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Level 3 Agricultural and Horticultural Science, 2018

91532 Analyse a New Zealand primary production environmental issue

2.00 p.m. Tuesday 27 November 2018
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Analyse a New Zealand primary production environmental issue.	Critically analyse a New Zealand primary production environmental issue.	Comprehensively analyse a New Zealand primary production environmental issue.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL parts of the task in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Excellence

TOTAL

08

ASSESSOR'S USE ONLY

INSTRUCTIONS

This assessment consists of ONE task, in TWO parts, which requires you to discuss the impact of the production of a specified agricultural or horticultural product on freshwater. Your answer should include the management practices that a producer of the selected product could implement to mitigate any negative impacts on freshwater.

Name of your selected agricultural/horticultural product: Milk solid

RESOURCE A

Fixing freshwater issues is an "enormous challenge"

A report by New Zealand's top scientist has urged politicians to address freshwater issues, which he says are clearly linked to intensive farming and urbanisation. Professor Sir Peter Gluckman, Chief Science Advisor to the Prime Minister, has released a report analysing the health of New Zealand's freshwater based on existing science and data. It found clear evidence the freshwater estate was under pressure in terms of both water quality and quantity. There was a link between farming and declining water quality in pastoral areas, and contamination of urban waterways by expanding cities.

"New ways of utilising our land for economic gain that also have lower environmental footprints need to be found and adopted if we are to meet the vision New Zealanders have for their freshwaters," said Gluckman.



Text source (adapted): <http://www.stuff.co.nz/environment/91418638/Top-scientist-Fixing-freshwater-issues-an-enormous-challenge>.

Image source: <https://pxhere.com/en/photo/1026654>.

PART A

Explain the negative social and environmental impacts on New Zealand's freshwater that might result from producing your selected product.

The goal of all dairy farmers is to keep costs of production to a minimal, and increase production in order to make profit. Because of this mindset we have seen negative social and environmental impacts of on New Zealand's freshwater, that have ~~resulted~~ resulted from producing milk solid. ~~some~~ Dairy farming is an intensive production system, which sometimes sees hundreds of cows packed into small paddocks in order to increase production and profits. With the rise of intensive farming in New Zealand (we have seen a 200% increase in fertilizer used over the last 10 years), and the technological advances in irrigation (which contributed \$5.4 billion to the NZ economy in 2017 according to the NZ Institute of Economic Research) the stocking numbers in New Zealand have increased. This has also caused the concentration of nutrients lost to ~~the~~ freshwater systems to increase. Nitrogen is a nutrient which is found in the urine of cows. ~~Urine~~ Urine has an extremely high ^{level} ~~concentration~~ of Nitrogen, with 800-1000 Kg/N/ha, compared to a common nitrogen based fertilizer called urea (46% nitrogen) which only has a ^{level} ~~concentration~~ of 50-100 Kg/N/ha. Research has shown that 69% of all nitrogen lost from farming systems comes from cows urine. The main ^{size of} issue with this is that intensive dairy farming decreases the ^{size of} urine patches of cows because they are so tightly compact in high stocking rates, which means that more nitrogen is leaching through the soil and into rivers and streams. Once the nitrogen has leached through the soil and into

More space for this answer
is available on the next page.

waterways, it increases the toxicity levels in the water. Sensitive micro invertebrate species cannot live in these conditions, so they either find a new habitat or are killed. This decreases the amount of food available for our native marine life (fish), which leads to the fish finding somewhere else to live or dying from lack of food. Nitrogen is a nutrient which is found in most fertilizers because it promotes the growth of plants, which leads to increased profits for farmers. When farmers use too much fertilizer on their land, the excess nitrogen which the soil cannot absorb is also leached through the soil and into rivers and streams. This promotes the growth of potentially toxic ~~algae~~ algae blooms, which has several negative effects on the environment. Firstly, algae decreases the oxygen levels in the water because it requires oxygen to grow and decompose. This kills our native fish and invertebrate species because they cannot survive on such low oxygen levels. Algae also limits the amount of sunlight which reaches the plant life at the bottom of rivers, which inhibits their growth ~~of~~ (sunlight is ~~required~~ required for photosynthesis), reducing the amount of food for marine species life. Phosphorus is a nutrient which is mostly found in the dung of cows. Studies have shown that 30% of the phosphorus consumed by cows in their food eventually leaves the farm and enters our waterways. Because phosphorus attaches to soil particles, we find that it enters rivers and streams more prominently through the process of surface run off rather than leaching. In times of heavy rainfall and flooding the sediment ~~on~~ ^(containing phosphorus) on the surface is washed into waterways, promoting the growth of algae. Aside from the negative environmental issues which this causes (discussed earlier), there are also negative ^{social} impacts ~~are~~ caused by nutrients ~~in~~ in waterways. Firstly, a negative social impact on farmers is that they receive a bad name in society, because the media makes it seem as if the pollution in the rivers is solely caused by dairy farmers. This is not always the case, ^{Agricultural and Horticultural Science 91532, 2018} although dairy farming has certainly

* Another social impact is that the ⁵ polluted rivers caused by nitrogen and phosphorus are seen as less attractive, affecting the recreational uses of rivers. Less fish in the water means that less fishermen use the river, and the number of people who use the river for swimming will decrease because of this it is less attractive. This could mean that towns and cities ~~surrounding~~ ~~nearby~~ which are close to the rivers could see a decrease in tourism, leading to local businesses suffering the consequences.

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part B continued

The second course of action which the farmer could implement is riparian planting. Riparian planting consists of planting a variety of deep rooted plants next to the waterway, in order to absorb any nutrients which have left the farm. Riparian planting has been proven to be 10-30% successful at absorbing nitrogen and phosphorus on flat land, and 100% successful at reducing nutrient loss on land which is not flat. This is because nutrients are more difficult for plants to absorb when they have gained speed and more force on steep land. Riparian planting acts as a final barrier between the river and nutrients, which will stop the negative effects that nitrogen and phosphorus have on the environment/water quality. The head home is the course of action which is more viable towards the pledge to make all New Zealand rivers swimmable in the future. This is because it is more successful at reducing the nutrient loss to the rivers and streams than riparian planting. The riparian planting course of action is only 10-30% successful at reducing nutrient loss on flat land, and only 10% successful on steep land. The head home on the other hand almost ~~entirely~~ reduces nutrient loss into waterways, almost reducing losses back to the farm's natural level. This means that the head home will prevent nitrogen from leeching through the soil and into waterways, and will prevent phosphorus from entering the water, through the process of surface runoff. This means that in the future there will be less death of marine life ^{and} less pollution in rivers through the head home course of action compared to the riparian planting, allowing more rivers to be swimmable in the future. To conclude, a farmer from Woodville, a town just north of Palmerston North, called Tony Kruger found his production increased by 20% by using a head home. Riparian planting has no economic benefit to the farmer. However Tony Kruger finds that his stock choose to enter the head home because it is more comfortable. This keeps environmentalists and animal groups like the S.P.C.A happy. contributed to the pollution in waterways.

Continues above.

RESOURCE B

ASSESSOR'S
USE ONLY**Farming leaders pledge to make all New Zealand rivers swimmable**

Farming leaders representing 80 per cent of the industry have pledged to make all New Zealand rivers swimmable. Confessing that not all rivers were in the condition they wanted them to be, and that farming had not always been right, the group said the vow was "simply the right thing to do".



Image: Michael Spaans, Bruce Wills, Federated Farmers president Katie Milne, Mike Petersen, Carolyn Mortland (Fonterra), John Loughlin, and James Parsons at the Ngaruroro River in Hawke's Bay.

Text source (adapted): <https://www.stuff.co.nz/business/farming/96026220/farming-leaders-pledge-to-make-all-nz-rivers-swimmable>.

Image source: <http://www.shersonwillis.com/wp-content/uploads/2017/08/Farming-leaders-have-pledged-to-help-make-New-Zealand%E2%80%99s-rivers-swimmable-for-future-generations.jpg>.

PART B

Evaluate at least TWO courses of action that a primary producer of your selected product could implement to minimise negative effects on water quality, and justify which course of action you believe would be the most viable towards the pledge to make all New Zealand rivers swimmable.

In your answer:

- discuss the conflicts or challenges that may currently exist between increasing production and the commitment to make all New Zealand rivers swimmable in the future (*Note: conflicts or challenges could be economic, cultural, social, technological, or environmental*)
- use data and evidence to support your claim.

A conflict which is currently occurring in New Zealand is between ^{dairy farmers} who are increasing production of milk solids, and those who want to make all New Zealand rivers swimmable in the future. The issue is that increasing production of milk solids will lead to an increase in nutrients.

which enter out waterways, which means that there are less rivers which are able to be used for swimming. From the perspective of most dairy farmers, they want to increase production in order to benefit economically. However, this will have negative social and cultural effects which must be addressed. New Zealand waterways have many recreational uses including fishing, boating, and swimming. Increased levels of nitrogen and phosphorus will cause rivers to experience algal growth in algae, which kills fish and pollutes the water. In some cases the nutrient levels are so extreme that the rivers are deemed un-swimmable. The Māori perspective is also important in this situation, because they believe that everyone should be able to experience the benefits of water in New Zealand. The killing of marine life and pollution of rivers and streams is not a sustainable plan for the future, so they too want to see change in the way that dairying is conducted. Perhaps the best way to resolve this conflict is by making dairy farms introduce management practices which will reduce the negative impact that they have on the water quality in New Zealand.

The first course of action which would reduce the negative impacts on water quality is by farms introducing herd huts. A herd hut is a structure with a roof, concrete floor, gaps in the floor, and sometimes walls. The herd huts are designed to store all effluent which the cows produce in bunkers below the structure. Depending on the location, cows are sometimes kept in the herd hut 24/7, and are fed either grain or silage which is inside. This ensures that all effluent makes its way through the gaps in the floor and into the storage bunkers. This means that no nitrogen from the urine, or phosphorus from the dung makes its way into rivers and streams.

Extra space if required.
Write the question number(s) if applicable.

ASSESSOR'S
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QUESTION
NUMBER

The ~~farmer~~ farmer only has to empty the bunkers ~~one~~ once or twice a year. This course of action is extremely sustainable because the farmer can use the effluent as fertilizer, which saves costs on the fertilizer usage. The effluent is left in the bunkers for 3-4 months to dry out, and is then put straight into a spreader and spread across the land, increasing pasture growth. Because the effluent has been left to dry for 3-4 months, the soil can absorb the nutrients as they are released, because dry effluent releases its nutrients at a slow rate. This means that leeching of nutrients and surface runoff are minimised, almost to the farm's natural level of nutrient loss. Because all stock is kept in one place the farmer can easily identify and treat sick or injured animals. The herd house is kept at a temperature of between $-5 - 15^{\circ}$ Celsius, which is the optimum temperature for milk production and cow comfort. This increases the quality and quantity of milk produced, because cows are less stressed and do not need to expend energy keeping warm or cold. Continued on pg 5

NZ institute of economic research estimate \$5.4 billion in 2017

Nitrogen 69% urea (46%)

urine 800-1000 kg/N/ha urea 50-100 kg/N/ha

Phosphorus 30% of consumed by cows is lost.

John Kruger from Woodville, north of PN let his cows out at 9, sees first batch at 10:30, next by 12:30. He saw a 20% increase in production because cows don't need to worry about heating or cooling, and they are less stressed.

Excellence Exemplar 2018

Subject	Level 3 Agricultural and Horticultural Science		Standard	91532	Total score	08
Q	Grade score	Annotation				
1	E8	<p>The candidate provided evidence on how the process of production had negative social and environmental impacts around fresh water. They were able to provide evidence with accurate figures that were able to be sourced. They could justify the impacts in the example of their production process.</p> <p>There were in-depth discussions around the conflicts between producers and the community around keeping fresh water safe to drink and how it affected them with regards to production. There were TWO valid courses of action that were given and both were justified and evaluated, with strengths and weaknesses in both. A course of action was recommended and justified.</p>				