ENVIRONMENTAL SYSTEMS AND SOCIETIES

Overall grade boundaries

Standard level

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 14	15 - 29	30 - 41	42 - 53	54 - 64	65 - 75	76 - 100

Standard level internal assessment

Component grade boundaries

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

General comments

The May 2010 session was the first mainstream session of this course. However, the type of practicals that centres have been carrying out over the last few years did not change. There was, as expected, greater evidence of work that draws on secondary data for analysis, in keeping with the new course's group 3 facets.

There was evidence to suggest that a number of practicals do not really allow candidates to come to grips with good, solid mathematical analyses. All candidates should have opportunities in their work to look at a range of values and calculate simple descriptive statistics, including means, medians, modes and standard deviations. The data should also lend themselves for graphical interpretation by means of bar graphs, pie graphs, histograms, scatter plots, etc. At times the sample set makes this difficult, and teachers should ensure that their ES&S/PSOW includes opportunities for manipulating data sets. Having said this, a number of centres used statistical tests (Chi Squared and Candidate's *t*-test) that are beyond the stated scope of the course (Mathematical requirements, page 5 of the subject guide), but certainly within the capabilities of the candidates. The use of these more sophisticated techniques is not required and their absence is not penalized.

As expected with the first year of a course, there were several administrative problems:

- A number of centres used the Group 4 PSOW (4/PSOW) instead of the subject specific ES&S/PSOW. The biggest impact here was in discussion, evaluation and conclusion (DEC) criterion, which is quite different from the Group 4 Conclusion and evaluation (CE) criterion.
- Some centres sent entire portfolios. Only the work to be moderated is required.
- Teachers are reminded to please send in the entire practical that is to be moderated. It is very difficult to evaluate DEC if the data upon which the discussion is based and the method used to gather the data are unavailable.

- Candidates that have received zero marks for work not submitted should be considered atypical and alternative work should be sent for moderation along with the atypical work.
- The group 4 project is **not** required for ESS candidates. Group work is not suitable for moderation, and its submission will often result in the school being asked for more work, with all of the delays that this implies. However, if centres choose to have their candidates participate in the project, and the work is to be used for assessing specific criteria, then it is up to the teacher to ensure that the work is individual.
- When packaging a sample, please ensure that each report or write up is somehow held together (stapled, clipped, etc.). It is not necessary to package each practical in a separate plastic sleeve or to place each candidate's work in an envelope, etc. Minimizing extra packaging is in keeping with the subject we are teaching.

Candidate performance against each criterion

Planning (PI)

There were some truly amazing efforts by candidates. For example, one practical compared NPP against density of planting of seeds, which turned out beautifully. Another studied cemetery data for different time periods postulating changes in survivorship; a really nice example of planning.

As in prior years, there was concern that for some centres, the learning of a technique (dissolved oxygen, soil texture, Simpson's index, Lincoln index, percent cover, etc) is used to assess Planning (PI). If a candidate is going to simply apply Simpson's diversity index to a quadrat of data, it's hard to imagine how this could be used for assessing PI. However, if the same candidate collects five to ten quadrats of data at each of two or three different sites, each linked perhaps with a varying abiotic characteristic (i.e. distance from a river, height along a slope, etc) then obviously this does lend itself to assessing PI, as there is an independent variable that is being manipulated and a dependent variable that is responding to this change. It is therefore recommended that teachers present techniques and then pose questions for candidates that can be answered (or at least an answer attempted) with the tools that the candidates have acquired.

The problems in the PI criteria lie equally in all three aspects. When candidates are posing a question, teachers can provide a little guidance to focus this question so that the practical work involved is likely to yield good results. This can be done on the first draft of the practical and can be very educational for the candidate. Too many candidates lose marks for not knowing the difference between an independent, dependent and controlled variable. These should be explicitly identified by the candidate (although the terminology is not mandatory, some candidates refer to the variable that they will manipulate and that which will respond, and those that will be held constant; good enough). As mentioned previously, the concept of controls needs to be taught explicitly, and candidates should be familiar with the idea of a fair test. When sampling, candidates must outline how those samples are to be selected, ensuring that there is no significant bias. Finally, there should be enough relevant data collected. In most cases, where candidates lost marks in this aspect, the data was in fact relevant to the question or topic that was being studied but it was insufficient in quantity.

Normally, five is the minimum number of samples required per site, treatment, repetition, etc. For example, if a candidate is measuring changes in rate of oxygen release with respect to light intensity in *Elodea*, it would be expected that the candidate would take at least five readings for each light intensity.

Note that the lack of sufficient data has a compound effect. If only a single measurement is generated per treatment, the data does not lend itself for processing and by extension is not suitable for the presentation of processed data. Time constraints in fieldwork can be quite problematic, and it is appreciated that in these cases candidates may need to collect fewer than five samples or transects. In these cases three may be acceptable.

Practicals that relied on secondary data did not do well when assessed against PI. The biggest problems are in Aspect 2. What constitutes a control when accessing secondary sources? This is something that candidates have difficulty with and probably requires direct instruction. If it is to be a fair test, candidates will probably have to rely on various different sources and average the results.

Data collection and processing (DCP)

Generally, the majority of centres provided their candidates with ample opportunity to generate good quality data. It is therefore frustrating to see candidates losing marks for Aspect 1 for simple things such as placing units in all the cells in the table, not placing units in the column or row headings, and finally reporting data to a varying number of decimal places within the same column or row. In a table, the temperature data and dissolved oxygen data may have different numbers of decimal places, but *within* the temperature readings all the cells must have the same number of decimals. On this topic, while indicating uncertainties for the instruments used is good practice and should be encouraged, it is not required for a complete in Aspect 1 of DCP.

For Aspect 2, it is expected that candidates **do** something with their data: calculate indices, averages, standard deviations, etc. Some centres used statistical techniques such as Chi squared, regressions, candidate's *t* – test, etc. These are not required, but if attempted must be done well for full marks. When processing data, candidates should be careful to not increase accuracy through mathematical means; for example, a mean calculated from numbers with two decimal places, should not be reported to four decimal places.

For Aspect 3, the processed data must be presented in some way to aid analysis. This usually takes the form of a scatter plot, pie chart, histogram, bar chart, or some other method of visually portraying the analyzed data. It is discouraging to see candidates present five temperature and five dissolved oxygen readings taken at various different stations along a river, and not have them graph the averages of these data against each other in a scatter plot and draw a line of best fit. They might even calculate the standard deviations and include error bars.

Discussion, evaluation and conclusion (DEC)

In the third and final criterion, DEC, the biggest problems center on the discussion (Aspect 1) and the conclusion (Aspect 3). In general, the discussions were an area of weakness. A good discussion should identify patterns in the data (or comment on their absence), place the research in context, that is relate it to theory and or research, and assess the quality of the data generated. Obviously this is much easier if PI and DCP have been done well. If the research question is tightly focused, and there is sufficient data to address the question, then a discussion is more likely to produce interesting insight by the candidates. For example, if candidates have carried out a study of the relationship between temperature and dissolved oxygen at sites above and below a pollution source, they should address the quality of their data. Is it reliable? Why, or why not?

This is where having means and standard deviations can be useful. If there is a very large standard deviation, candidates would be expected to comment on this fact and interpret it.

Were the samples collected without significant bias? Are there literature values that can be used for comparison? If there are, these should be mentioned. If these are non-existent or unavailable, a note to this effect should be included. Are there patterns that can be identified? Are there anomalies in the data? These should be discussed, and if they are to be ignored or excluded from the analysis, a case for this decision should be made.

Aspect 2 of this criterion should be done well by all candidates. However, many miss the most obvious improvement, i.e. collection of more data, repeating the experiment, calculation of averages. Where candidates have lost marks for improvements this is because their suggestions are either too simple or unrealistic.

Finally, Aspect 3 suffers generally from a lack of specificity. Candidates should cite their data in their conclusions. For instance, if a candidate concludes that in their study of soil moisture along a slope there is a trend towards increasing moisture down slope, this should be illustrated with the actual data. There should be a brief explanation as well, for example, “The increase in soil moisture down the slope may be due to runoff and infiltration.” In short, this should be a brief summary of the important findings and trends mentioned in the discussion.

Recommendations and guidance for the teaching of future candidates

When teaching future candidates, teachers should provide them with the criteria against which they will be assessed at the beginning of the course. These should be discussed with the candidates, and they should be made aware of what criteria will be assessed for any given practical. A useful exercise is to have the candidates read a practical and then assess it against the criteria in groups and/or with their teacher so that they can see how these are applied.

Candidates should have access to a good model of a data table together with the analysis and presentation. Some teachers provide their candidates with an annotated example of a table, the analysis and the presentation. Whatever the method, the handling of data needs to be taught explicitly in order to avoid the mistakes affecting candidate performance. Teachers should ensure that the practicals they are carrying out with their candidates have the potential to generate complex data sets that lend themselves to significant and meaningful analysis. One way of improving discussion is to have candidates read actual research by giving them a copy of an article from some scientific journal and having them comment on the data, and the conclusions. Finally, a number of centres sent in the same two practicals for all of their candidates, and often these were the only two on the PSOW that had been scored against the IB criteria. While this is not technically prohibited, it misses the point, which is to have candidates learn from their mistakes and improve their work.

Standard level paper one

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 7	8 - 15	16 - 22	23 - 27	28 - 32	33 - 37	38 - 45

General comments

A low number of G2 forms were received. Teachers are encouraged to submit feedback in the future. The examination papers were deemed by most to be of a good standard. All deemed the level of difficulty appropriate. Syllabus coverage, clarity of wording and presentation of paper was rated mostly satisfactory or good. Some centres rated syllabus coverage as poor.

One centre commented that there were insufficient application questions. Asking candidates to apply their knowledge is a higher (objective 3) level question. The majority of questions cannot be of a higher level but those we do include (in which candidates are asked to evaluate or explain, for example) allow higher ability candidates to showcase their knowledge.

It was commented that the syllabus cannot be covered without the use of a multiple choice paper. The structure of the examination papers allows candidates to draw on a breadth of knowledge. Overall, the examiners felt that the syllabus is well covered.

The areas of the programme and examination that appeared difficult for the candidates

Candidates struggled with the concepts of negative and positive feedback. A common misconception is the idea that negative feedback involves a feedback loop that has a detrimental effect on the environment (and the converse). Candidates also struggled to understand that a feedback loop is involved, at least when asked to draw or describe a feedback system. They sometimes earned a mark for recognizing that one effect leads to another, but failed to recognize that the second effect has a dampening or enhancing effect on the initial state.

Water cycle diagrams were often done in reverse for example, and were often incomplete. Likewise, even candidates who described negative/positive feedback did not always draw accurate and clear diagrams.

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

Candidates did well on ecological topics, demonstrating a range of knowledge from their own case studies and practical work. Most were able to describe ecological methods, and almost all were able to use the dichotomous key (Question 2). As might be expected, candidates did well on objective level 1 questions where they were asked to state a particular name or concept. For example, candidates generally did well on Question 1(d) and Q3 (b). There was an overall solid understanding of the water cycle although some candidates were confused about how to draw the diagram (see below). Question 5 was also answered well in general and candidates presented a wide range of correct justifications for selection of a landfill site.

The levels of knowledge, understanding and skill demonstrated

There was a wide range of ability and knowledge shown but in general candidates demonstrated a good level of knowledge. Candidates who answered questions well seemed to be drawing on direct experience with topics – through practical work, or through work on case studies. Where candidates were comfortable with the concepts, they were able to apply their knowledge well to a new situation.

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

Question 1

This question investigated knowledge of global warming and its relationship to a number of other areas of the syllabus.

b) As mentioned previously, candidates struggled with the concept of negative and positive feedback. One G2 comment was that candidates could be penalized twice for not knowing negative and positive feedback in questions 1 (b)(i) and 1(b)(ii). However, 1(b)(i) essentially asks candidates to show their understanding through a definition and comparison. Question 1(b)(ii) asks candidates to provide an example. In many cases where candidates lost points for 1(b)(i), they gained points in 1b(ii) because they were able to provide an example that was accurate.

d) Surprisingly, several candidates were unable to label the diagram in 1(d)(ii). This may have been because the scale involved meant that they had to apply their knowledge to an unfamiliar way of presenting the atmosphere.

Question 2

a) Several teachers felt that the diagrams were unclear or that the method of asking candidates to identify bones was unclear. However, a substantial number of candidates answered this part question correctly.

b) Candidates did not always distinguish between measuring population size and measuring diversity. Even candidates who had a fairly good grasp of the concepts sometimes failed to recognise that the number of individuals per species needed to be recorded and so lost a single mark. Many candidates answered this question well with regards to applying the concept of adaptation (i.e. why certain species were not found in the owl pellets).

Question 3

a) This part question required candidates to have a solid understanding of ecological footprint and carrying capacity. Few candidates answered this clearly and accurately, but many earned at least one mark.

b) Candidates did very well in both this part question and 3(c)(i).

c) (ii) As mentioned previously, candidates failed to read the question carefully. Although it was commented that without knowing 3(c)(i) a candidate could not answer 3(c)(ii), very few candidates demonstrated a total lack of understanding of transfer and transformations. This was not a critical question for the few that were unable to answer 3(c)(i).

(iv) Candidates often failed to tailor their responses to address future issues of water supplies. The key to earning full marks for this question was for candidates to recognize that current practices or situations will cause future shortages rather than explain why there may be current shortages.

Question 4

a) To gain a mark, candidates had to state processes leading to a reduced amount of sunlight, rather than physical entities.

Question 5

Teachers felt that this was a good question.

a) Most candidates could not accurately define an Environmental impact assessment in enough detail to earn full marks.

b) Almost all candidates answered this part question very well, drawing on a variety of rationale.

c) (i) Some candidates responded 'feces' as solid domestic waste, or focused on solid waste but not solid domestic waste.

Recommendations and guidance for the teaching of future candidates

- The misconception of global warming and ozone depletion is a frequent issue although in this paper it was not a focus. Global warming, natural selection and feedback systems all have 'emergent' effects – the effects are several steps removed from the initial incident and are the large result (often contrary to intuition) of small events. Research shows that such emergent processes are very difficult for candidates to grasp accurately so it is a case of trying multiple approaches. It is ideal if candidates lead their own investigations (using raw data to investigate trends and creating presentations for example), play with computer simulations and models (which helps them understand systems and models better as well), are taught about any misconceptions. Ideally candidates should be exposed to learning situations which force them to confront the misconception – getting results which don't make sense at first for example, will really stick with them.
- Candidates would benefit in practicing and learning details, for example, being specific about the word 'pollution' or drawing on their case studies to provide examples.
- Again, the best way to solve this is to have candidates investigate data and design and conduct their own investigations.
- Candidates could have benefited from practice in using and creating diagrams. This would have helped with the water cycle diagram and the negative feedback diagram.

Standard level paper two

Component grade boundaries

Grade:	1	2	3	4	5	6	7
Mark range:	0 - 8	9 - 16	17 - 23	24 - 30	31 - 38	39 - 45	46 - 65

General comments

As for Paper 1, there was a disappointing number of G2s received. The examination papers were deemed by most to be of a good standard. The level of difficulty was deemed mostly appropriate, though three centres thought the paper too difficult. Syllabus coverage and presentation of paper was rated as either good or satisfactory by all but one centre. Clarity of wording was rated mostly satisfactory or good.

There was an even spread of candidates opting for each of the essays indicating good coverage of the syllabus. Given that this was the first mainstream session of the course, with the inevitable challenges of a new syllabus and examination style for many teachers and candidates that this poses, it seemed that teachers had coped extremely well with the adjustments.

The areas of the programme and examination that appeared difficult for the candidates

Managing time in the examination was problematic, with some candidates writing pages on sections worth only a few marks, then running out of time later on. Ensuring all elements of a question are included was an issue for some candidates. Essay questions are compound in nature – with several aspects needing to be addressed. Most candidates managed parts, but not all aspects of the question. Some candidates struggled to use the resource booklet effectively, with weaker candidates simply writing out sections of the resource booklet inappropriately.

Whilst it was clear that some candidates had good syllabus coverage, sometimes they could not apply this knowledge to the questions. For many candidates, relating causes and consequences was problematic. The causes and effects of Global warming, acid deposition, photochemical smog & ozone depletion were frequently confused. Differentiating between key terms was problematic generally for weaker candidates.

The quality of written responses to the essay questions were sometimes very poor with vague and irrelevant statements, clichéd examples and poor expression. This seemed to be more a reflection of a lack of syllabus knowledge rather than problems with English, though this too, was a clear obstacle for some candidates. Quality of handwriting is a persistent problem in a minority of scripts, as was a tendency for some to write in continuous prose rather than subdividing their answers.

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

Knowledge of core content was encouraging. Factual recall of key ideas was often strong.

Many candidates displayed a good understanding of the conservation concept, and demonstrated a sound understanding of environmental ethics. However, it is important that candidates recognise that the conservation is underpinned by sound scientific knowledge.

The use of examples was encouraging. The essays showed that many candidates are capable of using examples effectively to support their answers, though unfortunately, many did not give clear examples even when the question asked specifically for them. On the other hand, often when the question was misinterpreted the candidates did use examples and could thus gain the extra marks for expression of ideas.

Many candidates were good at discussing human attitudinal factors and good at justifying responses when required. In terms of content, there was general good understanding of invasive species, causes of endangerment, impact of deforestation, interconnectedness of food webs, value of biodiversity, abiotic and biotic changes resulting from climate change, demographic transition, and human factors controlling population dynamics. The majority of candidates could calculate percentage land area protected.

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

Section A

Question 1

a) Tundra and deserts were often mentioned in the response to the case study showing poor understanding of biome distribution. A number of candidates are still confused by the differences between causes of high GPP and causes of high diversity. The role of climatic factors in the former is not understood by large numbers. Often the issue is that candidates are not able to provide a sufficient range of factors for each question to secure higher marks. One such example was that candidates were unable to identify *two* valid reasons for high diversity.

b) (i) Construction of a quantitative model was clearly very challenging for many candidates. There is a need to study formal techniques for representing a model (for example, boxes for stores, arrows for flows). Many candidates could not differentiate flows from storages. Key concepts such as respiration and photosynthesis were often absent.

Time was sometimes lost on elaborate drawings. Whilst these were not necessarily penalised if they showed relationships correctly, the same marks could have been achieved in less time if a simpler diagram had been used. The candidates tended to use the information given rather than going the logical step further to apply their own knowledge of how carbon cycling works.

(ii) When explaining the impact of deforestation on climate, many answers did not focus on *climate* at all but talked about soil or species loss, suggesting that candidates were not reading the question properly.

A more critical approach to material in the resource booklet is clearly required. Candidates were able to select the relevant information but then continued to write out sections of the resource booklet that were not relevant.

d) Umbrella species was an unfamiliar term, but the meaning was given in the resource booklet. The idea behind the resource booklet is that candidates are presented with new information that they have to use, and so an ecological term, presented together with its definition was not unreasonable. Candidates found it difficult to apply the term to their own knowledge, often confusing it with the term keystone species. The choice of example used by many candidates would suggest that they are aware of very few examples of individual species within named case studies of ecosystems.

f) One concern raised in a G2 form was that candidates might be penalized in their evaluation of the poster if they only made critical comments. The command term 'evaluate' demands that both positive and negative points should be made. This was a fair point, and although evaluation should involve an assessment of strengths *and* weaknesses, no candidate was penalized for a one-sided response.

Candidates produced responses that were generally good but there were some confused responses addressing the issue of international 'corporations' (rather than cooperation). Some candidates addressed the value of conserving rainforests, rather than the role of international cooperation in the process.

Section B

Question 2

a) This part question was generally answered very well. However, some responses were too brief, for example, 'cleaner' offered as an advantage of wind power with no development (e.g. cleaner than.. cleaner because..). Subtleties were only rarely identified, for example, that solar is relatively cheap *in the long term* (despite high initial start up costs). One centre commented if it was fair to ask candidates to apply their knowledge to a named country as the syllabus refers to 'different societies' and not specific countries. This is a valid point, though relating their discussion to a specific country seemed straightforward to most candidates.

b) Knowledge of the chemistry was generally very poor with a number of candidates not knowing the difference between nitrates, nitrogen, nitrogen oxide, nitric acid etc, or using the generic term 'chemicals'. A number of candidates thought CO_2 was the cause of all problems. Responses were also weakened by poor structure, with candidates addressing acid deposition and photochemical smog at the same time. A more appropriate response was perhaps to deal with each in turn.

c) This question required careful reading. It was about the human factors that affect successful implementation of pollution strategies, not the strategies themselves. Many candidates simply listed all the strategies they could think of and so scored poorly. Examples were often not mentioned.

Question 3

a) Many candidates answered this well, showing a detailed knowledge of Red List criteria. However, many confused the criteria with reasons why some species are more vulnerable than others so wrote about prevalence of, say, poaching. Whilst there is some overlap in factors, this question was testing specific knowledge.

b) The key problem here was over general case studies, for example, Rainforest. Stronger candidates referred to specific actions in actual ecosystems (usually at the local scale) rather than describing general human actions like 'pollution'. To score highly, candidates needed to make the link between human action and loss of diversity clear. It was not enough to simply describe how people make species die and degrade an ecosystem. The best responses showed an awareness of all the components of diversity i.e. habitat, species and genetic diversity and showed how different human actions were reducing diversity in their chosen case studies.

Whilst candidates who attempted to use Borneo as their case study were not penalised, the responses tended to be very poor, as candidates were trying to use material from the resource booklet without having an in depth knowledge of the ecosystem. Consequently, candidates attempted to talk about the extinction of orangutans as being evidence of diversity loss (when orangutans have not in fact become extinct). Stronger candidates talked about diversity loss at the local scale. The key was showing an understanding of the meaning of diversity.

c) This question demanded a comparison of the two approaches: species-based (e.g. Save the whale) as opposed to the protected areas approach (e. g. creation of National Parks). Many candidates misinterpreted the question as requiring a list of reasons why species diversity is important, or wrote about the pros and cons of conservation. These responses were given some credit, but could not score highly. Many statements were vague or irrelevant.

Question 4

a) There was a huge range in the quality of responses, from candidates who described in excessive detail how each sample was measured to identify changes in a specific case study, to candidates who did not know the difference between biotic and abiotic factors. A number of candidates listed factors that might change without relating it to any specific human activity, or identifying specific methods that could be used to assess the factors, or giving details of a method that would demonstrate 'change'. Candidates were credited for writing in detail about one factor, or several.

b) This was generally answered well by candidates who understood the difference between biotic and abiotic factors. Many candidates did not and so wrote generally about sea level changes or changes in climate without relating them to biotic components. The strongest responses explained in detail how agricultural systems might be affected and the consequences of, say, the vectors of tropical diseases increasing in their range. Weaker candidates tended to make simple statements about loss of food.

c) There were some encouraging responses from candidates showing a clear understanding of the difference between ecocentric and technocentric approaches to Global Warming. Many stereotypical claims were still being made such as 'ecocentrics only love earth and technocentrics only love machines'. Obviously a greater degree of sophistication here is needed for high marks. A number of candidates did not attempt to justify which were more important, or their justifications were limited to a repeated list of the different types of strategy with no attempt at persuasive argument.

Question 5

a) Many candidates wrote lengthy answers despite there being only three marks for this part question. Although the underlying reasons for changing pyramid shapes were clearly understood by many candidates, most did not relate their answer to pyramid shape and therefore gained no marks. Many candidates wrote about the demographic transition model or MEDC vs LEDC when a closer reading of the question showed that something a bit different was required here. Candidates appeared to know the material, but were not able to relate their answers specifically to the shape of pyramids.

b) This was generally done well, showing a clear understanding of how environmental attitudes change over time. Specific historical influences were sometimes not mentioned, and poorer responses tended to identify a few factors that affect environmental attitudes rather than relating them to actual influences.

c) There were some excellent responses to this question, but some candidates were hampered by not understanding what population dynamics were. These candidates wrote about economics and cultural factors affecting people generally.

Some candidates could identify factors affecting dynamics but were not able to accurately classify them as economic or cultural and therefore could not evaluate them properly.

A few answers were weakened by lack of knowledge. A worrying number of candidates wrote about the high birth rates in China, with no awareness of the one child policy that makes China an important exception to the rule. Some candidates made stereotypical claims such as 'everyone in Africa has lots of babies'. Stronger candidates demonstrated a sophisticated awareness of the interplay of economic and cultural factors, relating them to examples and explaining how different aspects of population dynamics were affected. Though there were many high scoring answers, few scored full marks because they lacked the full range of distinct points.

Recommendations and guidance for the teaching of future candidates

- Ensure an actual study of an existing ecosystem. Local level case studies should be used wherever possible to reinforce and illustrate concepts. As an ability to *apply* theory to real world ecosystems is central to this course, the importance of examples cannot be overstated.
- Encourage candidates to go for precision in their answers rather than vague statements. Exemplar material could be used to illustrate this.
- Practice identifying the different aspects of a compound question i.e. involve more than one task, especially when there is an evaluative element at the end. Reviewing command terms should help with this.
- Remind candidates that the final part question of each essay is likely to require more evaluative/discursive/higher order thinking, and that simple descriptive answers are unlikely to score highly. The single skill most requiring development would be to deal with part c) type questions that tend to ask both for content and evaluation/ justification of content.

- Advise candidates to break answers into sections rather than write as continuous prose. Many examiners commented that it was hard to mark responses where candidates had not subdivided the sections of the essay. Candidates should be instructed to leave at least a line between part questions for clarity. Candidates should also note on their scripts if a continuation sheet is used.
- Encourage candidates to use and apply their own case studies to questions, and not to use the resource booklet case study to answer Section B questions. Candidates are likely to have more in-depth knowledge of their own case studies.
- Samples of written responses could be used in guiding candidates to write tangible answers that reflect expression of ideas and structure.
- It may be helpful to encourage candidates to move away from pictorial flow diagrams to simple boxes and arrows. Firstly, they are far quicker to produce under exam pressure; and secondly, they will avoid the ambiguity that frequently loses credit on an exam question. As an exercise, getting candidates to construct such diagrams from pictorial versions, data tables or written text will help to develop a more analytical and accurate understanding of the functioning of systems.
- Candidates need to be more alert to the available marks for questions and consider whether they are making sufficient discreet points to gain full marks. Candidates often need to produce more than one or two valid points to achieve this.
- Candidates need further training in writing *full* descriptions of practical fieldwork procedures.
- Encourage candidates to draw diagrams when appropriate.
- Candidates should be taught to read the questions carefully before answering, and to frame their answers with an eye to the mark scheme. A common feature was for candidates to write extremely long answers to the opening part of the question, where there were few marks.

Further Comments

Specific definitions for terms (e.g. renewable and replenishable) can be found on page 70 – 75 of the Environmental systems and societies guide (glossary).