Carbon Farming

Specific learning intentions

- Become familiar with carbon farming terminology
- Understand the carbon and nitrogen cycles
- Differentiate between carbon neutral and net zero
- Identify carbon emitting, carbon storing and carbon reducing activities
- Understand Scope 1, 2 and 3 emissions
- Become familiar with the Carbon Calculator and other online data platforms
- Apply carbon farming principles within assessment tasks

Australian Curriculum Version 9 Achievement Standards

Technologies Year 9-10

By the end of Year 10 students explain how people consider factors that impact on design decisions and the technologies used to design and produce products, services and environments for sustainable living. They explain the contribution of innovation, enterprise skills and emerging technologies to global preferred futures. For the food and fibre production context, students explain the features of technologies and their appropriateness for purpose, and create designed solutions based on an analysis of needs or opportunities. Students create, adapt and refine design ideas, processes and solutions and justify their decisions against developed design criteria that include sustainability. They communicate design ideas, processes and solutions to a range of audiences, including using digital tools. Students independently and collaboratively develop and apply production and project management plans, adjusting processes when necessary. They select and use technologies skilfully and safely to produce designed solutions.

Science Year 10

By the end of Year 10 students analyse the relationship between science, technologies and engineering. They analyse the key factors that influence interactions between science and society.

Australian Curriculum Version 9 Content Descriptors

Strand: Technologies knowledge and understanding

1. analyse how people in design and technologies occupations consider ethical, security and sustainability factors to innovate and improve products, services and environments (AC9TDE10K01)
2. analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises (AC9TDE10K04)

Strand: Science as a human endeavour

3. analyse the key factors that contribute to science knowledge and practices being adopted more broadly by society (AC9S10H03)
4. investigate how advances in technologies enable advances in science, and how science has contributed to developments in technologies and engineering (AC9S10H02)

Suggested Teaching Sequence

These resources stem from a *Carbon Farming for Teachers* workshop facilitated by Landscapes SA Molly O'Dea and Elly Pratt. The recording of this workshop can be found at: Carbon Farming Teacher Workshop
All resources referred to throughout can be accessed at: https://padlet.com/suepratt/carbon-farming-for-teachers-workshop-vvgf4j2o81al5jvz

Key vocabulary

Carbon
Nitrogen
Carbon Footprint
Carbon neutral
Net zero
Emissions
Greenhouse gases
Carbon sequestration
Carbon credits
Insetting
Offsetting
Soil Organic Carbon

Carbon[1]	The chemical element of atomic number 6, a non-metal which has two main forms (diamond and graphite) and which also occurs in impure form in charcoal, soot, and coal.
Nitrogen[1]	The chemical element of atomic number 7, a colourless, odourless unreactive gas that forms about 78 per cent of the earth's atmosphere.
Carbon Footprint	The amount of GHGs emitted minus the amount of carbon stored, for example by a farm, region or country.
Carbon neutral	A state of emissions and absorption of GHGs from the atmosphere being in balance. Carbon neutrality is sometimes described only in terms of balancing carbon dioxide emissions and carbon storage.
Net zero	Taking steps to reduce GHG emissions as much as possible and to use carbon storage to balance remaining emissions, over a specified period.
Emissions	Outputs and discharges, as in the introduction of chemicals or particles into the atmosphere, usually used in relation to GHG emissions.
GHG	A gas that traps heat in the atmosphere. The main GHGs are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6).
Carbon sequestration	The process of removing carbon from the atmosphere and storing it in trees, soils, geologic formations, oceans and in engineered technologies.
Carbon credits	Tradable units generated from projects registered under a carbon scheme that sequester carbon or reduce emissions of GHGs. Australian Carbon Credit Units are units issued under the Carbon Credits (Carbon Farming Initiative) Act 2011, equal to 1 tonne of carbon dioxide equivalent emissions.
Insetting	Undertaking activities that reduce or avoid emissions, or store carbon within a value chain, which may comprise a farm and its supply chain, and counting the emissions reductions or carbon storage towards the operation's total emissions.
Offsetting	The buying and cancelling (also referred to as retiring) of ACCUs or other eligible carbon credits by an organisation to compensate for the emissions it produces.
Soil Organic Carbon	All living and dead organic material — plants, soil organisms and animal materials — in the soil in various stages of decomposition, but not the fresh, undecomposed organic material on the surface.

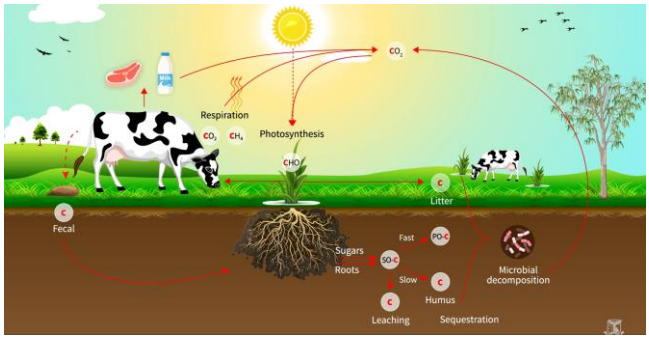
Resource:
https://www.dcceew.gov.au/climate-change/emissions-reduction/agricultural-land-sectors/carbon-farming-outreach-program/training-package/glossary
Padlet: Carbon farming glossary; Grain growers jargon buster

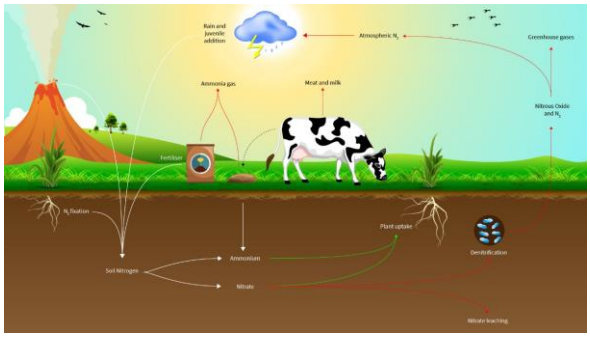
[1] Oxford Languages
All other definitions are sourced or modified from: https://www.dcceew.gov.au/climate-change/emissions-reduction/agricultural-land-sectors/carbon-farming-outreach-program/training-package/glossary

Beginners guide to carbon farming

Explore the Landscapes SA slides and provide students with time to discuss key concepts.
Padlet: Beginner's guide to carbon farming slides

Review the carbon and nitrogen cycles





Resources:
At Slide 12: Watch the C cycle video The carbon cycle
At Slide 13: watch the N cycle video The nitrogen cycle - YouTube
At Slide 22: listen to the ABC Country Hour podcast link for an interview with SA Minister for Primary Industries Claire Scriven regarding carbon emission targets and monitoring (starts at 2:30minutes).

Carbon emissions and carbon storage

In small groups, guide students to generate lists of carbon emitting, carbon storing and carbon reducing activities on farms.

Suggested responses:

Carbon emitting	Carbon storing	Carbon reducing
Feed wastage Conventional tillage Clearing native vegetation Burning off Using inorganic fertilisers Machinery operation Electricity use	Stubble retention Revegetation projects Protecting native vegetation Perennial fodder species eg saltbush	Minimum tillage & no till Feed efficiency strategies and supplements Recycling piggery & dairy effluent Controlled traffic Green urea Variable rate fert application Machinery maintenance Animal genetics - ASBVs for lower methane Renewable energy sources like solar

Carbon scenarios

Provide students with laminated images of agricultural scenarios. Use red sticky dots to identify carbon emitting aspects and green sticky dots to identify carbon sequestering aspects.

Resource:
See page 7-10 for copyright-free images.

Stop and check for understanding of key concepts with a Carbon Kahoot: Choose game mode - Kahoot!

Introduce the Carbon Calculator

Demonstrate the Primary Industries Climate Challenges Centre calculator. Discuss limitations and opportunities. Make sure you check for and download the latest version of the calculator as it is updated (and refined) regularly.
Discuss with students by showcasing relevant enterprise examples provided eg cropping, livestock and horticulture.
Allow students to explore the calculator with their own data. Useful data can be found in the 2024 Farm Gross Margin Guide | SAGIT

Resource:
Tools | Primary Industries Climate Challenges Centre
Padlet: Case studies; Excel calculators; SAGIT Farm Gross Margin guide; templates and scenarios

Introduce the LOOC-C

Demonstrate the Landscape Options and Opportunities for carbon abatement calculator and explore options for land use under the federal carbon emissions program.
Discuss with students by showcasing relevant enterprise examples provided.
Allow students to explore the calculator with their own location and data; and reflect on the options presented.

Resource:
Carbon Sequestration
Padlet: LOOC-C scenarios

Suggested assessment using carbon farming concepts:

- Within Stage Two Agricultural Production – AT3 Production Investigation: alongside production goals such as target weights or yields, set a carbon production goal using the PICCC carbon calculator
- Within experimental investigations, including Stage Two Agricultural Systems AT3 Experimental Investigation: include discussion of carbon implications of the trial within the Analysis and Conclusion
- Within a Deconstruction: include carbon implications alongside productivity and practical considerations for any topic
- Within Middle Years and SACE Science as a Human Endeavour (SHE) tasks: explore carbon farming concepts related to the topic of choice, with potential to address SHE Concepts of Influence and Application and Limitation:

Influence

- Advances in scientific understanding in one field can influence and be influenced by other areas of science, technology, engineering, and mathematics.
- The acceptance and use of scientific knowledge can be influenced by social, economic, cultural, and ethical considerations.

Application and Limitation

- Scientific knowledge, understanding, and inquiry can enable scientists to develop solutions, make discoveries, design action for sustainability, evaluate economic, social, cultural, and environmental impacts, offer valid explanations, and make reliable predictions.
- The use of scientific knowledge may have beneficial or unexpected consequences; this requires monitoring, assessment and evaluation of risk, and provides opportunities for innovation.
- Science informs public debate and is in turn influenced by public debate; at times, there may be complex, unanticipated variables or insufficient data that may limit possible conclusions.

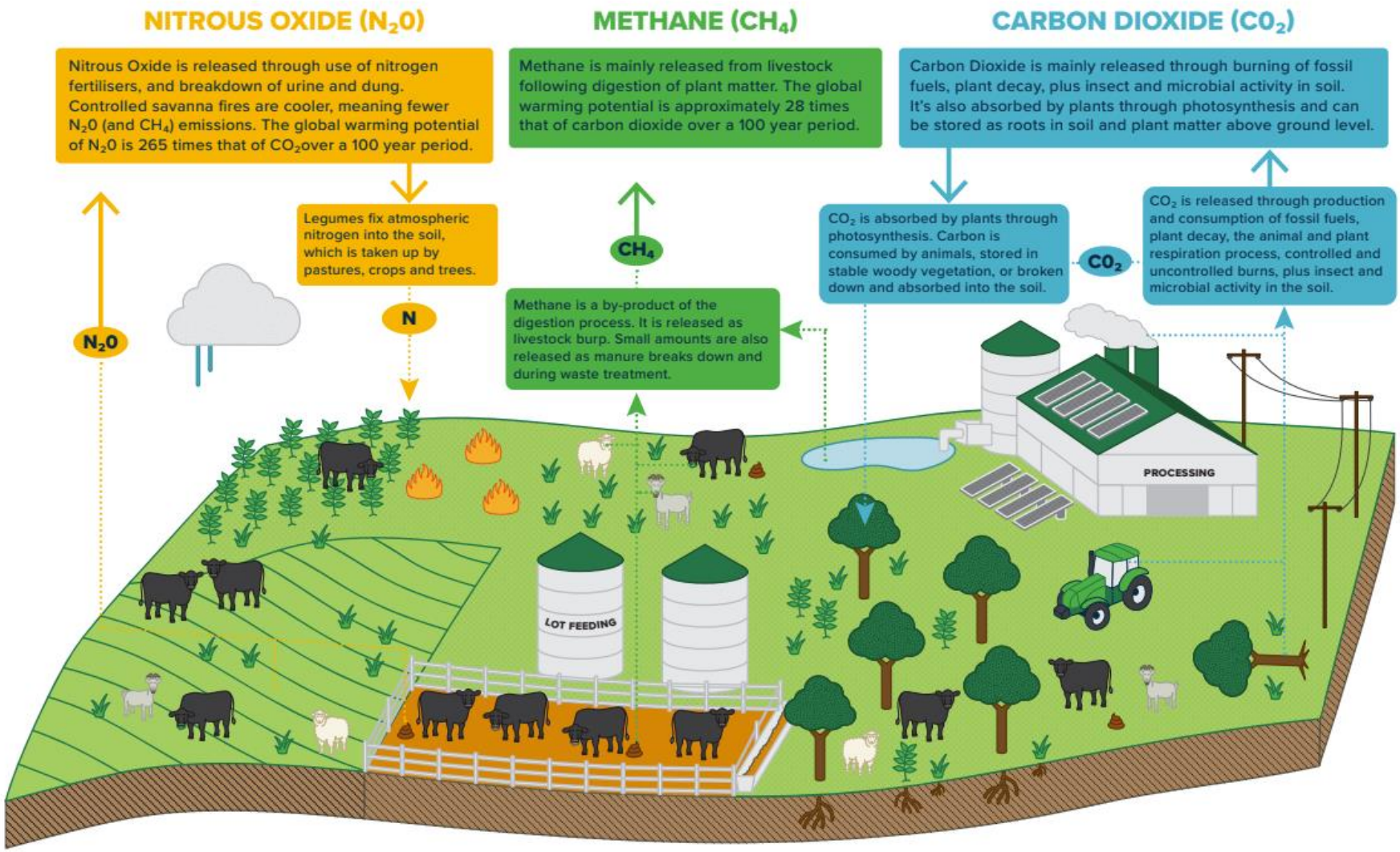
- Within Agribusiness topics:
    - ★ discuss the benefits for a primary producer in becoming a net zero business
    - ★ reflect on the financial and logistical costs for a primary producer in becoming carbon neutral
    - ★ compare the steps required to becoming carbon neutral and net zero
    - ★ discuss options for insetting and offsetting
- Within a soils task: discuss strategies to increase soil organic carbon; use the LOOC-C resource to make a recommendation for the best strategy to generate carbon credits within a particular soil type or scenario. Reflect on the pros, cons and co-benefits of each option and make a recommendation, providing justification for the selection
- Within any enterprise topic: identify aspects that contribute to carbon emissions and aspects that store carbon; make recommendations that increase the sustainability of an enterprise from a carbon perspective
- Within Technologies design tasks: identify ways the design of an environment/service/product reduces carbon footprint or maximises carbon sequestering potential
- Within school-based enterprises (such as laying hens and market gardens): explore the enterprise carbon footprint and how to achieve net zero for each enterprise; identify Scope 1, 2 and 3 emissions

With thanks: This resource was prepared using resources provided by the Northern and Yorke Landscape Board's Molly O'Dea, Sustainable Agriculture Facilitator and Elly Pratt, Climate Adaptation Facilitator.

Further resources:
All Lead Ag Teacher resources are hosted at Education Resources – AgCommunicators
Padlet: Links to resources

Videos
Carbon Farming Outreach Program (youtube.com)
Livestock emission reduction/avoidance (youtube.com)
Feed quality and livestock emissions - YouTube
Vegetation and carbon credits: Expert interview with Philip Ireland (youtube.com)

Figure 1: Greenhouse gas emissions sources and sinks in the Australian red meat and livestock industry.



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