BIODIVERSITY AND THE INTERCONNECTEDNESS OF LIFE

By the end of Year 12, students are able to:

- understand how classification helps to organise, analyse and communicate data about biodiversity
- understand that ecosystem diversity and dynamics can be described and compared with reference to biotic and abiotic components and their interactions
- understand how theories and models have developed based on evidence from multiple disciplines; and the uses and limitations of biological knowledge in a range of contexts
- use science inquiry skills to design, conduct, evaluate and communicate investigations into biodiversity and flows of matter and energy in a range of ecosystems
- evaluate, with reference to empirical evidence, claims about relationships between and within species, diversity of and within ecosystems, and energy and matter flows
- communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.

A visit to Currumbin Wildlife Sanctuary provides a holistic experience where the curriculum area is presented using real world examples and encounters, creating a meaningful teaching and learning experience.

By combining the knowledge from one of our experienced Education Officers, with the experience of "seeing" the curriculum, students will become engaged in the topic area.

YEAR LEVEL: Senior, Stage 6

DESCRIPTION: Currumbin Wildlife Sanctuary is home to over 1000 animals and over 100 species, including Vombatus ursinus and Canis lupis dingo just to name a few. That's Common Wombat and dingo! Many of the exhibits at Currumbin Wildlife Sanctuary have accompanying signage so students can learn more about how we classify our amazing biodiversity. Students can do a spot of wild bird watching and explore exotic ecosystems, their diversity and dynamics in our exciting 'Lost Valley' exhibit (self-guided). Students will also learn more about the wonderful conservation conducted by Currumbin Wildlife Sanctuary along the way. All of this, and more will be consolidated by an Education Officer with more animals during your exclusive Wildlife Discovery Lesson.

EXCURSION FORMAT: This excursion provides a mix of self-guided activities as well as a lesson presented by one of our educators. Students will learn more about how we classify and conserve our amazing biodiversity and explore ecosystems, their diversity and dynamics as they embark upon a learning journey to complete the provided work sheet (optional). Students will also meet and interact with some of our resident animals.

AUSTRALIAN CURRICULUM LINKS:

SENIOR: Biodiversity and the interconnectedness of Life (Unit 1); Describing Biodiversity; Ecosystem dynamics

STAGE 6: Module 3: Biological Diversity (BIO11/12-1, BIO11/12-2, BIO11/12-7), Module 4: Ecosystem Dynamics (BIO11/12-1, BIO11/12-2, BIO11/12-3, BIO11/12-4, BIO11/12-5, BIO11-11)

ACTIVITIES

BEFORE YOUR VISIT:

As a class, become a team of 'citizen scientists' and collect data on the wildlife species and biodiversity in your school or local bushland reserve over a period of time. Use field guides and identification keys to identify species. Collect data on numbers and make observations about impact of human activities, if any, and impact of seasonal change, if possible. Compare your data with data collected by other citizen scientists in your area.

https://biocache.ala.org.au/explore/your-area#-28.1386728|153.48031600000002|12|ALL_SPECIES

Other citizen science apps -

http://www.spatialvision.com.au/citizenscience/?gclid=EAIaIQobChMIm6jjwIbX2gIVS3ZgCh35hwnSEAAYASAAEgIKzvD_BwE

https://questagame.com/

https://www.frogid.net.au/

More activities -

https://earthobservatory.nasa.gov/Experiments/Biome/

http://www.resources.det.nsw.edu.au/Resource/Access/e3a04b04-3404-431c-b754-9889c94d788b/1

https://theconversation.com/au/topics/climate-change-27

http://gk12calbio.berkeley.edu/lessons/less_measbiodiv.html

DURING YOUR VISIT – SELF GUIDED:

In small groups, have students complete the work sheet, 'Biodiversity and the interconnectedness of Life', to learn more about how we classify and conserve our amazing biodiversity and explore ecosystems, their diversity and dynamics. This worksheet covers multiple topics and is sectioned by park locations. Teachers can adapt this worksheet to suit their specific topic focus.

Please note that we also have a Senior worksheet called 'Adaptations and Conservation'. Please request this work sheet during initial booking so you can print accordingly.

WILDLIFE DISCOVERY EXPERIENCE – LESSON – OPTIONAL

Our Education Officer will introduce your students to three various animals orders and discuss their classification and the role that each plays in an ecosystem. Animals may include python, bird **or** Echidna and lizard.

The Education Officer will also discuss local and international biodiversity conservation including economic and social issues, Currumbin Wildlife Sanctuary and other conservation programs and surveys, the impact of human activities and the evolution of ecosystems*.

Students will also be able to have a close look at these animals, while our Education Officers discuss and point out structural, physiological and behavioural adaptations that assist them with their role in the ecosystem.

Students will have time to ask questions of our Education Officers (it would be great if questions could be prepared beforehand).

***Please inform us during initial booking if you have one specific topic focus**

AFTER YOUR VISIT:

Continue collecting wildlife data in your area over a period of time -

As a class, become a team of 'citizen scientists' and collect data on the wildlife species and biodiversity in your school or local bushland reserve over a period of time. Use field guides and identification keys to identify species. Collect data on numbers and make observations about impact of human activities, if any, and impact of seasonal change, if possible. Compare your data with data collected by other citizen scientists in your area.

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https://questagame.com/

https://www.frogid.net.au/

How can we protect our amazing biodiversity?

As a class, discuss simple achievable actions that students can undertake to minimise the effect of human activities e.g. introduced species > responsible pet ownership and deforestation > planting a wildlife friendly habitat in your backyard and constructing and erecting a nest box in your backyard.

As a class, consider supporting Currumbin Wildlife Sanctuary conservation programs by fundraising to adopt an animal https://currumbinsanctuary.com.au/get-involved/adopt-an-animal or the wonderful work of the Currumbin Wildlife Hospital http://cwhf.org.au/get-involved/school-fundraising/

Other activities -

https://www.ala.org.au/classroom-exercises/exercises-years-11-and-12/

GLOSSARY

What is biodiversity? The existence of a wide range of different types of organisms in a given place at a given time. The diversity of plant and animal life in a particular habitat (or in the world as a whole); a high level of biodiversity is desirable. Pertaining to the diversity and frequency of organisms in a given area.

What is classification? The systematic grouping of living things based on characteristics, hierarchical, or phylogenetic relationships.

What is an ecosystem? An ecosystem is a community of living things and their non-living environment, and may be as large as a desert or as small as a puddle. An ecosystem must contain producers, consumers, decomposers, and dead and inorganic matter. All ecosystems require energy from an external source – this is usually the sun.

What is a food web? Food webs show the feeding relationships between organisms in an ecosystem.

What is a keystone species? A keystone species is one whose impact on its community or ecosystem is disproportionately large relative to its abundance.

What is a niche? A position or function in a habitat that provides all the requirements for life of a species.

What is biomass? The total mass of all living material in a specific area, habitat, or region.

What is symbiosis? A close, long-term association between organisms of different species.

What does abiotic mean? Nonliving, as in abiotic factor, which is a nonliving physical and chemical attribute of a system, for example light, temperature, wind patterns, rocks, soil, pH, pressure, etc. in an environment.

What does biotic mean? Pertains to a living thing (such as plant, animal, fungus, etc.) as well as its products (e.g. secretions, wastes, and remains).

What is a competitor? A symbiotic relationship between or among living things that compete for a limited resources, such as food, space, shelter, mate, ecological status, etc.

What is an adaptation? The adjustment or changes in behaviour, physiology, and structure of an organism to become more suited to an environment.

Behavioural Adaptations – Actions of an organism that enable them to survive in their environment (e.g. bears hibernate in winter to escape the cold temperatures and preserve energy).

Structural Adaptations – Physical features of an organism that enable them to survive in their environment (e.g. a penguin has blubber to protect itself from freezing temperatures).

Physiological Adaptations – Internal and/or cellular features of an organism that enable them to survive in their environment (e.g. snakes produce poisonous venom to ward o¬ff predators and to capture prey).

What is fossil record? The totality of fossilised artefacts and their placement within the earth's rock strata. It provides information about the history of life on earth, for instance what the organisms look like, where and when they live, how they evolved, etc.

What is climate change? Climate change is a change in the pattern of weather, and related changes in oceans, land surfaces and ice sheets, occurring over time scales of decades or longer.

DETAILED AUSTRALIAN CURRICULUM LINKS

Australian Curriculum links:		Elaborations:
Senior **Biological Sciences** **Science Enquiry Skills**	**Biodiversity and the interconnectedness of Life (Unit 1)**	• Conduct investigations, including using ecosystem surveying techniques, safely, competently and methodically for the collection of valid and reliable data (ACSBL003) • Select, construct and use appropriate representations, including classification keys, food webs and biomass pyramids, to communicate conceptual understanding, solve problems and make predictions(ACSBL006) • Communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports (ACSBL007)
Science as a Human Endeavour		• Science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility (ACSBL008) • The use of scientific knowledge is influenced by social, economic, cultural and ethical considerations (ACSBL011) • The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences (ACSBL012) • Scientific knowledge can enable scientists to offer valid explanations and make reliable predictions (ACSBL013) • Scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability (ACSBL014) **Technology as a tool to measure, analyse and monitor biodiversity** • Advances in remote sensing radar imagery and satellite tracking in real time have enabled scientists to measure and monitor populations and play a significant role in surveying and monitoring large or inaccessible ecosystems **International biodiversity protection** • International agreements about biodiversity protection, such as the World Heritage Convention, are based on the premise that local, regional and international biodiversity represent a global resource, vital for human survival, that should be maintained for future generations (ACSBL008) • The World Heritage Convention is designed to ensure the protection of natural and cultural heritage and encourage international cooperation in the conservation of biodiversity. Sites are selected as natural World Heritage based on a range of criteria, including, but not limited to, conservation of biodiversity

Science Understanding	**Describing Biodiversity**	(ACSBL011) • Selected sites are monitored to ensure continued integrity, protection and management, including evaluation of projected economic, social and environmental impacts on the site (ACSBL014) **Biodiversity targets** • Biodiversity includes the diversity of species and ecosystems; measures of biodiversity rely on classification and are used to make comparisons across spatial and temporal scales (ACSBL015) • Biological classification is hierarchical and based on different levels of similarity of physical features, methods of reproduction and molecular sequences (ACSBL016) • Biological classification systems reflect evolutionary relatedness between groups of organisms (ACSBL017) • Ecosystems are diverse, composed of varied habitats and can be described in terms of their component species, species interactions and the abiotic factors that make up the environment (ACSBL019) • Relationships and interactions between species in ecosystems include predation, competition, symbiosis and disease (ACSBL020) • In addition to biotic factors, abiotic factors including climate and substrate can be used to describe and classify environments (ACSBL021) **Keystone species and conservation** • Some biologists have advocated for keystone species to be special targets for conservation efforts and keystone species theory has informed many conservation strategies. However there are differing views about the effectiveness of single-species conservation (such as keystone species, flagship species or umbrella species) in maintaining complex ecosystem dynamics (ACSBL012). • The biotic components of an ecosystem transfer and transform energy originating primarily from the sun to produce biomass, and interact with abiotic components to facilitate biogeochemical cycling, including carbon and nitrogen cycling; these interactions can be represented using food webs, biomass pyramids, water and nutrient cycles (ACSBL022) • Species or populations, including those of microorganisms, fill specific ecological niches; the competitive exclusion principle postulates that no two species can occupy the same niche in the same environment for an extended period of time (ACSBL023) • Keystone species play a critical role in maintaining the structure of the community; the impact of a reduction in numbers or the disappearance of keystone species on an ecosystem is greater

	Ecosystem dynamics	than would be expected based on their relative abundance or total biomass (ACSBL024) • Ecosystems have carrying capacities that limit the number of organisms (within populations) they support, and can be impacted by changes to abiotic and biotic factors, including climatic events (ACSBL025) • Ecological succession involves changes in the populations of species present in a habitat; these changes impact the abiotic and biotic interactions in the community, which in turn influence further changes in the species present and their population size (ACSBL026) • Ecosystems can change dramatically over time; the fossil record and sedimentary rock characteristics provide evidence of past ecosystems and changes in biotic and abiotic components (ACSBL027) • Human activities (for example, over-exploitation, habitat destruction, monocultures, pollution) can reduce biodiversity and can impact on the magnitude, duration and speed of ecosystem change (ACSBL028) • Models of ecosystem interactions (for example, food webs, successional models) can be used to predict the impact of change and are based on interpretation of and extrapolation from sample data (for example, data derived from ecosystem surveying techniques); the reliability of the model is determined by the representativeness of the sampling (ACSBL029)
NSW Syllabus links:	**Outcomes:**	**Content:**
Stage 6	**Module 3: Biological Diversity** • A student: • develops and evaluates questions and hypotheses for scientific investigation BIO11/12-1 • designs and evaluates investigations in order to obtain primary and secondary data and information BIO11/12-2 • communicates scientific understanding using suitable language	• **Effects of the Environment on Organisms** Students: • predict the effects of selection pressures on organisms in ecosystems, including: (ACSBL026, ACSBL090) – biotic factors – abiotic factors • investigate changes in a population of organisms due to selection pressures over time, for example: (ACSBL002, ACSBL094) – cane toads in Australia – prickly pear distribution in Australia **Population Dynamics** Students: • investigate and determine relationships between biotic and abiotic factors in an ecosystem, including: (ACSBL019) – the impact of abiotic factors (ACSBL021, ACSBL022, ACSBL025) – the impact of biotic factors, including predation, competition and symbiotic relationships (ACSBL024) – the ecological niches

	and terminology for a specific audience or purpose BIO11/12-7 • describes biological diversity by explaining the relationships between a range of organisms in terms of specialisation for selected habitats and evolution of species BIO11-10 **Module 4: Ecosystem Dynamics** A student: • develops and evaluates questions and hypotheses for scientific investigation BIO11/12-1 • designs and evaluates investigations in order to obtain primary and secondary data and information BIO11/12-2 • conducts investigations to collect valid and reliable primary and secondary data and information BIO11/12-3 • selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media BIO11/12-4 • analyses and evaluates primary	occupied by species (ACSBL023) – predicting consequences for populations in ecosystems due to predation, competition, symbiosis and disease (ACSBL019, ACSBL020) – measuring populations of organisms using sampling techniques (ACSBL003, ACSBL015) • explain a recent extinction event (ACSBL024) **Past ecosystems** Students: • investigate the reasons for changes in past ecosystems, by: – interpreting a range of secondary sources to develop an understanding of the changes in biotic and abiotic factors over short and long periods of time (ACSBL025, ACSBL026) – evaluating hypotheses that account for identified trends (ACSBL001) **Future Ecosystems** Students: • investigate changes in past ecosystems that may inform our approach to the management of future ecosystems, including: – the role of human-induced selection pressures on the extinction of species (ACSBL005, ACSBL028, ACSBL095) – models that humans can use to predict future impacts on biodiversity (ACSBL029, ACSBL071) – the role of changing climate on ecosystems • investigate practices used to restore damaged ecosystems, Country or Place, for example: – mining sites – land degradation from agricultural practices

	and secondary data and information BIO11/12-5 • analyses ecosystem dynamics and the interrelationships of organisms within the ecosystem BIO11-11	