Farming Through History

Science and sustainability.
Years 3 – 4

Primary guide stage 2

Teacher's Resource

Stage 2 – Farming through history

Australia has long relied on its cattle and sheep industry for our food supply and to benefit our economy. Our farmers have a strong tradition of using innovation to meet the challenges of farming on our vast land and variable climate. Farming livestock is a complex process, which involves science at many levels. From managing soil and ground cover and the natural environment to understanding climate and how to best develop and use agricultural areas, there are a myriad of challenges to meet.

In April 1788, there were seven cattle and 29 sheep in Australia; today there are 28 million cattle and around 75 million sheep.

In this guide, you'll read about the history of Australian farming and how cattle and sheep production has developed from the time of the early settlers to the 21st century.

You'll also learn about how the role of the farmer and farming is changing and how modern farmers are using science to deliver more sustainable farming.

The FIVE Es model

This guide employs the 'Five Es' instructional model – a constructivist or inquiry-based approach to learning, in which students build new ideas on top of the information they have acquired through previous experience. Its components are:

Engage Students are asked to make connections between past and present learning experiences and become fully engaged in the topic to be learned.

Explore Students actively explore the concept or topic being taught. It is an informal process where the students should have fun manipulating ideas or equipment and discovering things about the topic.

Explain This is a more formal phase where the theory behind the concept is taught. Terms are defined and explanations given to models and theories.

Elaborate Students develop a deeper understanding of sections of the topic.

Evaluate Teacher and students evaluate what they have learned in each section.

Meat & Livestock Australia for a sustainable future

Meat & Livestock Australia is an initiative by Australian cattle and sheep farmers, along with the broader industry, to deliver more sustainable farming by 2020. It's a commitment to take positive action, both big and small, to continually improve how farmers operate, and improve sustainability in the beef and lamb supply chain. As caretakers of the land, farmers are committed to leaving it in better shape than when they found it by improving efficiency and reducing resources used. Meat & Livestock Australia is also about sharing ideas, celebrating successes and providing a focal point for environmental, social and ethical farming action to ensure we all enjoy a sustainable food supply into the future.

Farming through history

In a little more than 200 years, Australian cattle and sheep farming has grown from just a handful of animals to 28 million cattle and around 75 million sheep.

This guide looks at cattle and sheep farming in Australia in a historical context, looking at the influence of farmers in maintaining and growing Australia's economy and as caretakers of our land. Linking strongly to the literacy and history syllabus, this guide also touches on science outcomes, looking at uses of arid landscapes (for example northern Australia) and how farming, environment and community interact differently in remote and populated parts of Australia. The content covers Science Understanding links in living things and life cycles, as well as Science as a Human Endeavour links in historical knowledge and understanding and historical skills.

How do you know if something is alive?

To decide if something is alive, see if it can do all seven of these processes (they are usually remembered as MRS GREN):

- They can Move by themselves (even plants move).
- They get energy from food via Respiration.
- They are Sensitive to changes in their environment.
- As they get older, they Grow.
- They can Reproduce more of the same living thing.
- They can Excrete the waste they produce.
- They get Nutrition from food for energy and survival.

How can living things be grouped?

To make it easier to study the millions of different living things on Earth, scientists divide them into groups according to their characteristics. Red kangaroos, for example, would be placed in the animal kingdom, as they have multiple cells and consume food for energy (plants also have multiple cells, but they get nutrients and energy through photosynthesis). They are then divided into smaller groups based on other characteristics – kangaroos are vertebrates, as they have internal backbones, and mammals, because they have hair and give birth to live babies.

What is a life cycle?

A life cycle is the different stages that a living thing goes through, from when it is born to when it is able to create new life by giving birth or, in the case of plants, producing seeds. Adult frogs, for example, lay eggs in water, which hatch into tadpoles. As they grow, the tadpoles develop legs and lungs and turn into froglets. They become adult frogs when they finish growing and lose their tails, and can lay eggs to produce more tadpoles. All living things die, so they produce offspring to continue this life cycle.

How do living things depend on each other?

Every living thing on the planet relies on other living things to survive. Plants produce oxygen for animals and rely on fungi and animals for nutrients from the soil, which they convert into energy using sunlight (photosynthesis). In addition to oxygen, humans also rely on plants, and animals as well, for food, clothing and shelter. We even rely on some bacteria to keep us healthy.

How has Australian farming changed over time?

When settlers first arrived in Australia, they adapted their animal breeds and farming methods to suit Australia's drier climate. Cattle farmers in Queensland, where a large portion of Australia's beef industry is located, crossbred European and Brahman cattle to produce new breeds such as Brafords, which could survive in the hot climate. Today, farmers and scientists work together using genetic sciences to breed cattle and sheep that are better suited to a range of Australian environments and will produce more meat.

How has Australian farming stayed the same over time?

Australia's dry climate has always been a challenge to farmers, even with the introduction of irrigation systems. Different types of farming are concentrated in the areas where they are best suited to the temperatures and annual rainfall. Cattle stations in the north of Australia cover large areas of land and stock animals that are acclimatised to the hot, humid weather – cattle also need to be able to walk large distances for food and water. Cattle farms in the south tend to be smaller because of the higher rainfall and better pastures; sheep, which are also primarily farmed in the south, are usually crossbred to ensure they cope better with their local climate. Sheep can be bred for wool or meat, and sometimes both, depending on the breed.

How can Indigenous Australian knowledge of the land help farmers?

Indigenous Australians developed an excellent knowledge of the land through their long relationship with it; knowledge that can help farmers manage their land today. They understood the seasonal changes and how these affected the environment, gathering food and moving according to these. In some areas, they also used methods that helped them manage the land, like small fires to encourage food plants or those that would attract animals.

Who has played an important role in Australian farming?

Several people played an important role in developing Australia's farming industries, like ex-convict James Ruse, who started Australia's first wheat farm at Rose Hill (now Parramatta), and Richard Bower Smith, who invented the stump jump plough. Brothers George and William Chaffey introduced their irrigation system to Mildura, Victoria, in the 1880s and 1890s to overcome the challenge of providing water to farms in Australia's dry climate. Cattle King, Sir Sidney Kidman, recognised early the potential in the flood plains of the Channel Country in Queensland and the importance of being able to rest land for it to recover.

Australian farming through history

Three months after the First Fleet arrives in Australia, the colony's livestock includes 7 cattle, 29 sheep, 74 pigs, 18 turkeys, 29 geese and 35 ducks.

1790

Governor Phillip gives ex-convict James Ruse land at Rose Hill (now Parramatta) in New South Wales. This becomes Australia's first wheat farm.

1796

John and Elizabeth Macarthur, who established Elizabeth Farm in 1793, buy their first Merino sheep. They send their first bale of wool to England in 1807.

1813

Gregory Blaxland, William Charles Wentworth and William Lawson cross the Blue Mountains to find more farming land.

1876

Richard Bowyer Smith displays his invention of the stump-jump plough, which allows farmers to use land containing tree roots and stumps. This opens up the Mallee Country in Victoria and South Australia for farming.

1878

The discovery of the Great Artesian Basin – which sits under one-fifth of the Australian continent and is believed to hold 65,000 million megalitres of water – means much of arid Australia can become productive grazing land.

1880s and 1890s

George Chaffey and his brother William introduce his irrigation system, which he first developed in California, to Mildura in Victoria.

1930

CSIR scientists, led by Arthur Turner, develop a vaccine for black disease, which is considered to be the most serious infectious disease in sheep in Australia at this time.

1930s

Arthur Turner and his team develop a vaccine for contagious bovine pleuropneumonia, making it the first cattle disease in Australia that has been eradicated.

1950

The myxoma virus is released to control rabbits, which compete with livestock for food.

1972

The first Belmont Red cattle are released to a cattleman near Rockhampton as part of a program to develop cattle breeds for Australia's tropical regions. Other breeds have been developed in Australia such as the Braford, which is a cross between Brahmans and Herefords. Brafords are resistant to ticks and can cope well with drought.

2009

All living creatures have a 'map' of chemicals in the body that determine what their children will look like. In 2009, scientists discovered the full 'map', called a 'genome', for cattle. This led to important discoveries for cattle breeders, such as which animals will have the best chance of having healthy calves.

SIR SIDNEY KIDMAN was born in South Australia in 1857. He is now known as Australia's 'Cattle King' because he founded his own company, S. KIDMAN & CO Ltd, in 1899 and helped pioneer the first Australian frozen beef and mutton exports.

After leaving his home in Norwood at age 13, he went to the Barrier Ranges to work with a landless bushman named George Raines, who roamed around the land with his stock in search of good food. While working for Raines, Sidney shared a dugout with an Aboriginal man known as Billy, who taught him tracking and other bushcraft skills.

Over the years Sidney had many jobs, working as a station hand, drover, stockman, bullock team owner and butcher, before going into partnership with his brother Sackville in 1884.

He married Isabel Wright in 1885 and bought his first station in 1886. His plan was to buy a 'chain' of stations that would stretch from the Gulf of Carpentaria down to South Australia and move cattle that had been bred in the north of Australia down to his southern properties. Once the cattle were in the south, they could eat the more nutritious feed in abundance in this region before they were sold at market.

Sidney bought a second chain of stations in the 1890s, this time from the Fitzroy River and Victoria River Downs in the north down to Wilpena station near Adelaide.

His two property chains, knowledge of the land and good practice of never having too many animals on his properties helped him cope well with unpredictable rainfall and periodic droughts in central Australia.

During drought periods, he was able to move his cattle to other stations where there was still feed for them. And if there wasn't enough feed, he was able to sell the cattle at whichever market area had the highest prices.

Sackville died in 1899, but Sidney continued with

> **"Eventually all of his properties covered an area nearly as large as Victoria."**

Sir Sidney Kidman

his plans and eventually all of his properties covered an area nearly as large as Victoria. He retired in 1927 and died in 1935.

S. KIDMAN & CO Ltd is still run by his family and is one of Australia's largest beef producing companies.

JANE AND HAYDN SALE MOVED to the remote Yougawalla Station in Western Australia to farm cattle to supply beef to the growing Asian market. This meant taking on the challenge of keeping livestock healthy and productive in a hot, harsh environment.

It's a challenge for their family too – they live a long way from a supermarket, they have to muster cattle using helicopters, and their two children go to primary school over the internet.

Jane and Haydn have to plan ahead because severe heat affects the condition of their cattle. They have to make sure the cattle breed at certain times so that when calves are born their mothers are strong enough to feed them.

Looking after the cattle also means looking after the environment. The farmers protect the native grasses their cattle eat. Ground cover, such as grasses, can prevent soil erosion, which is destructive to the environment. Portions of the land are

Jane and Haydn Sale

They live a long way from a supermarket, they have to muster cattle using helicopters, and their two children go to primary school over the internet.

given a break from cattle grazing so they can grow back.

"Every three to four years, our main paddock will be totally destocked for a wet season to allow the area to rest and grow," says Jane. "The holding paddocks (closer to the yards) are more intensely grazed during the mustering season, so these are destocked every wet season."

They've put in more water points for the cattle, which has increased the number of birds, frogs and kangaroos on their property. They use solar energy in their house and for the water pumps at the bores. This means they use far less fuel, which also saves them transporting fuel over huge distances.

Jane thinks that people who work in agriculture in Australia have been very fast to adopt new technology to run their farms and make enough money to continue running them in the future. "We do what we do because we love the lifestyle and enjoy bringing up our family in a wholesome environment," Jane says. – Laura Boness

Food brainstorm

1. Think of your favourite type of food and...

a) State why you like this food.

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b) Suggest different ways of preparing, cooking or serving this food.

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c) Identify its main ingredient.

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d) Think about the nutritional value of the main ingredient – is it good for you?

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Teacher's note

For Question 3: Clean, empty food packages or unopened tins are good to use, such as small tins of tuna, corned or roast beef, cheese, milk, breakfast cereal, rice, biscuits, and anything else easily collected. Make sure there are at least a couple of packages or containers with meat protein in order to complete Question 3.

2. Describe where the main ingredient comes from before it arrives at the shop.

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3. Your teacher will provide you with a variety of different food packages. For each one, suggest what the main ingredient is and where it came from.

_____

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4. Which foods contained protein as their main ingredient? Where do the majority of Australians get most of their meat protein? Was this always the case? For example, where did Aboriginal and Torres Straight Islanders traditionally get their protein from?

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Teacher's information

The aim of the Explore section is for the students to investigate some of the ideas around the farming of sheep and cattle, such as: how the role of the farmer and farming is changing; how living things have lifecycles; how they depend on each other; and how they might be grouped. It is intended that the students make their own discoveries as they work around the stations in the room in any order.

The equipment table below lists the equipment and preparation required for each activity station.

Station no. and activity	Materials list
1. Life cycles	Images of animals at different stages of life – provided.
2. Cattle farming equipment	Images of farming – provided.
3. Interactions of living things	'Smart farm science' poster – provided.
4. 'Fun on the farm' interactive game	Computer to access the website: **www.mla.com.au/General/Fun-on-the-farm**

Station 1

Task
Life cycles

1. Create a lifecycle flowchart for a sheep by cutting out the following images and placing them so that they make a continuous cycle on the circular flowchart provided.

Flowchart

2. Describe how you chose where to place each image. What clues did you use in the images to help you construct this lifecycle flow chart?

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3. A lifecycle flow chart does not show the lifecycle of a single organism, but of the species in general. Does the lifecycle of sheep have a beginning? If so, where could it be? If not, why might it not have a starting or finishing point?

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Station 2
Task Cattle farming equipment

1. Examine the pieces of farming equipment used in cattle farming. Write what you think the farmer uses each piece of equipment for.

a) Tractor – used for: _____
_____

b) Pitchfork – used for: _____
_____

c) Tags – used for:_____
_____

d) Motorbikes – used for:_____
_____

e) Helicopters – used for:_____
_____

f) Water pumps – used for: _____
_____

g) GPS – used for:_____
_____

h) Lasso rope – used for:_____
_____

2. If you were a sheep and cattle farmer, which piece of equipment do you think you would find the most useful on your farm and why?

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3. Decide which pieces of equipment are really useful on 21st century cattle farms, and which were used more in the past (i.e. less useful on a modern 21st century cattle farm).

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REFRACTION

4. Write the letters next to each piece of farming equipment in the appropriate section of the table below.

Used on 21st century cattle farms	Used in the past

5. Which piece of equipment do you think is the most useful and has the greatest impact on a modern cattle farm? Why do you think this?

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6. Which piece of equipment do you think is the least useful for modern cattle farmers? Why?

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Station 3

Task

Interactions of living things

Examine the 'Smart farm science' poster, free to download from: *goodmeat.com.au/education*

1. List all the different living things you can see on the poster. You can include 'plants' as one thing if you don't know their individual names, but try to name all the different kinds of animals. Have a good look – there are quite a few!

Smart farm science

Australian cattle and sheep farmers care for almost half of our continent, working with scientists to save water and energy, look after the environment and keep their animals happy and healthy.

Backyard biodiversity

A great farm has a balance of healthy livestock, pasture, trees, plants and wildlife. This balance is called biodiversity. Biodiversity means a place has lots of different forms of life. It covers everything from plants to animals, fungi (like mushrooms) and microorganisms (life forms that are too small to see), as well as the environments they live in.

High biodiversity means an area has many different types (species) of life. The air we breathe, the food we eat and the water we drink all rely on a high biodiversity.

Farmers try to create greater biodiversity on their farms. Planting new trees helps native shrubs and bushes to grow. Tree roots hold soil in place, which stops the soil's food (nutrients) from washing away in the rain. Plus, trees keep animals cool in hot weather by giving them shade, and in winter they protect animals from wind and rain.

Farmers fence around native Australian trees (remnant vegetation) to give native animals a sheltered place to feed and breed. Fences also keep out feral pests like foxes, which prey on native animals.

Weeds are bad for biodiversity — they invade crops, damage soil and can harm cattle and sheep. Weeds cost Australian farmers $4 billion a year — that's a lot of money! But scientists have come up with some pretty cool weed solutions — for example, when a tree gets

Watch farmers Pip and Selwyn Job from Cumnock, NSW, talk about the importance of biodiversity on their farm: **bit.ly/1g1Xeo6**
Find out more: **www.target100.com.au/The-Issues/Biodiversity**

Wise up on water!

Australia is a dry country with weather that's hard to predict. It's tough to keep a farm running if you don't know when it's going to rain. So farmers are careful to save water, making every drop count towards watering their animals and keeping pastures growing.

Providing water for the animals is the biggest use of water on the farm. Every day, an adult cow drinks about 45 litres of water and an adult sheep drinks up to 7 litres of water!

Farmers are also becoming water smart in many other ways. Dams collect and store rainwater, supplying water to the farm for animals to drink and to water the pastures where they graze. Heat from the Sun can dry up a dam, just like it dries up puddles after the rain. Farmers can beat the heat by covering up their dams, so even when the weather is dry, or there's no rain, they'll still have a good water supply. They can also pipe water to where it's needed on the farm, and can use satellite images and weather websites to keep track of the driest areas of their property.

Farmers also plant perennial shrubs and bushes for their animals to eat. Perennials are plants that live for more than two years and can live on very little water, so they often survive a drought.

See how cattle farmer Peter Camp, from Kalyeeda Station, WA, keeps his waterways healthy: **bit.ly/OuMfaM**
Find out more: **www.target100.com.au/The-Issues/Water**

Fart smarts

We all do it! Farting and burping, or flatulence and belching, is a natural result of eating. It's caused by bacteria in our stomachs digesting our food and creating waste gases like methane. Cattle and sheep belch more than humans because of their unique digestion system that allows them to digest grasses that other animals couldn't eat.

Methane is a greenhouse gas. Large amounts of greenhouse gases can trap heat in our atmosphere in a way that scientists think could change our climate forever.

Methane from sheep and cattle creates up to 10% of Australia's greenhouse gases. To reduce this, scientists have found foods that make animals less gassy. For example, adding fat and oil to the diet of cattle can change their digestive process, producing less methane.

Some sheep and cattle naturally make less methane than others. Understanding why could help farmers and scientists work out how to breed other animals that do, too.

There are lots of other ways farmers can reduce greenhouse gases. Making electricity is a major cause of greenhouse gas emissions. So, instead, some farmers are collecting cleaner energy from the Sun by using solar panels.

Read about Danille Fox's story and how they save emissions on their farm Bona Vista, Qld: **bit.ly/OmP8wJ**
Find out more: **www.target100.com.au/The-Issues/Emissions**

Healthy herds

Caring for sheep and cattle is a big job. When your grandparents were young, the average Australian farmer produced enough food each year to feed 20 people. Today, each Australian farmer produces enough food to feed 600 people — 150 in Australia and 450 overseas.

We need to make sure that animals are protected from disease. Cattle and sheep can get sick from germs and parasites (creatures that live on or in another animal). Parasites, like ticks, can make cattle and sheep very sick and affect their ability to grow and reproduce. In one Target 100 project, scientists are working together to find a vaccine against tick fever.

It's not just science and medicine that can help to keep animals healthy. When animals are handled well as they are moved around, fed and housed, they are happier and healthier. Poor handling can make an animal feel stressed and afraid of people. Other Target 100 projects are looking at the best ways to handle animals.

Watch farmer Jane Sale describe how cattle are mustered on Yougawalla Station, WA: **bit.ly/1dd8pV7**
Find out more: **www.target100.com.au/The-Issues/Animal-welfare**

Meet some Young Farming Champions!

Joshua Gilbert
Joshua lives on a farm in Nabiac, on the Wallamba River near Forster, New South Wales. In the daytime he works in finance, but Josh loves agriculture and beef cattle farming.

Josh's family breeds strong, healthy Braford cattle and then sells them to other beef cattle farmers to produce offspring for their herds. The Braford is a cross between the Brahman and Hereford cattle breeds, which can cope with extreme heat and drought, as well as some parasites, like buffalo flies and ticks.

The Gilberts breed Braford selectively so their cattle are born without horns. Other breeders are willing to pay more for these cattle (called polled cattle), since they are safer for stock handlers and other animals.

The Gilberts take great care in low-stress stock handling. They know that if their cattle are strong and healthy, their calves probably will be too. Looking after animals as individuals rather than a group is also important in low-stress stock handling.

"Beef cattle are particularly vibrant as all of the cows have their own personalities," says Josh. "Being able to work hard and breed what you're after is very rewarding."

Hannah Barber
Hannah grew up north of Parkes in New South Wales, about 350 km west of Sydney. Parkes has been hit by drought in the past, but the Barbers have kept their farm in top condition by using sustainable farming practices.

For Hannah, farming is in her heart and in her blood: her family has owned and cared for the same farm for four generations! Hannah believes sustainable farming is an important social and historical duty that we all share.

"We are responsible for continuing the practices that have kept our land so strong and productive for the last 100 years," says Hannah.

Each generation in Hannah's family has taught the next how to care for their animals. For example, when moving livestock in large groups they use horses, bikes and utes and watch the animals closely for signs of stress. Hannah says that understanding their animals has now become second nature.

"It's important to work with other farmers and professionals to stay up-to-date with new ways of doing things," she adds. "Farming is a huge team effort."

To find out more about Young Farming Champions visit: **www.art4agriculture.com.au/yfc**

About Target 100

Target 100 is made up of 100 science projects focusing on environmental sustainability and animal welfare. The projects include: water, energy, climate variability, waste, pest and weeds, economics, animal welfare, soil and groundcover, biodiversity and reducing emissions.
www.target100.com.au

TARGET 100

2. Now put the animals you listed into different groups. Complete the table to show which animals are farm animals or livestock (the animals being farmed), wildlife, pests and animals that help farmers do their work.

Farm animals	Wildlife	Pests	Animals that help farmers

3. In what ways are people helping animals on the farm?

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4. In what ways are animals helping people on the farm?

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5. What are the farm animals eating and drinking? Where does this food and drink come from?

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6. In what ways are the farmers using the natural environment to promote sustainable farming? Identify some examples from the poster.

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Station 4

Task

'Fun on the farm' interactive game

1. Go to the website *mla.com.au/General/Fun-on-the-farm*

2. For each of the four games, note down:

   a) the aim of the task

   b) the equipment you used to complete the game

   c) the skills you used

Game name	Aim of the game	Equipment needed	Skills used
Thirsty cows			
Weigh station			
Mustering the cows			
Fence fixer			

3. What did you learn about sheep and cattle farming from these games?

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4. Suggest another game that could be designed and added here to help teach students about the jobs farmers have on sheep and cattle farms.

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Future farm resources

Student literacy activities

In this section, we explain the science of farming cattle and sheep by inviting students to read articles and watch videos about relevant issues and applications. This section suggests discussion topics and activities linked to those articles.

Each article/video will have its own literacy and/or numeracy activities, which include:

- Brainstorming.
- Glossary.
- Comprehension and summary.
- Question builder.

Stimulus One – A farmer's story

This short video provides a good insight into the life of a modern-day farmer.

From City Life to Cattle Farming: Farmer Stories: **youtube.com/watch?v=v_Rleq5koaw**

Stimulus Two – Sheep and cattle in Australia

This article examines how sheep and cattle breeding has changed in Australia since settlement, and looks at the different breeds that are farmed in Australia and where they came from.

Stimulus Three – The role of the Bureau of Statistics

Students examine a graph from the Bureau of Statistics to analyse the growth in population of cattle in Australia from 1900 to 2004.

S14.1 BEEF CATTLE, Distribution - 30 June 2001

Beef cattle per sq km

- 30 or more
- 10 to 30
- 2 to 10
- Less than 2
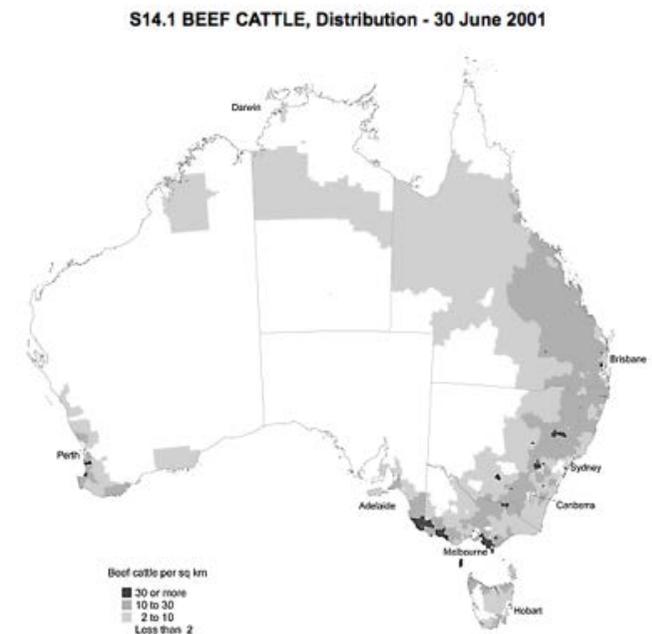
Source: 2000-01 Agricultural Census data.

Meat & Livestock Australia: A farmer's story

Task

Go to **youtube.com/watch?v=v_Rleq5koaw** and watch the video titled 'From City Life to Cattle Farming: Farmer Stories' (3:18 min).

Activity 1 – Brainstorming

Task

Imagine you are a cattle or sheep farmer. Letting your imagination guide you, write either:

a) A one-page entry in your personal diary, outlining one day of your life (what you did, what happened, and how you felt about it).

OR

b) A one-page short story, telling the reader about your life as a farmer (what your work involves, what you enjoy about it, and what you find hard about it).

Activity 2 – Glossary

Create a glossary. Use the table to define some of the science words and terms in the video.

Word/Term	Definition
Poddy herd	
Head of cattle	
Low stress stock handling	
The waters	
Desert grassland	
Erosion control	
Minimal impact	
Sustain	

Activity 3 – Summarising

1. Has Jane always been a farmer? Where did she used to live?

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2. Does Jane like being a farmer? What does she like the most?

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3. How big is the farm (in acres) and how many cattle live on it?

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4. What does Jane say about wildlife on the farm? Is there more or less of it than when she moved there? Why?

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5. How would you describe how Jane feels about looking after the land?

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6. How is Jane's life similar or different to the brainstorm you carried out about farming at the beginning of this activity?

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Activity 4 – Question builder

* Adapted from: Langrehr, John (2002). 'Question Time for the Gifted.' Gifted. July, 124, 12–14.

Use the Question Builder below to help create two of your own questions related to the video, or to sheep and cattle farming in general. Each question should start with a word from Step 1 and a second word from Step 2.

The four-step question builder	
Step 1 **First word** (choose one for each question)	**Step 2** **Second word** (choose one to add to your first word)
What… When… Which… Who… Why… How…	…is/are/do (for a question in the **present**) …did/was (for a question in the **past**) …would/could/can (for a question about **possibility**) …might (for a question about **prediction**)
Step 3 Write your two different questions in the spaces below.	
Example question: Why do cattle farmers care about looking after the land they farm on?	
Write Question 1 here:	
Write Question 2 here:	
Step 4 Now have a go at answering your own questions, or swap with a friend and answer their questions or suggest some possible answers. You can give your answer in any form you like, e.g. as a PowerPoint presentation, a poem, a report, a letter, or a mind map.	

Activity 1 – Brainstorming

How much do you know about the history of sheep and cattle in Australia? Before you read the following article, take this quick True/False quiz to find out.

Are the following statements True (T) or False (F)?

1. _____ The First Fleet arrived in Australia in 1788.

2. _____ As well as sheep and cattle, the First Fleet brought cats to Australia.

3. _____ All of the cattle breeds in Australia originally come from Europe.

4. _____ The first sheep to come to Australia came from South Africa.

5. _____ Meat from older sheep is known as mutton.

6. _____ Cattle are only farmed for their milk.

Sheep and cattle in Australia

When the First Fleet arrived in Australia they brought with them cattle and sheep. In April 1788, there were seven cattle and 29 sheep in Australia. Today there are 28 million cattle and around 75 million sheep.

At first, the settlers imported British cattle breeds like Shorthorns and Herefords. Also, at first the settlers imported sheep called fat-tailed sheep. Fat-tailed sheep were hardy and were able to survive in Australia, but their wool was coarse and not very valuable. Soon afterwards they imported Merino sheep. Merino sheep were better suited to Australia's climate, and their wool was valuable.

Farmers were able to develop their own strains of these sheep breeds. A strain is a group of animals within a breed that share similar characteristics. For example, the Booroola and the Peppin strains within the Merino breed.

Much of Australia's sheep farming takes place in the south. The south is better suited to lamb production. In the 1790s John Macarthur bred Merinos at Elizabeth Farm in Parramatta, NSW. He wanted to produce sheep with fine wool to export to other countries. He chose to breed purebred Merinos as they produced better wool.

A number of Merino strains have since been developed in Australia. In 1861, the Peppin brothers established a sheep farm in the Riverina

Merino

in NSW. The Peppin brothers took 200 of their best ewes and crossed them with a French Merino ram called Emperor. The lambs that were born grew up to produce lots of wool. They called this new strain the Peppin Merino.

In the 1950s, Jack and Dick Seears of Booroola near Cooma, NSW, wanted to produce a strain that gave birth to lots of lambs. They chose ewes that gave birth to multiple lambs and bred them.

Shorthorn

Hereford

Fat-tailed

Black Angus

Brahman

Africander

Droughtmaster

This produced the Booroola Merino strain. Today all Booroola Merinos have multiple births.

Today, Australian farmers breed sheep more for their meat than their wool. They produce 6% of the world's lamb and mutton.

The British cattle breeds that were originally imported did well in southern Australia as they were well-suited to the climate and conditions. Farmers also developed their own cattle breeds and in 1905, in the upper Murray River Valley in NSW, a Black Aberdeen Angus bull bred with a Shorthorn cow. The grey calves that were produced were the beginning of a new breed called the Murray Grey. This is now known as crossbreeding.

In tropical North Queensland, there were problems with drought, heat and ticks, and the British cattle breeds did not do so well. Farmers

used crossbreeding to produce cattle more suitable to the climate. Crossbreeding in the north produced the Braford and the Droughtmaster. Farmers crossed the Indian Brahman cattle with the British Shorthorns and Herefords to produce the Braford. Like the Brahman, the Braford and the Droughtmaster are more resilient to drought and ticks than the British breeds.

In 1956, near Rockhampton in Queensland, the CSIRO developed the Belmont Red. The Belmont Red is one half Africander, one quarter Hereford and one quarter Shorthorn, and has characteristics from all three types of cattle. Like the Africander, it can tolerate heat and it is more resistant to ticks. It also has a calm temperament and is easy to handle like the Hereford, and it can adjust to new conditions like the Shorthorn.

Today, Australia produces 4% of the world's beef. Farmers and scientists use computer databases to help them breed better cattle and sheep. These databases record information about the cattle and sheep, and can be used to predict the likelihood of characteristics being passed on – this is called genetics. The system for cattle is called Breedplan.

Activity 2 – Glossary

Create a glossary. Use the table to define any science words that are related to this article.

Word/Term	Definition
Strain	
Characteristic	
Climate	
Crossbreed	
Multiple births	
Adaptable	

Activity 3 – Summarising

1. Imagine you're a cattle farmer in North Queensland.
Which characteristics would you look for when choosing
a cattle breed? Rank the characteristics in order of importance.
(1 = most important; 5 = least important).

Characteristic	Rank
Resistance to ticks	
Colour	
Milk production	
Grow to adult quickly	
Adaptable	

2. Compare your rankings with a partner.

a) Which characteristic did your partner choose as most important?

_____

_____

_____

_____

_____

_____

b) Why do you think they chose this characteristic? Refer to the table below to help you explain.

_____

_____

_____

_____

_____

Type of sheep	Characteristics
Booroola Merino	• ewes have multiple births • small in size • lambs develop slowly • excellent wool quality
First cross (Border Leicester ram crossed with a Merino ewe)	• ewes produce lots of milk • caring, protective mothers • large in size • lambs grow quickly • good quality wool
Border Leicester	• ewes produce good milk • excellent mothers • large in size • docile • lambs grow quickly • quality meat

3. Which breed would you choose for the following situations? Explain your choices.

a) If you wanted to farm sheep for wool.

_____

_____

_____

b) If you wanted to farm sheep for meat.

_____

_____

_____

c) If you wanted a sheep you could farm for meat and wool.

_____

_____

_____

4. In your own words, explain why farmers and scientists use crossbreeding.

_____

_____

_____

_____

_____

_____

Activity 4 – Question builder

Adapted from: Langrehr, John (2002). 'Question Time for the Gifted'. Gifted. July, 124, 12–14.

Use the Question Builder below to help create two of your own questions related to the article about the history of sheep and cattle farming in Australia. Each question should start with a word from Step 1 and a second word from Step 2.

The four-step question builder	
Step 1 **First word** (choose one for each question)	**Step 2** **Second word** (choose one to add to your first word)
What… When… Which… Who… Why… How…	…is/are/do (for a question in the **present**) …did/was (for a question in the **past**) …would/could/can (for a question about **possibility**) …might (for a question about **prediction**)

Step 3
Write your two different questions in the spaces below:

Example question: How do we know that certain foods contain protein; is there a scientific test?

Write Question 1 here:

Write Question 2 here:

Step 4
Now have a go at answering your own questions, or swap with a friend and answer their questions or suggest some possible answers. You can give your answer in any form you like, e.g. as a PowerPoint presentation, a poem, a report, a letter, or a mind map.

The cattle country

Over time, Australia's herd has grown from just a few animals to many millions.

Farmers use data from the Australian Government's Bureau of Statistics to help them on their farms.
This graph shows the number of beef cattle in Australia from 1900 to 2004.

Title: _____

Million
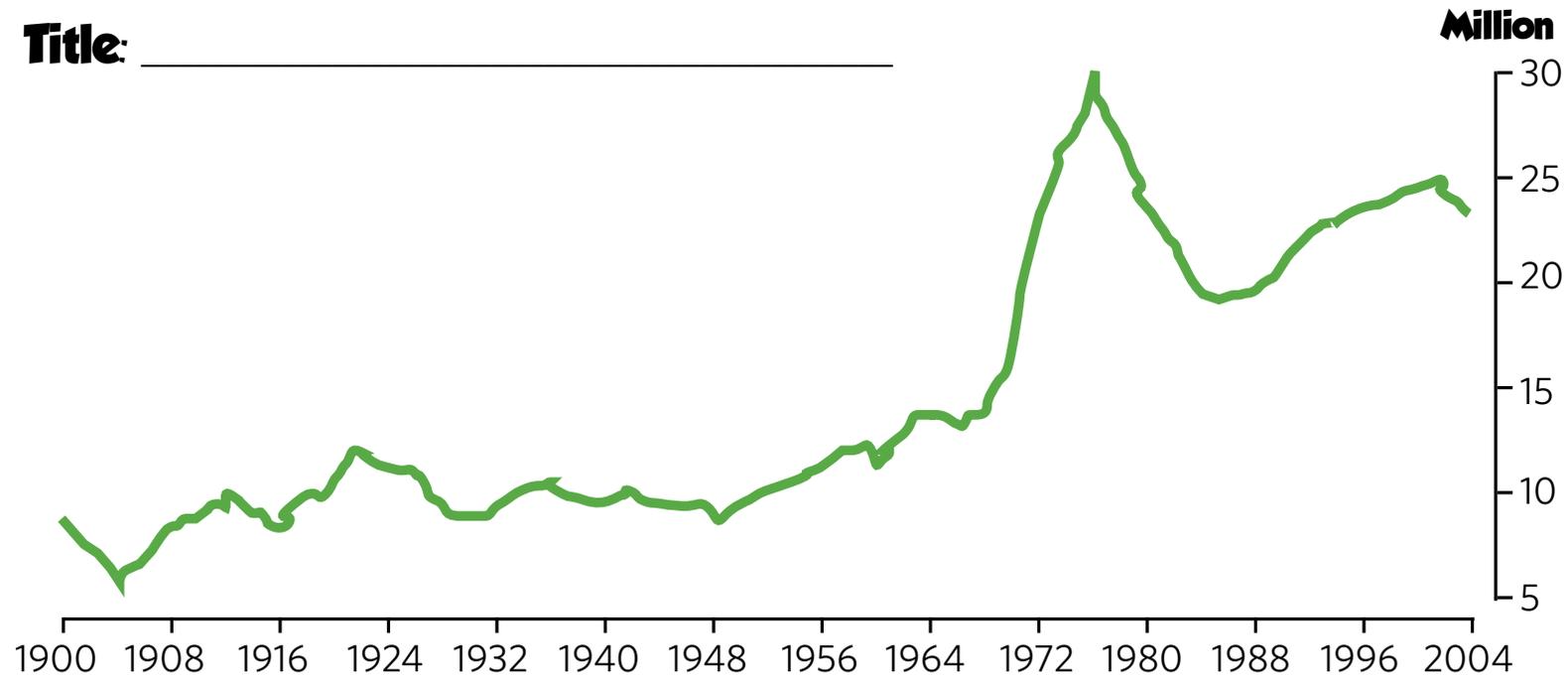
2004 level estimated by the Australian Bureau of Agricultural and Resource Economics (ABARE)

Source: ABS Agricultural Census and Surveys: ABARE

Activity 1 – Brainstorming

If you were a farmer, what kinds of facts and figures would you like to have access to?

1. Make a class list of all the data that you think would be useful to a farmer on a day-to-day basis. For example, what would you like to know about the climate, or how your stock might be valued at the market?

_____

_____

_____

_____

_____

_____

2. Once a class list has been made, write ideas about the way farmers could access and then use the different pieces of information in their jobs.

_____

_____

_____

_____

_____

_____

Activity 2 – Glossary

Creating a glossary. Use the table to define some science words/terms included in the article.

Word	Definition
Data	
Statistics	
Graph	

Activity 3 – Summarising

1. Write a title for the graph on page 32 on the line provided next to the word 'Title'. Don't forget to look at the information on the two axes to help you give the graph an appropriate title.

2. In what year did Australia produce the most beef cattle?

_____

_____

3. In what year did Australia produce the least beef cattle?

_____

_____

4. Add to the graph by drawing in the number of beef cattle for 2014 (28 million beef cattle).

5. Is there a general pattern or trend to the shape of the graph? How would you describe the shape of this graph to someone who has not seen it before?

_____

_____

_____

6. One of the reasons there was a decline in beef herd to 19.4 million in the 1980s was drought. Could drought affect the beef cattle herd size again in the future? Why/why not?

_____

_____

_____

Activity 4 – Question builder

Adapted from: Langrehr, John (2002). 'Question Time for the Gifted'. Gifted. July, 124, 12–14.

Use the Question Builder below to help create two of your own questions related to the use of data and statistics on sheep and cattle farms. Each question should start with a word from Step 1 and a second word from Step 2.

The four-step question builder	
Step 1 **First word** (choose one for each question)	**Step 2** **Second word** (choose one to add to your first word)
What... When... Which... Who... Why... How...	...is/are/do (for a question in the **present**) ...did/was (for a question in the **past**) ...would/could/can (for a question about **possibility**) ...might (for a question about **prediction**)

Step 3
Write your two different questions in the spaces below:

Example questions: **How might** cattle and sheep farmers continue to feed the same or more people if the climate changes too much? **What do** farmers do if there hasn't been a lot of rain and therefore not a lot of grass for their animals to eat?

Write Question 1 here:

Write Question 2 here:

Step 4
Now have a go at answering your own questions, or swap with a friend and answer their questions or suggest some possible answers. You can give your answer in any form you like, e.g. as a PowerPoint presentation, a poem, a report, a letter, or a mind map.

Activity 5 – Bringing it all together

1. What did you enjoy learning about the most?

_____

_____

_____

_____

_____

_____

2. List the two most interesting things about sheep and cattle farming that you have learnt about from doing these activities.

_____

_____

_____

_____

_____

_____

3. Draw a picture to summarise what you have learnt about sheep and cattle farming.

The Science Matrix

	Description	Activity Suggestions
Scientific Procedure	Hands-on activities that follow the scientific method. Includes experiments and surveys. Great for kinaesthetic and logical learners, as well as budding scientists.	**1.** A healthy farm contains a range of living things from plants to microscopic bacteria to fungi. Analyse some specimens and have a think about whether or not they are alive. See Activity 1.
Science Philosophy	Thinking about science and its role in society. Includes discussion of ethical issues, debates and hypothetical situations. An important part of science in the 21st century.	**2.** Could local farmers benefit from incorporating local indigenous knowledge into their daily routines to help manage their land? Research ways Aboriginal and Torres Straight Islander people care for the land and decide whether their knowledge should be consulted in order to improve the success of the farm. You can have a class debate to discuss the question.
Being Creative with Science	For all those imaginative students with a creative flair. Great for visual and musical learners and those who like to be innovative with the written word.	**3.** Imagine you are a TV personality interviewing one of the young farming champions. Read their profiles and/or blogs and use the information they have uploaded to create questions and then answers to those questions. Perform your interview with the young farming champion as a role play for the rest of the class.
Science Time Travel	Here we consider scientific and technological development as a linear process by looking back in time or travelling creatively into the future.	**4.** Find out about Australia's very first farmers. Choose a famous farmer (for example, James Ruse) and write a newspaper story about them, telling the reader who they were and what they did. Alternatively, you could put a scrapbook together showing the life and times of your chosen farmer.
'Me' The Scientist	Personalising the science experience in order to engage students more deeply.	**5.** Could you be a Beef Champion? To find out have a go at answering some of the questions that appeared on the Beef farming and by-products worksheet. Some of the questions you can answer from what you have remembered in this unit of work, and the rest you will have to research. See Activity 2.

Activity 1
– Teacher's notes

1. Before the activity a discussion about what is alive will be needed to prime the students and give them the tools to carry out the activity. There are plenty of useful examples of how to use MRS GREN (each letter representing one of the 7 characteristics of living things) to introduce the concept of being alive.

2. The specimens can be set up around the room for the students to examine. It is okay to place the tick on the line between alive and dead if students are unsure which category the specimen is in. The important thing is that they think about what it is to be alive rather than get the 'right' answer, as most of the specimens have been chosen due to being difficult to tell.

3. The value in the activity comes out during the class discussion once the students have finished categorising the specimens. To start the discussion, students can be invited to share the specimens they had difficulty classifying as dead or alive by explaining why they had difficulty. Here are a few notes to push the student thinking further and encourage their own questions around whether something is alive and its interactions with other living things.

Specimen	Comment for teacher
1. Piece of fruit	Some questions to consider here are: Was the fruit alive while it was on the tree? Why or why not? At what point does the fruit die? How does a fruit help a plant reproduce and create more plants?
2. Yoghurt	The best tubs of yoghurt to use here will have 'live culture' or 'contains live bacteria' written on the side as some students will pick up on this and use it in their response. This can stimulate a discussion about microorganisms that are too small to see without a microscope but still have an important role to play in day-to-day life and in particular on farms, such as helping to provide nutrients to the soils to promote rich pasture, causing disease that might affect the herds and flocks.
3. Seeds	Radish seeds are a good example to use here. The idea of dormancy can be introduced here. Questions can include: What needs to be added to the seed to be able to give it life? If the seed is not alive, is it dead? Could we test it in any way to see if it is dead?
4. Soil	This one is important for farmers. The soil must be looked after to promote good nutrient content and active microorganisms that can recycle nitrogen for plant use. Students will probably say the soil is dead, but this is a good opportunity to remind them that it contains plenty of living organisms that are necessary for healthy soil.
5. Fungus	If you cannot find some fungus growing on bark then a photo can be used. An edible mushroom is fine, but it won't be as effective to push the students to think about the role of recycling matter in an ecosystem. Students can say that the fungus is growing as it feeds off the dead log. They can then be led to think about why farmers might leave dead trees on their properties.
6. Cork	Students here can be reminded that cork comes from the bark of trees and any living matter can be recycled back into the farming ecosystem.
7. Leaves	Green and brown leaves can be used for comparison. This one can be paired with the fruit specimen. Were the leaves alive while they were on the tree? Why or why not? At what point does a leaf die? What is leaf litter? Can leaf litter provide a habitat for other living things? How can leaf litter help make the soil underneath more healthy?
8. Garlic sprouting	A clove of garlic can be suspended by a toothpick with the flat section facing down in some water. After a few days some roots will appear and then some shoots – students will probably recognise this as the plant being alive. Do shoots and roots always mean something is alive? What provides the energy and nutrients for the roots and shoots to grow?

Activity 1
– Is it alive?

Background information
Sustainable farms contain a variety of living things, but not all of them are obvious or easy to recognise. In this activity you will examine a variety of specimens and decide whether or not they are alive. Before you start you should have a clear idea of what to look for when recognising whether something is alive.

Aim: To identify signs of life in a variety of specimens.

What you need:
- magnifying glass;
- nine specimen of living and non-living organisms including a piece of fruit, yoghurt, seeds, soil, fungus, cork, garlic.

What to do:
1. Move around the room and examine the specimens labelled 1–9 with a magnifying glass.
2. Decide if each specimen is alive (a product of a living thing), dead (once living and now dead), or is non-living (has never lived).
3. Record your findings in the table below. Put a tick in the correct category for each specimen.
4. Comment on your findings. Are there any exceptions?
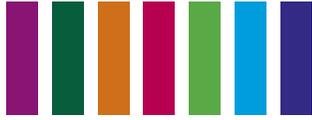
Results:

Specimen	Alive	Dead	Product of living thing	Non-living	Comment
1. Piece of fruit					
2. Yoghurt					
3. Seeds					
4. Soil					
5. Fungus					
6. Cork					
7. Leaves					
8. Garlic sprouting					
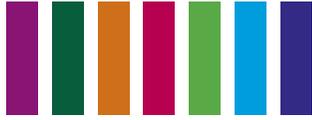
Discussion:

1. How did you decide which specimens were alive, dead or not living?

_____

_____

_____

_____

_____

_____

2. Which specimen(s) did you have trouble categorising and why?

_____

_____

_____

_____

_____

_____

3. When might recognising and understanding ALL the living things on a property help a sheep and cattle farmer run a more sustainable farm? Think of one example and write it here. Then share your idea with the rest of the class.

_____

_____

_____

_____

_____

_____

_____

Summarise your results:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Activity 2 – Beef farming and by-products worksheet

By completing these activities, students will be able to apply the knowledge they have learnt during this unit of work, as well as apply their research skills to put together responses for information not yet covered in this unit.

Question 1 – Answers

a)
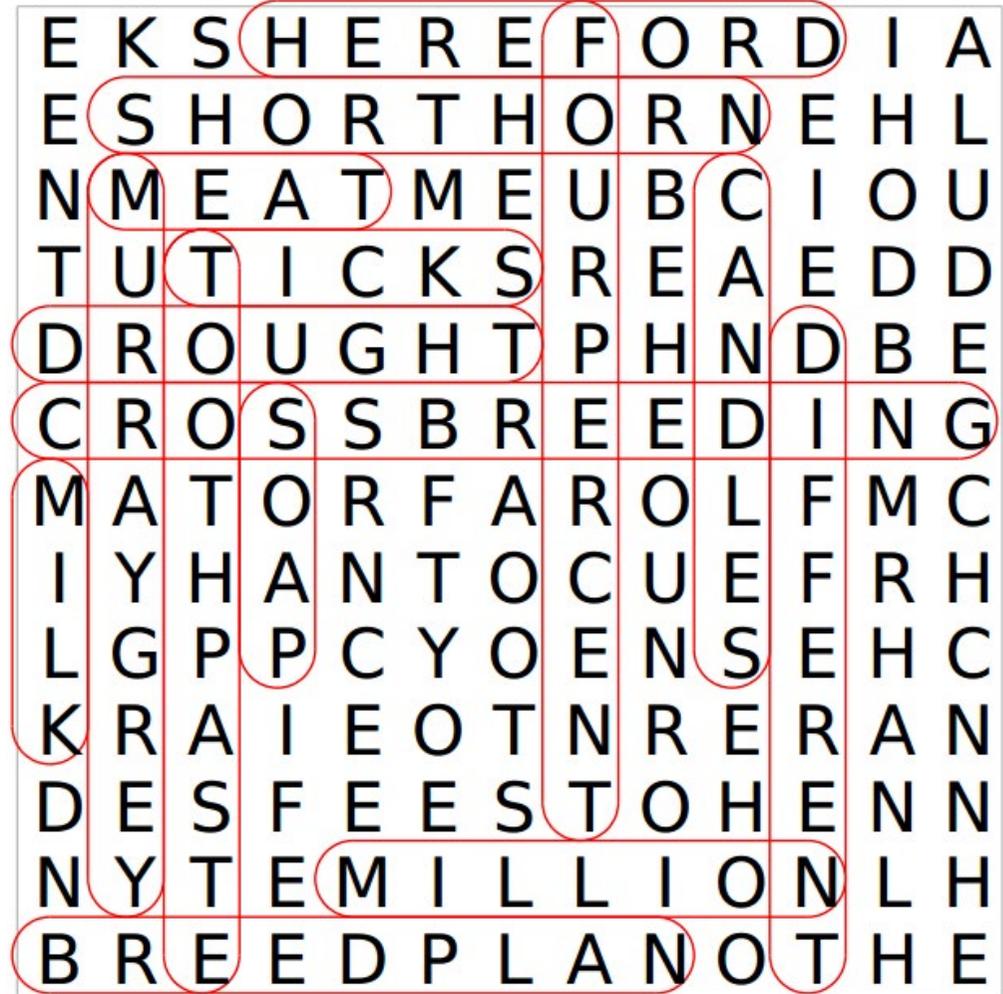
Question 2 – Answers

a) A by-product is a secondary product that is made when something else is the primary product.

b)

	Name of beef cattle by-product	Use of beef cattle by-product
1.	Example: Floor wax	To polish the floor
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Note: Students responses will vary depending on their research.

Question 3 – Answers

a) Jumbled words.

klanf	flank
hecke	cheek
kucch	chuck
uprm	rump
itrks	skirt
insh	shin
kisterb	brisket
pto ieds	top side
npiostilr	striploin
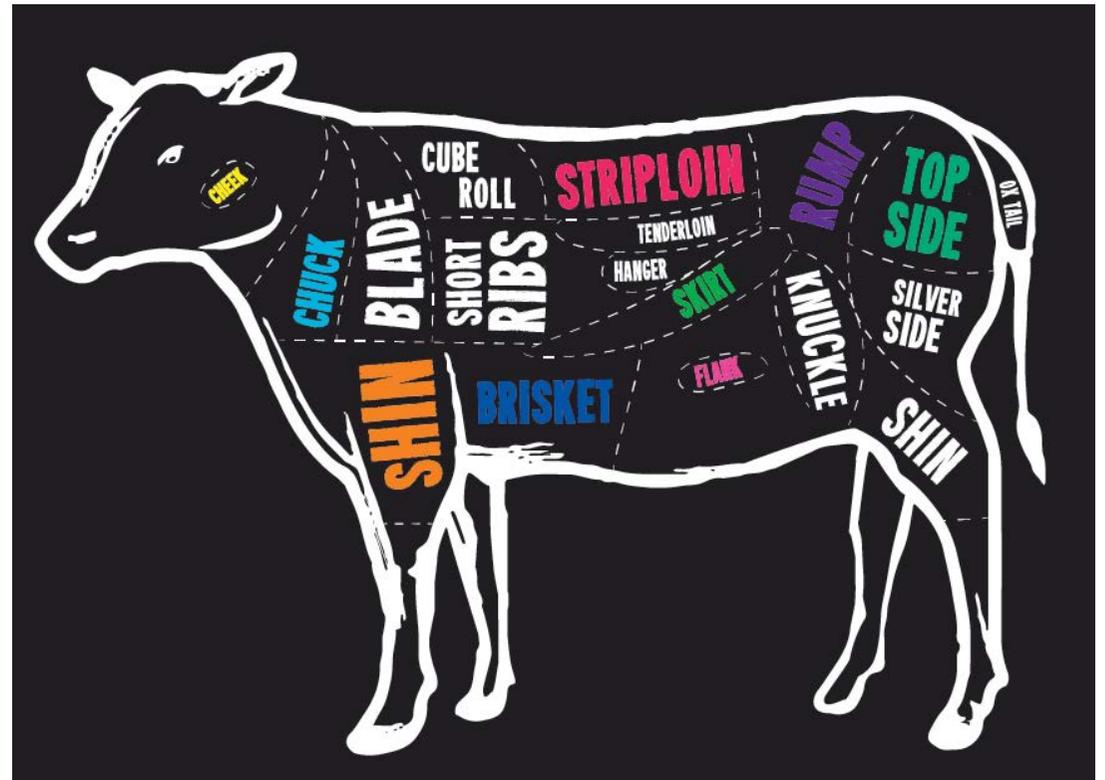
# Activity 2 – Beef farming and by-products worksheet

Question 1

Complete the word search and then use the words to complete the cloze passage on the next page.

a) Can you find all the words?

BREEDPLAN
DIFFERENT
HEREFORD
MILLION
SOAP

CANDLES
DROUGHT
MEAT
MURRAY GREY
TICKS

CROSSBREEDING
FOUR PER CENT
MILK
SHORTHORN
TOOTHPASTE

```
E K S H E R E F O R D I A
E S H O R T H O R N E H L
N M E A T M E U B C I O U
T U T I C K S R E A E D D
D R O U G H T P H N D B E
C R O S S B R E E D I N G
M A T O R F A R O L F M C
I Y H A N T O C U E F R H
L G P P C Y O E N S E H C
K R A I E O T N R E R A N
D E S F E E S T O H E N N
N Y T E M I L L I O N L H
B R E E D P L A N O T H E
```

Question 1

Fill in the gaps in the sentences with words from the word search.

1. There are many _____ types of cattle.

2. Cattle are farmed for their _____ , _____ and by products.

3. By products of cattle include _____ , _____ and _____.

4. Today Australia produces _____ of the world's beef.

5. There are 28 _____ cattle in Australia.

6. There are many different breeds of cattle, including _____ , _____ and _____.

7. Farmers can make their own cattle breeds by _____ . This is when one type of cow is bred with another. The system farmers use to do this is called _____ .

8. Some cattle are more resistant to problems than others. Some problems farmers might have with cattle are _____ and _____ .

Question 2

Beef cattle provide us with more than meat to eat. There are many different by-products of beef farming.

a) What is a 'by-product'?

_____

_____

_____

_____

_____

_____

b) Research as many different by-products we use from cattle as you can. List the by-products here and then outline their use. Can you list 10 different by-products of beef cattle?

	Name of beef cattle by-product	Use of beef cattle by-product
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

c) Check your responses with your teacher and then add up the number of correct by-products.

My total number of by-products researched:

_____

d) How well did you do? Use the table below to award yourself a ribbon!

Less than 3 by-products	Beef farming encouragement award
3 to 6 by-products	Third place Beef Farming Champion
7 to 9 by-products	Runner up Beef Farming Champion
10 or more by-products identified	Beef Farming Champion

**MEAT & LIVESTOCK AUSTRALIA**
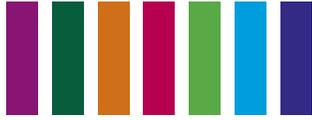
Question 3

There are many different cuts of meat that come from a single animal. Complete the word jumble of the different cuts of beef and then carry out some research to find out where they come from on the cow.

a) The following words are different cuts of meat. Use this list to help you un-jumble the words below.

brisket   cheek   chuck   flank   rump   shin   skirt   sirloin   top side

klanf	
hecke	
kucch	
uprm	
itrks	
insh	
kisterb	
pto ieds	
npiostilr	

b) Write the cuts of meat on the shapes drawn on the cow below.
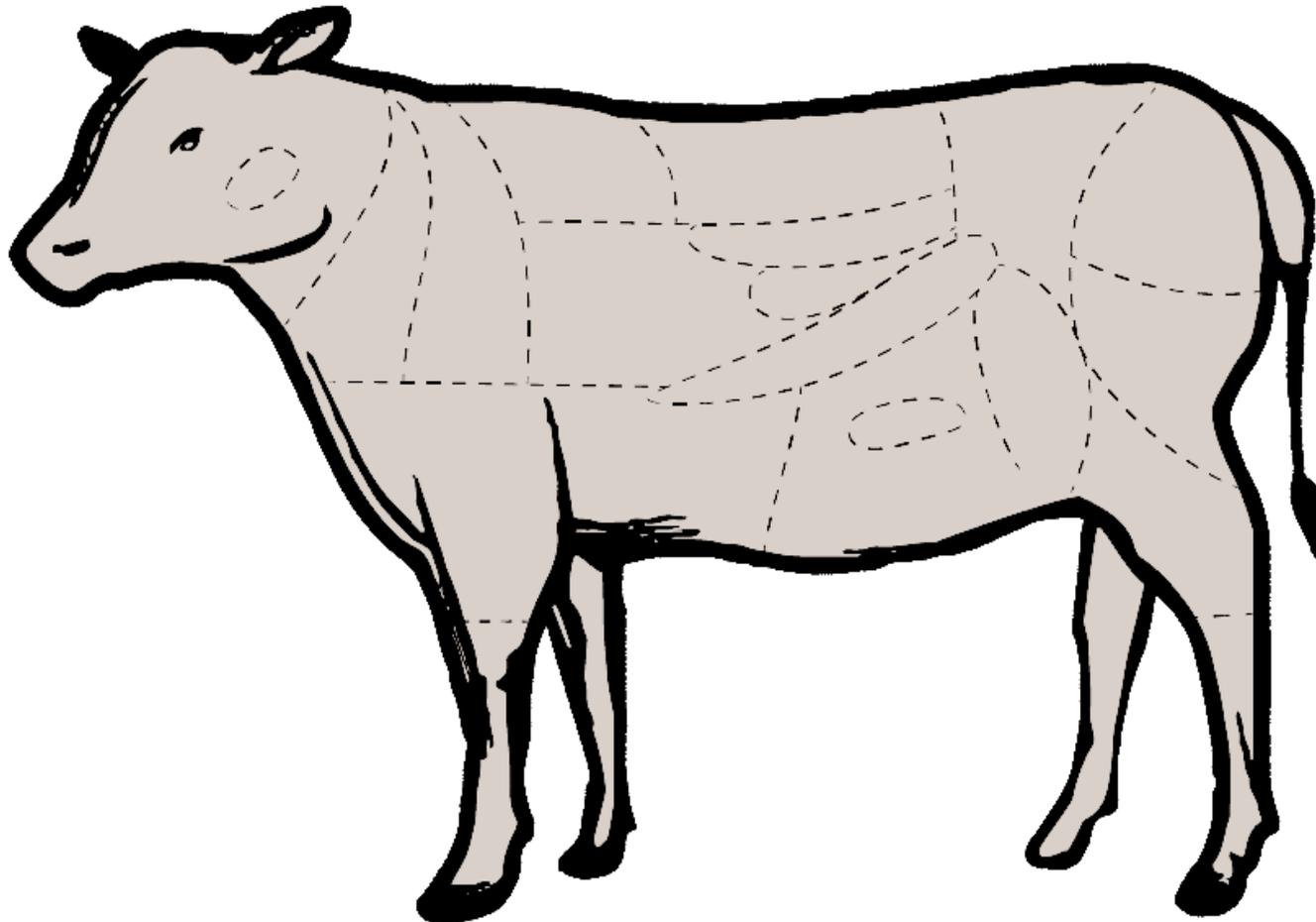
Section 1 – Draw your own poster

Draw your own poster about sheep and cattle farming to show what you have learnt during this unit of work.

Section 3 – Crossword

Across

3. Rounding up the cattle or sheep.

6. How many head of cattle does Australia produce each year?

7. Australia is one of the driest places on earth, which means it often experiences this.

8. The First Fleet brought these.

9. When soil is moved or washed away from its original site.

Down

1. Different types of sheep and cattle with different characteristics.

2. Breed of sheep well suited to the Australian climate.

4. Farmers use what from databases to help them run their farms?

6. Farmers now prefer to handle their stock with less of this.

9. A female sheep.
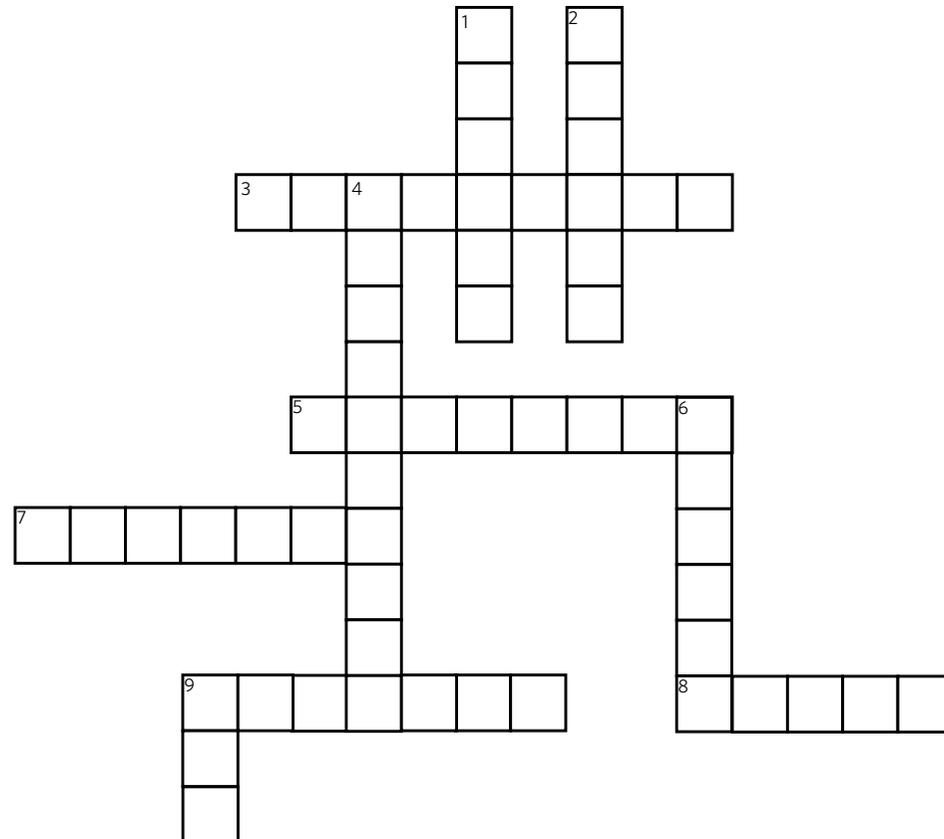
Section 4 – Individual unit review

Learning summary	Your philosophy
Write five dot points of things that you learnt about sheep and cattle farming that you didn't know before you started.	Describe your overall thoughts about cattle and sheep farming after completing this unit. Has this unit of work changed your thinking about cattle and sheep farming? Are you more interested in learning about cattle and sheep farming after studying it at school?
More questions	**What do you think?**
Write three questions that you still have about sheep and cattle farming or anything else related to this unit of study.	Which activities did you find helped you learn the easiest? Why?