VCE Environmental Science

GREAT OCEAN ROAD
COAST & PARKS AUTHORITY

VICTORIAN CURRICULUM LINKS

Updated 7 January 2022

Environmental Science	Study design / key knowledge notes
Unit 1: Area of Study 1 – Outcome 1 How are Earth's systems organised and connected?	**Investigation of local ecosystems** • the range of biotic and abiotic components that determine the environmental conditions of varied habitats within aquatic and terrestrial ecosystems • interrelationships within ecological communities as represented by food chains, food webs, energy and biomass pyramids **Earth systems thinking** • 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 • 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

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Unit 1: Area of Study 2 – Outcome 2 *How do Earth's systems change over time?*	**Earth's dynamic systems** • transformative processes occurring during Earth's deep history that shaped the formation of Earth's four interrelated systems • changes and disruptions to landscapes, ecosystems and biomes that influence their distribution and ecological characteristics. **Managing environmental challenges** • the role of innovation and science in responding to challenges as a result of environmental change and disruption • the contribution of scientific data, new technologies, regulatory frameworks and diverse stakeholder values, knowledge and priorities in managing environmental challenges of regional relevance.
Unit 2: Area of study 1 – Outcome 2 *How can we manage pollution to sustain Earth's systems?*	**Pollution effects on Earth's systems** • 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. **Managing pollution** • the contributions of scientific data, new technologies, regulatory frameworks and diverse stakeholder values and priorities when managing pollution • options for control and treatment of pollution to reduce local and global impacts.

Unit 3: Area of study 1 – Outcome 1
 	
Why is maintaining biodiversity worth a sustained effort?
	Importance of biodiversity
	• the definition and categories of biodiversity: genetic, species and ecosystem
	• the 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: potable water; food; fuel; fibre; and pharmaceuticals
	  • regulating services: control of climate and disease; pollination; and water purification
	  • supporting services that maintain conditions for life on Earth: cycling of nutrients; soil formation; and photosynthesis
	  • cultural services: aesthetic values; recreational benefits; and sense of place.
	
	Biodiversity changes over time
	• 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
	• 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.
	
	Assessing changes in species diversity
	• practical techniques used for assessing species diversity: sampling with grids, transects and different shaped quadrats, including consideration of edge effects and mark-recapture
	• conservation categories for ranking species according to their risk of extinction: extinct in the wild; critically endangered; endangered; vulnerable; near threatened; and least concern
	• qualitative assessment of conservation status to identify the species most in need of conservation action: changes in availability of suitable habitat, geographic distribution, and population size.

	Threats to biodiversity • 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. **Protection and restoration of biodiversity** • 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 • approaches to renewing and regenerating degraded ecosystems: restoration of habitat; erosion control; and reintroduction of previously endemic species • the application of relevant international, national, state and local legal treaties, agreements and regulatory frameworks that apply to the protection of threatened species: the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); IUCN Red List of Threatened Species; classified World Heritage areas; *Environment Protection and Biodiversity Conservation Act 1999* (Cth); *Flora and Fauna Guarantee Act 1988* (Vic); and local government conservation covenants • value systems that influence decision-making processes: anthropocentrism, biocentrism, ecocentrism and technocentrism • sustainability principles as they apply to biodiversity conservation: conservation of biodiversity and ecological integrity; efficiency of resource use; intergenerational equity; intragenerational

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	equity; precautionary principle; and user pays principle.
Unit 3: Area of study 2 – Outcome 2 *When is development sustainable?*	**Case study overview** • the aim and strategies proposed for addressing the environmental science challenges associated with the selected case study. **Sustainability principles** • the relationship between ecological, economic and socio-cultural dimensions of sustainable development and principles of sustainability • 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 • challenges to upholding sustainability principles, including population, food, water and energy. **Environmental decision-making and management** • circular economy thinking and tools for integrated sustainability assessment, including qualitative risk analysis, and cost-benefit analysis • interconnections and tensions between factors that influence responsible decision-making, 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.

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Unit 4: Area of study 1 – Outcome 1 *How can we respond to climate change?*	**Managing climate change** • 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 • mitigation options for reducing net greenhouse emissions to slow climate change • adaptation options for building resilience to the effects of unavoidable climate change at a selected region or location • interconnections and tensions between factors that influence responsible decision-making around managing climate change: 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.