

# Agri Leaders Wanted

EDUCATION  
IN AGRICULTURE

Teaching and Learning Plan  
NCEA Level 1 Science AS 90949

**KEEP CALM AND  
COUNT SHEEP**

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# Introduction

A unit of learning to be assessed for NCEA using Science 1.10 (AS90949):  
**Investigate life processes and environmental factors that affect them**

## Context

Pastoral farming of sheep and cattle is an important part of the New Zealand economy. Improving productivity in a changeable environment is a constant challenge, with farmers always striving to produce heavier offspring that put on weight more quickly or dams that produce multiple offspring.

In this unit of work, students investigate the life processes of mammals within the context of sheep and cattle raised pastorally in New Zealand, how the structure and function of these animals' organs allow them to be farmed successfully within their environment, and how environmental factors can affect these life processes.

This unit should be supported by a farm visit so that students can better understand the farming context through observation and by asking questions of a farmer or farming expert.

## Achievement standard

**Achievement Standard: 90949 (version 3)**

Investigate life processes and environmental factors that affect them (internal – 4 credits).

## Achievement objectives

**Life processes LW 6-1**

Relate key structural features and functions to the life processes of plants, animals, and microorganisms and investigate environmental factors that affect these processes.

**Investigating in science NOS 6-2**

Develop and carry out more complex investigations, including using models; show an increasing awareness of the complexity of working scientifically, including recognition of multiple variables; begin to evaluate the suitability of the investigative methods chosen.

## Key understandings:

By the end of this unit, students will have gained an understanding of:

- the main types of farming in New Zealand, where they are carried out, and the numbers of animals involved.
- the importance of the New Zealand agricultural industry, focusing specifically on the history of sheep and cattle farming.
- the benefits of a pastoral farming system – a mix of grass and clover with supplementary feeding of hay, silage, baleage and forage crops (swedes, kale, fodder beet and so on).
- the economics of a pasture-based system.
- the timing of farming activities on a sheep and beef farm.
- the seven life processes (MRS GREN) and how these relate to their chosen context
- a range of environmental factors present in this context and how they impact on the observed life processes.

# Background

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The farming of sheep and beef in New Zealand contributes over \$5 billion to the economy. According to Beef and Lamb Compendium of Farm Facts, there are 30 million sheep and 3.6 million beef cattle farmed on 25,000 farms in New Zealand.

While numbers of sheep and cattle have dropped in recent times, farming methods are more successful than ever. This is due to careful management of nutrients through pasture and supplementary feeding, as well as the use of genetics to select for animals that are higher producing, for example, by having offspring that mature more quickly and with higher muscle mass, or that produce more offspring (have a higher lambing percentage). The farming environment in New Zealand is very changeable and must be managed to ensure the optimum health and well-being of stock.

Managing livestock and the environmental conditions are the keys to increased productivity.

Through this unit students will investigate the life processes of sheep and cattle and how sheep and cattle can be raised successfully in the pastoral environment.

## Areas to cover in this unit

Students need a general understanding of the main life processes of mammals: support and movement, reproduction, sensitivity, growth, excretion, nutrition and gas exchange, with a particular focus on growth and reproduction.

A range of internal and external environmental factors must also be covered: temperature, pH, light intensity, photoperiod, moisture levels, concentration of gases, hormone levels and nutrient supplies.

Students should be taught terminology that is specific to sheep and cattle farming, including these terms:

'cattle', 'cow', 'bull', 'calf', 'heifer', 'sheep', 'ewe', 'ram', 'lamb', 'hogget', 'tupping', 'scanning', 'dam', 'sire', 'supplementary feeding', 'pastoral', 'pasture', 'legumes', 'feeding out', 'flushing', 'protein', 'cellulose', 'carbohydrate'.



# Teaching and learning plan

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## Online resources

- [Compendium of New Zealand Farm Facts 2016](#)
- [Sheep farming in New Zealand](#)
- [Beef farming in New Zealand](#)
- [Beef and Lamb NZ](#)

Note that *Country Calendar* episodes can provide a great introduction to sheep and cattle farming in different areas in New Zealand. More recent episodes can be viewed on TVNZ On Demand. 'Best Of' DVDs are available for purchase.

## Farm visits: (Approximate times)

- Ram out with ewes: May
- Scanning ewes for pregnancy: July
- Lambs born: September (or 5 months after the ram goes out)
- Weaning: December

Check with your local [NZ Young Farmers](#) representative for details about more specific timing.

## Life processes - Growth

- Compare and contrast management strategies that positively or negatively impact on the growth rate of animals (use *Growing Great Lambs*).
- Investigate environmental factors such as nutritional value of pasture, weather, or temperature, that can have an impact on the growth rate of lambs or calves.
- Evaluate ways to improve the growth rate of lambs/calves.
- Track growth rates of lambs or calves.
- Draw up a development chart for sheep and cattle, comparing milestones from birth to death.
- Evaluate the different nutritional needs of lambs or calves as they grow and at different stages of their lives: pre-mating, pregnancy, lambing/calving and milk production.

## Online resources

- [400 Plus: A guide to improved lamb growth for farmers and advisors](#)

## Life processes - Reproduction

- Develop an overview of the main structures involved in reproduction (models, diagrams, dissections).
- Highlight the functions of the main reproductive structures.
- Research how changes in diet can lead to reproductive success (for example, flushing during pre-mating to increase hormone levels leading to higher lambing percentages, faster lamb growth leading to higher prices at the sales).



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## Reproductive success is linked to factors that can be managed:

### • Sheep

- Timing of mating in autumn due to photoperiod in seasonally polyestrous sheep.
- Goal is to increase lambing percentage (number of lambs born per 100 ewes). Aim is to be over 100% – the New Zealand annual average of 119% represents an increase of 5% in recent years.
- Use a sample set of pre-lambing scanning data or collect a set of data on a farm visit to evaluate the numbers of ewes carrying singles and multiples, as well as dry (not pregnant) ewes. [Sheep scanning](#)
- Nutrient supply at pre-tupping (both pasture quality and quantity and supplementary feeding).

### • Cattle

- Mating is timed so that spring pasture growth and calving coincide.
- Goal is to produce calves with a high growth rate.
- Use a set of weight data to track the increase in calf weights as they reach weight milestones. Find out about feeding practices (nutrient supply from pasture quality and quantity, supplementary feeding).

### Online resources

- [Making every mating count \(sheep\)](#)
- [Beef breeding](#)
- [Profitable farming of beef cows](#)
- [Beef and Lamb NZ](#)

## Life processes - Nutrition

- Discuss the role of the digestive system in breaking down nutrients for use in growth.
- Describe a pastoral system, the species that are present and the nutrients it can supply (for example, grass for carbohydrate/energy and clover/legumes for nitrogen/protein) and the levels of cellulose that must be digested.
- Compare and contrast the structure and function of ruminant and nonruminant digestive systems (use models, diagrams, dissections).
- Stress digestibility of varying amounts of cellulose: [Plant structure and function](#)

### Online resources

- [Ruminant digestive system](#)
- [Flushing](#)
- [400 Plus: A Guide to Improved Lamb Growth](#)



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## Life processes - Excretion

- Describe the main excretory systems in mammals, for example, kidneys (models, diagrams, dissections) and explain how they function.
- Link excretion to the digestive system and the waste products produced during the digestion process.
- Discuss excretion of gases (for example, methane) and ruminants.

## Life processes - Sensitivity

Livestock are sensitive to changes in temperature, water supply and nutrient supply. These impact on different life processes and an animal's ability to function within its environment.

- Collect, graph and interpret climate data.
- Investigate the implications of climate for farmers of sheep and cattle and how the climate and temperature in New Zealand may affect livestock.
- Analyse articles on major weather events in New Zealand (for example, El Nino/La Nina weather patterns, drought, snow storms, late frosts) and how these have impacted on sheep and cattle.
- Link these environmental conditions to implications for farming/management issues for farmers, for example, heat stress, limited food intake, loss of condition in animals, selling/culling stock early, pasture preservation.

### Online resources

- [2015 El Nino - biggest in 18 years](#)
- [Drought stricken farmers brace for El Nino](#)
- [Super El Nino weather warning](#)

## Life processes - Gas exchange

- Gas exchange/respiration is the same in these two animals.
- Compare lung capacity of students, sheep and cattle by making models.
- Carry out a lung dissection if suitable material is available.

## Farm visit

It is highly recommended that this teaching and learning plan be supported by a farm visit, or accompanied by an opportunity for students to question a visiting farm expert about livestock and farming practices.

Before the farm visit or classroom visit by a farmer, students should develop jointly with their teacher a set of relevant, focused questions. These should be communicated to the farmer prior to the visit to ensure best use of their (and the students') time.

A farm visit could include the following:

- A tour of the farm, noting its topography, size, livestock farmed, natural resources.
- A look at pre-lamb scanning and record data.
- Talking to the farmer about management practices that will be undertaken following scanning (culling, feeding, monitoring, and so on).
- Visiting a sheep or cattle stud to look at improving genetic potential in stock and what traits are selected for and why.
- Discussion on feed management: when is this most important, what does the farmer do to manage feed, what times of the year is feed management most critical, and why?
- Asking about timing of mating, lambing/calving, and why the farmer undertakes these at the time they do.
- Having the farmer show examples of animals with different body condition scores and how he uses these to identify when animals are ready for the works.
- Observing and comparing the ages of animals and developmental differences.
- Taking notes and photographs to aid a debrief back at school.

The debrief is important.

### Additional readings

- [Sheep and beef cattle production systems](#)
- [Calf rearing guide](#)