IBDP ENVIRONMENTAL SYSTEMS AND SOCIETIES SL

COURSE OUTLINE

Lanterna Education

2023

INTRODUCTION

The Environmental Systems and Societies (ESS) course is taught at Standard level (SL) as part of group three and four of the IB Diploma program. It is a complex and contemporary course that engages students with the challenges of 21st century environmental issues. It requires students to develop a complex set of skills, knowledge and understanding from different academic disciplines. The interdisciplinary nature of the course requires students to assimilate knowledge from the eight units of work studied and be able to consider social, ethical, cultural, and economic issues when engaging with environmental issues at a local and global level.

The ESS syllabus of eight interconnected units is organised in a logical manner. 'Unit One: Foundations of ESS' gives students an introduction to the key concepts that will build understanding of the big questions and overarching issues that they will encounter through the rest of the course. The rest of the Units 2 – 8 can be taught in a variety of sequences depending on teacher preference and school's curriculum design. In this course, the focus will be on teaching the ESS course in order, Units 1 – 8. This gives students a logical approach to making the connections between the interconnected units. Unit 2 will be taught before starting with the Internal Assessment (IA), as this gives students the skills and knowledge that are a pre-requisite for completing the Internal Assessment. The IA could easily be completed in a block which could be taught as a stand-alone topic.

Exam skills are broken down into **two types of questions**.

Short Answer Questions - AO1, AO2 (SAQs) and **Extended Response Questions** - AO3, AO4 (ERQs).

Course structure (Topics and Content headings) feed into the Assessment structure.

OVERVIEW OF CONTENT COVERED OVER THE 2-YEAR PERIOD.

YEAR ONE - UNIT OVERVIEW	Expected teaching hours	Weeks (Out of 33)
Unit 1 – Foundations of ESS	16	6
Unit 2 – Ecosystems and ecology	25	9
Unit 3 – Biodiversity and conservation	13	6
Unit 4 – Water, food production systems and society	15	5
Internal Assessment	10	7
Total Hours / Weeks	**79**	**33**

YEAR TWO - UNIT OVERVIEW	Expected teaching hours	Weeks (Out of 26)
Unit 5 – Soil Systems and Society	12	8
Unit 6 – Atmospheric Systems and Society	10	6
Unit 7 – Climate change and energy production	13	4
Unit 8 – Human systems and resource use	16	8
Practical activities	20	Throughout the course
Total Hours / Weeks	**150**	**26**

OVERVIEW OF ASSESSMENT IN ESS

Component	Style of assessment	Weighting	Marks	Duration (Hours)
Paper 1	Case Study	25%	35	1 hour
Paper 2	Section A – Short answer questions Section B – Two essays from a choice of four	50%	65	2 hours
Internal Assessment	Individual investigation assessed using criteria mark bands	25%	30	10 hours

Paper 1 – Case Study

Duration – 1 hour

Weighting: 25%

Marks: 35

Syllabus content: Units 1–8

The students will be provided with a range of data in a variety of forms related to a specific, previously unseen case study. Questions will be based on the analysis and evaluation of the data in the case study. All the questions are compulsory and will assess objectives **AO1, AO2** and **AO3.** Paper 1 will be based on stimulus material that is presented in a resource booklet. The examination paper aims to assess students' knowledge of the Environmental Systems and Societies syllabus. Students will receive an examination booklet with questions based on the stimulus material seen for the first time during the examination. The stimulus material will be presented in parts.

It will be a combination of written and diagrammatic stimuli, such as charts and infographics. The exam questions will, for the majority of the exam, be made up of 1,2,3 and 4 mark questions. However, the final question is worth 6 marks and is a holistic question based around all material in the resource booklet. Students should give this question more time to answer, giving a response to both sides of the argument and including a conclusion.

Paper 2 – Short/Long response

Duration – 2 hours

Weighting: 50%

Marks: 65

Syllabus content: Units 1–8

Paper two is completed over 2 hours (120 minutes) and is worth 50% of a student's grade for ESS. Therefore, it is essential that students have practiced this style of examination with past papers and have strong examination techniques. The exam paper is made up of two sections, Section A, short answer, and data-based questions that will mainly test assessment objectives AO1 and AO2. Section A is worth 25 marks and students should work through the questions with efficient use of time, working at around a mark per minute. Section B is worth 40 marks and requires students to answer two structured essay questions, from a choice of four possible options.

Each question is worth 20 marks and test assessment objectives AO1, AO2 and AO3. It is often suggested that students start the exam focussing on these longer high value questions. The questions are made up of a 4, 7 and 9 mark question with the 9 mark question being assessed via a rubric. Students should consider which questions of the four options they are most confident in answering. Committing 5-10 minutes of their time to preparing a short essay plan, can help in the decision-making process. By starting the exam with a focus on the essay style questions, they can allocate around 40 minutes per question and therefore not run out of time or lose marks, for these high value questions.

SUMMARY

THE MODIFICATIONS PRESENTED HERE ARE MADE TO BENEFIT STUDENT LEARNING.

There is a lot of content in DP Environmental Systems and Societies, and it involves a lot of ESS specific terminology that students aren't typically exposed to. The teaching sequence of units 1-8 in the order they are given in the syllabus, will help students to make natural links between topics. I feel that this sequence of units would be most advantageous for students to develop skills and knowledge, in preparation for their internal assessment at the end of Year 1. This allows time over summer to complete their draft, before final completion during the early part of year two. The IB expects a minimum time allowance of 10 hours for the IA. However this structure gives extra time to support students with the complexities of data collection, and the often difficult methodologies involved with ESS investigations.

Throughout the course, there are opportunities built into the curriculum plan for formative assessment during specific lessons from each sub-topic. Larger blocks of time are allocated to give students revision time, to then complete summative assessments that might take the form of single or multiple unit tests and past paper practice. At the end of year two there is time allocated to revision and review of content, and to practice past papers in preparation for the final IB exams.

YEAR 1: UNITS 1, 2, 3, 4 AND INTERNAL ASSESSMENT

Week: Number of weeks out of 33 for Year 1

Content: Course content copied and pasted directly from the Guide.

Aims: Suggested lesson aims for the week.

Tasks: Tasks are not listed but revision can be built into classroom tasks. Students can be creating revision notes, diagrams, etc as classroom activities and homework.

Assessment: Students do not need to be assessed every lesson. Formative assessment = practice in extended time frames (e.g. 10 minutes for an SAQ); Summative assessment = IB Grading with IB Exam expectations (e.g. writing an SAQ in 20 minutes, ERQ in 40 minutes, depending on the Markbands).

Week	Content	Aims	Hours	Assessment/ Practical
1	Introduction to Environmental Systems and Societies	What is ESS? Concepts, content syllabus units and assessment.	1	N/A
Unit 1 – Foundations of ESS		**Suggested inquiry statements to explore:** • Historical events, among other influences, affect the development of environmental value systems (EVSs) and environmental movements. • A systems approach can help in the study of complex environmental issues. • The laws of thermodynamics govern the flow of energy in a system and the ability to do work. • All systems can be viewed through the lens of sustainability. Pollution is a highly diverse phenomenon of human disturbance in ecosystems		

Week	Content	Aims	Hours	Assessment/ Practical
1	1.1 Environmental Value Systems	Environmental value systems, ecocentric, anthropocentric and technocentric. History of the environmental movement, conflicting environmental worldviews, and personal value systems.	4	Design of EVS questionnaires using online platforms such as google forms
2	1.1 Systems and Models	Earth's Systems-Atmosphere, Hydrosphere, Geosphere, Biosphere. Systems are a set of inter-related parts that form a complex whole. Flow diagrams to represent the inputs, outputs, transfers, and transformations in a system. Open, closed, and isolated systems.	4	Daisy world simulation of feedback loops SAQ Practice (Formative)
3	1.1 Energy and Equilibria	Energy in systems and the 1st and 2nd laws of thermodynamics. Feedback loops and examples of positive and negative feedback in ecological systems. Factors that impact the resilience of systems and tipping points.	3	N/A
4	1.1 Sustainability	Define the term sustainability and ecological overshoot, understand the uses of ecological footprint calculators and evaluate the use of environmental impact assessments.	3	SAQ Practice (Formative)

Week	Content	Aims	Hours	Assessment/ Practical
5	1.1 Humans and Pollution	Consider the nature of pollution and the common sources of primary and secondary pollution. Discuss the uses of DDT pesticide and the impact of biomagnification and bioaccumulation of persistent organic pollutants in food webs and chains.	3	ERQ Practice (Formative)
6	Unit 1 - Assessment	Revision and exam	3	Summative assessment grade for Paper 1 & Paper 2 exam
Unit 2 – Ecosystems and ecology		**Suggested inquiry statements to explore:** • A species interacts with its abiotic and biotic environments, and its niche is described by these interactions. • The interactions of species with their environment result in energy and nutrient flows. • Ecosystems are linked together by energy and matter flows. • Climate determines the type of biome in a given area, although individual ecosystems may vary due to many local abiotic and biotic factors. The description and investigation of ecosystems allows for comparisons to be made between different ecosystems and for them to be monitored, modelled and evaluated over time, measuring both natural change and human impacts.		
7	2.1 Species and Populations	Definition of a species, biotic and abiotic factors in ecosystems. Interactions between species, population growth and carrying capacity. K and r selected species, J and S shape population growth curves.	3	Compare brine shrimp in different environmental conditions

Week	Content	Aims	Hours	Assessment/ Practical
8	2.2 Communities and Ecosystems	Photosynthesis and respiration and the flow of energy along food chains. The 10% rule and laws of thermodynamics. Interactions in ecosystems through food webs and the concepts of pyramids of number, biomass and productivity.	3	Investigate rates of photosynthesis in aquatic plants (lab or simulation) SAQ Practice (Formative)
9-10	2.3 Flows of Energy and Matter	Ecosystems are linked together by energy and matter flows. Calculations of productivity including GPP/NPP and productivity of various ecosystems. Examples of the flows of matter such as the carbon and nitrogen cycles.	5	N/A
11	2.4 Biomes, Zonation, and Succession	Climate determines the type of biome in a given area although individual ecosystems may vary due to many biotic and abiotic factors. Succession leads to the formation of climax communities over time. Zonation is related to changes in environmental gradients e.g. mountains and rocky shores.	3	Live or virtual fieldtrip – zonation on a rocky shore Live or virtual field trip – zonation on a mountain
12 - 15	2.5 Investigating Ecosystems	Ecosystems can be better understood through the investigation and quantification of their components. Measuring abiotic factors such as pH, light, dissolved oxygen, turbidity gives primary data for study. Fieldwork techniques such as transects, quadrats and kick sampling give biotic data. This data can be used to calculate indexes of biodiversity such as the Simpson and Lincoln index.	11	Live of virtual – Sand dune succession, freshwater kick sampling, air pollution and lichen indicator species, Questionnaire design. Simpsons index, transects, identification keys. Internal assessment practice (Formative)

Unit 3 – Biodiversity and conservation		Suggested inquiry statements to explore: • Biodiversity can be identified in a variety of forms, including species diversity, habitat diversity and genetic diversity. • Evolution is a gradual change in the genetic character of populations over many generations, achieved largely through the mechanism of natural selection. • There have been major mass extinction events in the geological past. • While global biodiversity is difficult to quantify, it is decreasing rapidly due to human activity. Classification of species conservation status can provide a useful tool in the conservation of biodiversity • The impact of losing biodiversity drives conservation efforts. • The variety of arguments given for the conservation of biodiversity will depend on EVSs. There are various approaches to the conservation of biodiversity, each with associated strengths and limitations.		
16	3.1 Introduction to Biodiversity	Biodiversity is the variety of forms of life on Earth, levels of biodiversity are difficult to estimate. Biodiversity can be divided into species, habitat and genetic diversity. Statistical measurements of biodiversity can be made using the Simpsons index. Global locations with high level of biodiversity are referred to as hotspots.	2	Natural selection PHET simulation
17	3.2 Origins of Biodiversity	Charles Darwin's theory of evolution by natural selection provides the mechanism for the formation of new species known as speciation. Continental drift and geographical isolation of island communities form endemic species. Extinction happens at a natural background rate but mass extinction events have occurred in the geological past.	3	ERQ Practice (Formative)

Week	Content	Aims	Hours	Assessment/ Practical
18	3.3 Threats to Biodiversity	Global diversity is hard to quantify, however it is decreasing rapidly due to human activities. These activities include introduction of alien species, habitat fragmentation, resource exploitation and many more. The IUCN Red List evaluates species level threats and provides conservation status categories. Some species are more prone to extinction than others.	3	SAQ Practice (Formative)
19 - 20	3.4 Conservation of Biodiversity	Conservation of biodiversity has both direct and indirect value. There are international, governmental, and non-governmental organisations that are involved with the conservation of habitat and species. Conservation strategies may involve in-situ or ex-situ options, flagship and keystone species. Protected areas give legal protection to many habitats and careful consideration must be given to criteria for their effective design.	5	Live or virtual fieldtrip to zoo with guided tour from education department. Live or virtual fieldtrip to local whale / dolphin charity talk and boat trip.
21	Unit 1,2,3 assessment	Revision and exam	3	Summative assessment grade for Paper 1 & Paper 2 exam

Unit 4 – Water, Food production systems and society		Suggested inquiry statements to explore: • The hydrological cycle is a system of water flows and storages that may be disrupted by human activity. • The supplies of freshwater resources are inequitably available and unevenly distributed, which can lead to conflict and concerns over water security. • Freshwater resources can be sustainably managed using a variety of different approaches. • Aquatic systems provide a source of food production. • Unsustainable use of aquatic ecosystems can lead to environmental degradation and collapse of wild fisheries. • Aquaculture provides potential for increased food production • Water pollution, both to groundwater and surface water, is a major global problem, the effects of which influence human and other biological systems.		
22	4.1 Introduction to water systems	The Earths water budget and availability of freshwater. Systems diagrams of storages and flows and the hydrological cycle. Water scarcity/stress and human impacts on the hydrological cycle. Ocean circulation systems and the impacts on global climate.	3	World water storage and accessibility modelling lab
23	4.2 Access to freshwater	Global distribution of fresh water and precipitation patterns. Potential conflict over water due to stress/ scarcity of supplies. Increasing demand for water resources in MEDC/LEDC. Strategies to meet demand for water resources such as desalinisation and sustainable usage through grey water systems etc.	3	SAQ Practice (Formative)

Week	Content	Aims	Hours	Assessment/ Practical
24-25	4.3 Aquatic Food Production Systems	Types of marine ecosystems and food webs. The development of industrial fishing methods has led to the reduction in fish stocks. Regulations try to manage fishing using quotas and maximum sustainable yields. Aquaculture (fish farming) has supplied the increasing demand for fish, however there can be environmental impacts from aquaculture.	5	ERQ Practice (Formative)
26	4.4 Water Pollution	There are a variety of marine and freshwater pollution sources. These can be point/non point sources, organic or inorganic in origin. A number of biochemical parameters can be used to monitor water quality, including indicator species. Eutrophication is a major water pollution problem and can lead to marine dead zones if pollution management strategies are not utilized.	4	Water pollution comparison of samples lab Growth of duckweed with different nitrate levels lab

Assessment – Internal Assessment

Suggestions:

- The ESS Internal assessment is an individual investigation which can be conducted through laboratory experiments, fieldwork, questionnaires, or secondary data collection.
- The investigation must have one focused research question and the maximum word count is 2250.
- Students are to be provided with a minimum of 10 hours of support.
- Work is assessed against the ESS IA criteria rubric.

Week	Content	Aims	Hours	Assessment/ Practical
27	Introduction to the ESS IA	Receive guidance document on IA preparation. Class time dedicated to introducing the expectations of the ESS IA. Discussion of IB animal experimentation policy. Understand command terms. Practice using the assessment criteria by grading exemplar work. Research and develop ideas for your research question.	3	N/A
28	Research and planning	The research stages of the investigation must be underway and the background research section complete Clear in text citations and bibliography included from a reliable and full range of sources Referenced according a formal academic referencing system Complete your planning of experimental variables (I.V, D.V, C.V) Write a clear scientific hypothesis explained with scientific reasoning Complete a risk assessment of safety, environmental and ethical issues related to your inquiry	3	N/A

Week	Content	Aims	Hours	Assessment/ Practical
29-30	Data collection	Complete an apparatus list including specific measurements and inaccuracies (±) Write a plan of your experimental method to include step by step guidance on how to carry out your experimental method Prepare raw data tables in an excel document ready for data collection during your experiment/survey Laboratory experiments seat up and data collected Field work completed and data collected Survey/questionnaire investigations completed and data collected	6	N/A
31 -32	Results, conclusions, and evaluations.	Data processed using calculations to include: Average, standard deviation, errors and uncertainties Specific calculations eg. Species diversity index Graphs of processed data created using Microsoft excel Conclusion section of report completed Evaluation section of report completed Application section of report completed	6	N/A
33	Unit 1,2,3, 4 assessment	Revision and exam	3	Summative assessment grade for Paper 1 & Paper 2 exam

YEAR 2: UNITS 5,6,7,8 AND EXTERNAL ASSESSMENT

Week: Number of weeks out of 26 for Year 2

Content: Course content copied and pasted directly from the Guide.

Aims: Suggested lesson aims for the week.

Tasks: Tasks are not listed but revision can be built into classroom tasks. Students can be creating revision notes, diagrams, etc as classroom activities and homework.

Assessment: Students do not need to be assessed every lesson. Formative assessment = practice in extended time frames (e.g. 10 minutes for an SAQ); Summative assessment = IB Grading with IB Exam expectations (e.g. writing an SAQ in 20 minutes, ERQ in 40 minutes, depending on the Markbands).

Week	Content	Aims	Hours	Assessment/ Practical
1	IA – Draft review	Post summer vacation teacher review with comments and feedback given on the students draft as per the IB guidance (One full assessment of a draft) Reflection on the feedback and improvements made.	3	N/A
Unit 5 – Soil systems and terrestrial food production systems and societies		**Suggested inquiry statements to explore:** • The soil system is a dynamic ecosystem that has inputs, outputs, storages and flows. • The quality of soil influences the primary productivity of an area • The sustainability of terrestrial food production systems is influenced by sociopolitical, economic and ecological factors. • Consumers have a role to play through their support of different terrestrial food production systems. • Fertile soils require significant time to develop through the process of succession. • Human activities may reduce soil fertility and increase soil erosion. • Soil conservation strategies exist and may be used to preserve soil fertility and reduce soil erosion.		

Week	Content	Aims	Hours	Assessment/ Practical
2	5.1 Introduction to soil systems	Ecosystem functions of soil, inputs, outputs, storages and flows of the soil system. Soil formation as part of the process of succession. Soil profiles and horizons and the soil texture triangle in relation to clay, sandy and loam soils.	3	SAQ Practice (Formative)
3-4	5.1 Terrestrial food production systems and food choices	The green revolution in agriculture in the 1940's, has provided greater agricultural yield, yet there is global food inequality. There are cultural, religous, and economic factors that impact food choices. There are also issues regarding food waste. Globally there are different methods of agricultural production from basic subsistence farming to industrial commercial farming and multinational corporations.	5	N/A
5	Soil degradation and conservation	To increase the sustainability of our global food supplies we must develop more sustainable farming practices. Protect agricultural land from soil erosion, desertification and increasing levels of salinity. Sustainable agriculture can protect and conserve soil through soil management strategies.	4	SAQ Practice (Formative)
6-7	IA – Final submission	Reviewing assessment criteria with a penultimate draft in hand. Making final revisions and submitting the research project.	6	N/A

Week	Content	Aims	Hours	Assessment/ Practical
8	Unit 1,2,3, 4 assessment	Revision and exam		Summative assessment grade for Paper 1 & Paper 2 exam
Unit 6 – Atmospheric systems and society		**Suggested inquiry statements to explore:** • The atmosphere is a dynamic system that is essential to life on Earth. • Stratospheric ozone is a key component of the atmospheric system because it protects living systems from the negative effects of ultraviolet radiation from the Sun. • Human activities have disturbed the dynamic equilibrium of stratospheric ozone formation. • The combustion of fossil fuels produces primary pollutants that may generate secondary pollutants and lead to photochemical smog, the levels of which can vary by topography, population density and climate. • Acid deposition can impact living systems and the built environment. • The pollution management of acid deposition often involves cross-border issues		
9	6.1 Introduction to the atmosphere	The atmosphere as a system and the evolution of the composition of the present-day atmosphere. Key structure of the atmospheric layers with a focus on the troposphere and stratosphere. Introduction to the greenhouse effect and greenhouse gasses.	2	SAQ Practice (Formative)
10	6.2 Stratospheric ozone	Chemical structure of ozone and the chemical formation of stratospheric ozone. Importance of the ozone layer in the protection of biodiversity from UV radiation. Understand the impact of ozone depleting substances (ODS) with a focus on CFC's. Evaluate the importance and impact of the Montreal Protocol.	3	N/A

Week	Content	Aims	Hours	Assessment/ Practical
11-12	6.3 Photochemical smog	Describe the chemicals that cause air pollution and recall the terms primary and secondary pollutants. Describe the chemical formation of photochemical smog also known as tropospheric ozone. Understand how geographical location and weather patterns such as thermal inversions can increase the frequency of photochemical smog formation.	2	ERQ Practice (Formative)
13	6.4 Acid deposition	Understand the term acid deposition and recall the chemical formation of acid rain. Identify the primary source of atmospheric pollutants that cause acid rain and understand the impact on biodiversity. Discuss international laws relating to transboundary air pollution caused by acid rain. Give examples of management strategies to reduce, regulate and restore.	3	Acid deposition lab
14	Assessment – Unit 1,2,3,4,5,6	Revision and exam. – IB trial final year exam papers.	3	Summative assessment grade for Paper 1 & Paper 2 exam

Unit 7 – Climate change and energy production

Suggested inquiry statements to explore:

- There is a range of different energy sources available to societies that vary in their sustainability, availability, cost and sociopolitical implications.
- The choice of energy sources is controversial and complex. Energy security is an important factor in making energy choices
- Climate change has been a normal feature of the Earth's history, but human activity has contributed to recent changes.
- There has been significant debate about the causes of climate change.
- Climate change causes widespread and significant impacts on a global scale.
- Mitigation attempts to reduce the causes of climate change.
- Adaptation attempts to manage the impacts of climate change

15	7.1 Energy choices and security	Discuss the development of human society and the link to fossil fuel energy. Evaluate the advantages and disadvantages of renewable energy sources and the net zero claims. Discuss factors that influence government policy in relation to energy security. Investigate the use of biofuel, fracking and tar sands as energy sources.	3	SAQ Practice (Formative)
16-17	7.2 Climate change – causes and impact	Give definitions of the terms weather and climate. Understand that climate has been changing throughout the Earths geological history. Discuss the complexity of climate modelling and the challenges of predicting future climate. Debate the causes and impacts of human driven anthropogenic climate change. Discuss the debate in regard to climate change and the contrasting viewpoints of many prominent individuals.	6	Albedo effect of various surfaces / ice melting rate

Week	Content	Aims	Hours	Assessment/ Practical
18	7.3 Climate change – mitigation and adaptation	Understand that climate change mitigation strategies are actions to reduce greenhouse gas emissions that lead to climate change. Mitigation strategies include carbon capture, geo-engineering, and alternatives to fossil fuels. Climate change adaptation are actions that minimize or prevent the negative impacts of climate change.	3	ERQ Practice (Formative)
Unit 8 – Human systems and resource use		**Suggested inquiry statements to explore:** • A variety of models and indicators are employed to quantify human population dynamics. • Human population growth rates are impacted by a complex range of changing factors. • The renewability of natural capital has implications for its sustainable use. • The status and economic value of natural capital is dynamic. • Solid domestic waste (SDW) is increasing as a result of growing human populations and consumption. • Both the production and management of SDW can have significant influence on sustainability. • Human carrying capacity is difficult to quantify. The EF is a model that makes it possible to determine whether human populations are living within carrying capacity.		
19-20	8.1 Human population dynamics	Population demographic key terms, birth/death rate, mortality rate, fertility rate and exponential growth of human populations. Factors impacting the changing birth and death rates and the theories of Thomas Malthus and Esther Boserup. Age gender pyramids and the demographic transition model. Sustainable population growth and anti/pro natalist population policies.	6	SAQ Practice (Formative)

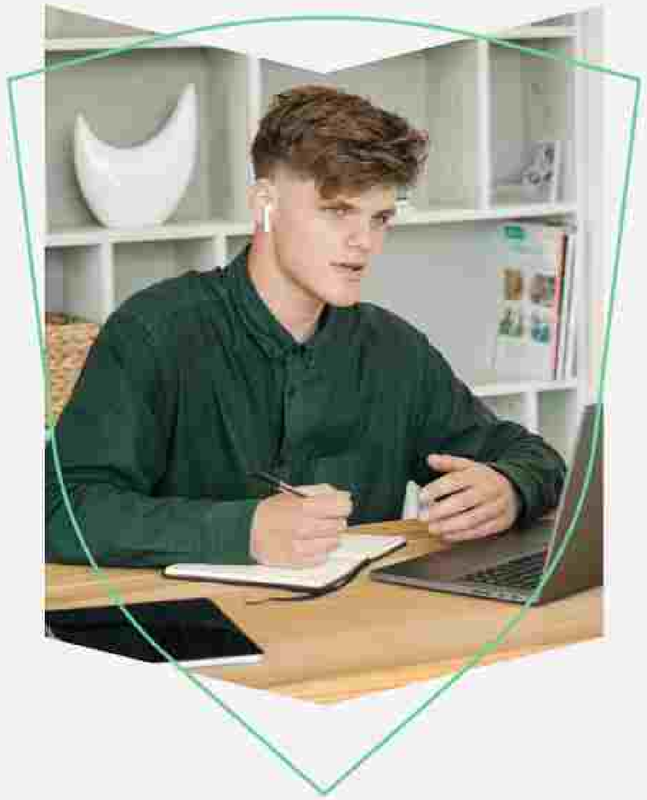
Week	Content	Aims	Hours	Assessment/ Practical
21	8.2 Resource use in society	Review natural capital and natural income and discuss the various ecological goods and services. Recall that resources can be renewable or non-renewable and that the importance of a resource can change over time eg uranium/cork. Discuss in economic terms how to value a resource in monetary terms.	3	N/A
22	8.3 Solid domestic waste	Define the term solid domestic waste and consider the common resources that we dispose of in our daily lives. Discuss how waste is often disposed of in land fill sites and understand the problems with this. Research the growing problem of e-waste on a global scale. Compare the linier and circular economy models and the importance of reduce, reuse, recycle as a sustainable method for waste management.	4	SAQ Practice (Formative)
23	8.4 Human population carrying capacity	Recall the term carrying capacity and relate this term to human population growth. Understand that is difficult to predict human carrying capacity due to factors such as migration and technological advances. Understand the use of ecological footprints (EF) as a way to model personal impact on carrying capacity.	3	ERQ Practice (Formative)

Week	Content	Aims	Hours	Assessment/ Practical
24-26	Syllabus revision and review	Review of specific syllabus content and development of exam techniques. Practice of past papers.	3	N/A

IA Rationale

Internal Assessment in Environmental Systems and Societies is an integral part of the course and compulsory for all students. The IA is worth 25% of the student grade and time should be given within the curriculum, to help students develop the knowledge, skills and understanding required to undertake the work. In the curriculum plan outlined, students spend time on the IA at the end of Year 1, with time planned for reflection and feedback at the start of Year 2. Starting the IA at the end of year one, gives students the foundation knowledge and skills needed to plan and collect data for their investigation. Having the work completed early in Year two, reduces the pressure on student's time, before many of the larger IBDP deadlines begin.

The IA in ESS is usually designed around four major styles of research methods which include: Laboratory experiments, field work, questionnaires, and secondary data investigations. Students must develop their own focused research question, that can be investigated via one of the research methods. Teachers are to guide and support students and give feedback against the assessment criteria. The report should be 1,500 to 2,250 words long. Students should be made aware that external moderators will not read beyond 2,250 words and teachers should only mark up to this limit. The final student report should be structured in a formal style laboratory report, this will be assessed with the IB internal assessment marking criteria, with a total possible score of 30 marks.



Week	Section	Hours
1	Introduction to the ESS IA	3
2	Research and planning	3
3-4	Data collection	6
5-6	Results conclusions and evaluations	6
7	Reviewing each student's final draft	3
7	Reviewing assessment criteria with a penultimate draft in hand. Making final revisions and submitting the research project.	3

Practical scheme of work (PSOW)

As part of the ESS course students should undergo 30 hours of practical work related to the syllabus. The following table indicates the names of the experiments, investigations and/or projects proposed for the different topics in the syllabus.

It is Indicated which part of the internal assessment criteria is being developed with each task — Identifying the Context (CXT), Planning (PI), Results analysis and conclusion (RAC), Discussion and evaluation (DEV), Applications (APP) and Communication (Com).

Name of the topic	Experiment/investigation/project	Indicate those you would use for assessing: Identifying the Context (CXT), Planning (PI), Results analysis and Conclusion (RAC), Discussion and Evaluation (DEV), Applications (APP) and Communication (Com).
Subtopic 1.1	Design of EVS questionnaires using online platforms such as google forms	CXT, PL, RAC, COM
Subtopic 1.3	Daisy world simulation of feedback loops	RAC, DEV

Name of the topic	Experiment/investigation/project	Indicate those you would use for assessing: Identifying the Context (CXT), Planning (PI), Results analysis and Conclusion (RAC), Discussion and Evaluation (DEV), Applications (APP) and Communication (Com).
Subtopic 2.1	Compare brine shrimp in different environmental conditions	PLA, RAC, DEV
Subtopic 2.2	Investigate rates of photosynthesis in aquatic plants (lab or simulation)	PLA, RAC, DEV
Subtopic 2.4	Live or virtual fieldtrip – zonation on a rocky shore Live or virtual field trip – zonation on a mountain	PLA, RAC, DEV
Subtopic 2.5	Live of virtual – Sand dune succession, freshwater kick sampling, air pollution and lichen indicator species, Questionnaire design. Simpsons index, transects, identification keys.	CXT, PLA, RAC, DEV, APP, COM
Subtopic 3.1	Natural selection PHET simulation	RAC, DEV
Subtopic 3.4	Live or virtual fieldtrip to zoo with guided tour from education department. Live or virtual fieldtrip to local whale / dolphin charity talk and boat trip.	CXT, PLA

Name of the topic	Experiment/investigation/project	Indicate those you would use for assessing: Identifying the Context (CXT), Planning (PI), Results analysis and Conclusion (RAC), Discussion and Evaluation (DEV), Applications (APP) and Communication (Com).
Subtopic 4.1	World water storage and accessibility modelling lab	RAC
Subtopic 4.4	Water pollution comparison of samples lab	PLA, RAC
	Growth of duckweed with different nitrate levels lab	PLA, RAC, DEV
Subtopic 6.4	Acid deposition lab	RAC, DEV
Subtopic 7. 2	Albedo effect of various surfaces / ice melting rate	PLA, RAC, DEV

Links to TOK

In Environmental Systems and Societies, there are rich opportunities for students to create links between their ESS and TOK courses. One way in which teachers can help students to make these links to TOK, is by drawing students' attention to knowledge questions that arise from their subject content.

Climate Protester Glues His Head to 'Girl With a Pearl Earring' Painting. The artwork by Johannes Vermeer, exhibited in The Hague, was the latest artwork to be targeted by protesters concerned about climate change. One person glued his head to the painting and another glued his hand to the wall.

In the latest of a series of actions by activists that have targeted world-renowned paintings in recent months as the protesters have sought to draw attention to climate change.

The stunts have recently included hurling mashed potatoes at a painting by Claude Monet and splattering soup on a painting by Vincent van Gogh. The protester who glued his hand to the wall addresses onlookers who have gathered around. People can be heard gasping, expressing their outrage and calling the pair "obscene." "How do you feel when you see something beautiful and priceless being apparently destroyed before your eyes?" the protester said. "Do you feel outraged? Good. Where is that feeling when you see the planet being destroyed before your very eyes?" do you agree with their actions?

> The Environmental Systems and Societies guide provides suggested links to TOK at the end of each unit and these could form the basis of class work and homework assignments.

ENVIRONMENTAL SYSTEMS AND SOCIETIES STUDENTS CAN BE ASKED TO DISCUSS:

1. The choice of energy sources is controversial and complex—how can we distinguish between a scientific claim and a pseudoscience claim when making choices?

2. There has been considerable debate about the causes of climate change—does our interpretation of knowledge from the past allow us to reliably predict the future?

3. There is a degree of uncertainty in the extent and effect of climate change—how can we be confident of the ethical responsibilities that may arise from knowledge when that knowledge is often provisional or incomplete?

International mindedness

At the core of an IB education is international mindedness, which aims at helping to create a better and more peaceful world. The ESS course is focused on the ecological systems at both the local and global scale. This leads students to an appreciation of the nature of the international dimension of ESS, since the resolution of the major environmental issues rests heavily upon international relationships and agreements. It is widely accepted that many environmental problems are international in nature and this has led to a global approach to research in many areas, such as climate change, biodiversity and population dynamics. The data from such research is shared worldwide and much of this is freely available to students.

The power of scientific knowledge to transform societies is unparalleled. It has the potential to produce great universal benefits, or to reinforce inequalities and cause harm to people and the environment. In line with the IB mission statement, ESS students need to be aware of the moral responsibility to ensure that scientific knowledge and data are available to all countries on an equitable basis, and that countries have the capacity to use this for developing sustainable societies.

Development of the IB Learner Profile

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Development of the IB Learner Profile

We critically appreciate our own cultures and personal histories, as well as the values and **traditions of others**. We seek and evaluate a range of points of view, and we are willing to grow from the experience. In ESS we look at environmental issues from the local and global perspective and try to thing critically about potential solutions.

We use **critical and creative thinking skills** to analyze and take responsible action on complex problems. We exercise initiative in making reasoned, ethical decisions. Many complex concepts in ESS require students to consider some of the ethical decisions that must be made by governments. There is often debate around protecting nature and the use of our planets resources that are needed to drive economic development forward.

We act with **honesty** and **integrity** with a strong sense of fairness, justice and respect for the individual, groups, and communities. We take responsibility for our own actions and the consequences that accompany them. We treat the environment with respect and fight for justice for all living things.

References

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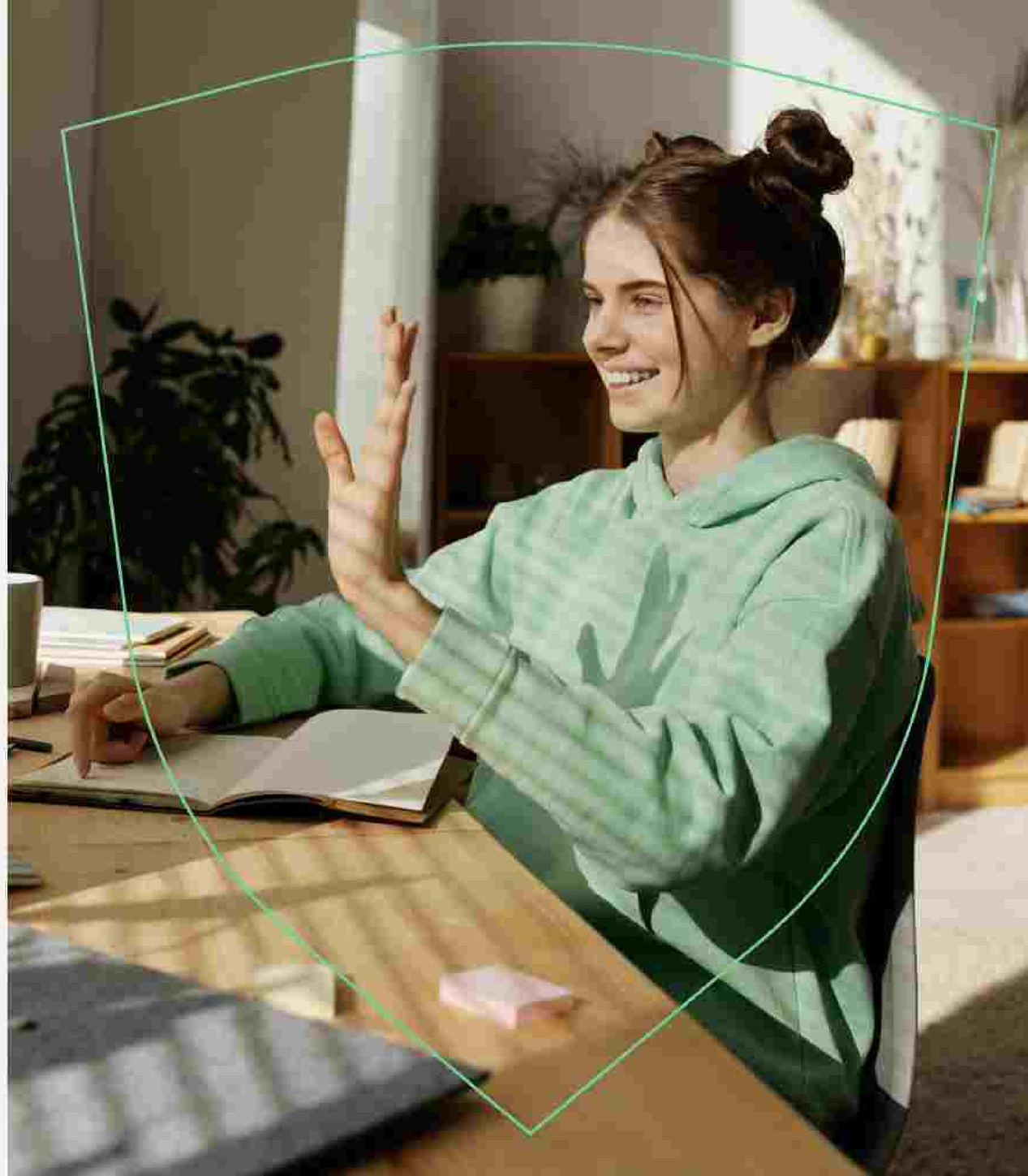

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