# **Agribusiness: AS91869 - Analyse Climate Change & Greenhouse Gas Emissions Future Proofing Strategies to ensure long-term viability of a dairy farm business scheme.**

**Duration:** 5-6 weeks

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| **Essence statement:** | Using agribusiness knowledge & skills to analyse dairy biosecurity future proofing strategies to ensure long-term dairy farm business viability. |
| **Big Picture:**  | Future proofing is the understanding of the impacts of outside influences on businesses & their ability to meet present & future needs to ensure long-term business viability for future generations. There are many influences facing the New Zealand dairy industry & its future, e.g., economic, environmental, political, cultural, social, ethical, technological, biological, scientific & legal. These influences must take priority & it is vital that our young people have an understanding of these challenges in order to make good business decisions to ensure long-term viability. There are many issues facing the New Zealand dairy industry & its future. Future proofing is having the foresight to limit impacts from influences such as greenhouse gas emissions. External influences must be predicted, prevented, limited, minimised, or corrected to ensure long-term dairy farm business viability. The following are important ideas within the Big Picture:* Apply future proofing knowledge & concepts to a dairy farm business.
* Understand the effects external influences may have on a dairy farm business.
* Being able to adapt & mitigate the external influences to ensure long-term dairy farm viability.
* Being able to predict impacts both within & beyond the dairy farm & the consequences of these impacts on the business.
* Using knowledge & skills to understand the different influences, rethink long standing ideas & consider alternative practices.
* Apply knowledge to meet dairy business needs, resolve their issues & develop new technologies.
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| **Principles:** | **Treaty of Waitangi:** Have an understanding the Māori perspective on dairy farm businesses & long-term viability.**Coherence:** Creating links between knowledge & skills gained within the dairy community & the agribusiness industry.**Future Focus:** Business decisions that allow long-term viability of dairy farming.**Cultural diversity:** Students examine a variety of worldviews in considering dairy farm business issues.**Community & participation:** Businesses are viable for the common good.**Integrity:** Involves business being honest, responsible, accountable & acting ethically. |
| **Values:**  | **Ecological sustainability,** which includes care for the environment.**Community & participation** for the common good. |
| **Key Competencies:**  | **Thinking:** Make sense of information, develop understanding, make decisions, & reflect on learning.**Using language, symbols, & text:** To access & communicateinformation & to communicate this information with others.**Participating & contributing:** To understand the importance of balancing rights, roles & responsibilities of social, cultural, physical & economic environments.  |
| **New Zealand Curriculum Links.** |
| **Science Curriculum Level 8:** |
| * **Living World:**
 | * Understand the relationship between organisms & their environment.
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| **Agricultural & Horticultural Science Curriculum Level 8:** |
| * **Life Processes**
 | **Learning Objective 2:** Critically examine how management practices used in production processes ensure marketable primary products. |
| * **Sustainability**
 | **Learning Objective 3:** Critically examine the impact of primary production management & processes on the environmental sustainability of primary production. |
| * **Profitability**
 | **Learning Objective 4:** Critically examine the impact of a range of specific factors on the profitability of primary production in New Zealand. |
| **Science Curriculum Level 7 & 8:** |
| * **Planet Earth & Beyond: Earth systems & interacting systems.**
 | Develop an in-depth understanding of the interrelationship between human activities & the geosphere, hydrosphere, atmosphere & biosphere over time.  |
| * **Living World:**
* **Life processes, ecology & evolution**
 | * Understand the relationship between organisms & their environment.
* Explore the diverse ways in which animals & plants carry out life processes.
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| * **Business Studies: Level 8**
 | Explore how & why large businesses in New Zealand make operational decisions in response to internal & external factors. |
| * **Economics: Level 8**
 | Understand how the nature & size of New Zealand economy is influenced by interacting internal & external factors.  |
| **Education for Sustainability Level 8:** |
| * **Knowledge & Understanding:**
 | * Evaluate social, economic, & technological measures that could be taken to sustain natural resources & improve biodiversity now & for the future.
* Analyse the impact of strategies & initiatives for a sustainable future.
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| * **Attitudes & values:**
 | Analyse the values & behaviours that will contribute to a sustainable future. |
| * **Actions**
 | Analyse actions necessary for sustainability & plan, implement, & critically evaluate personal action for a sustainable future. |
| **Textbooks** | * Dynamic Agriculture Years 11-12 (DA2).
* Climate Change & Agriculture: Understanding the biological greenhouse gases. Parliamentary Commissioner for the Environment (CCA).
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| **Background reading** | * Growing for Good. Intensive farming, sustainability, and New Zealand’s environment. Parliamentary Commissioner for the Environment.
* Hot Topic – Global Warming & the Future of New Zealand by Gareth Renowden.
* Clean & Green? The New Zealand Environment. Richard Tong & Geoffrey Cox.
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| **Depth of coverage.** | **Specific Learning Outcomes. Students understand:** | **Learning Activities.** | **Resources.** |
| **Hook them in.****What is future proofing?*** Future proofing is the understanding of the impacts of outside influences on businesses & their ability to meet present & future needs to ensure long-term business viability for future generations.
* Refers to the ability of the business to continue to be of value into the distant future & meet its needs & goals.
* The concept of future proofing is the process of anticipating the future & developing strategies to minimise the effects of shocks & stresses of future influences, events, or issues.

Future proof from the impact of “megatrends”. | * What are some future proofing issues that businesses face?
* How to apply future proofing knowledge & concepts to businesses?
 | * Students are presented with one or more “hooks”;
* Using the picture of a fistulated cow
	+ What is happening with this cow?
	+ Why does it have a hole in its side?
	+ Is this right?
	+ If you were to stick your hand in the fistulated cow, what would you feel? Do the Five senses graphic organiser on a fistulated cow.
* Using the picture of methanogens, use the Zoom-In Inquiry technique to uncover a small part of an image at a time. Start with a close-up & then uncover the image in stages as the ensuing discussion progresses.
	+ What is it?
	+ What are methanogens?
	+ Where are they found?
	+ What do they do?
	+ What relevance do methanogens have for NZ?
	+ Do you think by modifying methanogens will reduce greenhouse gas emissions?
	+ What is climate change?
* Using the picture of ‘Cows grazing in a paddock’, ask;
	+ “Are they killing us?” Is this statement fact or fiction?
* Listen to <http://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2487808/methanogens>
	+ Share their first impressions or initial understandings of the topic.
 | * Fistulated cow picture.
* Cows grazing in a paddock picture.
* Five senses graphic organiser – fistulated cows.
* Methanogens

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| **Importance of future proofing.** * The business will be progressively impacted by biosecurity, stakeholder demands, increased regulations & rising costs for resources, insurance, & finance & sustaining by itself is not enough. The business wants to thrive. These drive change.
* What are the consequences if we don’t future proof for climate change and greenhouse gas emissions? Reputation, Profitability, Innovation & Unviability.
 | * Why is it important for agribusiness?
* The consequences of the impacts.
* Farming in New Zealand.
* Sustainability land management
 | * Why is future proofing important for a dairy farm business?
* Why climate change and greenhouse gas emissions?
* The importance of farming to New Zealand.
* Sustainability land management (SLM).
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| **Long term viability*** Viability refers to ensuring the continuity of a business to meet current & future needs.
* The viability of a business is measured by its long-term survival, & its ability to have sustainable profits over a period of time
* If a business is viable, it is able to survive for many years, because it continues to make a [profit](https://www.thebalance.com/are-a-firm-s-cash-flow-and-profit-different-393585)year after year. The longer a company can stay profitable, the better its viability.
 | * How does future proofing businesses ensure long-term viability?
 | * What are the different perspectives of business viability here in New Zealand?
* What constitutes long-term viability in dairying?
* What is long or short-term viability in a dairy farm business?
* Why is being long term viable important for a dairy farm business?
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| **External Influences & their future issues or drivers of change leading to future proofing.** * Influences are;
* Environmental
* Social
* Cultural
* Economic
* Political
* Ethical
* Technological
* Biological
* Scientific
* Legal
* The concept of future proofing may change depending on the influence, e.g., in some environmental issues, future proofing is used to describe the ability of a business to resist the impact of potential climate change due to global warming, such as “dependency on fossil fuels will be more or less completely eliminated & replaced by renewable energy sources.”
* Explain the impacts that these influences will have on the short or long-term viability of a business.
 | * The different influences.
* That the concept of future proofing may change depending on the influence.
 | * What influences impact businesses?
* What effect do they have on businesses, other businesses, the community & New Zealand?
* Why do we need to be aware of influences in a business?
* Why does the concept of future proofing change / alter depending on the influence that is impacting the business?
* How can producers be more proactive rather than reactive?
* Explain the impacts that these influences will have, short or long term.
* Discuss the philosophy of producers: ethical vs profit.
* In groups of 3, using Stop Motion Studio, choose one influence, present a 1-minute video to show the class on your influence, what it is, how it can impact, & why it is important in future proofing.
* Economic - AgResearch cost to the economy. <http://bit.ly/2AYYmGd>
* **NOTE: If influences need to be understood in more depth, see 2.1 Future Proofing scheme.**
 | * AgResearch cost to the economy. <http://bit.ly/2AYYmGd>
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| **Global Warming / Climate Change** * Brief introduction to global warming & climate change & their relationship.
 | * What is the difference between global warming & climate change?
 | * Brainstorm what is climate change & global warming?
* What do you know about climate change? <https://www.washingtonpost.com/climate-solutions/2019/11/22/quiz-how-much-do-you-know-about-climate-change/?arc404=true&wpisrc=pw_acq_010920>
* Watch videos
	+ The Road to Change <https://www.youtube.com/watch?v=BMnCiOR3UoQ>
	+ <https://ab.co/2Znz1G4>
	+ <https://www.stuff.co.nz/environment/climate-news/115104544/frosty-starts-as-marlboroughs-winter-winds-back-the-years>
 | * Poster paper.
* Pens.
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| **Global Warming** * [Initial causes of temperature changes (external forcings)](http://en.wikipedia.org/wiki/Global_Warming#Initial_causes_of_temperature_changes_.28external_forcings.29)
	+ [Greenhouse gases](http://en.wikipedia.org/wiki/Global_Warming#Greenhouse_gases)
	+ [Particulates & soot](http://en.wikipedia.org/wiki/Global_Warming#Particulates_and_soot)
	+ [Solar activity](http://en.wikipedia.org/wiki/Global_Warming#Solar_activity)
* [Climate models](http://en.wikipedia.org/wiki/Global_Warming#Climate_models)
* [Observed & expected environmental effects](http://en.wikipedia.org/wiki/Global_Warming#Observed_and_expected_environmental_effects)
	+ [Natural systems](http://en.wikipedia.org/wiki/Global_Warming#Natural_systems)
	+ [Ecological systems](http://en.wikipedia.org/wiki/Global_Warming#Ecological_systems)
	+ [Long-term effects](http://en.wikipedia.org/wiki/Global_Warming#Long-term_effects)
	+ [Large-scale & abrupt impacts](http://en.wikipedia.org/wiki/Global_Warming#Large-scale_and_abrupt_impacts)
* [Observed & expected effects on social systems](http://en.wikipedia.org/wiki/Global_Warming#Observed_and_expected_effects_on_social_systems)
	+ [Habitat inundation](http://en.wikipedia.org/wiki/Global_Warming#Habitat_inundation)
* [Possible responses to global warming](http://en.wikipedia.org/wiki/Global_Warming#Possible_responses_to_global_warming)
	+ [Mitigation](http://en.wikipedia.org/wiki/Global_Warming#Mitigation)
	+ [Adaptation](http://en.wikipedia.org/wiki/Global_Warming#Adaptation)
	+ [Climate engineering](http://en.wikipedia.org/wiki/Global_Warming#Climate_engineering)
* [Discourse about global warming](http://en.wikipedia.org/wiki/Global_Warming#Discourse_about_global_warming)
	+ [Political discussion](http://en.wikipedia.org/wiki/Global_Warming#Political_discussion)
	+ [Scientific discussion](http://en.wikipedia.org/wiki/Global_Warming#Scientific_discussion)
	+ [Discussion by the public & in p](http://en.wikipedia.org/wiki/Global_Warming#Discussion_by_the_public_and_in_popular_media)opular media.
 | * What is global warming?
* The causes of global warming.
* The different points of view about global warming.
* How global warming is measured.
* The effects of global warming.
* The impact that global warming has on the individual as well as society.
* The possible responses to global warming.
 | * What is global warming?
* Go through PPTs.
	+ Global Warming PPT
	+ Pollution PPT
	+ Environmental Chemistry PPT
	+ Fossil Fuels PPT
* Watch clips on global warming
	+ <https://www.youtube.com/watch?v=1abN9E-Ojrc>
	+ <https://www.youtube.com/watch?v=4_eJdX6y4hM>
	+ Global Warning, Ozone layer (in file).
* Discussion on global change.
* Look at Global Warming cartoon.
* Read articles.
	+ Global warming and climate change - Introduction
	+ <https://www.ncdc.noaa.gov/monitoring-references/faq/global-warming.php>
	+ <http://www.theguardian.com/sustainable-business/blog/environment-climate-change-denier-global-warming>
* Climate change is transforming wine-making traditions and practices that may be centuries old [https://nyti.ms/2ISOlQU](https://u9546767.ct.sendgrid.net/wf/click?upn=nza-2FnbpHvU2wiNlrjmPg3SRTUT36O-2BVAFUgPvJ4tmSI-3D_rLi4eofUS9h9CUhSX18-2Fj6MzbfCKlUen2-2BOD9xE4aicLDGajp84H6auoxojfl-2FOEumIe-2BnwwtIV3wkI-2BDZlvqK2Bv-2FbI3YxNOU1z9Y8xgp8sscC-2BxMFHYbUMvl5iLi2XnRgRKaC0hkQMv7FHR5ozsZebfFEG0KnF717NYpUF6GQOOcU3LmCKNYd9ZmTL44rA9BZsBuqY6T-2Bo6HvkFxBw0WpUhxEh7gkgYBR7HJw7GTg-3D)
 | * Global Warming PPT
* Pollution PPT
* Environmental Chemistry PPT
* Fossil Fuels PPT
* Global Warming cartoon
* Global warming and climate change - Introduction
* <https://www.youtube.com/watch?v=1abN9E-Ojrc>
* <https://www.youtube.com/watch?v=4_eJdX6y4hM>
* <https://www.ncdc.noaa.gov/monitoring-references/faq/global-warming.php>
* <http://www.theguardian.com/sustainable-business/blog/environment-climate-change-denier-global-warming>
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| **Climate Change** * Climate change is a change in the statistical distribution of [weather](http://en.wikipedia.org/wiki/Weather) patterns when that change lasts for an extended period of time (i.e., decades to millions of years).

[Causes](http://en.wikipedia.org/wiki/Climate_change#Causes) * [Internal forcing mechanisms](http://en.wikipedia.org/wiki/Climate_change#Internal_forcing_mechanisms)
	+ [Ocean variability](http://en.wikipedia.org/wiki/Climate_change#Ocean_variability)
	+ [Life](http://en.wikipedia.org/wiki/Climate_change#Life)
* [External forcing mechanisms](http://en.wikipedia.org/wiki/Climate_change#External_forcing_mechanisms)
	+ [Orbital variations](http://en.wikipedia.org/wiki/Climate_change#Orbital_variations)
	+ [Solar output](http://en.wikipedia.org/wiki/Climate_change#Solar_output)
	+ [Volcanism](http://en.wikipedia.org/wiki/Climate_change#Volcanism)
	+ [Plate tectonics](http://en.wikipedia.org/wiki/Climate_change#Plate_tectonics)
	+ [Human influences](http://en.wikipedia.org/wiki/Climate_change#Human_influences)
* [Physical evidence](http://en.wikipedia.org/wiki/Climate_change#Physical_evidence) - using [observations](http://en.wikipedia.org/wiki/Proxy_%28climate%29) & theoretical models.
	+ [Temperature measurements & proxies](http://en.wikipedia.org/wiki/Climate_change#Temperature_measurements_and_proxies)
	+ [Historical & archaeological evidence](http://en.wikipedia.org/wiki/Climate_change#Historical_and_archaeological_evidence)
	+ [Glaciers](http://en.wikipedia.org/wiki/Climate_change#Glaciers)
	+ [Arctic sea ice loss](http://en.wikipedia.org/wiki/Climate_change#Arctic_sea_ice_loss)
	+ [Vegetation](http://en.wikipedia.org/wiki/Climate_change#Vegetation)
	+ [Pollen analysis](http://en.wikipedia.org/wiki/Climate_change#Pollen_analysis)
	+ [Precipitation](http://en.wikipedia.org/wiki/Climate_change#Precipitation)
	+ [Dendroclimatology](http://en.wikipedia.org/wiki/Climate_change#Dendroclimatology)
	+ [Ice cores](http://en.wikipedia.org/wiki/Climate_change#Ice_cores)
	+ [Animals](http://en.wikipedia.org/wiki/Climate_change#Animals)
	+ [Sea level change](http://en.wikipedia.org/wiki/Climate_change#Sea_level_change)
 | * What is climate change?
* The causes of climate change.
* What physical evidence has been gathered to determine climate change?
* The different points of view about climate change.
* The effects of climate change.
* The impact that climate change has on the individual as well as society.
* The possible responses to climate change.
 | * What is climate change?
* Watch clips on climate change.
	+ 100-year forecast <https://thespinoff.co.nz/climate/>
	+ <https://www.youtube.com/watch?v=gIUN5ziSfNc>
	+ <https://www.youtube.com/results?search_query=climate+change+videos&oq=climate+change+videos&gs_l=youtube.12..0j0i5.16055.25219.0.27253.21.17.0.4.4.0.426.2900.5j0j10j0j1.16.0...0.0...1ac.1.11.youtube.Au_5ZOBRXHA>
	+ <https://www.youtube.com/watch?v=BC3vuRSiLh4>
	+ Before the Flood - <http://www.etv.org.nz/programme.php?id=137840>
	+ Climate change – Lines of Evidence (in file)
	+ Watch the movie “The Day After Tomorrow” and answer the questions.
* Discussion on climate change – use climate change poster.
* Go through Coastal Hazards PPT.
* Do What is the greenhouse effect? w/s.
* Teacher Notes for Greenhouse Gases
* Read
	+ Pages 455-458 of DA2.
	+ Cloud study offers no silver lining on climate change.
	+ CC Impacts and Mitigation - A NZ perspective
	+ CC - Guide for Land Managers – Waikato
	+ Revolution changed the climate
	+ Likely impacts of climate change <http://www.mfe.govt.nz/issues/climate/about/impacts.html>
	+ Adapt or die. Climate change puts pressure on paua
	+ A massive & unavoidable financial burden.
	+ Doing nothing a good option.
	+ The Greenhouse Effect
	+ <https://niwa.co.nz/education-and-training/schools/students/climate-change/climate-change-the-science>
 | * Coastal Hazards ppt
* <https://www.youtube.com/watch?v=gIUN5ziSfNc>
* <https://www.youtube.com/results?search_query=climate+change+videos&oq=climate+change+videos&gs_l=youtube.12..0j0i5.16055.25219.0.27253.21.17.0.4.4.0.426.2900.5j0j10j0j1.16.0...0.0...1ac.1.11.youtube.Au_5ZOBRXHA>
* DA2.
* What is the greenhouse effect? w/s.
* Cloud study offers no silver lining on climate change.
* CC - Guide for Land Managers - Waikato
* CC Impacts and Mitigation - A NZ perspective
* Teacher Notes for Greenhouse Gases
* Revolution changed the climate
* Adapt or die. Climate change puts pressure on paua
* A massive & unavoidable financial burden.
* Doing nothing a good option.
* The Greenhouse Effect NIWA booklet.
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| **Climate Change & Agriculture.** * The impact that New Zealand pastoral agriculture has/is having on greenhouse gas levels & therefore climate change (global warming)
* How is this impact being addressed (greenhouse gas reducing initiatives, technologies, emissions taxes, Kyoto protocol etc.)?
* What climate change means for the future of New Zealand pastoral agriculture
* What are the agricultural greenhouse gases & how are they produced?
	+ Methane (CH4)
	+ Carbon dioxide (CO2)

Nitrous Oxide (N2O) | * How climate change is affecting New Zealand’s agriculture.
* The impact that climate change / global warming has on the individual farmers as well as New Zealand’s society.
* The possible agricultural responses to global warming / climate change.
* Methane (CH4)
* Carbon dioxide
* Nitrous Oxide
 | * Use St Paul’s Climate change presentation from Nicola Kloeten of AgFirst to have understanding of climate change & the positive & negative effects on agriculture.
* Do The Carbon Cycle w/s.
* Understand each of the gases pgs. 4-6 from NIWA booklet.
* Look at NCWNZ seminar PPT.
* Methane website <https://clear.ucdavis.edu/news/methane-has-been-achilles-heel-cattle-emissions-it-may-be-part-climate-solution>
* Watch
	+ <https://vimeo.com/351100969> Farms, Forest and Fossil Fuels from Parliamentary Commission for the Environment.
	+ <https://www.youtube.com/watch?v=NbO4EEaH7YM> The role of ruminants on CC mitigation. “The good and the bad”. This infographic video attempts to graphically illustrate why ruminants are not to be blamed for CC. Different arguments are shown regarding the differences between emissions from biogenic methane from ruminants & fossil fuel CO2, differences in production systems & the uncertainties regarding N2O emissions & the baseline of reference to compare emissions from ruminants compared with other activities.
	+ <https://www.youtube.com/watch?v=RW8BclS27aI&vl=en> explains how the GHG emissions from burning fossil fuels differ from those produced by livestock. Aims to explain livestock’s role in the global food system & our environment, focusing on CC, & promoting collaborative & research-based solutions that can further reduce emissions.
* Show Effect of elevated CO2 NO2
* Read
	+ CCA pgs. 14-15 on the biological gases.
	+ CCA pgs. 19-29 on pastoral farming & the biological gases.
	+ CCA pgs. 31-36 on greenhouse gases differ in important ways.
	+ A Beginner’s Guide to greenhouse gases.
	+ Hot Topic – Global Warming & the Future of New Zealand.
	+ Reducing NZ Ag Greenhouse Gases - Efficiency in farm systems
	+ Reducing NZ Ag Greenhouse Gases - How we measure emissions?
	+ Impacts cc land-based sectors adaptation
	+ Is dairying the real culprit
	+ Kyoto Protocol & New Zealand
	+ MAF climate change discussion document
	+ Farm lobbies propose a better way
	+ Methane information
	+ Multiple factors inform methane reduction targets.
	+ Short- and long-lived gg need different accounting systems
	+ DairyNZ Great Farming Guide
	+ Revolution changed the climate.
	+ How do we cut on-farm emissions?
	+ NZ's GGE & Contribution from Ag
	+ Climate change can happen without us.
	+ CC: Likely Impacts on New Zealand Agriculture.
	+ <https://www.stuff.co.nz/business/farming/109049034/carbon-calculator-simplifies-farmers-greenhouse-gas-footprints>
	+ <http://hot-topic.co.nz/adapting-agriculture-to-a-changing-climate/>
	+ <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/agriculture/>
	+ <https://bit.ly/2YVRppr>
	+ <https://farmersweekly.co.nz/section/dairy/view/gas-targets-a-threat-to-dairy>
	+ <https://farmersweekly.co.nz/section/agribusiness/view/no-way-yet-to-measure-emissions>
	+ <https://www.ruralnewsgroup.co.nz/dairy-news/dairy-opinion/why-are-nz-cows-giving-out-so-much-methane>
	+ <https://www.dairynz.co.nz/environment/climate-change/what-climate-change-means-for-farmers/>
	+ <https://niwa.co.nz/education-and-training/schools/students/climate-change/agriculture>
 | * <http://hot-topic.co.nz/adapting-agriculture-to-a-changing-climate/>
* <http://www.climatechange.govt.nz/emissions-trading-scheme/participating/agriculture/>
* CCA
* NIWA booklet.
* Short- & Long-lived gg need different accounting systems
* St Paul’s CC presentation - N Kloeten
* Methane information
* DairyNZ Great Farming Guide
* MAF climate change discussion document
* Kyoto Protocol & NZ
* NZ's GGE & Contribution from Ag
* A Beginner’s Guide to greenhouse gases.
* Is dairying the real culprit
* Impacts cc land-based sectors adaptation
* The Carbon Cycle w/s.
* Multiple factors inform methane reduction targets.
* Climate change can happen without us.
 |
| **Identifying dairy climate change and greenhouse gas emissions future proofing influences.** * Identify possible future proofing influences that may affect the dairy farm business.
* These could impact on: strategic, commercial reputation, operational, financial, &/ or compliance / regulatory areas of the business.
* Identify specific impacts that might arise from these influences.
* Assess likelihood of occurrence & the severity of any impact (e.g., sensitivity analysis).

Environmental.* Increased air temperatures.
* Increased plant growth
* Rising sea levels.
* More coastal & hill country erosion.
* More extreme weather events
* Changes to current ecosystems.

Economic* Increased costs associated with the control of erosion of both coastlines & rivers.
* Loss of production in drought affected areas & due to increased flooding / storm events & changing temperatures.

Social* Relocation of primary industries.
* Communities in rural areas losing numbers due to productivity losses & changing farming systems, profitability’s etc.
 | * The impact of influences on a business.
* Environmental, social & economic implications.
 | * Suggest some influences that are most likely to have impact on dairy farm businesses.
* What effect do they have on dairy farm businesses, other businesses, the community & New Zealand?
* Why do we need to be aware of influences on a dairy farm?
* Read DairyNZ Climate change basics <https://www.dairynz.co.nz/environment/climate-change/climate-change-basics/>
* Brainstorm the environmental, social & economic implications of climate change.
* Read Physical impacts & costs of CC in New Zealand
* Read <https://niwa.co.nz/education-and-training/schools/students/climate-change/impacts-for-NZ>
 | * Physical impacts & costs of CC in New Zealand.
 |
| **What are future proofing strategies?*** Future proofing is the process of anticipating the future & developing strategies to minimise the negative effects while taking advantage of the positive effects of shocks & stresses due to future influences, events, or issues.
* Outside influences must be predicted, prevented, limited, minimised, or corrected to ensure long-term business viability.
* Future proofing strategies are courses of action that influence a business & may affect long-term viability. The strategies could be innovative & revolutionary.
* Businesses need to show leadership by example & to contribute by making decisions that lead to actions for a viable future.
* Future Proofing a Business Process
* Once the influence has outlined, identify strategies to mitigate the high probability & / or high impacts.
* Analyse the strategies to ensure that they met the long-term viability of the business.
* Hypothesize the possible outcomes that are likely to occur under each given strategy.
* What will the consequences of each outcome be for each strategy?
* Recommend strategies that will best meet the future needs of the business to ensure long-term viability.
* Develop a plan to implement strategies.
* Monitor & review strategies regularly.
* Take an active approach: regularly evaluate & review current status in terms of future proofing. Scan the trends to provide a fresh perspective & determine how the business will respond to these trends.
 | * What are future proofing strategies?
* What strategies can a business use to future proof?
 | * What are future proofing strategies?
* Why are future proofing strategies important to a dairy farm business?
* How does having future proofing strategies improve the long-term viability of a business?
* Understand the Future Proofing a Business Process.
* Read “Managing risk key to future” article.
* What is being done in different businesses?
* Discuss the slogan “Knowledge is power”. How does that help businesses to future proofing?
* Mind map impacts that may occur from the strategies.
 | * “Managing risk key to future” article.
 |
| **Example strategies to mitigate future proofing.** |
| **What is the world doing about reducing greenhouse gas emissions?** * Kyoto Protocol.
 | * What is the world doing about reducing greenhouse gas emissions?
 | * Look at flights over Europe picture.
* Read Learning to live with Paris.
 | * Flights over Europe picture.
* Learning to live with Paris.
 |
| **What is New Zealand doing reducing greenhouse gas emissions?** * Department of Conservation
* Ministry for the Environment.
* Ministry of Primary Industries
* Laws / Acts
	+ Zero Carbon Bill.
	+ Emissions Trading Scheme.
* Different stakeholder’s points of view e.g.
	+ Beef+LambNZ
	+ The Pastoral Greenhouse Gas Research Consortium
 | * What is New Zealand doing reducing greenhouse gas emissions?
* Different stake holder’s points of view.
 | * Government
* Read Preparing for climate policy
* Read <https://www.dairynz.co.nz/environment/climate-change/climate-change-policies/>
* Read and watch <https://niwa.co.nz/news/methane-seep-research-bubbling-along?fbclid=IwAR0O6ND95DYAPlav2yWSeEs6GymYar_RRd_uV2Mmi5pzlU7HvztshQZz8c0>
* Read
* Reducing NZ Ag Greenhouse Gases - What are we doing?
* How strong is the goodwill?
* No more new coal boiler
* slm-&-climate-change-regional-release-presentation
* No more coal burners
* Target 1 billion trees
* Threat or Opportunity
* Carbon cost shock.
* Upton says treat gases differently
* Govt says no despite ags gas support
* Review calls for urgent action on livestock emissions
* Time for farmers to measure gases
* Govt creating climate crisis
* Ministers snubbed methane advice.
* Farm lobbies propose a better way
* <https://www.dairynz.co.nz/environment/climate-change/emissions-reduction-plan-consultation/>
* <https://www.tvnz.co.nz/one-news/new-zealand/james-shaw-frustrated-and-making-progress-climate-change-action>
* <https://farmersweekly.co.nz/section/agribusiness/view/gas-tax-closer>
* <https://www.stuff.co.nz/environment/climate-news/114439670/the-kiwi-food-businesses-blazing-a-carbonzero-trail>
* <https://farmersweekly.co.nz/section/agribusiness/view/climate-research-gets-green-light>
* <https://farmersweekly.co.nz/section/agribusiness/view/is-pms-climate-pledge-realistic>
* <https://niwa.co.nz/education-and-training/schools/students/climate-change/adapting-to-climate-change>
* Different stakeholder’s points of view e.g. The Pastoral Greenhouse Gas Research Consortium (PGgRc) <https://www.pggrc.co.nz/>
* Different stakeholder’s points of view e.g., Fonterra.
* armersweekly.co.nz/section/dairy/view/fonterra-will-record-farm-gases
* <https://www.ruralnewsgroup.co.nz/rural-news/rural-general-news/emissions-profile-for-every-farm>
* <https://ruralnewsgroup.co.nz/rural-news/rural-opinion/we-re-on-board-but-don-t-kill-the-cash-cow>
* <https://farmersweekly.co.nz/section/dairy/view/methane-matters-to-dairynz-head>
* Different stakeholder’s points of view e.g., Beef+LambNZ
* <https://bit.ly/30g5bjc>
* <https://bit.ly/33DI9ox>
* <https://bit.ly/2z7Plex>
* <https://www.ruralnewsgroup.co.nz/rural-news/rural-opinion/for-the-world-s-sake-get-it-right>
* <https://www.stuff.co.nz/national/the-detail/300370541/the-detail-coal-is-the-worst-emitter-you-can-find-so-why-is-nz-importing-it-by-the-shipload>
 | * How strong is the goodwill?
* No more new coal boiler
* No more coal burners
* Target 1 billion trees
* Threat or Opportunity
* Reducing NZ Ag Greenhouse Gases - What are we doing?
* Preparing for climate policy
* Carbon cost shock.
* Review calls for urgent action on livestock emissions
* Upton says treat gases differently
* Govt says no despite ags gas support
* Time for farmers to measure gases
* Govt creating climate crisis
* slm-&-climate-change-regional-release-presentation
 |
| **What are some reducing greenhouse gas emissions** **future proofing strategies?*** Breeding low emission sheep & cattle
* Low emission animal feed.
* Manipulation of methanogens
* Targeting urine patches & fertiliser.
* Planting trees.
* Soil Carbon
* Improving the quality of feed available to animals
* Ensuring breeding stock are managed accordingly to their nutritional needs
* Improved genetic selection programs to increase growth rates & reduce finishing times
* Managing livestock waste.
* Carbon trading
 | * Pest control
* Biodiversity plantings(shelter)
 | * Brainstorm all the possible management practices that could be utilised in the primary industry.
* CCA pgs. 37-40 on Evaluating ways in reducing biological emissions.
* Read
* <https://www.dairynz.co.nz/environment/environmental-leadership/climate-change-action-farms/>
* Mitigation & cost of on-farm greenhouse gas emissions.
* CC - Mitigation Adaption Strategies for PI
* <https://www.stuff.co.nz/environment/climate-news/115845613/new-zealands-horticulture-industry-adapting-to-meet-climate-change-challenges>
* Options Being Researched To Reduce GGE from NZ farms
* On-farm mitigation of greenhouse gases
* Meeting the gas challenge
* Science and fairness asked for by farmers
* Rolling with the climate change
* <https://www.stuff.co.nz/business/farming/114684873/capsicum-grower-underwrites-gas-pipeline-for-waiuku-residents>
* Mitigation of greenhouse gases in Ag sector
* Exciting world first for greenhouses
* Emissions down 20% in 27 years
* How do we cut on-farm emissions?
* Farming for a lower footprint.
* Barns have big footprints
* Climate report gives much needed detail.
* <https://www.stuff.co.nz/business/farming/109225066/farmers-want-to-cut-emissions-but-dont-know-how-report-finds>
* <https://www.ruralnewsgroup.co.nz/dairy-news/dairy-general-news/miraka-pioneers-farm-carbon-report>
* <https://farmersweekly.co.nz/section/agribusiness/deer/cutting-deer-emissions-tricky>
* <https://farmersweekly.co.nz/section/agribusiness/view/gas-targets-will-divide-society>
* <https://www.dairynz.co.nz/environment/climate-change/mitigation-options/>
* Managing nutrients
* <https://www.sciencelearn.org.nz/resources/928-managing-nutrients>
* Inhibiting nitrous oxide emissions.
* <https://www.sciencelearn.org.nz/resources/922-inhibiting-nitrous-oxide-emissions>
* Reducing livestock numbers
* Read <https://www.ruralnewsgroup.co.nz/dairy-news/dairy-general-news/is-reducing-cow-numbers-the-answer>
* <https://farmersweekly.co.nz/section/dairy/view/fewer-cows-produce-more-milk>
* <https://www.ruralnewsgroup.co.nz/rural-news/rural-farm-health/raising-in-calf-rate-helps-cut-farm-emissions>
* <https://www.ruralnewsgroup.co.nz/dairy-news/dairy-general-news/reducing-cow-numbers-no-silver-bullet-for-emissions>
* Tax livestock greenhouse gas emissions.
* Read
* Gas plan stinks
* Farm levy / rebates way to go.
* <https://farmersweekly.co.nz/section/agribusiness/view/gas-tax-wont-cut-farming-emissions>
* Breeding low emission sheep & cattle
* Read pgs. 41-44 of CCA.
* Low emission animal feed.
* Read pgs. 45-52 of CCA.
* Read
* <https://farmersweekly.co.nz/section/arable/view/gm-ryegrasses-ready-for-feeding>
* <https://www.agresearch.co.nz/news/hme-ryegrass-making-steady-progress/>
* <https://www.stuff.co.nz/environment/climate-news/116683942/government-supports-seaweed-project-to-reduce-cattle-methane-emissions>
* <https://ruralnewsgroup.co.nz/dairy-news/dairy-management/seaweed-could-bust-methane-emissions>
* Mitigation of methane
* Read
* Methane - we are facing it with you.
* Multiple factors inform methane reduction targets.
* <https://www.ruralnewsgroup.co.nz/dairy-news/dairy-general-news/methane-inhibitor-facing-hurdles>
* <https://www.dairynz.co.nz/news/tools-for-methane-mitigation/>
* Watch the video on methane research [Less methane - DairyNZ](https://www.dairynz.co.nz/environment/climate-change/climate-change-research/less-methane-project/)
* Soil Carbon Sequestration
* Watch the video [Dr Jacqueline Rowarth: Pasture and soil carbon sequestration explained - YouTube](https://www.youtube.com/watch?v=Q39G4hDVOCg)
* Listen to [Talking Dairy - Digging into soil carbon with Dr Jacqueline Rowarth | Ep. 27 (google.com)](https://podcasts.google.com/feed/aHR0cHM6Ly9mZWVkcy5idXp6c3Byb3V0LmNvbS8yNTkwNjEucnNz/episode/QnV6enNwcm91dC0xMDcxNDU5Mg?hl=en-NZ&ved=2ahUKEwjG4dO8u4H5AhWJ9DgGHc17CocQjrkEegQIBRAI&ep=6)
* Read about
* Reducing NZ Ag Greenhouse Gases - Soil Carbon
* Carbon trading pgs. 458-459 of DA2.
* Climate change can happen with us
* <https://farmersweekly.co.nz/section/arable/view/soils-could-become-a-carbon-sink>
* Read pgs. 75 of CCA.
* <https://www.ruralnewsgroup.co.nz/rural-news/rural-opinion/digging-deeper-into-soil-s-black-box>
* <https://www.stuff.co.nz/business/farming/116646839/researchers-dig-deeper-in-fight-against-climate-change>
* <https://www.stuff.co.nz/business/farming/116039148/soil-is-not-a-dirty-word-in-the-fight-for-carbon-capture>
* Emission trading scheme (ETS)
* Read about
* What is a forest in the ETS?
* Stumping up for carbon.
* Carbon & timber buoy forestry.
* Forest interest up on a back of growing carbon value & log prices.
* What the EFS means for farmers?
* Targeting urine patches & fertiliser.
* Read
* pgs. 59-64 of CCA.
* Nitrification & Urease Inhibitors
* Planting trees.
* Read pgs. 65-74 of CCA.
* Read about
* Shelterbelts – a farm friendly way to improve carbon sequestration in New Zealand’s agricultural sector.
* Tree plant only on marginal land.
* One Billion Trees – our forest future
* Making the most out of Manuka” & “Manuka for biodiversity & profit.
* Community or carbon?
* Myth conceptions – Are planted forests really the devil?
* <https://farmersweekly.co.nz/section/agribusiness/view/reports-at-odds-on-carbon-counting>
* <https://farmersweekly.co.nz/section/agribusiness/view/farm-credits-on-table>
* <https://www.mpi.govt.nz/funding-and-programmes/forestry/planting-one-billion-trees/>
* <https://www.nzherald.co.nz/business/news/article.cfm?c_id=3&objectid=12253862>
* <https://farmersweekly.co.nz/section/other-sectors/view/farmers-efforts-to-be-rewarded>
* <https://farmersweekly.co.nz/topic/opinion/view/off-the-cuff-im-still-waiting-for-jacinda>
* Manipulation of methanogens
* Read pgs. 53-58 of CCA.
* <https://en.wikipedia.org/wiki/Methanogen>
* <http://bit.ly/belching-cows-and-a-tiny-bacterium>
* <http://bit.ly/methane-emissions>
* <http://bit.ly/rummaging-in-rumens-for-methane-clues>
* <http://bit.ly/Reduce-methane-emissions-from-livestock>
* <http://bit.ly/kiwi-scientists-leading-the-world>
* <http://bit.ly/NZ-Grassland_Publication>
* <http://bit.ly/breakthrough-in-methane-research>
* <http://bit.ly/RadioNZ-Audio_reducing-methane-emissions>
* Watch video What Next” <https://www.tvnz.co.nz/shows/what-next/episodes/s1-e2>
* DairyNZ facility a world first in methane measurement
* Methane tools in the pipeline
* Gas culprits identified in rumen.
* “Methane emissions from ruminant livestock.
* “Tiny organism a big challenge to methane researchers”.
* “Breathe in, breathe out….”
* “Emissions down 20% in 27 years”.
* “GM ryegrass ticks all the boxes” http://bit.ly/2C7UaE5
* “Methane chewing bacteria offer good prospects” <http://bit.ly/2B3Pksj>
* 3-NOP set to block methane in rumens https://www.ruralnewsgroup.co.nz/dairy-news/dairy-farm-health/3-nop-set-to-block-methane-in-rumens
* “Low methane producing sheep could be way forward for New Zealand” http://bit.ly/2AqaEHc
* “Less heavier cows means lower emissions” http://bit.ly/2j5AVnm
* “Lab trials show promise for emissions reduction” <http://bit.ly/2o5Amix>
* “Hanging out for GM forage” <http://bit.ly/2ApRO2Y>
* <http://bit.ly/belching-cows-and-a-tiny-bacterium>
* <http://bit.ly/methane-emissions>
* <http://bit.ly/rummaging-in-rumens-for-methane-clues>
* <http://bit.ly/Reduce-methane-emissions-from-livestock>
* <http://bit.ly/kiwi-scientists-leading-the-world>
* <http://bit.ly/NZ-Grassland_Publication>
* <http://bit.ly/breakthrough-in-methane-research>
* <http://bit.ly/RadioNZ-Audio_reducing-methane-emissions>
* Carry out activities from “11\_bact can help or hurt cows”.
* Searching deep for microbes.
* So Squelch the Belch activity 1 & 2.
* <http://bit.ly/kiwi-scientists-leading-the-world>
* <http://bit.ly/RadioNZ-Audio_reducing-methane-emissions>
* Methane emissions from ruminant livestock; are they important & can we reduce them?”
* Clock ticking on greenhouse gas solutions.
 | * Mitigation of greenhouse gases in Ag sector
* Reducing NZ Ag Greenhouse Gases - Soil Carbon
* DA2
* CCA
* CC - Mitigation Adaption Strategies for PI
* Exciting world first for greenhouses
* Myth conceptions – Are planted forests really the devil?
* One Billion Trees – our forest future
* Mitigation & cost of on-farm greenhouse gas emissions.
* Nitrification & Urease Inhibitors
* Options Being Researched To Reduce GGE from NZ farms
 |
| **Implications of cutting emissions.**  |  | * Economic
* Do implications sheet.
* Read
* Bad sin tax will ruin farmers.
* <https://farmersweekly.co.nz/section/agribusiness/view/good-farmers-must-change-too>
* Don’t kill the cash cow <https://ruralnewsgroup.co.nz/rural-news/rural-opinion/we-re-on-board-but-don-t-kill-the-cash-cow>
* <https://www.stuff.co.nz/environment/climate-news/115854092/national-inventory-of-climate-risks-a-milestone-for-new-zealand>
* <https://www.nzherald.co.nz/the-country/news/article.cfm?c_id=16&objectid=12262073>
* <https://farmersweekly.co.nz/section/agribusiness/view/cash-needed-for-climate-change>
 | * Don’t kill the cash cow.
* Bad sin tax will ruin farmers.
 |
| **What are some reducing greenhouse gas emissions** **future proofing strategies?**Future proofing a business Process* Once the influence has outlined, identify strategies to mitigate the high probability & / or high impacts.
* Analyse the strategies to ensure that they met the long-term viability of the business.
* Hypothesize the possible outcomes that are likely to occur under each given strategy.
* What will the consequences of each outcome be for each strategy?
* Recommend strategies that will best meet the future needs of the business to ensure long-term viability.
* Develop a plan to implement strategies.
* Monitor & review strategies regularly.
* Take an active approach: regularly evaluate & review current status in terms of future proofing. Scan the trends to provide a fresh perspective & determine how the business will respond to these trends.
 | * What strategies can a dairy farm business use to future proof?
 | * Using the Future Proofing process, to develop on-farm strategies to future proof a dairy farm business.
* Use a SWOT analysis to determine the best strategies to use on a dairy farm business.
* Read articles
	+ Future proofing a dairy business.
	+ Response to risk.
* Will the implementation of these on-farm strategies future proof our dairy farms?
* Technological influences
	+ Read “Dairy Farmer says Technology can ease Pressure on New Zealand Agriculture”.
* Economic influences
* Read “On-farm strategies under a low dairy pay out”.
 | * Response to risk.
* Future proofing a dairy business.
* Health Check
 |
| **Assessment** * Analyse future proofing strategies to ensure long-term viability of a business.
 |  | * Bringing it all together – read pgs. 77-84 of CCA.
* Get guest speakers in e.g., Department of Conservation, Waikato Regional Council, DairyNZ e.g., Matt Highway, Nicola McAffie.
* Class debate, pretend to be a different stakeholder, present views. Either: grower / govt / public / or: environment / economic / political / social.
* Visit a local dairy farm & discuss the future proofing issues they face. Questions to ask.
* What are some greenhouse gas emission issues that you are facing on your farm?
* Why is undertaking reducing dairy greenhouse gas emissions important?
* What reducing greenhouse gas emission strategies do you undertake on your farm to ensure your farm is a long-term viable business?
* What impact does greenhouse gas emission strategies have on your business?
* What would the possible impacts be on your farm if you did not implement greenhouse gas emission strategies?
* What effect would reducing greenhouse gas emissions have on your farm, have on other businesses, the community & New Zealand?
* What effect would NOT reducing greenhouse gas emissions have on your farm, have on other businesses, the community & New Zealand?
* Whose problem is dairy greenhouse gas emissions?
* Are there any agencies that help you to implement reducing greenhouse gas emissions strategies on farm?
* What do you need help with to improve your greenhouse gas emissions?
* For a new person to dairy farming, what would be the best strategy to implement and why?
 | * CCA.
 |
| **Assessment.** AS91869 Agribusiness 3.8 Analyse future proofing strategies to ensure long term viability of a business (4 credits) |