Unit 2 Environmental Science learning context examples

The overarching Unit 2 question, ‘What affects Earth’s capacity to sustain life?’ enables teachers to design teaching and assessment programs that are tailored to meet the needs of their cohort, and the contexts in which their schools are placed and in which students are learning, including resources. These programs must be aligned to the *VCE Environmental Science Study Design* and comply with the VCE assessment principles.

The mandated assessment task for this unit is a response as to how science can be applied in the management of a selected pollutant or in securing food and/or water, as outlined on page 29 of the study design. It is expected that the task is largely a secondary data investigation and may therefore be based on the scientific methodologies of a case study or a literature review, but primary data may also be generated to supplement the investigation through fieldwork, laboratory work and/or modelling or simulations. A commercial or student’s own development of a product, process or system may also be relevant as the basis of the response, as may be the consideration of a proposed development as reported in scientific or research literature.

The following tables provide examples of learning contexts relevant to the key knowledge for Unit 2 on pages 24–27 of the *VCE Environmental Science Study Design* aligned with the outcome for the unit. Teachers should select relevant key science skills on pages 7–9 of the study design as appropriate to the learning contexts.

Unit 2 Area of Study 1: Pollution effects on Earth’s systems

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| **Key knowledge point** | **Examples of learning contexts** |
| chemical and physical characteristics of pollutants that influence dispersal of emissions from natural and manufactured sources | * state of matter at 25 oC,
* solubility in oil and water
* density
* chemical activity
* radioactivity
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| the transport mechanisms, persistence, fate and toxicity of pollutants throughout Earth’s four interrelated systems | * transport of dissolved pollutants in rivers and streams by current flow
* transport of gaseous pollutants via diffusion and transport by air currents
* transport of pollutants into soils via leaching
* biodegradable versus persistent pollutants
* chemical reactions, for example, formation of ozone, NOx and SOx in the atmosphere
* toxicity: gases (for example, hydrogen chloride, benzene or toluene, dioxin); compounds (for example, asbestos) or elements (for example, cadmium, mercury, chromium).
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| 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  | * examples of pollutants: chemical pollutants; endocrine disruptors; optical radiation; electromagnetic fields; noise; heat; odours
* concepts of: risk; exposure; dosage; tolerance limits; LD50; chronic and acute toxicity; synergistic action
* human effects: allergies; disruption of system regulation; cancer; respiratory illnesses; deafness
* environmental effects: smog, bioaccumulation
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Unit 1 Area of Study 1: Managing pollution

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| **Key knowledge point** | **Examples of learning contexts** |
| the contributions of scientific data, new technologies, regulatory frameworks and diverse stakeholder values and priorities when managing pollution | * urban sprawl and urban infill
* noise from industry and recreational pursuits
* emissions from agriculture and transportation
* solid waste and landfill
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| options for control and treatment of pollution to reduce local and global impacts | * legislated incentives and/or penalties
* remediation and restoration of affected sites
* new technologies
* education
* personal and/or institutional behavioural modification/change
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Unit 2 Area of Study 2: Sustainable food systems

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| **Key knowledge point** | **Examples of learning contexts** |
| challenges to supplying adequate and affordable food in regional and global locations that achieve regional and global food security | * populations: rapid population growth; aging populations; urbanisation, industrialisation and/or globalisation; social instability and conflict
* transportation of agricultural resources, raw foods and/or food products
* growing wealth
* changing food habits
* food loss and food waste practices
* land use competition between food and biofuel crops
* land degradation
* pollution including chemicals used in or produced as by-products of industrial activities such as the production of agrochemicals and petroleum-derived products; generation, impacts and management of domestic, livestock and municipal wastes
* water scarcity
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| qualitative differences between food produced by conventional monoculture and organic monoculture agricultural systems | * food quality: nutrient content; presence of pesticide and/or hormone residues; the use of synthetic chemicals; susceptibility of crops to pests, weeds and drought
* crop yield
* land area requirements: water use and water quality, soil quality, energy use
* ethical treatment of animals
* greenhouse gas emissions
* economic and labour costs
* maintenance of ecosystem services
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Unit 1 Area of Study 2: Maintaining food and water security

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| **Key knowledge point** | **Examples of learning contexts** |
| options for improving food security that consider organisational, political and structural enablers and barriers to change | * government subsidies and incentives
* health and food system education
* advocacy by individuals, communities and organisations
* research, development and use of new technologies
* integration of agro-ecological farming practices
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| the use and limitations of ecological footprint analysis, in terms of the sustainability principles of intragenerational equity and the efficient use of resources  | * advantages of ecological footprint analysis: easy comparisons between goods, activities and services; easy to make links between local and global consumption; the relationship between different impacts can be explored; values are based on ecological realities rather than arbitrary weightings
* limitations of ecological footprint analysis such as: assumptions in calculations are not always identified; calculations are often limited by poor data availability; oversimplification of environmental impacts due to aggregated data; calculations do not take into account land degradation
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| 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 | * use of online carbon footprint calculators
* use of online water footprint calculators
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| options for decreasing water demand and improving water-use efficiency | * installation of water-efficient devices
* water restrictions
* government subsidies
* application of the user-pays principle to recover costs of treatment and pumping of water, or brackish and seawater desalination
* advanced wastewater treatment
* alternative dietary choices
* alternative crop selection
* reduction of use of crops for biofuels
* advocacy by individuals, communities and industry
* use of land management techniques that slow water run-off, increase water percolation into the soil and reduce evapotranspiration
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Unit 2 Area of Study 3: Investigation design, scientific evidence and science communication

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| **Key aspects of the student investigation** | **Examples of learning contexts** |
| environmental science concepts relevant to the student investigation* selection and approval of methodology and method
* techniques of primary data generation
* analysis and evaluation of data
* science communication
 | Content of the student investigation may relate to Area of Study 1 and/or Area of Study 2 and may involve one of seven practical scientific methodologies:* classification and identification
* controlled experiment
* correlational study
* fieldwork
* modelling
* product, process or system development
* simulation
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