2023 VCE Environmental Science EP Curriculum Map

Unit 1: How are Earth's dynamic systems interconnected to support life?

Area of Study 1: How are Earth's systems organised and connected?

Content Descriptor	EP Lessons in *1.1.1. Investigation of local ecosystems*
1.1.1.1. the range of biotic and abiotic components that determine the environmental conditions of varied habitats within aquatic and terrestrial ecosystems **1.1.1.2.** interrelationships within ecological communities as represented by food chains, food webs, energy and biomass pyramids	• Biotic and Abiotic Factors • Ecosystems • Introduction to Ecosystems • Focus on Data: Taking a Lichen to Moss • Food Chains and Food Webs • Trophic Levels • Photosynthesis • Ecological Relationships • Focus on Data: Predator-Prey Dynamics • Topic Test: Interactions Between Organisms • Topic Test: Interactions in Ecosystems (40 marks)
Content Descriptor	**EP Lessons in *1.1.2. Earth systems thinking***
1.1.2.1. natural interactions between Earth's four systems – the atmosphere, biosphere, hydrosphere and lithosphere – that support and are affected by the movement of energy and matter within and between local and global ecosystems **1.1.2.2.** systems thinking as a way of exploring relationships in environmental systems by identifying inputs, outputs, components and processes that may be visible or invisible to the human eye, including representation of a local and regional environmental system.	• Spheres • Carbon Cycle • Nitrogen Cycle • Phosphorus Cycle • Water Cycle • Influences on the Water Cycle • The Water Cycle and Weather • Topic Test: Global Cycles Investigation: Weather in a Jar • Weather in a Jar • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)

Area of Study 2: How do Earth's systems change over time?

Content Descriptor	EP Lessons in *1.2.1. Earth's dynamic systems*
1.2.1.1. transformative processes occurring during Earth's deep history that shaped the formation of Earth's four interrelated systems **1.2.1.2.** changes and disruptions to landscapes, ecosystems and biomes that influence their distribution and ecological characteristics	• Plate Tectonics • Earth's Magnetic Field • Supercontinents • The Biosphere - Life • El Niño and La Niña • Bushfires • Australian Bushfires • Harnessing Fire in Australia • Drought • Flooding • The Enhanced Greenhouse Effect • Disappearing Polar Ice • The Palm Oil Predicament • Mechanical Layers of the Earth
Content Descriptor	**EP Lessons in *1.2.2. Data and modelling***
1.2.2.1. ways of using data and models to study Earth's systems and changes in Earth over time **1.2.3.1.** the role of innovation and science in responding to challenges as a result of environmental change and disruption	• The Geological Timescale • Developing the Geological Timescale • Computer Modelling and the Environment
Content Descriptor	**EP Lessons in *1.2.3 Managing environmental challenges***
1.2.3.1. the role of innovation and science in responding to challenges as a result of environmental change and disruption **1.2.3.2.** the contribution of scientific data, new technologies, regulatory frameworks and diverse stakeholder values, knowledge and priorities in managing environmental challenges of regional relevance	• CFCs and the Ozone Layer • Greta Thunberg and the School Strike for Climate Change Movement: DocPlay

Unit 2: What affects Earth's capacity to sustain life?

Area of Study 1: How can we manage pollution to sustain Earth's systems?

Content Descriptor	EP Lessons in *2.1.1. Pollution effects on Earth's systems*
2.1.1.1. chemical and physical characteristics of pollutants that influence dispersal of emissions from natural and manufactured sources **2.1.1.3.** the impacts of a range of pollutants on the health and survival of living things in the biosphere, including humans, and on the quality of the atmosphere, hydrosphere and lithosphere with reference to risk, exposure, dosage, tolerance limits, LD50, chronic and acute toxicity, allergies, disruption of system regulation and synergistic action	• What is Pollution? • Pollution and Ecosystems • Oil Pollution and Industrial Waste • Pesticides • The Environmental Impacts of China's Megacities
Content Descriptor	**EP Lessons in *2.1.2. Managing pollution***
2.1.2.1. the contributions of scientific data, new technologies, regulatory frameworks and diverse stakeholder values and priorities when managing pollution **2.1.2.2.** options for control and treatment of pollution to reduce local and global impacts	• Effect of Temperature on Solubility • Recycling Sewage • Water Treatment • Waste Management • STEM: Cleaning Up Our Litter

Area of Study 2: How can we manage food and water security to sustain Earth's systems?

Content Descriptor	EP Lessons in *2.2.1. Sustainable food systems*
2.2.1.1. challenges to supplying adequate and affordable food in regional and global locations that achieve regional and global food security **2.2.1.2.** qualitative differences between food produced by conventional monoculture and organic monoculture agricultural systems	• Population and Food Security • Food Waste and Inequality • Indigenous Food Security • Land Degradation and Food Security • Water Scarcity and Food Security • Competitive Land Use and Food Security • Climate Change and Food Security • An Agricultural Affair • Agroecosystems • Irrigation

Content Descriptor	EP Lessons in *2.2.2 Maintaining food and water security*
2.2.2.1. options for improving food security that consider organisational, political and structural enablers and barriers to change **2.2.2.2.** the use and limitations of ecological footprint analysis, in terms of the sustainability principles of intragenerational equity and the efficient use of resources **2.2.2.3.** the ecological footprint of either an individual, local and/or international community or business, or a local or imported raw food and/or food product **2.2.2.4.** options for decreasing water demand and improving water-use efficiency	• Case Study: Agricultural Potential in Northern Australia • Improving Agroecosystem Sustainability in Australia • Genetically Modified Organisms (GMOs) • Transgenesis: Food Production • Sustainable Development • Ecological Footprints • Carbon Footprints • Water Conservation • Focus on Data: Our Water Use • Water Pollution and Solutions

Unit 3: How can biodiversity and development be sustained?

Area of Study 1: Why is maintaining biodiversity worth a sustained effort?

Content Descriptor	EP Lessons in *3.1.1. Importance of biodiversity*
3.1.1.1. the definition and categories of biodiversity: genetic, species and ecosystem **3.1.1.2.** the importance of genetic diversity within a species or population experiencing environmental change	• Biodiversity • Factors Affecting Biodiversity Investigation: Assessing Biodiversity • Assessing Biodiversity • Risk Assessment (in RiskAssess) • Invertebrate Guide PDF • Lab Report Material PDF • Student Worksheet PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)
Content Descriptor	**EP Lessons in *3.1.2. Biodiversity changes over time***
3.1.2.1. evidence of variation in rate and extent of change in biodiversity over time: significant mass extinctions and periods of rapid species diversification that can be inferred from the fossil record **3.1.2.2.** natural changes occurring over different time scales that influence ecosystem diversity, species endemism, the formation of diversity hotspots, and rate of extinction: volcanic eruptions; fire; El Niño; tectonic plate movement; and evolution	• A Brief History of the Earth • Evidence of Past Ecosystems • Fossils and the Fossil Record • Australian Fossils • Darwin's Theory of Evolution • Natural Selection • Gene Flow and Allele Frequency • Genetic Drift • Modes of Speciation • Wegener's Theory of Continental Drift • Evidence from Living Species • The Wallace Line • Changes to Australia's Biota • Focus on Data: The Southern Oscillation Index • Predicting Population Changes • Topic Test: The Evidence for Evolution • Topic Test: The Mechanisms of Evolution

Content Descriptor	EP Lessons in *3.1.3. Assessing changes in species diversity*
3.1.3.1. practical techniques used for assessing species diversity: sampling with grids, transects and different shaped quadrats, including consideration of edge effects and mark-recapture **3.1.3.2.** measurement of species diversity, including species richness, endemism and the application of Simpson's Index of Diversity (SID): SID = (see SD doc for formula)	• Sampling Methods Investigation: Determining Species Diversity • Determining Species Diversity • Risk Assessment (in RiskAssess) • Student Worksheet (PDF) • Lab Report Material • Teacher Guide (PDF) • Lab Technician Guide (PDF) • Editable Docs (.docx) Investigation: Sampling a Leaf Litter Ecosystem • Sampling a Leaf Litter Ecosystem • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Lab Report Material PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)

Content Descriptor	EP Lessons in *3.1.4. Threats to biodiversity*
3.1.4.1. human and non-human threats to biodiversity: creation and isolation of small populations through habitat loss and over-exploitation; inbreeding due to small population size; loss of pollinators, dispersal agents, host species or symbionts that affect reproduction and persistence of species; bioaccumulation that concentrates some persistent pollutants within organisms and biomagnification along a food chain; climate change; disease; and introduced species that compete for shelter, food and water	• The Human Impact: Habitat Loss • Human Impacts on Land • The Human Impact: Dams, Diversion and Depletion • Human Impacts on Forest Biomes • Habitat Destruction and Overcropping • Human Impacts on Wetlands • Human Impacts on Marine Biomes • The Human Impact: Pollution • Climate Change and Biodiversity • Introduced and Invasive Species • Cane Toads as an Introduced Species

Content Descriptor	EP Lessons in *3.1.5. Protection and restoration of biodiversity*
3.1.5.1. strategies for maintaining and growing populations that also build species resilience to changes in the environment: protected areas; retaining remnant vegetation; wildlife corridors or zones; translocation of animals; captive breeding and reintroduction programs; gene banks for the collection of specimens and genetic material; and reduction and improved targeting of pesticides in agricultural and urbanised areas **3.1.5.5.** sustainability principles as they apply to biodiversity conservation: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; and user pays principle	• History of Conservation • Indigenous Perspectives of Conservation • Conservation of Biodiversity • Saving the Tasmanian Devil

Area of Study 2: When is development sustainable?

Content Descriptor	EP Lessons in *3.2.1. Sustainability principles*
3.2.2.1. the relationship between ecological, economic and sociocultural dimensions of sustainable development and principles of sustainability **3.2.2.2.** sustainability principles as they apply to environmental management: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; and user pays principle **3.2.2.3.** challenges to upholding sustainability principles, including population, food, water and energy	• Sustainability as a Geographical Concept • Australia's Sustainable Cities • Ecotourism • Impacts of Tourism • Reducing the Impacts of Tourism • Caring for Country • Sustainable Cities

Content Descriptor	EP Lessons in *3.2.2. Environmental decision-making and management*
3.2.2.2. sustainability principles as they apply to environmental management: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; and user pays principle	• The Life Cycle of Consumer Electronics • Joint Environmental Management in Australia

Unit 4: How can climate change and the impacts of human energy use be managed?

Area of Study 1: How can we respond to climate change?

Content Descriptor	EP Lessons in *4.1.1. Major factors that affect Earth's climate*
4.1.1.1. identification of natural phenomena and anthropogenic factors that affect Earth's energy balance: volcanic eruptions; solar variability; and changes in atmospheric gas composition due to human activities **4.1.1.2.** the interactions between solar energy that is absorbed, re-emitted and reflected by atmospheric gases and other matter, including the albedo effect, the natural greenhouse effect, and ocean circulation **4.1.1.3.** carbon sequestration in land and water that results in short-term (less than 100 years) and long-term (more than 1000 years) changes in the carbon cycle	• Climate and Weather • If Climate Change is Real, How Come…? • Human Influences on Climate • Ocean Currents • Carbon Capture Investigation: Climate Change • Climate Change • Student Worksheet PDF • Lab Report Material PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)
Content Descriptor	**EP Lessons in *4.1.2. Understanding climate change***
4.1.2.1. the differences between natural and enhanced greenhouse effects **4.1.2.2.** altered greenhouse gas concentrations over different time periods – seasons, years, centuries and millennia – due to natural events, and human activities associated with the combustion of fossil fuels, cement production, agriculture and land use changes **4.1.2.4.** methods used for measuring past and present changes in the atmosphere: ice core sampling; use of palaeoclimate records; and atmospheric and ocean temperature monitoring **4.1.2.5.** data accessed through direct measurements and from modelling in assessing the rate of local, global and regional past and future climate variability: global average temperatures; local climate extremes; sea level rise; and snow and ice coverage	• The Greenhouse Effect • The Enhanced Greenhouse Effect • CFCs and the Ozone Layer • Evidence for Climate Change • Examining Past Climates • Computer Modelling and the Environment • Global Temperature and Permafrost • Disappearing Polar Ice Investigation: Polar Ice • Polar Ice • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Lab Report Material PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)

	Investigation: The Greenhouse Effect • The Greenhouse Effect • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Lab Report Material PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)
Content Descriptor	**EP Lessons in *4.1.3. Managing climate change***
4.1.3.1. the risks and opportunities associated with climate change for humans and ecological systems at a selected region or location: increase in range of exotic species; changes in length of plant growing seasons and animal breeding cycles; phenological changes for plant-pollinator interactions; increasing risks to coastal infrastructure from continuing sea level rise; reduction in agricultural production due to warmer and drier conditions **4.1.3.3.** adaptation options for building resilience to the effects of unavoidable climate change at a selected region or location	• The Great Barrier Reef and Coral Bleaching • Where Have all the Turtles Gone? Investigation: Purifying Saltwater • Purifying Saltwater • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)

Area of Study 2: What might be a sustainable mix of energy sources?

Content Descriptor	EP Lessons in *4.2.1. Comparison of different energy sources*
4.2.1.1. non-renewable energy sources: oil, coal, natural gas, coal seam gas and nuclear **4.2.1.2.** renewable energy sources: biomass, biofuels, solar, hydro-electric, wind, tidal and geothermal **4.2.1.3.** the consequences of fossil fuel combustion for the carbon cycle **4.2.1.5.** energy efficiency calculations of single and multi-step conversions between different forms of energy, including potential, mechanical, kinetic, thermal, and chemical energy, to generate electricity **4.2.1.7.** sustainability principles as they apply to accessing, extracting, processing, transporting, and using energy resources: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; and user pays principle	• Renewable and Non-Renewable Energy Sources • Fossil Fuels as a Resource • Minerals and Ores as Resources • Mining • The Carbon Cycle • Nuclear Fuel as a Resource • Nuclear Fission • Nuclear Fusion • Solar Energy • Water Power • Hydroelectricity • Wind as a Resource

	• Wind Turbines • Geothermal Energy • Biomass - Living Things as a Resource • Comparison of Fossil Fuels and Biofuels • Identifying KE or PE • Conservation of Energy • Energy Efficiency • The Power Grid and You • Displaying Energy Transformations • Electricity Generation In Australia Investigation: Turbine Power • Turbine Power • Risk Assessment (in RiskAssess) • Student Worksheet PDF • Lab Report Material PDF • Teacher Guide PDF • Laboratory Technician Guide PDF • Editable Documents - Word (.docx)
Content Descriptor	**EP Lessons in *4.2.2. Managing the impacts of human energy use***
4.2.2.3. options for building a sustainable energy future that produces lower greenhouse gas emissions and supplies reliable and affordable energy services: improving resource efficiency; increasing the efficiency of energy conversion devices; replacing fossil fuels with non-fossil fuel energy sources; and reducing personal energy consumption **4.2.2.4.** interconnections and tensions between factors that influence responsible decision-making around building a sustainable energy future, including diverse stakeholder values, knowledge and priorities, regulatory frameworks that inform environmental management strategies, use and interpretation of historical and current scientific data, and application of new technologies. **4.2.1.7.** sustainability principles as they apply to accessing, extracting, processing, transporting, and using energy resources: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational equity; precautionary principle; and user pays principle	• Energy Efficient Houses • Cars of the Future Investigation: Different Perspectives on Mining • Background Information: Different Perspectives on Mining • Research Project: The Carmichael Coal Mine • Student Worksheet PDF • Teacher Guide PDF • Editable Documents - Word (.docx)