



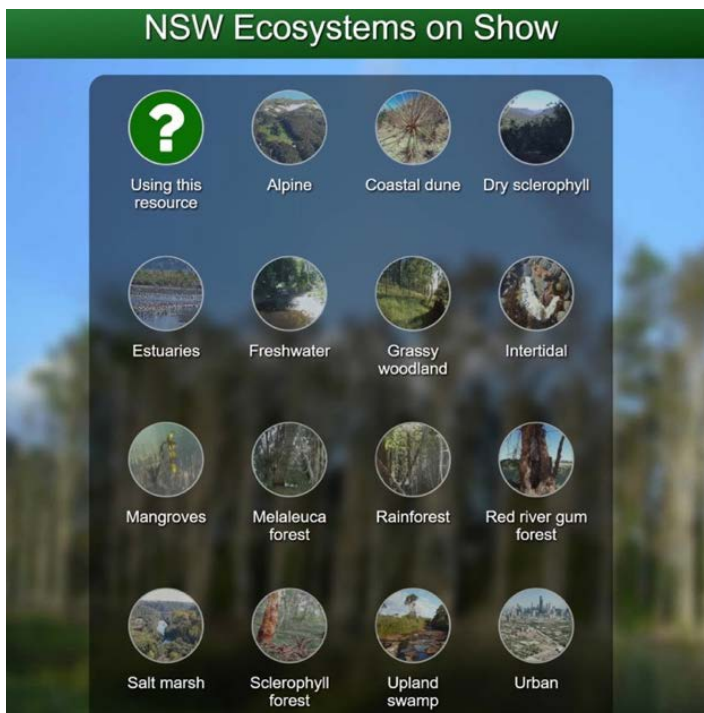
Source: Shutterstock

## SPaRK – NSW ECOSYSTEMS ON SHOW

### What are the systems within ecosystems?

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*Note: The Editor has inserted additional images and headings into this article*



### RESOURCE OVERVIEW

#### NSW Ecosystems on Show by NSW Department of Education (2018)

Showcasing fourteen natural ecosystems and one urban ecosystem in New South Wales, **NSW ecosystems on show** is an interactive resource that supports teaching and learning in science and geography. Each ecosystem is introduced by an overview of its characteristics, climate, plants and animals. Further tabs outline the significance of the ecosystem to animals, people and the environment, and describe strategies for its conservation and protection.

When used in Google Chrome, a Google Earth link takes users to an example of each ecosystem, positioning them within a photo sphere for a rich, virtual, immersive experience. Clicking out of Street View delivers a bird's eye view of the ecosystem, its location and surrounding land uses. This, and links to further examples of the ecosystem, enable virtual fieldwork experiences.

For those seeking hands-on fieldwork investigations in the natural environment, the department's widespread network of environmental education centres is featured in the resource. Related reading and other secondary sources are also suggested, and could be used in preparation for, or as follow-up to, the collection of primary data in the field.

Using the resource to build understanding of the functioning of ecosystems enables students to consider and determine personal sustainability actions that contribute to protecting these ecosystems into the future.

## EDUCATIONAL SIGNIFICANCE (Curriculum links)

Highlighting the diversity of environments and ecosystems in NSW and their ecological functioning, **NSW ecosystems on show** supports the Geography K–10 Syllabus, Science and Technology K–6 Syllabus and Science 7–10 Syllabus. It strongly aligns with a systems thinking approach to understanding and working towards sustainability.

With a focus on ecology, the website also supports the Living World modules and strands of the **Science syllabuses**, particularly assisting investigations into the interdependence of living things. It enables students to use systems thinking and the skills of working scientifically as they explore and observe the interrelated living and non-living components of virtual ecosystems. The structure of the resource models ways in which scientific information can be organised and communicated.

For Stage 2 students investigating the survival of living things, the 'significance' tab for each ecosystem provides information on the interrelationships among and between species and their habitats. Students in Stages 4 and 5 investigating and evaluating strategies for conserving and maintaining sustainable ecosystems will find examples of human impacts, threats and management strategies in the 'conservation' tabs.

From a **Geography** perspective, NSW ecosystems on show enables students to acquire information through a variety of geographical tools including photographs, virtual maps, satellite images and web tools. With an emphasis on the characteristics of and interconnections within each ecosystem, the resource reinforces the geographical concepts of place, space, environment, interconnection and sustainability. In particular, it supports the **Geography K–10 Syllabus focus areas: The earth's environment (Stage 2) and Environmental change and management (Stage 5)**. It could also

support Features of places (Stage 1) and Factors that shape places (Stage 3).

At a glance, the website's landing page provides Stage 2 students with a snapshot of different environments and the diverse natural characteristics of Australia. Students could select several of the ecosystems to compare their climate, vegetation and animals. For deeper investigations into the significance of environments, students could use one of the featured ecosystems as a case study.

For Stage 5 students investigating the functioning, role and importance of natural environments in Environmental Change and Management, the resource provides introductory information and an overview of environmental management as a springboard to deeper investigation.

## SUGGESTIONS FOR USING THIS RESOURCE

As a class, view an ecosystem in **NSW ecosystems on show** and make connections using text-to-self, text-to-text and text-to-world strategies. For example, ask questions such as:

- Have you seen environments like this?
- Have you visited a place like this?
- Have you seen photographs, documentaries or social media posts of places like this?
- Have places like this been in the news recently?
- How are places like this being used?
- What issues are you aware of relating to places like this?
- Does this information remind you of other information, websites or books you have accessed previously? See References and further reading for related picture books.

Define the words 'system' and 'ecology', then define 'ecosystem' as an 'ecological system'. Highlight and define terminology relating to systems such as 'relationships', 'interrelationships', 'interactions', 'interdependence' and 'interconnections'. Use images in the resource to provide examples, for instance the image of beetles feeding on blossoms in the sclerophyll forests – Sydney ecosystem.

Provide time for students to personally explore the resource using computers or mobile devices. Students use a Y-chart to identify something that was new knowledge, something that generated an emotive response, and a link they found interesting.

Focussing on interconnections and interdependence, students record any questions which emerge as they

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browse through the resource. These can be used to generate a set of inquiry questions for a scientific or geographical investigation.

## TEACHING ACTIVITIES

### STAGE 2 GEOGRAPHY

*What are the natural characteristics of Australia?*

Working in Google Chrome, students explore the ecosystems in **NSW ecosystems on show** and view the images within each tab. They select the Google Earth link to view a photo sphere of each environment at the personal scale. Students then select the yellow figure to view the area at a local scale, and the minus icon to zoom out to a regional scale.

Using Google My Maps, students plot the locations of the featured ecosystems. They add photographs and labels to each site.

### Geography: The Earth's Environment

A student:

- examines features and characteristics of places and environments GE2-1
- acquires and communicates geographical information using geographical tools for inquiry GE2-4.

### Content

#### Different environments

Students investigate the natural characteristics of Australia and a country in Asia (ACHGK020), for example: comparison of climate, natural vegetation and native animals

### STAGE 2 GEOGRAPHY AND SCIENCE

*How does the environment support the lives of living things?*

*How are they interdependent?*

Plan a field trip to a nearby natural area for a geographical and scientific investigation. This can be organised through one of the department's environmental education centres or managed independently.

#### Pre-fieldwork

As a class, using Google Earth in Google Chrome, view a satellite image of the natural area to be visited. Select the yellow figure to view the Street View level. Using NSW ecosystems on show as a reference, determine the ecosystem type and identify the plants and animals it may support.

Create a mind map to show the potential interconnections between:

- plants and animals. For example, plants as food, plants as shelter

- plants and animals and the non-living features of the environment. For example, plants growing in soil, tadpoles in a pond, plants providing oxygen
- people and the living and non-living features of the environment.

Formulate a set of inquiry questions to guide the fieldwork investigation.

#### Fieldwork

Plan data recording activities with a focus on interconnections and interdependencies between living things and the environment. Fieldwork activities should include sensory observations, time for exploration and creative ways of recording observations using a variety of media. Suggested fieldwork activities include:

- taking photographs of natural living and non-living features of the environment, human features and examples of interactions, such as a water dragon sunbathing on a tree branch or rock
- constructing field sketches that identify and position human and natural features
- creating labelled scientific drawings detailing specific habitats, such as a habitat tree, rock pool or rotting log
- recording natural and human sounds using a sound map
- hunting for invertebrates using sampling techniques such as sifting through leaf litter, shaking shrub branches onto a mat and dip-netting in ponds
- observing and recording evidence of animals using the environment, such as parrots using tree hollows, termite nests on tree trunks, nests and diggings in the soil
- reflecting on personal experiences and perceptions of the environment as student investigators and visitors.



Source: <https://schoolsequella.det.nsw.edu.au/file/6fccb196-b448-40b3-abd8-64dc662b8079/1/NSWEcosystems.zip/LOs/dry-sclerophyll/index.htm>

## Post-fieldwork

Tables, annotated photo collages and maps could be used to organise and present the components of an ecosystem and some of the interconnections observed. Supplementary information could be acquired from NSW ecosystems on show and other secondary sources to identify relationships and connections.

Students construct mind maps to show the interactions within the ecosystem. With plants in the centre, students insert animals that rely on the plants and use arrows and labels to identify the relationships. Students also include non-living features of the environment. As evidence of knowledge and use of systems thinking, students verbally explain some interdependencies illustrated in their concept map. They start to consider actions they could take which conserve and protect the sustainable functioning of ecosystems.

Students select an ecosystem for independent research using NSW ecosystems on show as a source. In groups, students share their information and identify similarities in interrelationships across ecosystem types.

## Geography: The Earth's Environment

A student:

- examines features and characteristics of places and environments GE2-1
- describes the ways people, places and environments interact GE2-2
- acquires and communicates geographical information using geographical tools for inquiry GE2-4.

### Content:

#### Significance of environments

Students investigate the importance of natural vegetation and natural resources to the environment, animals and people (ACHGK021, ACHGK022, ACHGK024), for example:

- identification of types of natural vegetation, for example forests, grasslands, deserts
- explanation of the importance of natural vegetation to animals and the functioning of the environment, for example provision of habitats, production of oxygen.

## Science: Living world

A student:

- questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations ST2-1WS-5

- compares features and characteristics of living and non-living things ST2-4LW-5.

### Content

#### Survival of living things

Students describe how living things depend on each other and the environment to survive (ACSSU073, SysT), for example:

- bees and flowers
- birds eat and disperse seeds.



Snow Gum *Eucalyptus pauciflora*. Tatters | CC BY-NC-ND 2.0  
Source: <https://schoolsequella.det.nsw.edu.au/file/6fccb196-b448-40b3-abd8-64dc662b8079/1/NSWEcosystems.zip/LOs/alpine/index.htm>

## STAGE 5 GEOGRAPHY AND SCIENCE

### *How can environments be sustainably managed?*

As a stimulus, view the dune photograph (within the 'Conservation' tab) showing various management strategies used to restore a coastal dune ecosystem. Note the accompanying list of 'current management issues' for coastal dunes in the Illawarra region of NSW.

Using a jigsaw strategy, students use NSW ecosystems on show to consider a selection of the available ecosystems, determining their significance and identifying conservation issues and management strategies. Students discuss similarities and differences in threats and approaches to conservation of ecosystems.

For one or more selected ecosystems, students summarise their information in a table that lists specific threats and management strategies. Students discuss the immediate and broader impacts of the listed management strategies.

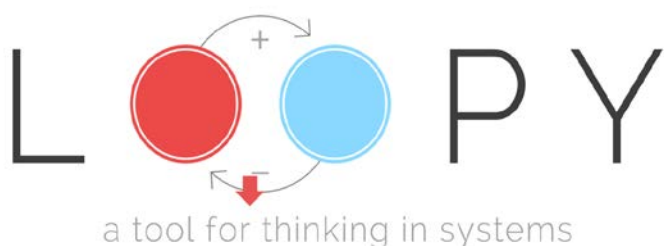
Students undertake fieldwork in an ecosystem, organised through one of the department's environmental education centres or planned independently by the school. Students:

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- collect abiotic and biotic data to assess the health of the ecosystem
- identify threats and issues
- record current management strategies.

Following this fieldwork, students use holistic thinking to analyse impacts of management strategies on relationships within the ecosystem and interconnections regionally. Students construct a causal loop diagram that illustrates the impacts of these management strategies.

Causal loop diagrams illustrate interconnections and interrelationships and the holistic nature of an ecosystem. Animated diagrams can be created using Loopy, an online tool for systems thinking.



Source: <https://ncase.me/loopy/>

## ACTION FOR SUSTAINABILITY

Students consider ways in which they can take individual or collective action to contribute towards ecosystem conservation.

### Geography:

#### Environmental change and management

A student:

- assesses management strategies for places and environments for their sustainability GE5-5
- acquires and processes geographical information by selecting and using appropriate and relevant geographical tools for inquiry GE5-7
- communicates geographical information to a range of audiences using a variety of strategies GE5-8.

### Content

#### Environmental management

Students investigate environmental management, including different worldviews and the management approaches of Aboriginal and Torres Strait Islander Peoples (ACHGK071, ACHGK072), for example discussion of varying environmental management approaches and perspectives.

Using the sustainability action process, students use design thinking and systems thinking to investigate and propose solutions to a local environmental management issue that threatens a local ecosystem,

ideally within the school grounds or surrounding area. Informed by their fieldwork and research, students undertake actions that restore or protect the ecosystem and work towards achieving environmental sustainability. Potential actions could include bush regeneration, restorative planting, fencing, signage or a stormwater filtration system.

### Science: Living world

A student:

- processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions SC5-7WS
- analyses interactions between components and processes within biological systems SC5-14LW.

### Content

LW2 Conserving and maintaining the quality and sustainability of the environment requires scientific understanding of interactions within, the cycling of matter and the flow of energy through ecosystems.

Students evaluate some examples in ecosystems of strategies used to balance conserving, protecting and maintaining the quality and sustainability of the environment with human activities and needs.

### Experimenting

#### Stage 2

Students follow the sustainability action process to improve or enhance biodiversity in an area of the school grounds or local area with a focus on interconnections and relationships between species. Habitat improvement projects could include creating small bird habitat using ground covers and native flowering shrubs, building 'insect hotels', or creating 'lizard lounges' by adding rocks, fallen logs and ground covers to native gardens. The grassy woodland 'Conservation' tab lists suggestions for students to help protect remaining areas of biodiversity.

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*Geography K-10 Syllabus* © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2015.

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**Science and Technology K-6 Syllabus** © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2017.

**Science K-10 Syllabus** © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2012.

## Sustainability action process

Learning for sustainability seeks to enable and empower students to make decisions and take actions that contribute to creating a sustainable society and ecosystem.

The sustainability action process provides a scaffold for teachers and students to investigate real issues and needs. It supports authentic problem solving through active student participation.

The sustainability action process has five steps:

Make the case	+
Explore	+
Plan	+
Take action	+
Reflect	+

Source <https://education.nsw.gov.au/teaching-and-learning/curriculum/learning-across-the-curriculum/sustainability/sustainability-action-process>



The poster features a central image of two hands holding a small globe of the Earth against a background of bokeh lights. The text is overlaid on the image.

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