**

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each marking point has a separate line and the end is signified by means of a semicolon (;).

- An alternative answer or wording is indicated in the markscheme by a "/"; either wording can be accepted.

- Words in ( … ) in the markscheme are not necessary to gain the mark.

- The order of points does not have to be as written (unless stated otherwise).

- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the mark scheme, then award the mark.

- Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalising them for what they have got wrong.

- Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with "**ECF**", error carried forward.

- Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by "**U-1**" at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.

- Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

**Section B**

Each essay is marked out of *[20]* of which *[3]* are for expression and development of ideas (EDI).

*[0]* No expression of relevant ideas.
*[1]* Expression and development of relevant ideas is limited.
*[2]* Ideas are relevant, satisfactorily expressed and reasonably well developed.
*[3]* Ideas are relevant, very well expressed and well developed.

## SECTION A

1.  (a)  (i)   Japan = –3.4 hectares person$^{-1}$ (*units not required*)          *[1]*
                *Answer may appear in table*

        (ii)  United States = 10.3 hectares person$^{-1}$ (*units not required*)     *[1]*
                *Answer may appear in table*

        (iii) 6                                                               *[1]*

        (iv)  a high proportion of people exist below the poverty line (*i.e.* they do not
              have all the resources they need);
              soil is particularly fertile (volcanoes) and so they are able to support a lot
              of people by using the land very intensively;
              very low rates of pollution per person perhaps because of high proportion
              of people in agriculture;
              relatively low dependence on fossil fuels especially in terms of transport; *[2 max]*
              *Accept other reasonable suggestions.*
              *Do not accept "because they have a lot of available capacity", as other
              countries have similar amounts of land, smaller populations, but are in
              deficit.*

    (b)  (i)   *Rank for footprints [1]*
              United States, Australia, Singapore, Norway, Russian Federation,
              Germany, United Kingdom, Japan, Venezuela, Indonesia, India, Ethiopia;

              *Rank for GDP [1]*
              United States, Norway, Singapore, Japan, Germany, Australia, United
              Kingdom, Venezuela, Russian Federation, Indonesia, India, Ethiopia;     *[2]*

        (ii)  countries with highest GDPs generally have the largest footprints       *[1]*

        (iii) they depend on imports for resources;
              they are sufficiently wealthy that they can afford to buy these resources
              in from abroad;
              they have a developed economy that is not based on primary industries;  *[2 max]*

    (c)  (i)   no it is not sustainable; *[1]*
              world footprint is 2.8 hectares person$^{-1}$ and there is only 2.1 hectares
              person$^{-1}$ available;
              Earth currently in ecological deficit –0.7 hectares person$^{-1}$;
              we are looking at *global* footprint so cannot offset larger footprints
              against smaller ones as you can when looking at whether individual
              nations are sustainable;                                                *[2 max]*
              *If no justification is attempted award [0]*
              *Figures not necessary if candidate has demonstrated conceptual
              understanding.*

(ii)    using technology to remanufacture or recycle can reduce the overall amount of resources consumed and so ecological footprint is reduced;
*e.g.* through bottle banks;
absolute reductions in energy and material use can reduce ecological footprint;
*e.g.* energy efficiency initiatives;
reduction in pollution by technological advances;
*e.g.* through renewable / alternative energy technologies instead of fossil fuels;
use of technology to intensify and therefore maximise production from available land;
*e.g.* through GM crops;                                      *[4 max]*
*Each way of decreasing footprint must be adequately described for [2].*

(iii)   *For full marks, an answer must refer to attitudes of both technocentrist and ecocentrist. If only one is discussed award [2 max].*
ecocentrist will see deficit as evidence that we are not living sustainably;
emphasis will be on humans to change their behaviour / lifestyles;
will stress the need to strive for greater social equality between people in LEDCs and MEDCs;
economic growth seen by ecocentrics as a cause of the problem;
technocentrist will stress importance of technology for addressing the deficit;
economic growth seen as a solution to the problem;
technocentrist will believe in human ability to find technological solutions for present and future deficits;          *[4 max]*
*Accept other reasonable answers*

## SECTION B

> **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.

**2.**   (a)   *Award [1] for each factor identified. Specific ecosystem examples must be included e.g. Australian coral reef, Brazilian tropical rainforest, for full marks. If no examples given [3 max] can be awarded.*
natural hazard events *e.g.* in montane forest loss of species due to eruption of Mount St Helens;
global catastrophic events *e.g.* meteor impact and extinction of dinosaurs;
habitat degradation, fragmentation and loss *e.g.* pandas and bamboo forest in China;
introduction and/or escape of non–native and genetically modified species;
monoculture *e.g.* loss of wild grass species and insects in North American grain belt;
pollution *e.g.* DDT and loss of bird species in North America in 1970s;
hunting or collecting *e.g.* shooting of large predators in tropical Savannah;
harvesting *e.g.* cod population in North Atlantic Ocean;          *[6 max]*

(b)   more diverse ecosystems are generally more stable and therefore are less fragile;
due to their variety of nutrient and energy pathways;
species have a greater choice of food sources if one species becomes extinct;
biodiversity includes diversity of habitat as well as diversity of species;
more diverse ecosystems are better able to cope with natural threats to their survival and therefore less fragile;          *[5]*
*credit given for different interpretations of "fragility" though concept of fragility must still be valid within an understanding of ecosystem functioning.*

(c)    many groups are involved in loss of biodiversity and therefore education to a wide audience is important;
       people who are often the direct cause of biodiversity loss (*e.g.* through hunting) need to be educated as to the longer term value of preserving ecosystems;
       as they will play a central role in their conservation (producer);
       other communities may indirectly play a role (*e.g.* as a market for tropical hardwoods) and so should be educated to help reverse destructive practices (consumer);
       education can have a huge, immediate impact when damage is inadvertent;
       *e.g.* coral reef education programmes for divers;
       education is the first step in increasing lobbying of Governments to ensure environmentally sustainable practice (policy makers);
       education is not the only factor – legislation plays a vital part in establishing *e.g.* conservation areas;
       and international treaties to control trade in endangered species and agreements over pollution;
       proper finance is vital to run conservation areas and ensure enforcement of international agreements;                                            *[7 max]*
       *Give credit to candidates who link their response to the statement in the question e.g. by use of terms such as producer, consumer etc.*
       *Answers which fail to recognize that education alone is not enough to reverse loss of biodiversity should be awarded [5 max].*

                                                            *Expression of ideas [2 max]*

                                                                    **Total [20]**

**3.**    (a)    systems are assemblages of parts and the relationships between those parts, which together constitute the entity or whole;
both types of systems will have common features such as inputs, outputs, flows and stores;
social systems are more general, however, in that there will be lots of different types *e.g.* a transport system/economic system/farming system/class system;
energy and matter will flow through ecosystems, whereas social systems will have flows of *e.g.* information/ideas/people;
both types of system will exist at different scales;
and have common features such as feedback and equilibrium;
trophic levels and levels in society;
there are consumers and producers in both;                                    *[5 max]*
*For full marks answers should show both similarities and differences.*

(b)    herbivory – when a consumer feeds on a producer;
*e.g.* rabbit eating grass;
competition – a common demand by two or more organisms upon a limited supply of a resource (*e.g.* food / water / light / space / mates / nesting sites);
*e.g.* two male lions competing for the same territory and mates;
parasitism – a relationship between two species in which one species (the parasite) lives in or on another (the host), gaining all or much of its food from it;
*e.g.* strangler fig tree and mahogany tree in a tropical rainforest;
mutualism – relationship between individuals of two or more species in which both benefit and neither suffer;
*e.g.* elephant and acacia tree;
predation – when one species hunts another;
*e.g.* lion and wildebeast                                                    *[6 max]*
*Award [4 max] if specific examples of species are not included. Candidates need to describe each interaction. All examples may be from the same ecosystem.*

(c)    *Candidates may choose any contrasting biomes. Award [3 max] if specific biomes are not mentioned.*
climate determines the global distribution the productivity of biomes;
climate is a limiting factor as it controls the amount of photosynthesis which can occur in plants;
water availability, light and temperature are the key climate controls;
photosynthesis is a chemical reaction, therefore temperature will also affect rates of photosynthesis;
this is why *e.g.* tropical rainforests, which have high constant temperatures (typically 26 °C) and rainfall (over 2 500 mm *p.a.*) throughout the year;
have high rates of NPP;
*e.g.* hot deserts have high temperatures, but low precipitation (typically under 250 mm *p.a.*);
therefore rates of NPP are very low;                                          *[7 max]*
*Give credit if appropriate diagrams are included.*

*Expression of ideas [2 max]*

**Total [20]**

**4.**    (a)    natural capital is a term sometimes used by economists for natural resources that, if appropriately managed, can produce a "natural income" of goods and services;
the natural capital of a forest might provide a continuing natural income of timber, game, water and recreation;
sustainability – using global resources at a rate that allows natural regeneration and minimizes damage to the environment;
*e.g.* a system of harvesting renewable resources at a rate that will be replaced by natural growth might be considered to demonstrate sustainability;
Wilson is advocating that countries should adopt this approach when assessing their resource base;                                                                        *[5]*
*Answers which do not refer to the statement should be awarded [4 max].*

(b)    *Water [7 max] or [6 max]*
water is replenishable natural capital (it is non–living but is dependent on the solar engine for renewal);
but globally it is being used at a faster rate than it can be replenished;
only a small fraction of the Earth's water supply is available as a readily usable resource for humans;
there are growing demands on water resources as populations increase;
societies become more affluent and expectations rise;
irrigation, industrialization and domestic demand are all increasing;
withdrawal of water from underground aquifers is often occurring at a faster rate than it can be replenished;
this has lead to falling water tables;
degradation of water supplies through pollution reduces the amounts which are available to us;
global warming may disrupt rainfall patterns and supplies and make matters worse;
a lot of water is wasted or used inefficiently;
*Give credit for named examples and case studies.*

S*oil [6 max] or [7 max]*
soils are renewable in that they will regenerate naturally given enough time;
however, misuse of soils by a variety of human activities is leading to degradation of soil resources at a faster rate than they can cope with;

*examples of unsustainable practice with regard to soils include:*
overgrazing – where the trampling and feeding of livestock leads to loss of vegetation, and exposure of underlying soil;
deforestation – removing vegetation;
overcultivation – leading to a loss of soil fertility and structure;
all leave top soil vulnerable to erosion by wind and water;
excessive irrigation can lead to salinization and toxification;        *[13 max]*

*Expression of ideas [2 max]*

*Total [20]*

**5.**    (a)    *stratospheric ozone [3 max]*
halogenated organic gases are very stable under normal conditions;
but can liberate halogen atoms when exposed to UV radiation in the stratosphere;
these atoms react with monatomic oxygen and slow the rate of ozone reformation;
pollutants enhance the destruction of ozone thereby disturbing the equilibrium of the ozone production system;
sources of these pollutants include refrigerants / gas blown plastics / methyl bromide / some propellants;

*photochemical smog [3 max]*
photochemical smog is a mixture of (about 100) primary and secondary pollutants formed under the influence of sunlight;
ozone is the main pollutant;
local conditions can increase the incidence of photochemical smog;
*e.g.* topography / climate / population density / fossil fuel use;            *[6 max]*

(b)    acid deposition is regional rather than global because sulfur dioxide and nitrogen oxide pollutants are blown by local winds from industrial areas before being deposited (in rainfall as wet deposition or directly as dry deposition) in a nearby area;
global warming will be global in impact because the greenhouse gases which are involved play a role in maintaining mean global temperature;
these gases are not constrained by local weather conditions but are diffused in the upper atmosphere;
the integrated and complex nature of the atmospheric system means that there may be knock on effects;
and these effects may be macro in scale *e.g.* sea level rising due to thermal expansion;            *[4 max]*

(c)  *Global warming*
management strategies may operate at a variety of scales *e.g.* intergovernmental and international agreements such as carbon tax;
these are likely to have a large scale impact and be effective because legislation will affect large numbers of people;
however, it is not possible to force countries to sign or indeed ensure they abide by agreements;
LEDCs may feel that development should be a priority over environmental concerns;
often financial issues may get in the way, *e.g.* under funding of alternative energy supplies;
there may be technological constraints, *e.g.* alternative energy may simply not be able to supply enough energy to replace fossil fuels;
national or local initiatives *e.g.* energy efficiency drives / public transport programmes / alternative energy;
these may be more effective because communities are more directly involved;
although the impact on a wider scale will inevitably be lower;
management strategies are hampered by groups who argue that there is insufficient evidence to support the case for global warming;
precautionary principle – where insufficient understanding is not a good enough argument for doing nothing – is the response;

*or*

*acid deposition*
can be divided into preventative or curative;
preventative includes reducing fossil fuel emissions;
*e.g.* by encouraging alternative energy sources such as solar;
public transport schemes;
reduction in energy demand for electricity by increasing energy efficiency;
these address the cause of the problem so are arguably more effective;
but are expensive and unpopular *e.g.* leading to job losses in the coal industry;
may be currently impractical *e.g.* alternative energy supplies cannot replace the amount of energy we currently get from fossil fuels;
curative involves responding to the effects of the problem;
*e.g.* spraying forests / liming lakes;
clean up measures at points of emission *e.g.* desulfurisation in coal fired power stations;
these measures may be cheaper in the short term but do not address the cause of the problem and are therefore not a long term solution;                    *[8 max]*

*Expression of ideas [2 max]*

*Total [20]*