VCE Environmental Science: Sample teaching plan

Sample Course Outline – VCE Environmental Science Unit 3: How can biodiversity and development be sustained?

**Note:** This is a sample guide only and indicates one way to present the content from the *VCE Environmental Science Study Design*. VCE units are designed on the basis of a minimum of 50 hours class time; this sample teaching plan is based on 3 hours per week over 19 weeks and includes activities covering the nine scientific methodologies. The nine scientific methodologies should be incorporated into the teaching plan across the unit. Teachers are advised to consider their own contexts in developing learning activities: Which local fieldwork sites would support learning in the topic area? Which local case studies and issues lend themselves to debate and investigation? Which experiments can students complete within the resource limitations of their learning environments?

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| **Week** | **Area of study** | **Key knowledge** | **Learning activities** | **Science skills focus** | **Assessment tasks** |
| **1** | **Area of study 1:**  ***Why is maintaining biodiversity worth a sustained effort?*** | **Importance of biodiversity** (definition and categories of biodiversity: genetic, species and ecosystem; importance of genetic diversity within a species or population experiencing environmental change; ecosystems as a source of renewable services that impact on human health and well-being: provisioning services, regulating services, supporting services and cultural services) | * *PMI organiser*: the relative values of preserving an individual species versus its gene pool versus the ecosystem in which it lives * *Classification and identification*: access past and present photographs of a specific landscape; identify the ecosystem services; determine to what extent ecosystem services have changed over time * *Fieldwork*: take a field trip to generate and collate data about a threatened endemic species – Eastern Barred Bandicoot * *Case study*: discuss cultural services involving different stakeholder perspectives in relation to the Grampians and the preservation of rock art and as a facility for rock climbing * *Correlational study*: investigate whether there is a relationship between wellbeing and being in different environments * *Literature review*: investigate the role of moulds in ecosystem functioning and their importance in medicine * *Controlled experiment***:** make predictions and compare the photosynthetic rates of different plants in providing supporting services for ecosystems | * formulate hypotheses to focus investigations * predict possible outcomes of investigations * apply relevant occupational health and safety guidelines while undertaking practical investigations * design and conduct investigations * select appropriate sampling techniques in fieldwork (including grids, quadrats, transects and mark-recapture) * explain the effects of varying sample sizes in obtaining robust data * organise and present data in useful and meaningful ways, including schematic diagrams, flow charts, tables, bar charts and line graphs * evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis |  |
| **2** |  |
| **3** | **Biodiversity change over time** (evidence of variation in rate and extent of change in biodiversity over time including significant mass extinctions; natural changes occurring over different time scales: species endemism, diversity hotspots, rate of extinction, volcanic eruption) | * *Modelling*: in groups, create a timeline identifying significant mass extinctions and periods of rapid species diversification. Discuss if the fossil record is based on opinion, anecdote or evidence. * *Literature review*: work in pairs to investigate one of the world’s 36 biodiversity hotspots’ produce a poster or infographic summarising habitat/s and species present; natural changes, renewable services and conservation programs to maintain and preserve the location * *Literature review*: research the effects of El Nino or other natural change on one threatened Australian species * *Simulation***:** investigate the spread of firesusing an online simulation**;** research the strategies for protecting wildlife during high fire danger periods | * distinguish between opinion, anecdote and evidence * systematically generate and record primary data, and collate secondary data, appropriate to the investigation, including use of databases and reputable online data sources * use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with evidence and relevant to the question under investigation |  |
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| **5** |  | **Assessing changes in species diversity** (practical techniques used for assessing species diversity; measurements of species diversity; conservation categories; qualitative assessments to identify the species most in need of conservation action) | * *Fieldwork*: use quadrats, transects, sampling methods to assess biodiversity in the school * *Simulation*: investigate changes predicted to occur on an island over time using virtual biology simulations * *Fieldwork*: use Simpson’s Index of Diversity to investigate and compare the species diversity of three similar ecosystems which have different levels of human impact * *Correlational study*: investigate the biodiversity of ants in different ecosystems * *Data analysis and evaluation*: use the ‘Atlas of Living Australia’ to graph data related to local species populations over time | * select appropriate sampling techniques in fieldwork (including grids, quadrats, transects and mark-recapture) * systematically generate and record primary data, and collate secondary data, appropriate to the investigation, including use of databases and reputable online data sources * organise and present data in useful and meaningful ways, including schematic diagrams, flow charts, tables, bar charts and line graphs |  |
| **6** |  |
| **7** |  |
| **8** | **Threats to biodiversity** (human and non-human threats) | * *Video*: watch the ABC Catalyst episode ‘Are we killing our koalas?’ to explore how habitat loss, climate change and bushfires are threatening koala populations * *Simulation*: investigate how competition for natural resources between two species can affect population growth using an online simulation * *Video*: watch the ABC Catalyst episode ‘Micro-plastics’ and use this to discuss the difference between bioaccumulation and biomagnification | * critically evaluate and interpret a range of scientific and media texts (including journal articles, mass media communications and opinions in the public domain), processes, claims and conclusions related to environmental science by considering the quality of available evidence * evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis |  |

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| **9** |  | **Protection and restoration of biodiversity** (strategies for maintaining and growing populations that build species resilience to changes in the environment; application of relevant international, national, state and local legal treaties, agreements and regulatory frameworks that apply to the protection of threatened species; the influence of different value systems that influence decision-making processes; sustainability principles as they apply to biodiversity conservation) | * *Group work*: analyse and evaluate conservation strategies for a selected species from the Flora and Fauna Guarantee Act * *Fieldwork*: Generate primary and/or collate secondary data specific to a site to identify and assess the biodiversity of the environment: identify the threats to biodiversity at the site; suggest and justify a strategy to reduce the threats * *Field trip*: visit a a conservation site and report on the success of the program * *Fieldwork*: visit a site of remnant vegetation and generate data to analyse the significance of remnant vegetation and wildlife corridors in protecting biodiversity * *Debate*: in pairs, students debate which is the most important value system in making decisions about biodiversity * *Product, process or system development*: develop a presentation for primary students about the importance of bird or insect biodiversity; design, construct and test a shelter for a bird or insect to be located in the primary school grounds; monitor effectiveness of the shelter | * work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications * systematically generate and record primary data, and collate secondary data, appropriate to the investigation, including use of databases and reputable online data sources * organise and present data in useful and meaningful ways, including schematic diagrams, flow charts, tables, bar charts and line graphs * record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data |  |
| **10** | **Presentation of recommendations using evidence-based decision-making, including analysis and evaluation of primary data (50 minutes):** students are given a set of data extracted by the teacher from data sets available from field trip to respond to the question, ‘Are conservation efforts aimed at increasing populations of the Eastern Barred Bandicoot working?’ Students will be expected to plot data in responding to the question. They also have access to their logbooks for further primary data and information. |
| **11** | **Area of study 2:**  ***When is development sustainable****?* | **Sustainability principles** (ecological, economic and sociocultural factors in sustainable development; sustainability principles; challenges to upholding sustainability principles) | * *Classification and identification*: Access the United Nations’ 17 Sustainable Goals and explain how these goals align with sustainability principles * *Evaluation*: construct a PMI chart of the environmental, social and economic impacts of an environmental science case study * *Debate*: use sustainability principles to debate whether a selected development project should proceed | * analyse and evaluate environmental science case studies and challenges using the sustainability principles of conservation of biodiversity and ecological integrity, efficiency of resource use, intergenerational equity, intragenerational equity, precautionary principle, and user pays principle |  |
| **12** |  | **Environmental decision-making and management** (circular economy thinking; integrated sustainability assessment; cost-benefit analysis; factors that influence responsible decision-making: stakeholder perspectives, use and interpretation of historical and current scientific data, application of new technologies) | * *Field trip* or *research*: evaluate a waste minimisation plan/strategy developed by your local council; present findings in a concept map * *Group activity*: Cost-benefit analysis of a selected environmental science case study * *Infographic*: circular economy * *Classification and identification*: discuss how definitions of ‘sustainability’ and ‘ecologically sustainable development’ are reliant on the needs and interests of various stakeholders | * organise and present data in useful and meaningful ways, including schematic diagrams, flow charts, tables, bar charts and line graphs |  |
| **13** |
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| **16** | **Case study overview and evaluation** (the beneficial and harmful impacts of the selected case study on Earth’s four interrelated systems; the effectiveness of environmental management strategies implemented in relation to upholding sustainability principles) | **Selected environmental science case study**  Students work in small groups to analyse and evaluate a case study of interest, selected from*:*   * Budj Bim Cultural Landscape submission for nomination as a World Heritage listed site * Sustainable greenhouses – growing tomatoes using sun and seawater * Converting roofs to ‘green roofs’ * analysis and evaluation of the selected local or global case study is undertaken * results presented by each group to class using a maximum of four PowerPoint slides | * analyse and evaluate environmental science case studies using sustainability principles * apply Earth systems thinking to analyse and evaluate responses to environmental science scenarios, case studies, issues and challenges in terms of supporting and sustaining ecological integrity * discuss relevant environmental science information, ideas, concepts, theories and models and the connections between them * identify and explain when judgments may be based on sociocultural, economic, political, legal and/or ethical factors and not solely on scientific evidence |  |
| **17** | **Analysis and evaluation of a case study with reference to sustainability principles and stakeholder perspectives** (50 minutes):students will be presented with an unfamiliar case study related to the management of coastal erosion that outlines a set of strategies; students will complete a table to explain how each of the sustainability principles relates to one selected management strategy, identify stakeholders and their perspectives, and use cost-benefit analysis to evaluate the strategy. |
| **18** | **Unit revision** | | | | |
| **19** |