**ACTIVITY: Farming and environmental issues**

**Activity idea**

In this activity, students explore ethical issues related to farming and environmental pollution. Students learn about the science involved and the associated ethical dilemmas. They have opportunities to discuss and deliberate before making their own decision that they can justify.

By the end of this activity, students should be able to:

* explain some of the science involved in the issue
* explain some of the ethical aspects of the issue
* have some ideas about possible solutions.

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**Introduction**

In this activity, students explore ethical tensions related to farming and the environment. Stakeholders involved might include farmers, scientists, environmentalists, local councils and the public.

Often in ethics teaching, students are offered a question to explore and debate. In this activity, students are presented with a question to discuss but not necessarily debate. The question – Should there be laws to make farmers reduce nutrient run-off? – is used to help students explore possible tensions between farming and environmental pollution with a view to understanding the complexity of decision making. Students should appreciate that various views need to be taken into account when considering this issue. They should also appreciate that the views are complex – stakeholders don’t hold simplistic ‘for’ and ‘against’ views. For example, many farmers are concerned citizens, and sustainable farm practices that respect the environment are becoming more prevalent.

Students investigate links between farming and environmental pollution. They consider possible solutions and how these ideas might be viewed from various perspectives (for example, farmers, scientists, environmentalists, government). They also look at examples of farmers whose farm management respects the environment. Students may then role-play a discussion between stakeholders that reiterates the problems from the various perspectives. They may offer possible solutions for farmers.

**Background**

Farming has long been the backbone of New Zealand’s economy. From the mid 1800s to the late 1900s, government policy was one of support to farmers. Subsidies (such as for fertilisers), loan schemes, tax breaks and grants helped and encouraged farmers to improve and intensify their farms for increased production.

There is also no doubt that New Zealand has had enormous economic benefits from exporting farm products. In addition, large industries such as the dairy company Fonterra and manufacturing businesses, employing thousands of people, have developed to process raw materials and make new products such as innovative materials from wool (see the article [Wool innovations](https://www.sciencelearn.org.nz/resources/866-wool-innovations)).

The development of fertilisers greatly improved the quality of raw materials. They provided richer pastures resulting in more milk, better wool, higher-quality meat and healthier, more abundant crops. The addition of nutrients such as nitrogen and phosphorus to the soil enables the production of more food and farm products from the same sized piece of land – catering for the continued expansion of the human population.

However, in recent times, scientists have become aware of the harmful effects of too many nutrients in the environment, such as eutrophication, water pollution and greenhouse gas emissions. This has also been recognised by the New Zealand Government. Subsidies to farmers have been withdrawn. Government money is funding environmental research, and farmers are encouraged to farm responsibly to reduce nutrient run-off. Scientists are developing management practices and techniques to help with this and to restore an already damaged environment.

Scientists like [Dr Selai Letica](https://www.sciencelearn.org.nz/resources/971-dr-selai-letica), [Professor Richard McDowell](https://www.sciencelearn.org.nz/resources/972-professor-richard-mcdowell) and [Dr Ross Monaghan](https://www.sciencelearn.org.nz/resources/974-dr-ross-monaghan) feel there should be some “light” regulation(s) that require farmers to reduce nutrient run-off. Along with this, they advise that farmers should be encouraged to implement various management practices to protect the environment. These practices vary depending on the particular farm concerned, taking into account the type of farm (beef, dairy, sheep and so on), weather, temperatures, soil conditions, terrain, water bodies and so on.

Farmers, however, need to make a living. They have to balance the cost (including loss of possible income) of implementing some of these ideas against the long-term benefits to the farm and the environment.

In this activity, students explore some relevant science (nitrogen and phosphorus cycles) and how farmers use this knowledge to get the most out of their land (adding fertilisers and effluent). Students also investigate environmental problems such as eutrophication and water and air pollution and see how these can be connected to farming practices. In addition, students explore the latest research ideas scientists are suggesting to help farmers care for both their farms and the environment.

Students consider these ideas from various perspectives (such as farmers, scientists, environmentalists, government) and decide whether regulations should be made by the government to enforce management practices designed to reduce nutrient run-off on farms. The alternative is that farmers are left to decide for themselves whether they will implement them, and if so, which ones.

**The ethics question**

Should there be laws to make farmers reduce nutrient run-off?

**What you need**

* Access to the timeline [Farming and the environment](https://beta.sciencelearn.org.nz/resources/1575-farming-and-the-environment-timeline)
* String or chalk and agree/disagree cards for continuum line
* Copies of the articles [Farming development and changing landscapes](https://www.sciencelearn.org.nz/resources/963-farming-development-and-changing-landscapes), [Farming and environmental pollution](https://beta.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution), [Farm management practices](https://www.sciencelearn.org.nz/resources/969-farm-management-practices), [Fertiliser](https://www.sciencelearn.org.nz/resources/964-fertiliser), [The nitrogen cycle](https://www.sciencelearn.org.nz/resources/960-the-nitrogen-cycle), [The phosphorus cycle](https://www.sciencelearn.org.nz/resources/961-the-phosphorus-cycle), [Focusing on phosphorus](https://www.sciencelearn.org.nz/resources/925-focusing-on-phosphorus), [Inhibiting nitrification](https://www.sciencelearn.org.nz/resources/2364-inhibiting-nitrification), [Inhibiting nitrous oxide emissions](https://beta.sciencelearn.org.nz/resources/922-inhibiting-nitrous-oxide-emissions), [Denitrification beds – a creative approach](https://www.sciencelearn.org.nz/resources/924-denitrification-beds-a-creative-approach), [Keeping it clean](https://www.sciencelearn.org.nz/resources/715-keeping-it-clean), [Managing nutrients](https://www.sciencelearn.org.nz/resources/928-managing-nutrients), [The role of clover](https://www.sciencelearn.org.nz/resources/966-the-role-of-clover) and [Iwi and kaimoana](https://www.sciencelearn.org.nz/resources/1141-iwi-and-kaimoana)
* Access to the video clips [Fertilisers](http://www.sciencelearn.org.nz/Contexts/Soil-Farming-and-Science/Sci-Media/Video/Fertilisers), [Phosphorus](https://www.sciencelearn.org.nz/videos/496-phosphorus), [Nutrient leaching](https://www.sciencelearn.org.nz/videos/517-nutrient-leaching), [Reducing nitrous oxide](https://www.sciencelearn.org.nz/videos/516-reducing-nitrous-oxide), [Nitrification inhibitors](https://www.sciencelearn.org.nz/videos/490-nitrification-inhibitors) and [Managing the nutrient problem](https://www.sciencelearn.org.nz/videos/49-managing-the-nutrient-problem)
* Access to the interactive [The terrestrial nitrogen cycle](https://www.sciencelearn.org.nz/image_maps/14-the-terrestrial-nitrogen-cycle)
* Examples of farmers who are farming while respecting the environment such as award-winning farmers Mick and Karen Williams (see Stuff article [Nurturing land yields top results for couple](http://www.stuff.co.nz/business/farming/agribusiness/8623897/Nurturing-land-yields-top-results-for-couple)).

**What to do**

1. In pairs or as a class, students go through the timeline [Farming and the environment](https://www.sciencelearn.org.nz/resources/1575-farming-and-the-environment-timeline) to get a sense of farming development and related environmental issues over time. You may like to read the above [background notes](#Background) to the students.

***Warm-up activity***

1. Display the question: Should there be laws to make farmers reduce nutrient run-off? Set up a continuum line – you can use chalk or ribbon/string to make the line clear if necessary – and place one A4 card at each end. When students have thought carefully about the question, they should move to a position on the line that represents their view. For example, if they agree strongly, they should move to that end of the line and stand as close to the card as possible. If they disagree with the statement, they might position themselves a couple of metres away from the ‘strongly disagree’ card. If students are unsure or don’t know, they should stand in the middle. Make it clear to the students that there is no right or wrong answer, and they should make up their own minds. If appropriate, demonstrate by moving along the line and discussing different positions with the students, asking them to share their reasons for their place on the line:
* How did you make your decision?
* What personal experiences did you draw on to make your decision?
* What further information do you need to make your decision
* Whose perspective are you prioritising?

***Investigating the issue***

1. Divide the class into groups – one each of farmers, scientists, environmentalists, government and local councillors, community representatives, fishing enthusiasts and iwi. Students in their groups take on given roles to become ‘experts’ so they can view issues from their roles’ perspectives. Students consider their perspective as they research, read, listen and discuss the articles and anything else that they may find and consider relevant. All groups should read and discuss these articles and what this may mean for them in their role:
* [Farming development and changing landscapes](https://www.sciencelearn.org.nz/resources/963-farming-development-and-changing-landscapes)
* [Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution)
* [Farm management practices](https://www.sciencelearn.org.nz/resources/969-farm-management-practices)
1. All students need to understand the science and the issues in the question they are investigating. The following questions could form the basis of group discussions. These questions could be explored by each group as they work through related articles. Alternatively, the questions could be divided up between the groups with each group reporting back to class what they found out. The role for each group should determine students’ perspectives as they learn about the science involved, for example, As a farmer/scientist/fisherman etc., how do I feel about this? What does this mean for me?
* What are fertilisers and why do farmers use them? ([[Fertiliser](https://www.sciencelearn.org.nz/resources/964-fertiliser), [Fertilisers](http://www.sciencelearn.org.nz/Contexts/Soil-Farming-and-Science/Sci-Media/Video/Fertilisers)](http://www.sciencelearn.org.nz/Contexts/Soil-Farming-and-Science/Looking-Closer/Fertiliser))
* Why are nitrogen and phosphorus important? Why are they important to farmers? Can you explain the nitrogen and phosphorus cycles? ([The nitrogen cycle](https://www.sciencelearn.org.nz/resources/960-the-nitrogen-cycle), [The phosphorus cycle](https://www.sciencelearn.org.nz/resources/961-the-phosphorus-cycle), [Focusing on phosphorus](https://www.sciencelearn.org.nz/resources/925-focusing-on-phosphorus), [Phosphorus](https://www.sciencelearn.org.nz/videos/496-phosphorus), [The terrestrial nitrogen cycle](https://www.sciencelearn.org.nz/image_maps/14-the-terrestrial-nitrogen-cycle))
* How has farming changed over the last 100 years? What has been the main development? ([Farming development and changing landscapes](https://www.sciencelearn.org.nz/resources/963-farming-development-and-changing-landscapes), [Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution), [Farming and the environment](https://www.sciencelearn.org.nz/resources/1575-farming-and-the-environment-timeline))
* What is eutrophication? How does this happen? ([Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution), [Water and nutrient leaching](https://www.sciencelearn.org.nz/resources/982-water-and-nutrient-leaching))
* How does groundwater get contaminated and become toxic? ([Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution), [Water and nutrient leaching](https://www.sciencelearn.org.nz/resources/982-water-and-nutrient-leaching))
* What are greenhouse gases? Why are they considered air pollution and how does farming contribute to these gases? ([Farming and environmental pollution](https://www.sciencelearn.org.nz/resources/920-farming-and-environmental-pollution), [Reducing nitrous oxide](https://www.sciencelearn.org.nz/videos/516-reducing-nitrous-oxide))
* How do nitrogen inhibitors work? ([Inhibiting nitrification](https://www.sciencelearn.org.nz/resources/2364-inhibiting-nitrification), [Inhibiting nitrous oxide emissions](https://beta.sciencelearn.org.nz/resources/922-inhibiting-nitrous-oxide-emissions), [Nitrification inhibitors](https://www.sciencelearn.org.nz/videos/490-nitrification-inhibitors), [Reducing nitrous oxide](https://www.sciencelearn.org.nz/videos/516-reducing-nitrous-oxide))
* How do denitrification beds work? ([Denitrification beds – a creative approach](https://www.sciencelearn.org.nz/resources/924-denitrification-beds-a-creative-approach), [Keeping it clean](https://www.sciencelearn.org.nz/resources/715-keeping-it-clean))
* What are some of the farm management practices suggested by scientists, and how do they reduce nutrient run-off? ([Managing nutrients](https://www.sciencelearn.org.nz/resources/928-managing-nutrients), [Farm management practices](https://www.sciencelearn.org.nz/resources/969-farm-management-practices), [Managing the nutrient problem](https://www.sciencelearn.org.nz/videos/49-managing-the-nutrient-problem))
* How is clover helpful to farmers? ([The role of clover](https://www.sciencelearn.org.nz/resources/966-the-role-of-clover))
1. These questions could be discussed in stakeholder groups. All stakeholders should have a good understanding of the all issues involved so groups could report back to class.

**Government and local councillors**

* After exploring the timeline [Farming and the environment](https://www.sciencelearn.org.nz/resources/1575-farming-and-the-environment-timeline), what do you think the government has felt about farming in New Zealand over time? Did you notice any changes? If so, what were they, and why did they take place? (Support for farming was shown by subsidies, incentive schemes etc. As awareness of environmental issues increases, subsidies are removed, landowners made responsible for impacts of their activities, regulations implemented by local councils to tighten water and soil management.)

**Farmers**

* What are some of the problems farmers might face implementing management practices suggested by scientists? (For example, initial and on-going costs, loss of income, time to set them up, not understanding the environmental problem, not understanding how the management practice will help, fencing off water means having to set up alternative water sources, inhibitors may not work because of differences in temperature and rainfall etc.)
* What might some of the benefits for farmers be in implementing some of these practices? (Healthy water, clear streams and rivers, improved pasture – due to less pugging and compacting by stock (using stand-off pads), long-term benefits for future generations in helping reduce greenhouse emissions and slowing global warming.)

**Scientists**

* Scientists have worked out some ways to stop nutrient run-off from farms. How might they introduce these ideas to farmers? (Educating farmers, educating government bodies, articles and science papers, news items etc.)
* How might local governing bodies (e.g. district or regional councils) encourage farmers to put some of these ideas in place? (Regulations, incentives, education.)

**Environmentalists**

* Environmentalists are concerned about New Zealand’s environment. What might their stand be towards farming in New Zealand? (For example, there has been some contentious targeting of dairy farms, with the term ‘dirty dairying’ bandied about. Search ‘dirty dairying’ and ‘farming and environmentalists in NZ’ to get some opinions.)

**Iwi**

* Nutrient leaching can lead to eutrophication and water pollution. How might this impact on iwi who live near rivers and waterways? ([Iwi and kaimoana](https://www.sciencelearn.org.nz/resources/1141-iwi-and-kaimoana))

**Community representatives and fishermen**

* How might environmental pollution impact on the community as a whole, including recreational fishermen?
1. As a class or in groups, explore some examples of farmers who are farming responsibly – respecting the environment, for example, award-winning farmers Mick and Karen Williams ([Nurturing land yields top results for couple](http://www.stuff.co.nz/business/farming/agribusiness/8623897/Nurturing-land-yields-top-results-for-couple)).

***Discussing the ethics***

1. Students could use a [noisy round robin activity](#Noisy) to identify consequences for stakeholders.
2. Discuss the results as a class:
* Are some consequences greater or lesser than others?
* If one is harmed and another benefits, how do you decide who or what matters most?
* Which groups have rights associated with this issue? What are their rights?
* Which groups have responsibility to ensure that the rights are achieved?
* Do we value some rights more than others? Whose rights do we want to protect?
* Do any codes, declarations and/or conventions relate to this issue? (Resource Management Act 1991.)
1. Value could be added by each group taking their final sheet of paper and placing the consequences in order of most important to least important. You can record the top 2–4 of each group’s list. A report could be made as a written document, a poster or an advertisement etc.

***Role-play***

1. Stakeholders – scientists, farmers, environmentalists, local councillors/government, community representatives, fishing enthusiasts and iwi – convene for a discussion concerning the question: Should there be laws to make farmers reduce nutrient run-off?
2. Each stakeholder should state and justify their viewpoint. They may then be challenged or questioned by others. Encourage students to stay in role and not to give their personal view. The role-play could be done instead of a debate because of the complexities involved in decision-making (see [introduction](#Introduction)). Students may come to a common agreement concerning possible solutions.

***Final continuum***

1. Repeat the values continuum from the warm-up activity.
2. Discuss the following;
* Have you changed your place in line?
* Why? Why not?
* How did you make your decision?
* Did you draw on personal experience? New information?
* Do you feel you need more information to make a decision?

***Transactional writing***

1. As a formative or summative assessment activity, students could express their argument through transactional writing. Discuss how to plan the essay:
* Introduction (state the issue – check students are clear about the issue).
* Explain the issue.
* Explain your argument.
* Give reasons (scientific evidence to support your argument).
* Use powerful words (e.g., therefore, in addition to, furthermore, equally important, there is evidence, in conclusion).
* Sum up ideas (conclusion).
* Decide on number of paragraphs and what each of them will be about (e.g. P.1 Introduce issue and give background, P.2 and 3 present your own view and give reasons to support your view (possibly add another paragraph to show what other people think and why) and P.4 (or 5) sum up the ideas.
1. Give students time to plan their writing and to make notes on what they plan to write for each paragraph (they could mind-map it). These could be shared with the class to help others who might be struggling. Give students an adequate amount of time for the writing.

**Noisy round robin and PMI: Reducing nutrient run-off through regulation**

**Main idea**: To generate a great number of ideas in groups of 3–5 people.

1. Divide the class into small groups (3–5 people). Depending on the number of groups, have large [PMI worksheets](#pmi), each with a different stakeholder group that may be affected (harmed or benefited) by the regulation of practices to minimise nutrient run-off:
* **What effect might regulations forcing farmers to reduce nutrient run-off have on me?**
* **What effect might it have on farmers?**
* **What effect might it have on the scientists?**
* **What effect might it have on iwi?**
* **What effect might it have on environmentalists?**
* **What effect might it have on fishing enthusiasts?**
* **What effect might it have on the government and local councils?**
* **What effect might it have on community representatives?**
1. When you say ‘farming’ (or some other word that gives the signal to change and write), the students have 2–3 minutes to think of an idea or two (through discussion – hence *noisy* round robin). A writer for the group records the idea(s) on the sheet. When you call ‘farming’ again, the groups move to the next piece of paper (the paper stays at each station). The students are timed again and required to generate and write down their ideas. Because ideas cannot be repeated, students cannot write what is already there.

**PMI worksheet**

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| I am a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Establishing laws to reduce nutrient loss from farms will affect me by: |
| **Benefits (Plus)** | **Harm (Minus)** |
| **An interesting thought or idea** |