

May 2015 subject reports

## Environmental systems and societies

Overall grade boundaries

### Standard level

<b>Grade:</b>	1	2	3	4	5	6	7
<b>Mark range:</b>	0-11	12-23	24-33	34-45	46-55	56-67	68-100

Standard level internal assessment

### Component grade boundaries

<b>Grade:</b>	1	2	3	4	5	6	7
<b>Mark range:</b>	0-7	8-14	15-19	20-24	25-29	30-34	35-42

### The range and suitability of the work submitted

Environmentally related problems continue to grow and unfortunately there is no abatement of this trend on the horizon. Simultaneously concern for these problems grows as well and this is reflected in more and more schools offering the subject and so the need for moderators grows as well. During the May 2015 session two new team leaders were added for internal assessment in the subject. New candidates come from new schools as well as older schools that decide to offer the course. And so, the problems that have been written about in the past continue to surface as schools go through the inevitable learning curve. However, what is also true is that many schools continue to repeat the same mistakes despite having had these pointed out in previous feedback reports.

## Candidate performance against each criterion

### Planning

Planning continues to be the criterion that seems to pose the most problems for both candidates and schools. Evidence of this is the number of schools that submit “theoretical” planning labs which are assessed only against this criterion and are not actually carried out. Although this is acceptable it makes it difficult for candidates to test their ideas in practice. It also leads to candidates inventing methods that cannot in practice be carried out, resulting in a loss of marks.

Some teachers are penalizing candidates for not describing how variables are to be controlled in Aspect 1 and this is a mistake. Candidates are required only to identify the relevant variables in the first part of planning and then design a method for controlling variables in Aspect 2. Finally, candidates continue to lose marks for insufficient relevant data. The problem is not with the relevance but rather with the amount. Five treatments and five repeats of each are required as a minimum for lab based practicals. Less than this minimum results in the loss of a mark in Aspect 3. For field work, three transects are considered sufficient due to practical constraints. This topic is repeated year after year and yet far too many candidates continue to compare say one tomato plant in saline earth with one in normal earth and of course are marked down. The frustrating aspect of this is that this type of design automatically generates data that is insufficient for any meaningful analysis which of course affects the discussion.

### Data Collection and Processing (DCP)

Tables of raw and/or processed data and graphs all require a good explanatory title. It is a shame to see a candidate lose marks for such a simple detail. But when the data, calculations or presentation cannot be easily interpreted for the lack of a title, then the aspect cannot be considered to be fully met. There were far fewer examples of data tables without units or with units in the individual cells, and schools are doing a better job of teaching candidates to report their data to a consistent number of decimal places. Some schools include uncertainties in their column headings, but as this is not a requirement, their absence should not result in the loss of a mark. However, if the uncertainty is reported the data must reflect this. For example if temperature is measure  $\pm 0.1^{\circ}\text{C}$  the data cannot then be reported to three decimal places. Moderators are instructed to dock a mark for this type of mistake.

The second aspect of DCP most often suffers from not enough processing and the lack of sample calculations. Some teachers are encouraging candidates to indicate that averages (for example) were calculated using a spreadsheet formula. This is fine but the formula and the range of data should be indicated.

### Discussion, Evaluation and Conclusion (DCE)

This session saw the usual continuum of discussions, from outstanding to far below the level required an expected for this age candidate. It is very difficult to specify when a discussion is sufficient, but some candidate work was far beyond what would be required for a complete in Aspect 1. The only cause for concern here is managing candidate work load and helping over achieving candidates to maintain perspective. On the lower end, teachers should encourage candidates to assess the quantity and quality of their data (standard deviations can be very

useful here) and discuss their confidence in their findings. Their work should also be placed in a broader context by either relating it to theory or comparing it with literature values where these are available.

There are still a number of schools using a group four model and assessing evaluation and improvements as two separate aspects. Coordinators in schools that teach ESS are advised to look at the guides carefully as there are important differences here.

Finally conclusions tended to be better and more candidates are citing their data or findings when formulating conclusions, however fewer are providing correct explanations of their conclusions. This is actually a difficult skill as it should be concise and to the point, not a rehashing of the discussion.

This session saw an unusual number of logistic problems and mistakes directly attributable to teachers.

One such problem is the identification of the work that is to be marked and the correct filling out of the PSOW form. It is very important that the moderator be able to determine what level was awarded to each criterion for the samples selected for moderation. This is not possible if the work to be moderated is only marked with an X on the PSOW and the marks awarded entered only at the bottom of the form. The title on the ESS/PSOW should be the same as that on the title page or heading of the work to be marked or some other method must be used to ensure that it is easy to find the work to be moderated. What is crystal clear to the teacher, who is familiar with the work, can be really difficult to interpret for the moderator. This problem becomes especially difficult to handle when teachers mistakenly send the entire candidate portfolio instead of limiting the sample to the work that is to be moderated.

Many moderators commented on the absence of teacher's marks on candidate work or notes indicating how levels were awarded. If candidates are not receiving feedback on how they are progressing, it is difficult for them to improve.

Moderators also commented on the fact that schools will often use the same two practicals to assess the entire cohort. This obviously makes work easier for teachers; however it does also indicate that candidates may not be receiving enough opportunities to be assessed. Moreover, at times on the ESS/PSOW there are other practicals that have achieved higher marks on one of the three criteria than the two practicals that seemed designed to comply with IB criteria. Strictly speaking these higher scoring efforts should be sent in for moderation.

When providing feedback, moderators can access the previous four years' reports. It is disheartening to see how many moderators reminded schools that the same comments had been made last year. On the other hand, when they see a program that has made the suggested adjustments, and the candidates have benefited, it is immensely rewarding.

## Further comments

Generating sufficient data continues to be a challenge and as this is not a particularly difficult skill, it would seem that the problem stems from teachers not informing their candidates of the minimum requirements. When marks are lost for controlling variables it is often due to omission

rather than lack of know how. Data processing skills vary widely from school to school. Powerful statistical tools are in evidence among stronger programs. In weaker schools, there is little if any evidence of meaningful processing of data above the calculation of an average. These are skills that require direct instruction. Most importantly these skills cannot be applied in the absence of a suitably complex data set.

The discussion of data and findings in general is an area of relative weakness. This is a skill that needs to be developed in candidates and that requires practice. Many candidates will have had few opportunities to process and analyze complex data sets and even less discussing these. Open discussions of a class data set with the entire group may be a good tool to use, and obviously plenty of opportunities to analyze data can only help. Some good questions to drive the discussions are: Can these data be trusted? (Why or why not?) Do these data agree with theory? Do these data support or refute a candidate hypothesis? Was the research question addressed? What do these findings mean? How does this work relate to the broader field of work?

## Standard level paper one

### Component grade boundaries

<b>Grade:</b>	1	2	3	4	5	6	7
<b>Mark range:</b>	0-4	5-9	10-14	15-19	20-23	24-28	29-45

### General comments

The majority of respondents (90%) to the G2 questionnaires confirmed that the level of difficulty of Paper 1 was 'appropriate' for a Standard Level paper, although 9% of respondents considered it to be 'too difficult'. When compared to May 2014 paper, 61.8% of respondents considered the May 1205 to be of a similar standard, although 21.82% believed it to be more difficult and 12.73% respondents thought it was easier.

Most G2 respondents considered the clarity and presentation of the paper to be fair or better. The majority of respondents also agreed that questions were accessible to all candidates with learning support and irrespective of religion/belief system, gender or ethnicity.

Other salient points from the G2 respondents include:

- The scheduling of the ESS paper towards the end of the exam period and on the same day as two other exams (Maths and Business & Management) may lead to candidates underperforming.
- Lack of spacing between lines and more writing space for each question.
- No definition questions or other questions for weaker candidates.
- Paper covered more application of concepts.

- A few questions were quite subtle and this may have been more difficult for second language learners.
- There was wide coverage of the syllabus topics.

Candidates performed significantly less well on Paper 1 this session than in May 2014. The provisional mean for May 2015 was 15.74 (standard deviation 6.26) compared to the mean for May 2014 of 22.58 (standard deviation 6.88). A number of contributing factors to this include:

- The paper examined less rote learning and more application of concepts and principles. For example, as commented on the G2 feedback, there were no questions on definitions.
- Coverage of topics previously more typically covered in detail within the optional essay paper (e.g. photochemical smog and succession) and also inclusion of topics in which candidates have previously performed poorly on (e.g. dynamic value of a resource).
- There were more questions carrying 3 or 4 marks within the paper than in previous papers (3 such questions in May 2014 compared to 6 in May 2015). Unfortunately candidates performed badly in many of these questions, thereby significantly affecting their overall marks.
- The lateness of the ESS exams resulted in less time to discuss and finalise the markscheme, placing additional pressure on the standardisation team. Although the markscheme this time was more specific and focused, it may have opened up more if there had been longer for debate and discussions.
- A face to face rather than a virtual standardisation meeting may have also facilitated further discussions and widening of the markscheme.

Overall this paper was more demanding of the candidates than in May 2014.

### The areas of the programme and examination which appeared difficult for the candidates

- Poor knowledge of precursors of photochemical smog.
- Limited understanding of factors which influence levels of tropospheric ozone.
- Confusion between effects of tropospheric ozone and stratospheric ozone.
- Poor understanding of the concept 'per capita' and reasons which lead to differences in ecological footprint.
- Limited understanding the relationship between biomass and trophic level along a food chain.
- The ability to relate the process of succession to changes in productivity of trophic levels.
- Knowledge of the criteria used by the IUCN Red List and the differences between classification categories.
- Reasons for net gain in forest through afforestation.
- Many answers lacked sufficient detail or appropriate links to the question asked e.g. when asked to 'explain' many responses were very generalised and lacked focus and detail.
- Where there were 2 or more marks allocated to a question, candidates did not always attempt to cover more than one marking point. Candidates need to provide more information, when there are more marks available.

- Overall candidates seem to struggle more with science based questions compared to the social issue based questions.

## The areas of the programme and examination in which candidates appeared well prepared

- Reasons for increase in non-fossil fuels.
- Advantages and disadvantage of fossil fuels and renewable energy
- Using graphic data to calculate changes in percentage.
- Reasons for illegal killing of species.
- Role of keystone species.
- Reasons for soil degradation
- Natural services provided by forest.

## The strengths and weaknesses of the candidates in the treatment of individual questions

### Question 1

1(a) Few candidates correctly identify both primary air pollutants that contribute to photochemical smog. Nitrogen oxides (NO<sub>x</sub>) were identified by some candidates but many incorrectly gave either sulphur dioxide or carbon dioxide as the second pollutant.

1(b) Responses varied widely for this question. Many recognized that ozone is a greenhouse gas at ground level and that it causes respiratory problems. A significant proportion of candidates confused tropospheric ozone with stratospheric ozone.

1(c)(i) Many responses only focused on either levels of sunlight or pollution emissions being greatest during the day causing the peaks in ozone levels. Few candidates identified two contributing factors. A common error was to suggest temperature increases ozone levels rather than sunlight.

1(c)(ii) Most candidates focused on either high emissions of air pollutants or difficulty of wind dispersing pollutants in the valley. Although a number of answers were too vague to be credited. Very few candidates appeared to be aware of the role of thermal inversion in containing pollutants within the valley. Many candidates incorrectly suggested that elevation affected tropospheric ozone levels and that the valley was closer to the ozone layer.

### Question 2

2(a) Candidates often gave responses that were too vague e.g. North America is a MEDC without giving a reason why this could result in greater energy consumption.

2(b) Responses often lacked sufficient detail e.g. why different diets would result in a different ecological footprint or only gave one reason covering one marking point. Candidates sometimes misunderstood the concept of 'per capita'.

2(c) The majority of candidates answered this question well.

2(d) Although there were some good responses to this question, marks were often lost for being too vague e.g. renewables are 'environmentally friendly'.

2(e) Very few candidates achieved full marks for this question. Many candidates did not relate their answer directly to the change in value of nuclear energy resources during the time periods shown in Figure 3.

### Question 3

3(a) A significant number of candidates did not appear to understand the relationship between biomass and energy transfer along the food chain. Few candidates attained both marks for this question.

3(b) Many responses only focused on dehydrating a sample of individuals to determine biomass and omitted how they would sample the area and extrapolate to determine the biomass of primary producers in the area.

3(c) Few candidates obtained full marks for this question. Some answers described succession well but did not relate this to changes in productivity of trophic levels. This topic did not appear to be well understood by the majority of candidates.

### Question 4

4(a) Most candidates were able to correctly calculate percentage change.

4(b) Most candidate correctly identified a reason for the increase in poaching.

4(c) The majority of candidates stated Lincoln Index and did not appear to be aware of other more appropriate methods for large mammals.

4(d) Few responses directly related to the criteria used by the IUCN Red List to categorise the conservation status of elephants. Some candidates did not understand that 'vulnerable' was better than 'endangered' status.

4(e) Most candidates achieved some marks for this question, although few attained all 3 marks. Many responses only focused on one aspect e.g. elephants as keystone species.

### Question 5

5(a) Most candidates demonstrated some understanding of how economic development can lead to loss of forests.

5(b) Few candidates attained full marks, most candidates incorrectly focused on preventing deforestation i.e. maintaining forest areas rather than reasons for an increase in forest areas.

5(c) There were many good responses to this question.

5(d) The majority of candidates were able to correctly identify two natural services provided by the forest.

## Recommendations and guidance for the teaching of future candidates

- Ensure the whole syllabus is covered in sufficient detail and that candidates can explain and apply concepts to different situations.
- Ensure candidates understand the requirements of each command term.
- Emphasize the importance of reading questions carefully and train candidates on how to answer directly.
- Ensure when a question is worth more than 1 mark, sufficient points are covered to attain all available marks. For example, a four mark question needs four marks worth of information.
- Enable candidates the opportunity to practice and discuss questions that allow for application of ESS concepts, principles and issues.
- Encourage candidates to write legibly and not outside the answer box, if required additional sheets should be used.

## Standard level paper two

### Component grade boundaries

<b>Grade:</b>	1	2	3	4	5	6	7
<b>Mark range:</b>	0-7	8-14	15-19	20-27	28-34	35-42	43-65

### General comments

110 schools completed the online G2 form. This an increase from previous years. The majority found the paper at a suitable level of difficulty, with 7 indicating the paper was too difficult. 68 schools found the exam of a similar standard to the previous year with 13 finding it easier and 24 finding it more difficult. The presentation of the paper was considered good by all responses. However the clarity of wording had 3% as poor. In terms of bias and accessibility the paper was considered suitable except for learning support where 8% of schools disagreed.

There were a number of comments made on the G2 forms. In terms of syllabus coverage very few mentioned this, one stated “there was a variety of topic covered in the paper” and another “addressing a wide range of environmental issues”.

The Resource Booklet was considered clear and easy to follow. Some schools expressed concern over terms not used in the syllabus but the terms such as hypoxic were defined and explained in the resource booklet and did not seem to cause problems for the candidates. The information presented in the Resource Booklet was generally regarded as interesting and useful and linked to the questions asked. A query was made about the lack images for the organisms mentioned, as these have been seen in previous resource booklets. The case study used and the Resource Booklet are not fixed in terms of what they can or cannot include. So the exclusion



of images of organisms and the use of terms not in the guide may well occur in a resource booklet. One mention was made of an unclear image for the floating garden, however floating gardens were also described in the text, so this was not considered an issue for the candidates.

One school noted that some terms in Question 1 should have been in bold to make them stand out in the question. The grade award team agreed that this was a reasonable suggestion for future papers. This would allow the candidates to understand where the focus of the question was or them to craft an answer.

Section B questions had a range of comments but generally these were positive on the layout and wording. Please note that although the parts of a question may have connections the parts should not be linked together in one continuous essay. These are extended response answers rather than a single formal essay. There was a query about the term “cornucopian” however this is in the guide and can be used in an exam paper.

The Section B questions showed a distinct preference for answering questions 2 and 4, with questions 3 and 5 being the least popular.

A few schools mentioned the use of the term “complete” for a question. This has been used before for the filling in of a table where there is no command term used.

The standardizing team considered how the candidates answered questions as the final markscheme was prepared. When candidates approached questions in a different way from the original exam writers expected interpretation then the markscheme is reviewed. Generally both the original interpretation and the post-exam interpretation are included, as long as the concepts are correct.

## The areas of the programme and examination which appeared difficult for the candidates

In Section A, some candidates gave one sentence answers for two or three mark questions, usually meaning only one mark was awarded. The questions which required application of syllabus content, rather than information from the resource booklet directly, gave the most difficulty. A significant minority of candidates just quoted from the resource booklet, rather than answering the question asked.

The questions linking the case study to sustainability, natural income, flow diagrams, the role of the atmosphere with biomes, application of environmental value systems and evaluating environmental impact assessments proved to be harder for the candidates.

The candidates did find interpreting what the questions were asking for challenging. Their lack of understanding of the command terms is reflected in their answers. Evaluate and discuss are the command terms that are most often misunderstood, the answers often lack balance and a summary statement/conclusion.

The application of the information from the resource booklet to a range of topics from the guide proved to be difficult for many candidates.

In Section B some candidates are still trying to incorporate the three parts of the essay into a continuous prose. This should not happen. Each part of the question should be answered separately.

The essays often repeat points and use weak, vague examples to support the topics. Often the example used wandered off from the question asked. Here the candidate was just writing all the information they knew about the example or topic without referring back to the question. Application of concepts and examples to a specific question indicates the holistic aspects of the course are lacking.

Q 3 b. Many of them failed to show the link between soils and the other three components. The flow diagram was often poorly drawn.

Assessment Objective 4 stresses the need to make reasoned and balanced judgments using appropriate economic, historical, cultural, socio-political and scientific sources. Only the very best candidates were able to demonstrate this balance.

## The areas of the programme and examination in which candidates appeared well prepared

Most candidates completed the paper answering all the parts of Section A and two essays in Section B. The candidates seemed to generally have enough time to complete the paper. The resource booklet did not seem to cause problems with accessing information. They were able to extract the required details from the resource booklet when asked in specific questions. Not many candidates required extra paper, indicating that the space provided was adequate.

The handwriting was generally clear this session, most candidates used a dark enough pen (it should be blue or black) and so the computer image was clear.

Section B answers had many examples used to illustrate the answers, this was generally effective in detailing the content required for an answer.

The concepts of human population dynamics, agricultural techniques, natural selection and global warming were seen to be grasped by the candidates.

## The strengths and weaknesses of the candidates in the treatment of individual questions

### Section A

#### Question 1

ai) Only a very small minority gave an incorrect answer here. Most candidates mentioned 2 food sources, rice and vegetables being the common answers.

ii) Most candidates described sustainability rather than explained. This meant many candidates gained zero or one mark only.

iii) The majority gained the marks here. The ones who did not only stated impacts rather than identified them, meaning their answers were too vague.

bi) Many candidates did not read the stem correctly and mentioned inputs and outputs that were not linked to water associated with Inle Lake. Those that did use water usually gained both the marks.

ii) Very few candidates gained a mark for this question. As only one mark was available a simple water inputs minus water outputs was all that was required.

ci) The candidates generally had no problems completing the table. A few gave the answers the wrong way round.

ii) This was generally well answered for the altering the activity part, slightly fewer candidates identified a clean-up and restoration strategy.

iii) The candidates mainly mentioned the process of eutrophication and how that leads to hypoxia. Only the stronger candidates used the map to indicate where in the world this occurs and why. There were some incorrect statements indicating the algae used up the oxygen.

d) The majority of candidates did look at both the positives and negatives of having grass carp in the lake. Only a handful of candidates left this blank. The weaker candidates usually gave the water hyacinth being eaten by the grass carp as their only answer.

e) The majority of candidates gained at least 2 marks here. They were able to identify social and culture impacts and most gave at least one positive and one negative effect. However many candidates also gave ecological impacts which the question does not ask for. This led to candidates using extra booklets to complete their answers.

## Section B

### Question 2

a) The differences between predation and competition provided no problem for most candidates. The similarities were much more difficult for them to articulate. Weak answers showed glimpses of understanding and too vague was the annotation often used. Some candidates mentioned predation being a subset of competition this usually ended up with the candidate writing a confused answer.

bi) Many candidates gave very clear, precise answers here showing a good understanding of predator/prey relationships. Some candidates were confused by the term “stability” and so wandered off the topic of the question.

bii) The majority of candidates struggled with this question and many ended up repeating their answer to 2bi. In doing this they often managed to gain one mark from mentioning the prey reproduction rate. Stronger candidates mentioned invasive species or environmental changes for the prey. When candidates mentioned humans and hunting they usually assumed the humans were the predator by the fact they were hunting. This was not accepted as a correct

answer. Hunting by humans could be used as a factor making the prey numbers very low, and so natural predation could make the species decrease or become extinct.

c) The candidates found naming two countries and 2 strategies for stabilizing human population straightforward. The tendency was to use one country per strategy, this was fine. The stronger candidates did use more countries for each strategy they used. Very few candidates mentioned more than two strategies or only one. The weakest part of the question was giving the effectiveness of the strategy. The candidates found the positive and negative impacts easier to write about.

### Question 3

a) The majority of candidates were able to gain a mark for renewable and sustainable as definitions. But making a clear distinction between the terms was only possible for the stronger candidates.

b) The guide specifically mentions that candidates should be able to draw diagrams that show the links between the soil, lithosphere, atmosphere and living organisms. The use of the terms systems diagram or flow diagram is not in the guide specifically, though in Topic 1.1.9 candidates are expected to construct models of flows and storages in a system. Very few candidates produced a clear diagram that linked the soil to the other three storages. However most candidates who attempted this question did manage to show the processes that link the storages with an example of the matter involved.

c) The candidates clearly knew about different agricultural techniques and were mostly able to evaluate these for sustainability to gain a number of marks.

### Question 4

a) Most candidates gave a reasonable description of natural selection and linked this to biodiversity. This indicates good progress as natural selection questions in the past have been poorly answered. Gaining full marks for this question was generally the stronger candidates.

b) The use of the term atmosphere did seem to confuse many candidates who answered this question. However the candidates are expected to be able to explain biome distribution and so should have been able to link the atmosphere to the climatic conditions required for biomes. For those candidates who recognized the link they generally gained 2 or 3 marks for the question. A few candidates did mention the tri-cellular model of atmospheric circulation, but this was not required to gain marks.

bii) The term plate activity is in 4.1.4 of the Guide. The candidates generally had no difficulty mentioning plate separation isolating species and leading to speciation. Also popular were mountain building and the creation of volcanic islands.

c) The candidates obviously know plenty about global warming. Many candidates had no problem discussing the positive and negatives of both the distribution and diversity of ecosystems. Weaker candidates tended to focus on the negatives only. The only area most candidates missed was writing a conclusion.

## Question 5

a) The candidates either knew the answer to this question and gained most/all the marks or they had no clue what to answer. A significant number could name two indirect methods but then gave no measurement method.

b) Candidates often misread this question and only described an EIA rather than discussed the effectiveness of using one. For the candidates who did discuss they generally gained a number of marks and mentioned both positives and negatives of using an EIA. All the candidates did link their answers to the project mentioned in the question. This was good to see.

c) Most candidates could distinguish between a deep ecologist and a cornucopian to gain some marks. Only the stronger candidates were able to adequately discuss their approach to the hydro-electric power plant and give a reasonable conclusion. A few candidates confused the two environmental philosophies.

## Recommendations and guidance for the teaching of future candidates

The following is a summary of the advice for teaching future candidates:

Review the meanings of command terms so candidates know what is required in each question. Especially for Assessment Objective 3 command terms.

Encourage candidates to make annotated diagrams large and clear if they are using them.

Make sure candidates pay attention to the "point value" for each question to gauge how many different and distinct statements they need to address to earn full marks. Encourage candidates to give clear, diverse and discreet marking points, rather than a single vague, limited, and repetitive discourse.

Encourage candidates to break up their answers into the relevant sub sections to make it easier for the examiner to identify which part of the question they are answering. The answers are not expected to be one long essay.

Ensure sufficient time is dedicated to the teaching of the systems and values elements of the course. To enable the holistic nature of the course to be recognized and used in the answers.

Reinforce the importance of learning key definitions and terminology.

Clarify how expression of ideas marks are allocated and perhaps use them in your own marking so candidates get used to developing their answers, including examples and structuring their ideas.

Candidates should be encouraged to write within the space provided within the exam paper.

Please encourage candidates to print specific examples as these are often hard to interpret when the handwriting is bad.

Detailed examples are needed for all areas of the syllabus. Local ecosystems should be used and then the inter-relationships can be explicitly noted.