Agri Leaders Wanted

EDUCATION IN AGRICULTURE

The Red Meat Industry

LIGHTENING THE LOAD

Contents

This resource has been funded by the Red Meat Profit Partnership, in conjunction with NZ Young Farmers and CORE Education.

Context

This resource supports teachers to create learning opportunities for students to explore the complementary relationship between science and technology within a farming context. It is designed for students studying within Levels 4–5 of the science curriculum and Level 4 of the technology curriculum.

The activities use the contexts of sheep and beef farming to prompt students to discover how natural phenomena are harnessed through technology to increase productivity, to solve problems, and to expand human horizons. They illustrate how scientific and technological concepts, skills, and knowledge have improved farming practices.

The context of a New Zealand sheep and/or beef farm allows students to:

- explore the application of key physics and technology concepts to a real life context
- develop critical thinking skills as they investigate how physics and technology have made farming less physically demanding and less dangerous
- learn a range of skills and concepts within the authentic context of a farm visit.

New Zealand Young Farmers field officers can help schools to arrange a farm visit. If this is not possible for the school, they can arrange for a class to email or skype a farmer to discuss aspects of the learning activities. Territory Manager's can be contacted on 0800 6993 4636 or emailed at info@youngfarmers.co.nz.

Prior knowledge and links to students' understanding

Sheep and cattle are the most widely farmed animals in New Zealand

- 44% of all farms in New Zealand are sheep and beef farms
- There are 29.5 million sheep and 3.6 million beef cattle in New Zealand.

(Farm Facts 2017)

The global market for New Zealand sheep and beef products is highly competitive and our farmers must make smart use of developments in scientific research and technological innovation to compete in the global marketplace.

New Zealand's temperate climate provides year-round growth of high quality pasture that feeds stock well. However its location in the South Pacific adds considerable costs to getting produce to international markets. We need to maintain the high quality of our products and be open to innovation to compete in the global economy. Science and technology can provide skills and processes that increase our productivity and efficiency. New Zealand primary industries have earned a well-deserved reputation for trying out new ideas and this innovation boosts the ongoing development of sheep and beef farming in this country.

The activities in this resource will support students to:

- apply Newton's Laws of Motion to a sheep or beef farming context (science)
- identify different types of forces and their effects (science)
- understand the role electricity has played as a major technological advance for sheep and beef farmers (science and technology)
- develop an understanding of different energy transformations that may be present in selected contexts (science)
- compare and contrast technological developments and understand their purposes (technology)
- identify the physical and functional attributes of technological developments (technology)
- investigate historical developments in farm-based technologies (technology)
- present their findings, based on their investigations into a sheep and/or a beef farm (science and technology)
- identify how scientific and technological concepts, skills, and knowledge can improve sheep and beef farming practices (science and technology).

Achievement objectives

Science – Nature of Science

Level 4	Understanding about science • Students will appreciate that science is a way of explaining the world and that science knowledge changes over time. Investigating in Science • Students will build on prior experiences, working together to share and examine their own and others' knowledge. Students will ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations. Communicating in science • Students will begin to use a range of scientific symbols, conventions, and vocabulary. Participating and Contributing • Students will use their growing science knowledge when considering issues of concern to them.
Level 5	Understanding about science • Students will understand that scientists' investigations are informed by current scientific theories and aim to collect evidence that will be interpreted through processes of logical argument. Investigating in Science • Students will develop and carry out more complex investigations, including using models. • Students will show an increasing awareness of the complexity of working scientifically, including recognition of multiple variables. • Students will begin to evaluate the suitability of the investigative methods chosen. Communicating in science • Students will use a wider range of science vocabulary, symbols, and conventions. • Students will apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy). Participating and contributing • Students will develop an understanding of socio-scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate.

Science – Physical World

Level 4	Physical inquiry and physics concepts • Students will explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and non-contact) on the motion of objects; identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.
Level 5	Physical inquiry and physics concepts • Students will identify and describe the patterns associated with physical phenomena found in simple everyday situations involving movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe energy changes and conservation of energy, simple electrical circuits, and the effect of contact and non-contact on the motion of objects.

Technology – Nature of Technology

Level 4	Characteristics of technology • Students will understand how technological development expands human possibilities and how technology draws on knowledge from a wide range of disciplines **Indicators** • Students can identify examples where technology has changed people's sensory perception and/ or physical abilities and discuss the potential short and long term impacts of these. • Students can identify examples of creative and critical thinking in technological practice. • Students can identify and categorise knowledge and skills from technology and other disciplines that have informed decisions in technological development and manufacture. Characteristics of technological outcomes • Students will understand that technological outcomes can be interpreted in terms of how they might be used and by whom and that each has a proper function as well as possible alternative functions. **Indicators** • Students can explain the proper function of existing technological outcomes. • Students can explain how technological outcomes have been successfully used by end-users for purposes other than what they were originally designed for. • Students can explain how technological outcomes have been unsuccessfully used by end-users for purposes other than what they were originally designed and discuss the impacts of this. • Students can explain possible physical and functional attributes for a technological outcome when provided with intended user/s, a purpose, and relevant social, cultural and environmental details to work within.

Curriculum links

Key competencies

As students work through the activities in this resource they will develop and practise the five key competencies outlined in *The New Zealand Curriculum*.

Participating and contributing: Students will contribute to class discussions by generating questions and ideas that relate physics and technology to farming contexts. They will participate in group tasks, such as those that involve research, and they will debate the effects of technological developments in farming contexts.

Thinking: Students will explore technological innovations, their implications and their effects on communities. They will consider how technology both changes and responds to society. They will gain an understanding of the specialist knowledge and skills required for technological developments.

Using language, symbols, and texts: Students will learn specialist vocabulary and scientific concepts. They will read and make sense of texts that have been written for a specific audience – producers in the sheep and beef primary industry.

Relating to others: Students will work collaboratively to develop understandings about concepts and ideas and about the relationships between physical science phenomena, technological developments, and sheep and beef farming.

Managing self: Students will show initiative, meet commitments made to their groups, and contribute to class or group research projects.

Key understandings

- New Zealand is economically dependent on its primary industries, including the sheep and beef cattle industry.
- Scientific and technological developments have contributed considerably to advances in farming, processing, transporting and distribution.
- New Zealand has a reputation for pioneering innovative scientific and technological solutions to problems. These solutions have increased productivity and contributed to the national economy.
- Scientific and technological developments draw on multiple areas of specialist knowledge and skills.

The structure of this resource

The content of this resource is structured into three stages:

1. **Before the farm experience** students learn generic baseline physical science (physics) and technological skills and knowledge that will scaffold their learning. Later they will recognise and investigate aspects of this knowledge and the skills as they can be applied to sheep or beef farming.
2. **During the farm experience** students choose from a range of different learning opportunities designed to recognise, observe, and investigate aspects of physics and technology in action on a sheep or cattle farm. Student access to devices to take photos, recordings, and video is recommended.
   When a farm visit is not possible, other options are available. Arrange for the class or for small groups to talk to or interview people working in the primary industries, such as a sheep or beef farmer, a shearer, a wool handler, or a stock agent. Students can contact these people through Skype or Google Hangouts. Some students in rural schools may have knowledge, experience, and skills in sheep or beef farming. Schools could work collaboratively online to support students to share their expertise.

These activities can also be supported by a range of video clips.

- 2017 World Sheep Shearing Championships (Invercargill)
  - International Training Day #2
  - The Devil Went Down to Mossburn
  - Prime Minister Bill English vs Sir David Fagan
  - World Machine Shearing Final
  - Sheep Dogs
- Shearing Technique 1958
- Hannah Wallace - Ahuwhenua Young Māori Sheep and Beef Farmer of the Year 2015
- Whenuanui Farm

Useful, free online tools with videos:

- Clipping videos, adding in questions and voice comments with EdPuzzle.
- Making notes while watching with VideoNot.es.

3. **After the farm experience** students can create a presentation or exhibition about their observations, investigations, and thinking to demonstrate their ability to relate their learning in science and technology to a real life context. They can share their presentations with a range of audiences, including their classmates, their families and whānau, a class or a group or the farmer they have been to visit. Their presentations could be used to assess the skills and knowledge acquired during their investigations against the outlined science and technology achievement objectives and indicators.

Teachers can choose to use or adapt some or all the content in this resource to meet the needs of their students. Students can demonstrate their learning from one or both curriculum areas through assessment tasks that integrate these subject areas.

Before the visit

Sheep and beef cattle farms provide a range of opportunities for students to explore the physical sciences and technology in action. This part of the resource ensures that students have the baseline skills and knowledge to later recognise and explore aspects of the physical sciences and to gain a better understanding of how technological developments have allowed farming to become less labour intensive, safer, and more efficient.

Activity 1: Setting the scene

Science explains the natural world. Physics explains physical phenomena involving forces, movement, types of energy, work, and machines.

Technology investigates the cultural artefacts that humans have created and explores the development of these to meet our needs and to solve our problems.

When viewing the context of a sheep or beef farm through a technological lens, students focus on understanding how and why products and systems were developed. Students develop skills to be able to critically evaluate these developments and look at developing their own solutions in response to needs and opportunities.

Have the students view these two videos.

- Introduction to Physics - physics in everyday life
- Introduction to Physics

Using the information from the videos and their prior knowledge, the students can then discuss what they think are some aspects of physics and technology that they might see on the farm they will be visiting.

Have them make a list of their ideas to refer to after their farm visit. They can add to this list at any time throughout the activities.

The students as a group can then generate questions they could ask a farmer about aspects of physics and technology on the farm – the effects, advantages and disadvantages, and possible future scientific and technological advances. Students should discuss all the questions generated before refining a final set of questions. These final questions can then be allocated to individual students who are charged with finding answers to them during their farm visit. Questions and answers could be recorded digitally or in hard copy.

Activity 2: The Laws of Motion

The understandings that explain how things move were first formulated over 300 years ago by Sir Isaac Newton in his Laws of Motion.

View these videos that explain Newton's Three Laws of Motion.

- Professor Mac Explains Newton's First Law of Motion
- Professor Mac Explains Newton's Second Law of Motion
- Newton's Third Law of Motion by Professor Mac

1. Forces at work

We cannot see or touch forces and only know they are there by the effect they have on objects. A force is a push, pull, or twist acting on an object. It is measured in units named after Sir Isaac Newton – the Newton (N).

Students need to practise recognising and identifying forces in action before their visit to a sheep or beef farm so that they can collect evidence of forces in that context.

Present them with a series of examples so that they can name the type of force (push, pull, or twist) or the combinations of forces that result in something happening. Examples of forces include:

- turning on a tap
- writing notes using a pen on paper or a keyboard on a digital device
- hammering a nail into a wall
- opening a bottle
- standing still on the ground
- using a drench gun to drench cattle
- opening a paddock gate
- riding a skateboard
- batting a ball
- sitting on a chair
- wringing out a wet cloth
- playing with two magnets
- jumping out of a plane
- zipping up a hoodie
- lifting hay bales.

Students could use their prior knowledge of farming to add some examples. These could be used to create a bingo style game, or a digital quiz using Quizlet, Google Forms or Kahoots.

2. Moving about

Unbalanced forces result in objects moving. Forces have size (magnitude) measured in Newtons (N), and direction. Most forces act in pairs, opposite to each other

If the forces are balanced, then nothing will happen. The object stays doing whatever it was doing – moving at a steady speed or remaining stationary.

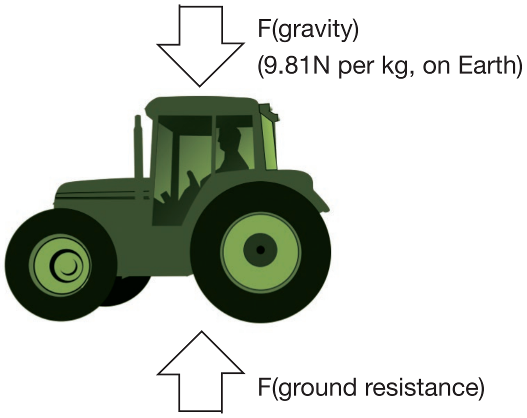
If the forces are unbalanced, the object could either slow down, speed up, or change direction, depending on the direction and magnitude of the two forces involved.

A moving tractor will speed up.
A motionless tractor will start to move forward.

The force of gravity on Earth is 9.81 N for every kilogram of the object's mass. The force of gravity on other planets varies according to the size of the planet, which determines its gravitational force.

The tractor stays doing what it was doing - ie motionless or at a steady speed.

In all cases the force of gravity acts to pull the object downwards, and the force of resistance of the ground is pushing upwards. As the car in these diagrams is not falling downwards, these opposing forces are balanced. On Earth, all objects always have these four sets of forces acting on them.



List a range of situations where objects have forces acting on them. You could provide images of moving objects or have the students capture images in photographs or video as examples. Have the students draw diagrams that explain the actions of the forces in each situation. Have them check that their explanations meet the Laws of Motion.

Tractor images retrieved from pixabay.com

Investigation – how fast can you go?

Have the students work in groups of 4. One person acts as the director of action, one as the recorder of data, one times the action (in seconds), and one is the "action hero". Use either a field or hard surface courts.

Measure out a set distance, such as 10 or 20 metres. The group decides on 5 different ways that the action hero can travel from the beginning to the end of the pre-measured distance. The action hero is timed in seconds.

In order for this investigation to be a fair test (discuss the meaning of fair testing in advance of the activity), the action hero must repeat each method of travelling at least 5 times. The group then calculates the action hero's speed for each repeat and the average speed for each type of action.

The group then present their results in graphical form.

In developing their conclusions students could be given sentences starters such as:

- In our group the fastest method of travel was …
- The average speed was … metres per second.
- In our group the slowest method of travel was …
- The average speed was … metres per second.
- In our whole class the fastest person was …
- They travelled by …
- Their average speed was … metres per second.
- In our whole class the slowest person was …
- They travelled by …
- Their average speed was … metres per second.
- We could improve our investigation by …
- Different ways of moving around a farm are …
- Technological devices that have been developed to make it easier to move around a farm include …

3. Power to the people

The generation and distribution of electricity is one of the most significant technological achievements of the last century. Electricity is an essential part of our lives and the efficient running of a farm. In New Zealand electricity is generated by:

- the movement of magnets around a wire coil, using the flow of water (hydroelectric power stations)
- steam, created by heating water with coal or natural gas (thermal power stations) or geothermal activity
- wind energy
- solar energy.

Students can investigate where their electricity comes from and how it is generated. They can locate the main sources of electricity generation in their area. They can also research the main sources of electricity for the farm they plan to visit and whether the farm relies on renewable or non-renewable sources of energy.

They can use Google maps to locate and map these sources.

Useful resources

- Electricity sector in New Zealand; Energy in New Zealand
- Electricity generation; Energy in New Zealand 2016
- Energy Use: 2016
- How is electricity made?
- How is electricity made?
- Energy 101: Electricity Generation
- Electricity – Bill Nye the Science Guy

4. Detecting energy

Energy, like forces, cannot be seen. We know it is there because we see its effects – what it can do. Energy is needed to make things work.

All energy can be traced to the Sun. It comes in many different forms:

Active Energies – used immediately	• Potential Energies – stored to use later
• Electrical • Heat (Thermal) • Kinetic (Mechanical) • Light (Radiant) • Solar • Sound	• Atomic (nuclear) • Chemical • Elastic • Gravitational

Students can make a list of the forms and sources of energy they use daily. They can discuss the type of energy they use most often.

Investigation: Energy circuit

Set up activity stations around the classroom with one student responsible for each activity. At each station, have students investigate the energy transformations that are occurring and record a simple 2-step energy chain to show one transformation.

Ideas for stations include:

• A wind up toy • A yoyo • A slinky spring toy • Watching a video on energy • Using matches to light a candle • Bouncing a tennis ball.	• Connecting a light bulb to batteries • Searching online to find out how electricity is produced • Talking on a cell phone or a walkie-talkie • Placing a small strip of magnesium ribbon in acid • Heating water in an electric jug or over a bunsen burner • Quickly stretching a rubber band several times.

Extension activities

- How many other energy chains can be constructed for each activity?
- How can each activity be developed into more than a 2-step energy chain?

Students can discuss the types of energy transformations they experience regularly.

They can create a 4 x 4 card and record up to 16 different energy transformations they have experienced within the last twenty-four hours. Alternatively, they could prepare a similar recording card and complete it in the course of their farm visit, recording energy transformations they observe on the farm. Their cards can later be swapped with other students to compare examples.

Some starters:

Electrical → kinetic Example	Chemical potential energy → kinetic Example	Gravitational potential energy → kinetic Example	Chemical potential energy → kinetic Example
Chemical potential energy → heat Example	Kinetic → elastic potential energy Example	Solar → chemical potential energy Example	Electrical → light Example
Solar → chemical potential energy → kinetic Example	Solar → chemical potential energy. → heat Example	Kinetic → electrical Example	Kinetic → kinetic Example
Electrical → sound Example	Example	Example	Example

Useful resources

- Kinds of Energy
- Science in Action Energy Transfer
- Types of Energy Song
- The Energy Song

5. Machines

From the point of view of a scientist, machines perform mechanical functions. From a technology point of view they are devices, tools, or objects designed to allow us to carry out functions using less human effort and energy. For example, human beings expend a lot less energy when a conveyor belt lifts a bale of hay into a loft.

Case study: making hay while the sun shines

- What is baleage?
- Why do farmers rely on hay/baleage?
- What devices do farmers use to make hay?
- How do farmers turn hay into baleage?
- What devices do farmers use to feed out hay or baleage?
- What mechanical advantages does baleage offer farmers over traditional hay bale methods?
- Two New Zealand innovators invented edible wrapping for baleage. Why was this developed? What are the advantages and disadvantages of this type of wrapping?

Students can make a list of the forms and sources of energy they use daily. They can discuss the type of energy they use most often.

We use machines to carry out a range of functions. In science we talk about 'simple machines' and 'complex machines', which are made up of combinations of simple machines. There are six different types of simple machines:

- Inclined planes or ramps – The angle and length of the ramp affect its performance. Examples are a conveyor belt or a ramp that is attached to a stock truck.
- Screws – These are just curled up, inclined planes. An example is a fence post auger.
- Levers – Levers have three aspects, a fulcrum or pivot point, a load force, and a force of exertion. Examples are a crowbar or a front-end loader.
- Wedges – These are sometimes sharpened into a blade for cutting. An example is an axe.
- Pulleys – These are a series of moving wheels connected by rope. The more pulleys used, the less force required to lift something. An example is a block and tackle.
- Wheels and axles – Examples are tractors, bikes, and trailers.

Using a range of different images, have the students identify examples of simple machines.

These simple machines can be used in a range of combinations to make compound machines. Scissors and bicycles are examples of compound machines. Scissors use a wedge and a lever. Have the students in groups list the machine components in a bicycle.

Prompt students to find their own examples of compound machines. Create questions for a Kahoots-type quiz on machines.

Useful resources

- Mechanisms and science knowledge
- Simple Machines
- Simple machines: Facts
- What are simple machines? Definitions, types and examples
- Simple Machines for Kids: Science and Engineering for Children
- Simple Machines
- Simple and Complex Machines

Technology creates change in response to a need or a problem. As background to their farm visit, have the students investigate a range of these technological developments that have made farming easier, safer, and more efficient.

Farm Work Key focus question: What problem was the technology designed to solve?
Sheep drenching – past and present How and why do farmers drench sheep? How did farmers drench in the past? How has drenching changed over time? **Resources** • The Back Country – Sheep drenching in 1955 • How to drench orally
Quad bikes What were farm quad bikes originally designed for? What are the effects of their use? What are the advantages and disadvantages of the use of quad bikes on farms? **Resources** • Farmers fall out of love with quads
Workhorse on wheels What was the Land Rover originally used for? How has its function changed and why? **Resources** • The Back Country – Workhorse on Wheels
Innovation on the farm The Mystery Creek Field Days have a competition each year for innovation in farming technologies. Research one of the innovative technologies being presented - current year or previous years. What was developed and why? What need did they meet? **Resources** • Fieldays Innovation Centre
Post hole digging What physical and functional attributes do the new post hole diggers have? How do they improve the work of farmers? **Resources** • Those holes • Boring device impresses judges in Fieldays competition

Sheep conveyor belts What are sheep conveyor belts used for? How do they make farming easier? **Resources** • Gallagher sheep conveyer • New sheep conveyor belt multi-tasking in Marlborough
Administering medicines to animals Why are these pharmaceuticals used? How do they improve farming? What technology did Simcro use that inspired the development of the new drench gun? **Resources** • Simcro
Farming using digital technologies "... in today's environment you've got to be far more efficient and accurate in all aspects of farming." (Pete Watt - Brownrigg Agriculture) What types of technology help farmers be more precise, more efficient, and less wasteful in their practices? How do these technologies improve farming practice? **Resources** • NZTech, Precision Ag NZ helping agriculture grow faster • Farmbots • Precision fertilising in the hills • EM Surveying
Self-driving tractors What are these tractors used for? How do they make farming easier? **Resources** • Farmers reap benefits of driverless tractor tech

Useful resources

- Five Technologies Changing Agriculture
- 20 Technologies Changing Agriculture
- Farm technology is the Silicon Valley of NZ

During the visit

Ako board tasks

Have the students investigate 6–8 of these tasks during their farm visit. The number and range of activities can be adapted to meet student and class needs and to relate to the activities they observe during their visit.

Key: S = Science T = Technology S&T = Science and Technology

Curate a series of photos, drawings, or examples of forces in action on the farm. Draw force diagrams for each image. Consider a range of situations – stationary objects and moving objects – speeding up, slowing down, steady speed. (S)	Describe a selection of 4–6 technological machines you have seen on the farm. What are their physical and functional attributes? What are they used for? How do they make farming easier? (T)	Choose one of Newton's 3 Laws of Motion. Create a video based on something in motion seen during your farm visit and explain what is happening in terms of the Laws of Motion. (S)
Investigate one example where electricity is used to operate a machine. Investigate how this machine has changed and developed throughout history. (S&T)	Create a profile of electricity use on the farm. Where does the electricity come from? How does it get there? What is it used for? (S)	How do the farmers move about the property? What are the advantages and disadvantages of each form of transport. (S&T)
Find out about the work on the farm that interests you most and research the machinery that has been developed to make this work easier for the farmers. (T)	**Explore! Ako Board**	Produce a timeline to show the different stages in the development of a piece of technology the farmer uses to make their work easier. (T)
What are the main sources of energy on the farm and what are they used for? Are they renewable or nonrenewable? What are the implications for the farmer? (S)	Create a portfolio of examples of simple and compound machines found on the farm.What are they used for? How do they make the farm work easier? (S&T)	Add examples seen during your farm visit to match with the energy transformation bingo cards another student has made for you. Points can be allocated for every square completed. (S)
Find examples of technology that were designed for one purpose but are now used for another. What was it designed to do? What is it used for now? Why? Is this successful? What effects does it have? (T)	Are animals used to carry out work on the farm. Discuss the advantages and disadvantages of using animals rather than machines for farm work. (S&T)	Capture a range of examples of technology in action on the farm. How have these made farming more efficient? What knowledge and skills from technology and other disciplines have informed their development? (T)
Capture a range of examples of physics in action on the farm, linking what you have learned with the reality. How have these made farming more efficient? Explanations will be required to justify your choices. (S)	Suggest some ideas for making a job currently carried out on the farm more efficient. Explain the physical and functional attributes of your proposed change. Consider its users, purpose, and the relevant social, cultural and environmental details you have to work within. (T)	Find out the mass (in kilograms) of a range of different objects on the farm and then convert these into the amount of force they exert due to gravity. Calculate the amount of force these objects would exert in 3 other planets or satellites in our solar system. (S)

Any other questions?

Students can take the opportunity during the visit to ask their allocated questions that the class generated before the visit.

After the visit

Students can reflect on the knowledge and ideas about the aspects of physics and technology they predicted they would see prior to their visit to the farm. Have them discuss how accurate their ideas were. What was different to what they expected?

They can discuss the answers they found their initial questions through observations on the farm or by talking to the farmers. They could use Padlet to record their questions and answers and share them with others.

Students can then collate their information and organise a presentation or exhibition of their investigations during these activities. Presentations should relate to their learning about aspects of physics and/or technology in the context of the sheep and/or beef farm they visited. They can choose to work on these reports individually or in a group. Their findings can be presented in digital or print formats. They can be presented to a choice of audiences, including groups, classes, families and whānau, or people in the sheep and beef cattle industry who helped them with their investigation.

Assessment

Determine the learning area(s) you wish to assess and the achievement objective(s) and indicators you will focus on. Design an assessment task (which may be based on an activity already completed from this resource) and construct your assessment rubric.

Example of assessment tasks:

- Students present a photo essay showing a concept of physics or technology seen during the farm visit. Students must demonstrate links between their chosen concept and how it has lead to successful farming practice. Photos can be taken during the visit or from attributed sources online. Photos should be annotated to indicate the aspects of physics and/or technology they have been chosen to illustrate (Nature of science [Level 5] – Understanding about science and Participating and contributing; Physical World [Level 5]; Technology [Level 4] – Characteristics of technological outcomes).
- Students describe the technological practices sheep and beef cattle farmers have undertaken that allow them to work more efficiently, more safely, more sustainably and/or more effectively. (Technology [Level 4] Characteristics of technology)
- Students carry out and report on a scientific investigation comparing and contrasting their speeds moving on different surfaces or in different footwear on the farm. (Nature of Science [Level 5] – Investigating in science and Participating and contributing; Physical World [Level 5])

Additional resources

- Farm Facts 2017
- The relationship between science and technology – Discussion document prepared for the New Zealand Ministry of Education Curriculum Project.
- The Pond, NZ
- Science Learning Hub
- TKI – Science Online
- TKI – Technology Online
- The Pond NZ – General keyword search
- Science Learning Hub