Australian Government
Department of the Environment,
Water, Heritage and the Arts

Sustainability Curriculum Framework

A guide for curriculum developers and policy makers

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The supporting conceptual publication ***Earth Citizenship: background paper for learning for sustainability (2009)***[1] has been influential in guiding the content of the sustainability curriculum framework. ***Earth Citizenship***, developed through extensive reviews of literature and research into school-based sustainability practices, identifies the knowledge and practices required for citizens to create more sustainable futures. A copy of the publication is available at: http://www.curriculumsupport.education.nsw.gov.au/env_ed/teaching/framework/index.htm

1 Curriculum K-12 Directorate, NSW Department of Education and Training (NSW DET), *Earth Citizenship: background paper for learning for sustainability*, NSW DET, 2009

INTRODUCTION

This document is intended for curriculum developers and policy makers at national, state and territory levels (and, indirectly, all who use curricula in learning environments). It provides information and guidance on how education for sustainability may be structured to support a progression of learning from Kindergarten to Year 10.

It has been developed through national consultation with experts in education and in education for sustainability, primarily through state and territory government agencies and academics with expertise in these areas.

The importance of education for sustainability

Put simply, sustainability is about reducing our ecological footprint[3] while simultaneously improving the quality of life that we value—the 'liveability' of our society.[4]

Education for sustainability is both present- and future-oriented. It's about learning to design and implement actions for the present, in the knowledge that the impact of these actions will be experienced in the future. In this way it leads to students developing an overall capacity to contribute to "a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations".[5]

In an era marked by concerns about the future of the planet, education for sustainability can be empowering, and an antidote to a sense of helplessness. It equips students to act, individually and collectively, in ways that can contribute to sustainability. It provides the opportunity for students to explore and evaluate contested and emerging issues, gather evidence, and create solutions for a sustainable future. Education for sustainability can enable students to become effective citizens and active change agents by helping them to deal with complexity and uncertainty. It can also help them to understand that there is rarely a single solution because new knowledge is continuously generated, and diverse viewpoints exist in society.

There can be few more pressing and critical goals for the future of humankind than to ensure steady improvement in the quality of life for this and future generations, in a way that respects our common heritage – the planet we live on… Education for sustainable development…challenges individuals, institutions and societies to view tomorrow as a day that belongs to all of us, or it will not belong to anyone.[2]

2 UNESCO Education Sector, *United Nations Decade* on *Education for Sustainable Development (2005-14): International Implementation Scheme*, 2009, at http://unesdoc.unesco.org/images/0014/001486/148654E.pdf, p.5

3 **Ecological footprint**: how much biologically productive land and water area a given population occupies to produce all the resources it consumes and to absorb its waste, using prevailing technology.

4 Newman P and Kenworthy J, *Sustainability and Cities*, Island Press, 1999, and adopted by the WA State Sustainability Strategy in 2003, by the House of Representatives Environment Committee *Sustainable Cities Sustainability Strategy* in 2003, the House of Representatives Environment Committee *Sustainable Cities* report in 2005 and by the Australian State of the Environment Reports in 2001 and 2006; Submission to the Victorian Competition and Efficiency Commission's Inquiry into Enhancing Victoria's Liveability, January, 2008

5 UNESCO Education Sector, *United Nations Decade on Education for Sustainable Development (2005-14): International Implementation Scheme*, 2009, at http://unesdoc.unesco.org/images/0014/001486/148654E.pdf, p.5

In summary, education for sustainability means that students will be able to assess competing viewpoints, values and interests; manage uncertainty and risk; make connections between seemingly unrelated concepts, ideas and outcomes; and test evidence and propose creative solutions that lead to improved sustainability.

Sustainability education in Australia

Education for sustainability in Australia builds on approaches used by environmental education over the past 30 years or more. Its scope is more far-reaching; it includes the built environment and social and economic considerations as well as the natural environment.

There has been an emerging body of effective practice and exemplary efforts by teachers to incorporate sustainability into learning. At the same time, the state and territory education and environment agencies have been working on education for sustainability.

These activities, along with the advent of the first Australian Curriculum which includes sustainability as a cross-curriculum dimension, have provided an impetus for this document. Together, these initiatives support actions under the Australian Government's second National Action Plan for Education for Sustainability, *Living Sustainably*.[6]

The broad coverage of disciplines required to effectively teach education for sustainability has made it difficult to develop a systematic and cohesive progression of learning from Kindergarten to Year 10. The cross-disciplinary nature of education for sustainability is challenging to those who seek to develop it, as it represents ways of conceiving of content that are neither traditional nor mainstream, and demands new ways of thinking about curriculum. This framework is a major step towards meeting those challenges.

Purpose of the document

The purpose of this document is to provide information and guidance to curriculum developers and policy makers on how education for sustainability may be effectively incorporated into curriculum. It achieves this through a framework that describes what students may need to learn to live sustainably, and considers the most appropriate times and environments in which these learnings should occur.

The framework has been structured into three broad year groupings (K–2, 3–6 and 7–10) to give curriculum developers flexibility to align the framework's content across learning areas and enable in-depth focused teaching in particular years.

The document is not intended to specify how education for sustainability will be taught across the curriculum.

The following sections are, firstly, a summary of principles, specific purposes, and structural logic of the framework and secondly, the framework itself presented in sequential order: K–2, 3–6 and 7–10.

6 Department of the Environment, Water, Heritage and the Arts (DEWHA), *Living Sustainably – The Australian Government's national action plan for education for sustainability*, DEWHA, Canberra, 2009

DEVELOPING THE FRAMEWORK

In order to have a sustainable environment and society, consideration must be given to what people need to know and be able to do to achieve improved sustainability. In education, this means we need to have a clear idea about what students need to learn for sustainability.[7]

Education for sustainability is cross-disciplinary, as no single learning area provides all the essential knowledge and opportunities to enable students to contribute to sustainability. Appropriate knowledge and skills must be interconnected throughout the learning years and across the disciplines if sustainability is to be achieved.

Embedded in this curriculum framework is the principle that education for sustainability is not simply the acquisition of knowledge or skills, but a total approach which generates motivation and commitment to take sustainability action for improved outcomes for a sustainable world.

The framework provides sustainability content in three broad year groupings: K–2, 3–6 and 7–10, and has been structured to:

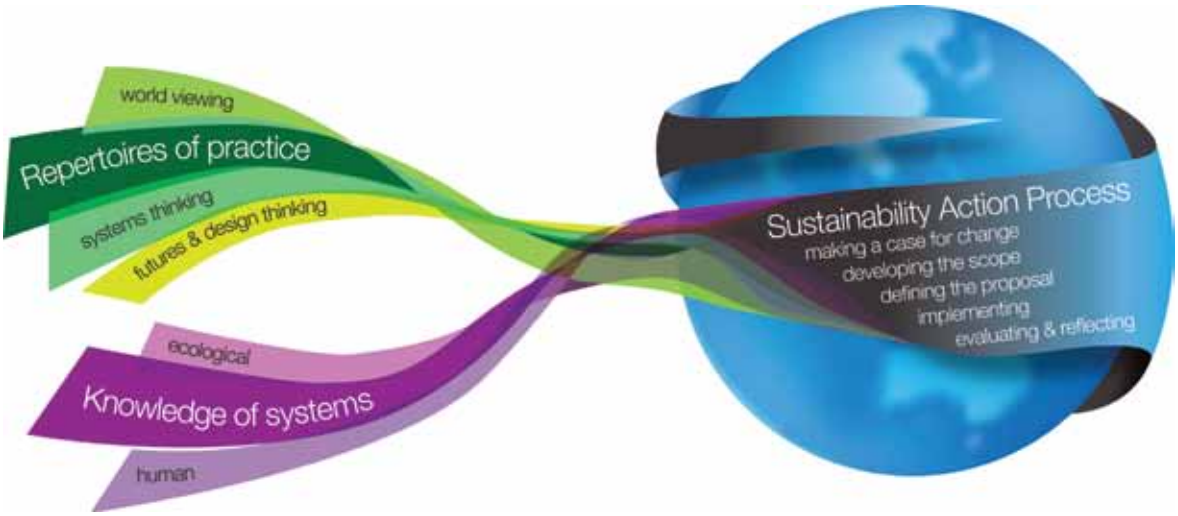
1. demonstrate a holistic and integrated continuum of education for sustainability across stages of schooling;
2. assist writers across the full range of learning areas to clearly identify content relevant to sustainability, suitable for different stages of schooling;
3. assist curriculum developers in aligning related content across learning areas, so that the curriculum supports teachers in building deep understandings and skills about sustainability with their students at particular points in time;
4. provide sufficient flexibility in the whole curriculum to enable teachers to teach this content richly, using locally relevant sustainability issues and opportunities in schools, at home and in the wider community.

The framework's content has been structured into three organisers that apply at each of the three broad year groupings:

- Sustainability action process
- Knowledge of ecological and human systems
- Repertoires of practice.

These organisers, as shown in the illustration following, are interdependent and overlapping—none is sufficient on its own.

7 Curriculum K-12 Directorate, NSW Department of Education and Training (NSW DET), *Earth Citizenship: background paper for learning for sustainability*, NSW DET, 2009



Sustainability action process

Learning to take action that will result in people living more sustainably is the central learning goal of the framework, as the acquisition of knowledge and skill has little meaning if it does not lead to effective action. The central organiser for the framework's content is thus the sustainability action process.

This organiser includes the knowledge and practices involved in addressing and taking action for sustainability. It provides a process for students to develop understandings and apply them with increasing levels of sophistication as they take sustainability action from Kindergarten to Year 10.

The sustainability action process involves

- **making a case for change**—exploring a sustainability issue, assessing the current situation, investigating sustainability concepts and ideas, and stating a case for change;
- **defining the scope for action**—exploring options for making a change, identifying available resources and constraints, seeking consensus, and developing a statement of the agreed direction for action;
- **developing a proposal for action**—generating and selecting ideas, developing and modifying these to make them ready for implementation, and preparing, communicating and agreeing upon the proposal;
- **implementing the proposal**—turning the proposal into action;
- **evaluating and reflecting**—assessing the degree of success of the action and the efficiency of the processes used, identifying possible future directions and the learning that has resulted from the action.

Knowledge of ecological and human systems

This organiser identifies knowledge which is developed through a range of learning areas and which is drawn upon and applied in the sustainability action process.

- **Ecological systems** involves knowledge associated with the processes and interactions of living and physical systems that support the functioning of the Earth's biosphere.[8]
- **Human systems** involves knowledge associated with social, cultural, political, economic and technological systems, structures, beliefs and actions that impact upon the functioning of the Earth's biosphere and influence the capacity for people, both individually and collectively, to live sustainably.

Repertoires of practice

This organiser identifies a wide body of knowledge and practices that is developed through a range of learning areas and is drawn upon and applied in the sustainability action process.

- **World viewing** involves practices associated with reflecting on, comprehending, negotiating and changing fundamental beliefs, perceptual orientations, ethical principles and values.
- **Systems thinking** involves practices associated with comprehending and working rationally with complexity, uncertainty and risk, so that they can be managed effectively.
- **Futures and design thinking** involves practices associated with visualising, modelling, selecting and developing ideas, products, environments, processes and systems that contribute to preferred futures, with the aim of formulating viable solutions.




8 **Biosphere**: is the sphere of life on earth that envelops the planet, encompassing the atmosphere, the hydrosphere and the outer layer of the lithosphere/geosphere. It is impregnated with life and its chemical and physical characteristics have evolved with the evolution of life (e.g. life has created the current atmosphere).

THE CURRICULUM FRAMEWORK

The framework focuses on what students should know and be able to do by the end of each of three stages of schooling: Year 2, Year 6 and Year 10.

In each of the three broad year groupings, the content is presented under the three organisers

- Sustainability action process
- Knowledge of ecological and human systems
- Repertoires of practice

YEARS K–2

YEARS K TO 2: SUSTAINABILITY ACTION PROCESS

MAKING A CASE FOR CHANGE

Exploring the following to identify a sustainability issue:

- water systems and water use at home and school
- energy systems and energy use at home and school
- use of materials and products at home and school
- use of local places and spaces
- caring for particular living things or a part of the local natural environment.

Assessing the current situation to identify the needs and wants of people (and where applicable, other species) in relation to the issue.

Investigating ideas or concepts necessary to understand the identified sustainability issue, including both ecological and human system ideas or concepts.

Stating a case for change in relation to the issue that demonstrates:

- why a change is needed
- how the change could result in an improvement
- a potential for the students to make a difference, individually or collectively.

DEFINING THE SCOPE OF THE ACTION

Exploring options for action and setting a direction by:

- identifying possibilities for modifying their behaviour or that of others, changing procedures or systems for doing something, or altering the physical environment
- identifying how the students would judge if the change is successful, and establishing criteria for success
- prioritising the possibilities and selecting a direction for action that best meets the criteria for successful change.

Identifying available resources and constraints including:

- people with expertise who can help
- available materials
- limits of cost, time, technology and community/school rules.

Stating a brief for action that includes:

- a description of the nature of the desired change
- criteria for judging the success of the change.

YEARS K TO 2: SUSTAINABILITY ACTION PROCESS

DEVELOPING THE PROPOSAL FOR ACTION

Generating ideas for action, including:

- identifying what others have done in response to similar issues
- imagining and drawing or modelling ideas for action
- trialling, testing and evaluating ideas using success criteria and recognising available resources and constraints
- selecting an idea for the further planning of an action.

Preparing and communicating the proposal, including:

- taking advice from experts, and talking with stakeholders or decision-makers, to refine plans
- describing the proposal for others with the use of appropriate media
- discussing the likelihood and consequences of relevant chance events (e.g. regarding safety, health, the environment)
- talking about ways of avoiding or reducing risk.

Gaining agreement on the proposal by presenting it to stakeholders and decision-makers using appropriate media.

IMPLEMENTING THE PROPOSAL

Planning implementation by

- organising equipment and resources to be used
- sequencing an order of activities to be carried out.

Implementing the action, including

- using tools, equipment and resources with guidance
- acting with regard to the safety of self, others and the immediate environment
- monitoring the progress of implementation activities.

EVALUATING AND REFLECTING

Evaluating the action in relation to the success criteria using

- feedback from others
- recorded observations of results and impacts of the action.

Reflecting on

- success of the action as a means of creating a more sustainable environment
- the process used to design and implement the action
- their learning.

YEARS K TO 2: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Life cycles, growth and change

- Living things and their internal systems that support life.
- Observable stages of the life cycle of common/local species.
- Conditions that support growth and change in plants and animal species including needs for sun, water, food and nutrition, shelter, certain temperature ranges and social groupings.
- Dependence of healthy plants and animals on having all their needs met in the right way.
- Diversity of living things found in nearby environments.
- Ways humans care for themselves, others and for other species.

Ecosystems and local environments

- Ways environments provide for the needs of different species.
- Relationships between species in simple and ecosystems and food chains.
- How we can assess the health and wellbeing of the natural environment and our community by observing, taking samples, measuring and comparing, and discussing results obtained over a period of time.

Weather and climate

- Features of phenomena described as weather.
- Methods of observing, describing and recording weather.
- Effects weather has on themselves, family, community and on plant and animal life.

Seasons

- Ways seasons are described and named.
- How seasonal changes impact on themselves, their environment and their personal choices.
- Seasonal differences in relation to latitude and the impact of seasonal differences on different people's way of living.

Water

- Importance of water to all life.
- Stages of the natural water cycle including naming of key stages.
- Managed water cycle, including systems in the built environment and the place of school, home, self in that cycle.
- Managed sources of water e.g. tap, rainwater, etc.
- Harvesting of water as a means of conserving sources of water used and managed in the immediate environment.
- Productive ways of using waste water and possible risks to human or environmental health.

Energy

- Sources of energy used in our lives.
- Uses of different forms of energy in our lives (including heat, light, sound and mechanical) and the needs being met.
- Products and systems that provide energy for personal use.
- Ways of saving/conserving energy in the immediate environment.

YEARS K TO 2: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Social systems and culture

- Ways families, schools and communities depend on natural environments.
- Ways groups utilise the natural environment to meet their needs and wants in different ways.
- How our culture affects how we see and think about the natural and built environments.
- How stories and other evidence from the past can help us learn of people's use and care for their natural and built environment.
- How stories from the past show that all people have traditions but also make changes to survive or to improve their ways of life and communities.

Civics and citizenship

- Opportunities provided by schools and communities for caring for our environment and for making it more sustainable.
- How children all over the world are working for sustainability and the reasons why it would be valuable to link up with them.

Ownership and value

- The importance of ownership and recognising responsibilities of people who manage different parts of our environment when planning activities to improve sustainability.
- Decisions we make as consumers in relation to their economic and environmental costs.
- Money as a system for assigning an economic value to things.

Materials and waste

- Sources of some materials used in everyday products.
- Properties of some common materials that influence their re-use and/or recycling.
- Procedures for waste avoidance and minimisation.
- Systems for managing and recycling waste.

Built environments

- Features of buildings and spaces necessary to meet people's needs.
- Aspects of building and spaces that use resources including energy and water.
- Ways of managing buildings or spaces to minimise environmental impacts and costs.
- Systems that provide services in built environments, including communication, energy, waste and transport systems.

Agriculture and food

- Processes and requirements for growing plants and raising animals.
- Sustainable methods of enriching and replacing plant nutrients in the soil.
- Sources of commonly eaten foods.
- Local plants and ecosystems that provided food for first Australians.

YEARS K TO 2: REPERTOIRES OF PRACTICE

WORLD VIEWING

- Tuning in to and sharing own and others' perceptions of and feelings toward living things and natural environments through:
  - practising moments of solitude in, and becoming familiar with, a variety of natural and built environments
  - appropriately interacting with and caring for domesticated and native/wild animals
  - cultivating or otherwise caring for native and non-native plants
  - describing, representing and talking about these experiences
  - contemplating and recounting the stories and interpretations of other people about living things and environments.
- Discussing own and others' accounts or stories of the origins of life, the universe and ourselves.
- Describing and discussing 'why I care' in regard to various things or issues.
- Describing and discussing the reasons for certain rules of behaviour or use of resources (e.g. recycling, water) at home and school.
- Reflecting on 'why should we do this' in regard to sustainability issues and actions; in particular,
  - needs, wants and values of self, family, other people/cultures
  - needs of other species and of natural systems.

SYSTEMS THINKING

Taking a big picture view

- Identify parts of a familiar system at home or school.
- Describe some of the functions or processes of a system.
- Explain how the removal or malfunction of part of the system affects the whole system.

Identifying and modelling interdependencies

- Explain cause and effect as an event or part of a system directly causing a change in a second event or part.
- Show causal relationships.

Tracking change over time

- Identify and order key events.
- Describe change as a series of events that connect over time.

Assessing probability, risk and benefit

- Distinguish the likelihood of an event from its consequences (desirable or undesirable).
- Qualitatively estimate the likelihood and consequences of relevant chance events (regarding safety, health, sport, the environment).
- Discuss ways of avoiding or reducing risk.

Identifying intended and unintended consequences and leverage

- Recognise that actions can have desirable and undesirable effects.
- Identify short-term, intended consequences.
- Give an example of how a specific action can affect what happens in the short term.
- Describe a basic concept of leverage, i.e. an action that would bring about a desirable effect.
- Given a specific situation, identify a relevant action.

YEARS K TO 2: REPERTOIRES OF PRACTICE

FUTURES AND DESIGN THINKING

Appreciating change over time

- Demonstrate a sense of time from past, to present and to future based on personal experience of events and places.
- Identify continuities, trends and patterns in relation to personal experience of events and places.
- Identify and give reasons for change in objects, places and behaviour over the immediate past.

Envisioning futures

- Predict events and changes based on trends and patterns that have been personally experienced.
- Envision future events and places from a projection of personal experience by making drawings of what might be imagined for the future, and explain the need that would be met by key features.

Creating solutions

- Follow a systematic design process to realise designs and actions for change in the immediate future.
- Generate ideas for products and environments that respond to people's needs and reflect a view of their personal future.
- Anticipate the impact of their designs and actions on people and environments in the immediate future.

Managing change

- Identify reasons why predictions of the future can be wrong.
- Demonstrate flexibility by adjusting designs and actions as a result of feedback.

YEARS 3–6

YEARS 3 TO 6: SUSTAINABILITY ACTION PROCESS

MAKING A CASE FOR CHANGE

Exploring a sustainability issue by identifying trends in family, school or local community relating to:

- ecosystems & biodiversity
- local water use
- resources, products, waste & pollution (including food)
- built environments, travel & transport
- energy.

Assessing the current situation by:

- combining assessments of family or school or local community sustainability in relation to the state of the biosphere and their ecological footprint and peoples' wellbeing
- using a systems model to identify major causes of observed trends and to evaluate existing or past responses to the issue.

Investigating ideas or concepts necessary to understand the current situation including:

- ecosystem and human system ideas or concepts
- needs and wants and values of stakeholders/stakeholder groups.

Stating a brief for action that:

- advocates a case for change
- recognises the views, interests and values of different stakeholder groups.

YEARS 3 TO 6: SUSTAINABILITY ACTION PROCESS

DEFINING THE SCOPE OF THE ACTION

Exploring options for action and setting a direction by:

- sharing ideas about a local preferred future in relation to the identified issue
- relating a local preferred future to possible actions to modify their own behaviour or that of others, change procedures or systems for doing something, or alter the physical environment
- taking into account practicality, potential effectiveness, appropriateness and fairness when establishing criteria for evaluating the success of the action
- selecting a type of action that best meets the criteria.

Identifying resources and constraints including:

- available time, money and other resources
- the people with expertise who can help and who are available
- limits that may restrict the action e.g. council requirements, environmental concerns.

Stating a brief for action that includes:

- a description of the agreed type of action to be undertaken
- criteria for evaluating the success of the action
- details of stakeholders, major milestones, budget, resources, and potential risks and possible benefits.

DEVELOPING THE PROPOSAL FOR ACTION

Generating ideas for action by:

- researching actions others have taken in response to similar situations, and evaluating the usefulness of their approach
- thinking laterally and transferring ideas
- modelling, testing, evaluating, selecting and refining ideas using criteria for judging the success of the action
- negotiating agreement with others by recognising differences and finding common ground
- estimating risk and possible benefit in a decision situation (e.g. regarding safety, health and sustainability)
- making judgements based on qualitative assessment of risks and benefits.

Preparing and communicating the proposal using appropriate means and media, which includes:

- sufficient detail to support its implementation
- specification of resources selected for their sustainable use
- procedures to minimise risk or mitigate consequences for people and the environment.

Gaining agreement on the proposal by:

- presenting it to those with authority to approve and support the action
- providing justification of the action in terms of 'leverage' to produce a significant desirable result.

YEARS 3 TO 6: SUSTAINABILITY ACTION PROCESS

IMPLEMENTING THE PROPOSAL

Planning implementation by:

- investigating, selecting and organising equipment and resources to be used
- preparing a basic budget, timeline
- allocating roles and responsibilities for implementation tasks
- identifying and developing necessary skills and knowledge.

Implementing the action, including:

- managing implementation activities
- choosing and using tools, equipment and resources, adjusting activities when required to improve efficiency
- identifying and responding to issues of safety and observing safe working procedures.

EVALUATING AND REFLECTING

Evaluating the action in relation to success criteria, including:

- planning and implementing evaluation strategies using a variety of methods
- using quantitative and qualitative data to make evaluation judgements recognising the validity and possible weakness of data from scientific investigation and/or social research
- developing strategies to monitor short and long-term impact and to inform future action.

Reflecting on success of the action in relation to:

- potential impacts, both short-term and long-term, on the environment and on stakeholders
- efficiency, effectiveness and appropriateness of processes used to design and implement it.

YEARS 3 TO 6: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Life cycles

- Fungi, plant and animal species, their needs, growth and health.
- Photosynthesis and respiration.
- Subsystems that enable life and reproduction in living things, including support and movement, digestion, circulation, respiration, sensing and response, reproduction.
- Life cycles of common/local species.
- How humans care for themselves, others and other species.

Ecosystems and local environments

- Adaptations, roles and relationships among fungi, plant and animal species and their physical environment in local gardens and natural ecosystems; food chains, food webs and cycles of energy and materials.
- Features of local terrestrial and aquatic ecosystems, their change over time and indicators of the state of their health.
- Human management of different ecosystems and places (historical or cultural contexts).
- Ways of caring for and describing different ecosystems at different times of the year.
- Issues and options for managing a classroom or natural area.

Evolution of life

- Evolution of main forms of life, long-term trends in species change and major events in Earth's history affecting evolution.

Change in living systems

- Techniques for investigating, assessing and describing physical environmental features.
- Ways of monitoring trends in the health of ecosystems and reasons for changes in ecosystem health.

Weather and climate

- Difference between weather and climate.
- Patterns, trends and longer term changes to climate.
- Systems put in place to manage weather and extreme weather events.

Solar system and energy

- Sun as the source of all energy on Earth.
- Structure of the solar system, orbits and orientation to sun, seasons and gravity, moon and tides.
- Sources of energy including renewable and non-renewable and the benefits or consequences of using them.
- Sustainable energy choices and their impact on humans and the environment.
- Processes used to transform energy for human purposes.
- Processes and devices for measuring and metering energy consumption.

YEARS 3 TO 6: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Water

- Natural and managed water systems and cycles.
- Impact on the water cycle of human intervention (storage, supply, use and release to the environment) and the importance of, and issues related to, harvesting water at local, state and national levels.
- Impact of climate change on availability of water.
- Purposes of engineered water systems, including large- and small-scale.
- Processes and devices for measuring and metering water flow and consumption.
- Systems for managing the quality of water returned to the water cycle.
- Issues associated with sustainable vs. non-sustainable water technologies.

Social systems and sub-systems

- Systems used to meet the needs of different groups and ways of managing these systems while recognising that ecosystems and their resources are finite.
- Groups and organisations that need to take sustainability into account when making decisions and taking action, including our school, the local council, businesses, clubs, state and federal parliaments and state and federal governments, international agencies.

Methods of assessing ecological sustainability

- Factors that influence our ecological sustainability including the health of our ecosystems, the conservation of our natural resources and the well being of our community.
- Alternative methods and ways of thinking required to measure ecological sustainability while recognising differing values regarding the biosphere (economic, spiritual, sentimental, historical, etc).

Processes of historical change

- Reasons why people, events, changes in technology and issues of the past need to be understood in relation to the natural and social environment in which they occurred.
- Historical change as a two-way relationship between communities and their natural environments, i.e. ecosystems affect communities and their cultures; communities and their cultures affect and change ecosystems.

Civics and citizenship

- Opportunities for citizens to take sustainability action through engagement with social, economic and democratic institutions and processes.
- Ways people and their communities are connected throughout the world, and how people can act as global citizens.
- Responsibilities of global citizens to future generations for achieving ecological sustainability.

Ownership and property rights

- How ownership and property rights are often determined by social, cultural and economic institutions and the ways these institutions contribute to shaping people's interactions with the environment.

YEARS 3 TO 6: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Economic systems and costs

- Relationships between lifestyle decisions and their economic and environmental costs.
- Relationships between wealth, consumption and ecological footprint.

Materials and production

- Processing of common materials from source and the effects of their extraction and use.
- Renewable and non-renewable nature of resources including marine, forest and mineral resources.
- Systems for waste avoidance, minimisation, re-use and recycling.
- Local and remote, social and environmental impacts of the processing and use of common materials.

Built environment

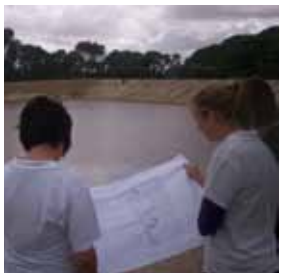
- Ways of designing buildings to minimise environmental impacts and costs.
- Re-purposing of buildings and neighbourhoods to preserve cultural features and qualities.
- Sustainability considerations in the choice of building materials.
- Urban and regional waste and recycling systems.

Transport

- Transport planning for a more sustainable use of resources at a personal and community level.
- Social and environmental costs and impacts of common power sources used for transport.
- Strategies and technologies that can minimise movement of people and resources.

Agriculture and food

- Cost and benefits of large-scale and small-scale agricultural production.
- Sustainability issues in relation to food production and nutrition including local and global equity.
- Sustainable agricultural and land use practices.



YEARS 3 TO 6 : REPERTOIRES OF PRACTICE

WORLD VIEWING

Perceptions, feelings, values

- Becoming aware of and sharing own and others' perceptions of and feelings towards living things and natural environments, through:
  - practising moments of solitude in a variety of natural and built environments
  - describing, representing, storytelling about these environments and their sense of connection with them
  - recounting a personal experience of changed perception of an environment as a result of learning from another person's way of perceiving
  - describing perceptions of environments in terms of developing systems understanding
  - working in and caring for various environments and various plants and animals.

Beliefs, ethics and actions

- Discussing own and others' beliefs about creation/origins of life and the universe.
- Describing and discussing 'why I care' in regard to various things or issues and empathise with others who care about different things.
- Reflecting upon and discussing own and others' values and ethical principles when:
  - explaining why a particular action is right or desirable, including reference to sustainability
  - negotiating agreement with peers or adults who have different viewpoints in regard to issues being addressed at school.
- Identifying where own beliefs, values and ethical principles are different from others, and discussing possible reasons for this.
- Negotiating common ground for collaboration on a project, by recognising and accommodating differences of belief and values.
- Using a variety of aggregated information regarding human needs, wants, happiness, health and wellbeing.

YEARS 3 TO 6 : REPERTOIRES OF PRACTICE

SYSTEMS THINKING

Taking a big picture view

- Identify and explain issues, goals, and/or problems within a system as a series of interrelated details or processes.
- Explain how parts of a system link or interrelate to make a whole.
- Interpret existing systems models of an issue.
- Create a model of a system and use it to demonstrate how change to a part of the system affects the whole system.

Identifying and modelling interdependencies

- Explain cause and effect as happening in a circular fashion.
- Represent causal feedback relationships as either positive (reinforcing) or negative (balancing).
- Explain some interdependent elements of a system including, stocks and flows, with at least one feedback relationship.
- Recognise and describe how a system's organisation creates its behaviours over time.

Tracking change over time

- Identify elements of a system that are changing over time.
- Describe change as a series of events that are connected in time to produce a particular pattern of behaviour.
- Represent continuous change over time (e.g. on a line graph), interpret trends and make projections into the future.

Assessing probability, risk and benefit

- Use dice or other tools to develop intuitive understandings of probability.
- Use a likelihood/consequence table to estimate risk and possible benefit in a decision situation (e.g. regarding safety, health, sport and sustainability).
- Qualitatively estimate probability and risk of data, relationships and outcomes of own systems model.
- Propose, evaluate and enact ways to minimise risk or mitigate its consequences.
- Make judgements about future school or community actions based on qualitative assessment of risks and benefits.

Identifying intended and unintended consequences and leverage

- Explain how actions can create consequences, both wanted and unwanted.
- Represent an identified short-term consequence, using a systems archetype or causal loop diagram.
- Given a specific situation, explain how certain actions may affect what happens in the short term and the long term (probability and risk/benefit of intended and unintended).
- Given a challenge, use understanding of system structure to identify and explain possible leverage actions.
- Represent how an action functions as leverage in a given system using systems archetypes, stock/flow diagrams, or models.

YEARS 3 TO 6 : REPERTOIRES OF PRACTICE

FUTURES AND DESIGN THINKING

Appreciating change over time

- Demonstrate a sense of time and place based on personal and historical experience.
- Identify continuities, trends and patterns to support forecasting of probable local futures.
- Identify how changing circumstances influences the way people meet their needs.
- Relate change in objects, places and lifestyle to developments of technology.

Envisioning futures

- Make predictions of local events and change based on a systems understanding of trends and patterns.
- Envision preferred futures that respond to emerging social and environmental issues.
- Build futures scenarios in images and text that reflect personal values and world views.

Creating solutions

- Implement systematic design processes that responds to people's needs and wants, and recognises potential impacts on people and environments into the future.
- Generate ideas for strategies, environments and products that reflect a preferred future in relation to emerging social and environmental issues.
- Use a systems approach to identify and analyse potential future impacts of designs and actions on people and environments.

Managing change

- Recognise uncertainty and risk as conditions of planning for preferred futures.
- Make provision for uncertainty and risk when designing and taking action for change.




YEARS 7–10

YEARS 7 TO 10: SUSTAINABILITY ACTION PROCESS

MAKING A CASE FOR CHANGE

Identifying a sustainability issue in the local or immediate environment by:

- gathering and responding to information about community, national or global sustainability
- taking account of alternative theories, views and values.

Making an overarching assessment of school, local community, national or global sustainability by:

- identifying significant processes and relationships in a system from a wide or big picture view of sustainability
- generating a systems model that represents significant processes and relationships in a system
- using the systems model to identify and provide reasons for the most concerning trends**,** to critically evaluate past policy and management responses to the issue, and to identify and evaluate possible leverage responses that address the trends
- evaluating reliability, probability and risks regarding the data used and the assessments based on it.

Investigating ideas or concepts that underpin the assessment, including concepts of ecosystem health, stocks and rates of consumption/replenishment of renewable and non-renewable resources, and human wellbeing.

Stating a case for change by:

- developing a report or presentation for relevant stakeholders or decision-makers
- presenting and advocating the case for change.

DEFINING THE SCOPE OF THE ACTION

Exploring options for action by:

- consulting with stakeholders about their preferred futures in regard to the chosen issue/s
- envisioning a preferred future that responds to the case for change and that provides evidence of systemic thinking
- back-casting from the preferred future to identify options for action in the physical environment, in systems or processes, or in the behaviour of others/informing others
- reflecting on and affirming or changing own views and values regarding issues and actions that have implications for sustainability
- seeking greater understanding of the beliefs, morals, values, needs and wants of stakeholders
- negotiating with stakeholders to establish criteria for judging the success of the change.

YEARS 7 TO 10: SUSTAINABILITY ACTION PROCESS

Setting a direction for action by evaluating options, using established criteria and by assessing:

- potential for change toward a preferred future, i.e. the leverage potential of possible actions
- appropriateness and fairness for stakeholders and others who may be at risk of experiencing consequences.

Identifying resources and constraints including:

- available time, money and other resources
- the people with expertise who can help and who are available
- factors that will limit the action including government regulations and approval processes.

Stating a brief for action that includes:

- a description of the agreed type of action to be undertaken
- criteria for evaluating the success of the action
- details of major milestones, budget, resources
- an assessment of risks and possible benefits
- methods for consulting with stakeholders.

YEARS 7 TO 10: SUSTAINABILITY ACTION PROCESS

DEVELOPING THE PROPOSAL FOR ACTION

Generating ideas for action by:

- exploring the application of sustainable design and technology
- lateral and creative thinking strategies
- using trials, tests and collaboration with experts to assist with the evaluation of ideas against success criteria and with their selection and refinement
- identifying the potential leverage of actions to produce the greatest desirable effect.
- modifying personal ideas or understanding to reach agreement in collaborating with others and recognising multiple views toward the environment and sustainability
- selecting resources to suit action with reference to their sustainability.

Preparing and communicating the proposal using appropriate means and media to suit a range of audiences including those with and without technical expertise.

Gaining agreement on the proposal by:

- consulting with stakeholders
- presenting and explaining the proposal to those with authority to approve action
- justifying the proposal, using a systems model that demonstrates complex cause-effect and time delay processes and that can be used to identify strategic leverage actions
- advocating ways to minimise risks of the action.

IMPLEMENTING THE PROPOSAL

Planning the action by:

- allocating roles and establishing management processes
- researching and selecting tools, equipment and resources to meet the requirements of implementation
- assessing environmental implications of using production methods, tools and resources, and employing environmental safeguards in their use
- scheduling tasks in relation to order and time
- preparing budgets
- developing skills necessary to implement the action.

Implementing the action by:

- using tools, equipment and resources while adjusting processes as necessary to improve efficiency and to better meet success criteria
- anticipating and responding to issues of safety
- observing safe working procedures.

EVALUATING AND REFLECTING

Evaluating the action, including:

- devising ways to assess the action in relation to each success criterion using quantitative and qualitative data where appropriate.
- explaining accurately how specific actions are expected to affect what happens in the short-term and the long-term
- representing identified short-term consequences, using a systems archetype or causal loop diagrams
- making judgements about the potential for future school or community actions based on qualitative assessment of foreseen risks and benefits.

Reflecting on the action considering:

- likely short-term and long-term impacts on the environment and stakeholders
- personal feelings toward the value of the action and the processes used.

YEARS 7 TO 10: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Living things

- Living things as self generating/organising/regulating systems that utilise energy and materials captured from their environment.
- Classification of living and non-living things, i.e. organic vs. inorganic, biotic vs. abiotic.

Major forms of life

- Biological structures (simple, unicellular and complex multi-cellular).
- Sources of energy for living things and metabolic processes and growth.
- Reproduction and life cycles, and health and wellbeing of individuals and groups.
- Sensory, communication, social and cognitive processes.
- Cell metabolism and function, reproduction, DNA, genetics and heredity.

Biochemistry

- Chemistry of living things, key elements and compounds, their sources, abundance and cycles.
- Photosynthesis and the role of plants as the base of food chains, ecosystem and energy flows.

Ecosystem and ecosystem relationships

- Species and their physical environment, habitat and niche.
- Populations, communities, food webs, self-organising, population dynamics and controls in the energy and materials' cycles of ecosystems, energy pyramid.
- Biotic and abiotic interactions in ecosystems.
- Key terrestrial and aquatic/marine ecosystems, including soils.
- Role of biodiversity in ecosystem function (including bacteria, fungi, invertebrates, vertebrates).
- Self-regulation, balance, equilibrium, and tipping points of ecosystems, the Gaia concept.
- Human communities viewed as functioning parts of the biosphere; impact on natural energy and materials' cycles and net primary production; role of ecosystem health in defining human sustainability.

Evolution of life and the biosphere

- Concept of species.
- Influence of ecosystems in species evolution, sequence of evolution over geological time (major periods and their characteristics).
- Role of plants in the development of the atmosphere/biosphere.
- Past mass extinctions/ecological collapse and their causes.
- Current mass extinction period and its human causes.
- Causes and effects of climate change in geological time vs. recent history.
- Emergence of unique features or processes as a result of evolution.
- Emergence applied to organisms, ecosystems and the whole biosphere.

YEARS 7 TO 10: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Biosphere processes

- Global material and energy flows and cycles (including water, carbon, nitrogen, oxygen, phosphorous).
- Net primary production of the biosphere (net global sequestration of solar energy through photosynthesis) and the proportion used by humans.
- Limits to human use of resources and biosphere services and their relevance to human sustainability.
- Biosphere uncertainty (issues such as climate change).

Methods of mapping, monitoring and assessing living systems

- Probability and the issue of uncertainty in monitoring ecosystem and biosphere processes, sampling and hypothesis testing.
- Ecosystem state and pressures, their indicators and methods of assessment.

Forces and energy

- Gravity, friction and potential, kinetic, chemical, radiant, electromagnetic energy.
- Renewable and non-renewable energy sources (solar, wind, fossil fuel, nuclear etc).
- Laws of thermodynamics.
- Emerging technologies for sustainable energy production.
- Sustainability issues relating to the production and use of different forms of energy.
- Energy limits that influence the use of non-sustainable technologies (e.g. peak oil, Earth's net primary production).

Structure of the Earth

- Lithosphere, hydrosphere, atmosphere (development and change over time) and their relation to the biosphere.
- Earth's geothermal and tectonic activity and influence on the biosphere (including effects on evolution), geological time scales.

Solar system

- The sun and solar processes, solar system electromagnetic radiation and energy source for Earth and influence of solar flares on Earth's climate.
- Planets and other bodies, Earth's orientation to the sun, seasons.
- Gravity (sun and Earth) effect on planetary orbits, influence of the Moon (earth rotation and tides).

Climate

- Earth's climate systems and major processes, energy stocks, flows and feedbacks in the atmosphere and hydrosphere; greenhouse gas concept.

Social systems and culture

- Social systems designed to meet human needs and wants by utilising ecosystem (biosphere) services and resources.
- Systems for regulating access to ecosystem services and resources.

YEARS 7 TO 10: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Sub-systems

- Structure of social systems as comprised of a number of sub-systems, such as political, legal and economic.
- Influence of subsystems on the way a society interacts with its natural environment and their critical importance for achieving ecological sustainability.

Methods of assessing ecological sustainability

- Techniques for holistically assessing ecological sustainability including economic, environmental and social measures and ecological footprint analysis.

Historical evaluation and processes of historical change

- Processes for evaluating the history and development of human society and technology and their relation to the natural environment, including whether or not present and past societies can be judged to be or to have been ecologically sustainable.
- Periods and processes of change in history that provide potential models for moving society towards sustainability.

Civics and citizenship

- Practical approaches to civics and citizenship, including strategies to influence others through the democratic process, media, purchasing power of consumers and various forms of networking and social action at local, state and national levels.
- Responsibilities and roles of citizens in relation to global equity, now and into the future.
- Mechanisms for global cooperation and methods of facilitating intercultural understanding, including processes and functions of the United Nations and non-governmental organisations, major forums, summits and conventions.

Ownership and property rights

- Systems of ownership and property rights that are fundamental to issues of sustainability and that need to be recognised when designing sustainability action.

Economic systems and costs

- Economic costs, now and into the future, of the overuse of resources.
- Different types of value placed on particular environments and life forms.
- Factors that influence whether or not an economic value should be assigned to a particular environment or life form by current generations.
- Economic and work opportunities created by new ‘green’ industries.

Water technologies

- Principles of total water cycle management and total catchment management.
- Principles and practices of water sensitive urban design (an application of total water cycle management).

YEARS 7 TO 10: KNOWLEDGE OF ECOLOGICAL AND HUMAN SYSTEMS

Materials and production

- States of matter, changes of state; atomic structure, elements and the periodic table; molecules, compounds (organic and inorganic) and mixtures for the function of living things.
- Social and environmental costs and benefits of processing and using resources including marine, forest and mineral resources.
- Factors that determine the sustainability of resource use and the classification as renewable and non-renewable resources, including considerations of embodied energy.
- Sustainability in design and production, including the management of mass production systems, design for disassembly/recycling, issues of designed/engineered obsolescence.
- Product road map as a means of identifying social and environmental impacts of products.
- Method of 'cradle to grave' analysis including assessment of embedded energy/water.

Built environment technologies

- Urban planning for sustainable development.
- Models of the function of urban systems (urban metabolism) as a means of identifying and analysing flows of the materials and energy.
- Biomimicry as a source of ideas for design.
- Passive solar design principles and technologies.
- Integrated urban and rural planning (including transport and community health).

Transport

- Innovation in transport planning to improve resource use and quality of life.
- Social and environmental costs and benefits of different modes of transport and transport systems.
- Emerging technological developments in energy efficient power sources.

Agriculture and food production

- Impacts of contemporary agricultural practices on health, nutrition, water security and ecosystem wellbeing.
- Integration of traditional land management practices in contemporary agriculture.
- Impacts of genetically engineered agricultural products on agricultural production and biodiversity.

Information and communication technologies

- Application of control systems to efficiently manage systems and processes.
- Remote sensing to collect data and monitor change in ecosystem and biosphere health.
- Use of ICT for managing data and modelling and projecting change over time in ecosystems.

YEARS 7 TO 10: REPERTOIRES OF PRACTICE

WORLD VIEWING

Identifying perceptions, feelings and values

- Become aware of and share their perceptions, feelings, values and behaviour towards ecosystems and the biosphere by
  - observing and reflecting
  - describing, representing, storytelling
  - seeking to understand alternate cultural perspectives and values
  - developing systems understandings
  - assessing the state of systems
  - working in and caring for living systems (local to global).

Clarifying beliefs, ethics and actions

- Become aware of, reflect upon and share their own and others' beliefs, morals, values, needs and wants.
- Seek greater understanding of the beliefs, ethics, values, needs and wants of others in order to
  - enrich own understanding of the world and
  - negotiate agreement regarding issues and actions that have implications for sustainability.
- Critically use a variety of aggregated information regarding human needs, wants, happiness, health and wellbeing and the state of the environment to make judgements and support recommendations regarding sustainability action.

SYSTEMS THINKING

Taking a big picture view

- Identify and explain issues, goals, and/or problems within a system from a wide, "big picture" view, rather than focusing on details.
- Gather information about a system to form an overarching assessment of the situation.
- Create a digital model of a systems relevant relationship by taking a whole-system perspective on an issue or process.
- Explain key assumptions of the model and the evidence supporting these assumptions.
- Interpret the implications of the model for the issue under consideration.

Identifying and modelling interdependencies

- Explain cause and effect as happening in a circular fashion that involves positive and negative feedback and multiple causation.
- Explain the key interdependent elements of a system including, stocks (accumulations and levels) and flows, with multiple feedback relationships.
- Represent causal feedback among two or more elements of a system and/or create multiple loops that illustrate different interpretations.
- Describe how the structure of both natural and human systems determines their behaviours over time.

YEARS 7 TO 10: REPERTOIRES OF PRACTICE

Tracking change over time

- Identify, describe and distinguish between changes in qualitative (e.g. happiness) vs. quantitative (e.g. population) characteristics or entities that change over time.
- Describe change as a continuous trend over time.
- Identify and explain a system component's continuous pattern of change/trend over a specified period of time.
- Compare different patterns of change and make future projections based on current trends.
- Represent continuous change over time of more than one variable, e.g. on a line graph.

Assessing probability, risk and benefit

- Apply quantitative estimates of probability and risk to personal, community and environmental situations and issues, and their solutions.
- Estimate probability and risk of data, relationships and outcomes for a modelled system.
- Estimate the benefits and risks for sustainability in proposed actions or policies at school, in the community, or by governments.
- Propose, evaluate and enact ways of minimising risk or mitigating its consequences.
- Make recommendations about future school or community actions based on assessments of risks and benefits (related to the concepts of consequence and leverage).

Identifying intended and unintended consequences and leverage

- Represent or model how aspects of a specific situation inherently cause certain intended or unintended consequences over time (drawing upon concepts of causal loop, stock/flow and common systems archetypes).
- Given a challenge, use mental models and understanding of system structures to identify and select among possible leverage actions.
- Identify and assess the probability of a proposed solution resulting in undesirable consequences, and assess the risks involved.
- Examine and test assumptions about potential leverage actions within a real-world context, such as student-action committees, class projects, or community involvement.

FUTURES AND DESIGN THINKING

Appreciating change over time

- Demonstrate a sense of personal location in time and place based on a world view and an understanding of global change over a significant time span.
- Identify continuities, trends and patterns as factors to inform systems thinking for the construction of preferred futures.
- Explain change in objects, places and lifestyle in relation to the development of technology.

YEARS 7 TO 10: REPERTOIRES OF PRACTICE

Envisioning futures

- Predict probable futures based on a systems understanding of patterns and trends.
- Envision preferred futures that anticipate developments in science, technology and design.
- Build detailed future scenarios that reflect personal values in relation to global and intergenerational equity and ecosystem health.

Creating solutions

- Plan, implement and manage systematic design processes to realise ideas and actions that support change for a preferred future.
- Backcast from a preferred future to generate ideas for behaviours, strategies, environments and products.
- Reconcile visions of a global future with personal actions to promote behaviours and design strategies, environments and products.

Managing change

- Assess and make provision for uncertainty and risk in planning for preferred futures.
- Accommodate changing circumstances and reconciling differing responses from stakeholders when designing and taking action for change.

IMAGE CREDITS

Front Cover: Tatachilla Lutheran College students in greenhouse (Tatachilla Lutheran College, South Australia), Laganda-Emu Fruit Tree (orange fruit) & almond nut (D. Markovic), Penshurst West Public School students in classroom, (D. Markovic), Newmarket State Primary School

Page 1: Penshurst West Public School student using smart board (D. Markovic)

Page 3: Students with sustainable city (ACT school)

Page 4: Yellow Water Lagoon, Kakadu National Park (J. Baker)

Page 6: Tatachilla Lutheran College students weighing (Tatachilla Lutheran College, South Australia), Penshurst West Public School students giving a presentation (D. Markovic), Cravens Peak Reserve (N.Rains)

Page 7: Strathfield South High School students looking at building design drawings (D. Markovic)

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Page 11: Penshurst West Public School students building chicken coop (D. Markovic)

Page 12: Mt Barker Community College student in vegetable garden (Mt Barket Community College, Western Australia), Strathfield South High School students in biology laboratory (D. Markovic), Penshurst West Public School students in classroom (D. Markovic)

Page 13: Penshurst West Public School student in classroom (D. Markovic)

Page 18: Penshurst West Public School students building chicken coop (D. Markovic), Tatachilla Lutheran College students in greenhouse (Tatachilla Lutheran College, South Australia)

Page 19: Penshurst West Public School students (D. Markovic), Newmarket State Primary School, Tasmanian Devils (D.Watts)

Page 21: Strathfield South High School students in classroom (D. Markovic), Penshurst West Public School students in computer laboratory (D. Markovic), Port Noarlunga Jetty from the northern end of Noarlunga Beach (J. Baker)

Page 24 Pumpkins (Youngtown Primary School, Tasmania), Mt Barker Community College students at dam (Mt Barker Community College, Western Australia), School of Snapper (Paradise Ink), Urban Images Canberra City (M. McAulay)

Page 25 Eucalyptus flowers in the Chauncy Vale Wildlife Sanctuary (N. Rains), Penshurst West Public School students (M. Markovic), Old growth Red Gums in a coastal dune forest near Bairnsdale (J. Baker)

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Page 28: Strathfield South High School students in biology laboratory (D. Markovic)

Page 29: Tatachilla Lutheran College student studying wildlife (Tatachilla Lutheran College, South Australia), Strathfield South High School students in classroom (D. Markovic)

Page 31: Soft Coral Sea Fans, Strathfield South High School students discussing sustainable housing (D. Markovic), Wetlands at the Cobourg Peninsula Aboriginal Land & Wildlife Sanctuary (M. McAulay), Sydney Harbour Bridge (M. Lindquist)

Page 38: Irrigation channels running through farmland, Strathfield South High School students in biology laboratory (D. Markovic), Russell Falls in the Tasmanian Wilderness (J. Baker)

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