Activity Overview

Most of New Zealand's land is either forest or the rural environment with approximately 2-3% in urban land use. So decisions that are made within the rural and forest environments have a big impact on the environmental, economic and social outcomes of New Zealand. There is high need for good decision makers that are able to make informed decisions.

The purpose of this exercise is to get students to be the decision makers and to use the information that they gather from the cards. Some cards have decision making points (in yellow); good decisions have positive points, better decisions are worth more points, poor decisions have negative points and sometimes all options are either negative or positive outcomes and it is about which option is the best one. To make good decisions we often connect with other specialists within the field to gather information and use a range of soft and hard data.

Instructions

- Each group of 3-4 students will need their own set of cards to play though.
- On the back of every card in that set, write the set number and the card number. The cards are on the desk blank side up so students don't see any information until they choose the card.
- Get one person in each group to be the 'runner' and they need to remember which pile/ set of cards is theirs. It is easier to administer if they all ask you for their cards saying = Set X: Card X.
- Hand out the **blank score card** so they can record the information and the **blank careers card** that only has the descriptions and not the titles. They will keep all the cards they gather as students often like to refer back to the information or see/ compare options after the game. However after playing a number of students have expressed they would like to play again, so you may not want to hand out the different option cards. Another round is also a good way to show that experienced advisors are often valued and paid more.
- Hand out the introduction card. From then on you just need to keep handing out the cards they request. Some cards have decisions, some hold information. Most groups tend to progress well and discuss the different options.
- The team with the **most points (including 2 points per correct career title and top wine label design)** has the most successful wine and environmental/ economic and social outcomes.
- **Optional extra:** If students can use scientific reasoning or logic to argue that a negative consequence would not occur or a way to avoid it, then you can choose to negate negative points.

Expansion/ Discussion: this activity was based on no financial constraints. As a class or in groups go through the cards and list the things that cost money and assign a number of $$$ signs (eg: cheap ($), medium expense ($$), expensive ($$$), very expansive ($$$$)). You could then allocate a number of $$$ signs they can spend and get them to decided where they would invest the $ and why.

Soils

- Each correctly matched career title and description earns an extra soil health point.

Career Title	Description	Career Title	Description
agricultural contractor	has the specialist machinery (tractors, ploughs, fertiliser trucks etc) to carry out on-farm tasks.	soil lab technicians	use specialist lab equipment to analysis soil and provide information to help inform decision making.
soil surveyors	that take numerous samples across New Zealand to provide the data to build soil maps. They can also work as consultants if someone wants an in-depth report of a specific location.	geotechnical engineers	to assess risks and hazards associated with land for building projects or earthworks.
soils advisor	Consults with clients about what they want to achieve and provides site specific recommendations using science and industry knowledge.	Seed and fertiliser advisor	Provides site specific recommendations using science and industry knowledge, with a specialisation in fertilisers including mapping and modelling nutrient plans for consent compliance.
irrigation field technician	Services irrigation equipment and other related infrastructure to prevent leaks, soil damage, and to ensure the proper application of water.	irrigation consultant	Designs irrigation systems and project manage the installation. They organise the equipment, materials and people needed to complete the project on time.
GIS specialists	handle the data so it can be presented visually online, and they can also provide technical analysis and reports.	resource consents officer	works for the Regional Council. They monitor resource consents and process consent applications. They also conduct site visits, discuss minimum requirements and best practice.
soil scientist	Research, model and experiment to discover solutions to modern problems.	Agricultural Consultant	Agricultural/horticultural consultants advise farmers, growers and organisations on business, production and land management solutions.

Scorecard: Answers

Tick the properties and information that you find out along the way to determine what is the best land use.

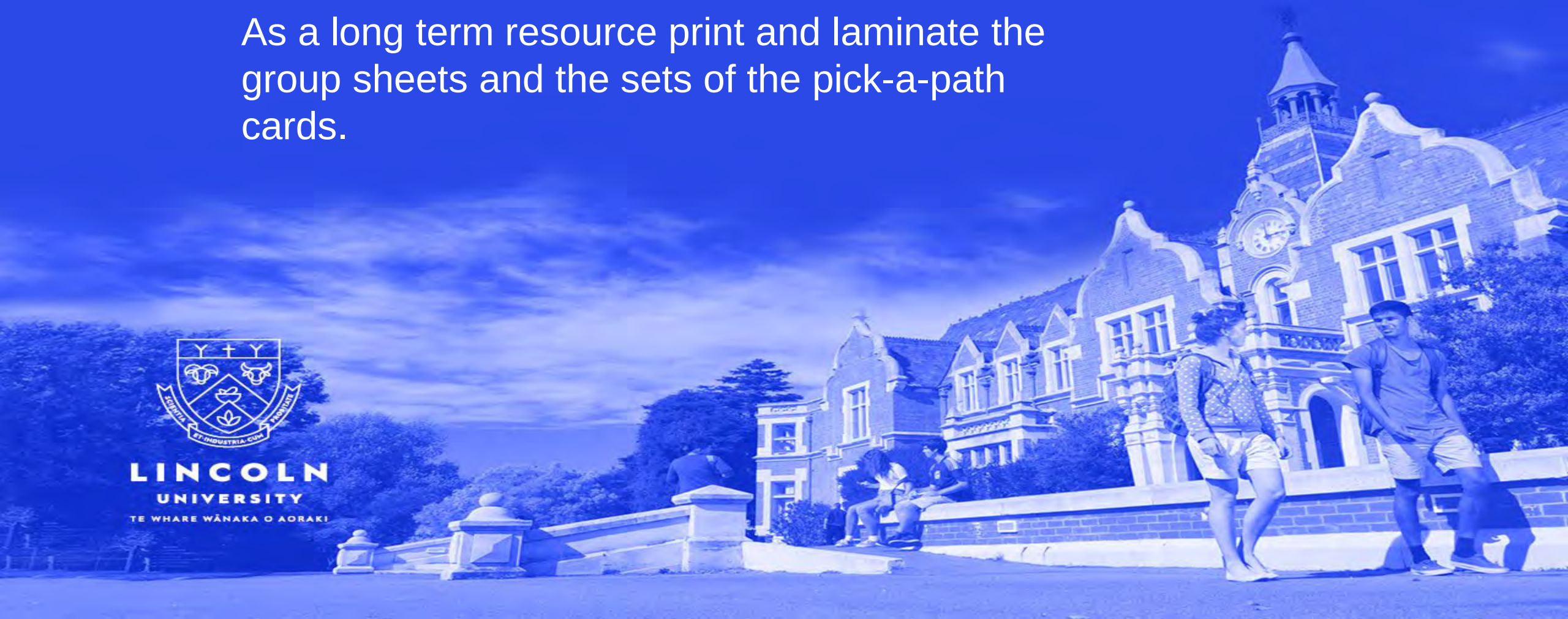
Final Recommendation	Soil Health Score
Pasture grazing or orchard	

	Land Use				
Soil Information	Pine Trees	Pasture Grazing	Vegetable Growing	Orchard	Cropping
pH	5 - 5.5	5.8 – 6.2	6 - 7	6 – 6.5	5.8 – 6
Lime requirements	Low	Medium	High	Medium	Medium
Soil drainage	Well drained	Poor – Well drained	Well drained	Medium – Well drained	Medium – Well drained
Organic matter	Low	High	Low	High	Medium
Soil organisms	High – in the litter layer	High	Low	High	Medium
Fertiliser needs	Low	Medium	High	Medium	Medium - High

Card Number															
Soil Health Tracker															

Group sheets: to be printed and written on. Recommend groups of 2-3.

As a long term resource print and laminate the group sheets and the sets of the pick-a-path cards.



Scorecard: Answers

Tick the properties and information that you find out along the way to determine what is the best land use.

Final Recommendation

Soil Health Score

Card Number	1														
Soil Health Tracker	0														

	Land Use				
Soil Information	Pine Trees	Pasture Grazing	Vegetable Growing	Orchard	Cropping
pH	5 - 5.5	5.8 – 6.2	6 - 7	6 – 6.5	5.8 – 6
Lime requirements	Low	Medium	High	Medium	Medium
Soil drainage	Well drained	Poor – Well drained	Well drained	Medium – Well drained	Medium – Well drained
Organic matter	Low	High	Low	High	Medium
Soil organisms	High – in the litter layer	High	Low	High	Medium
Fertiliser needs	Low	Medium	High	Medium	Medium - High

Careers Card

- Each correctly matched career title and description earns an extra soil health point.

Career Title	Description	Career Title	Description
	has the specialist machinery (tractors, ploughs, fertiliser trucks etc) to carry out on-farm tasks.		use specialist lab equipment to analysis soil and provide information to help inform decision making.
	that take numerous samples across New Zealand to provide the data to build soil maps. They can also work as consultants if someone wants an in-depth report of a specific location.		to assess risks and hazards associated with land for building projects or earthworks.
	Consults with clients about what they want to achieve and provides site specific recommendations using science and industry knowledge.		Provides site specific recommendations using science and industry knowledge, with a specialisation in fertilisers including mapping and modelling nutrient plans for consent compliance.
	Services irrigation equipment and other related infrastructure to prevent leaks, soil damage, and to ensure the proper application of water.		Designs irrigation systems and project manage the installation. They organise the equipment, materials and people needed to complete the project on time.
	handle the data so it can be presented visually online, and they can also provide technical analysis and reports.		works for the Regional Council. They monitor resource consents and process consent applications. They also conduct site visits, discuss minimum requirements and best practice.
	Research, model and experiment to discover solutions to modern problems.		Agricultural/horticultural consultants advise farmers, growers and organisations on business, production and land management solutions.

Determine Land Use Pick-a-Path

Created by Faculty of Agriculture and Life Sciences 2024/2025 – Lauren Roberts

Introduction

You are a farming cooperative (a business model which is owned and run jointly by its members, who share the profits or benefits), who owns a high country station (who's name you need to decide on).

You know soil is a key part to making decisions and creating a successful operation. Make decisions, see who you consult with along the way and get information to figure out the best option.

As you make decisions your **soil health score** will either decrease or increase. Keep track of your soil health and **record the careers** you come across along your journey.

Circle the information on the table as you find out information about your soil to determine what is a good land use option.

Go collect Card 1.

Remember to ask = set number: card number

You have just taken over the property in January (Summer) and it is looking overgrown and untidy.

Do you want to top (mow) the pasture, or would you like to identify some of the weeds in the paddock?

If you choose:

Top/ mow the paddock	Go to 2
Identify the plant species	Go to 3

1

The grass being mowed is great for improving animal feed as it takes the grass from the reproductive phase where it is tough and fibrous (horses won't eat it), back to the growth phase where it is soft and nutritious feed.

Clumps of grass in autumn are prone to providing an environment where a fungus spore (facial eczema) likes to grow and if exposed to it in large amounts the spores can cause damage to livestock livers – except for horses which are unaffected.

Your grass has a better feed-value, and **you have added organic matter to the soil**. But you still don't know much about your soil and what is the best land use.

Do you want to take a soil sample to send through to the lab or look up the soils map online?

+1

If you choose:

To take a soil sample	Go to 5
To look up the online soils map	Go to 6

2

Black nightshade grows in soils with low Calcium and Phosphorus but with high Potassium and Magnesium.

The plant often indicates that the soil has the **anaerobic** types of bacteria, meaning they operate in an environment lacking adequate oxygen. Beneficial microbes have difficulty functioning in this soil.

It may indicate that the **soil has low organic matter and is compacted**.

You decide to hire a contractor as you are looking at investing money in cultivating the paddock to remedy the compaction.

+2

Go to 4

3

You decide to talk to an agricultural contractor who has the specialist machinery (tractors, ploughs, fertiliser trucks etc) to physically improve the soil.

They recommend that you should get some soil samples done before work takes place in case other additives or work needs to be done at the same time.

Do you want to take a soil sample to send through to the lab or look up the soils map online?

+2

If you choose:

To take a soil sample	Go to 5
To look up the online soils map	Go to 6

4

It would have been wise to consult the soils map as you would have seen that there are 3 different types of soil on your land. The New Zealand Soils Map has been created by soil surveyors that take numerous samples across New Zealand to provide the data to build soil maps. They can also work as consultants if someone wants an in-depth report of a specific location.

These maps and reports are used by geotechnical engineers to assess risks and hazards associated with land for building projects or earthworks.

GIS specialists handle the data so it can be presented visually online, and they can also provide technical analysis and reports.

-1

Go to 7

5

The New Zealand Soils Map has been created by soil surveyors that take numerous samples across New Zealand to provide the data to build soil maps. They can also work as consultants if someone wants an in-depth report of a specific location.

These maps and reports are used by geotechnical engineers to assess risks and hazards associated with land for building projects or earthworks.

GIS specialists handle the data so it can be presented visually online, and they can also provide technical analysis and reports.

You realised that on your property there are **3 different soil types**. So, you will need to get three soil samples sent to the lab.

+2

Go to 8

6

A sample requires 20 soil cores to be taken and then placed into the same bag and sent to the labs.

A sample costs $68 for the basic soil analysis. Soil lab technicians use specialist lab equipment to provide accurate results. Your result comes back as a pH of 5.5, so it is slightly acidic.

Would you like to pay an extra $53 for the mineral nitrogen test?

A soil auger tool for taking cores.

+1

If you choose:

You want the mineral nitrogen test	Go to 9
You don't pay for the mineral nitrogen test	Go to 11

7

A soil auger tool for taking cores.

Each sample requires 20 soil cores to be taken and then placed into the same bag and sent to the labs.

Each sample costs $68 for the basic soil analysis. You require 3 samples so it will cost $204. Soil lab technicians use specialist lab equipment to provide accurate results.

Would you like to pay extra for the mineral nitrogen test? It cost $53/test and you would need 3 so it is an extra $189, making a total testing cost of $393.

+1

If you choose:

You want the mineral nitrogen test	Go to 9
You don't pay for the mineral nitrogen test	Go to 10

8

Mineral nitrogen is what is stored in organic matter and released via micro-organisms. This means it is slowly released and gives plants the time to absorb it and use it for their growth.

The test result comes back and there is low amounts of Mineral Nitrogen, it may be worth thinking about improving the amount of Nitrogen present and available on your land.

+2

Go to 11

9

Your soil results come in… Soil pH indicates the relative acidity or alkalinity of a soil, and significantly influences various soil functions, soil quality and fertility.

Soil 1	Soil 2	Soil 3
5.9	5.5	5.6

2/3 of your soil is slightly acidic so and decide to apply lime to 2/3 of the property to increase the pH level of the soil. By applying the lime where it is needed you have saved money and resources.

+2

Go to 11

10

You consult a soils advisor, and they recommend that you apply lime in autumn during still (no wind) conditions. It takes 4-6 months for it to take affect so liming in mid to late fall will prepare the soil for the spring growing season. For it to take its full effect will be between 12-18 months. They also give you a good lead on differences in lime products and price.

Increasing the pH allows more minerals and nutrients to be accessible to plants. By applying lime, you increase the pH of the soil up to 6 across the whole farm.

Go to 12

You want to increase the fertility of the soil since it is low. Do you want to…

- plant a winter crop (oats and peas) that can provide organic matter and nitrogen. The nitrogen is sourced from the peas (legume).
- apply soluble (dissolvable in water) nitrogen which is easily broken down
- apply slow-release nitrogen which slowly dissolves over 6-8 weeks

If you choose:

Soluble nitrogen	Go to 13	Winter crop	Go to 15
Slow-release nitrogen	Go to 14		

12

"It's too cold!"

You discuss it with your seed and fertiliser advisor, and they advise against it.

Most of the nitrogen will not be used by the plants as it is winter, and the plants are not growing or their growth is very slow, so they won't absorb it because they don't need it.

Instead, the nitrogen leaches through the soil and into the water which is bad for the waterways. So, it would be a waste of money and damage the environment.

They advise to use a winter crop.

-4

Go to 15

13

"It's too cold, I'm staying asleep"

You discuss it with your seed and fertiliser advisor, and they advise against it.

Most of the nitrogen will not be used by the plants as it is winter, and the plants are not growing or their growth is very slow, so they won't absorb it because they don't need it. Because it is slow release there is more time for the plants to use the nitrogen, but they still won't use a lot of it because its winter.

Instead, the nitrogen leaches through the soil and into the water which is bad for the waterways. So, it would be a waste of money and damage the environment.

They advise to use a winter crop.

-2

Go to 15

14

After having a discussion with an Agricultural Consultant, you decide against planting pines. You find out that pines take 25 years to grow before they are harvested. There are also running costs as there is some regular work that needs to be done over that time. This set up isn't of interest to you at this time.

After consulting your seed and fertiliser advisor, the soil is cultivated (broken up) before planting the crop. This will help remedy compaction and improve drainage from poor to medium.

Oats and peas are fast growing and can grow in cold conditions, so weeds are suppressed. The roots from the plants hold onto the soil and prevent it being swept away from the winter rainfall.

The oats provide a frame for the peas to grow up and add carbon into the soil. The peas are a source of nitrogen.

+4

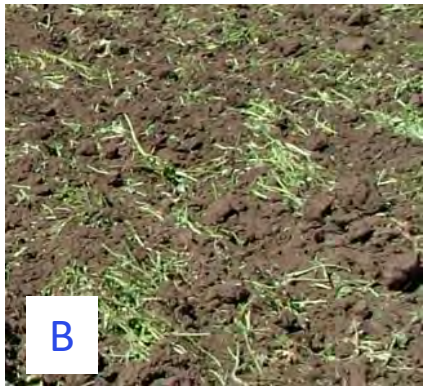
Go to 16

15

The soil microbial populations have also benefited from the crop and are now high.

You will be replacing the crop with fresh pasture in early spring. What would you like to do with the crop…

- Cut the crop and leave it to slowly decompose on the surface. (A)
- Cut and mulch (mix) it into the soil. (B)
- Graze the crop with animals like sheep or cows. (C)
- Or cut it then put it into bails so it can be used to feed animals latter or sold. (D)



If you choose:

Option A	Go to 17	Option B	Go to 19
Option C	Go to 18	Option D	Go to 20

16

Cutting and leaving the crop to decompose on top of the soil, means the soil is protected from wind and rain. There is also less contact of cut material with the soil, so it will take longer for the soil microbes to break it down.

The increase in organic matter in the soil results in more available nitrogen and less nitrogen leached. You now have soil high in organic matter.

Organic material and nitrogen will be added to soil as it slowly breaks down. However, it does tend to form a dense mat which can make resowing the pasture difficult and can hinder and suppress seed growth so the new pasture will not establish easily.

+2

Go to 21

17

The crop is cut, mulched and mixed into the soil before the new pasture is planted. By mixing it into the soil the decomposition rate is faster, resulting in better soil health more quickly.

The increase in organic matter in the soil results in more available nitrogen and less nitrogen leached. You now have soil high in organic matter.

Although the soil has been cultivated and is unprotected from wind and rain, this is only for a short period of time as the grass seed gets established.

+3

Go to 21

18

The animals come in and graze the crop. Their digestive system breaks down the organic matter and it comes out the other end as urine and poop.

This provides nutrients and organic matter back into the soil, but it not evenly distributed across the paddock, rather it is in concentrated spots. You now have soil high in organic matter.

The cows are heavy (around 450 kgs), and some pugging occurs in the paddock which damages the soil structure and exposes the soil to erosion.

-2

Go to 21

19

You decide to bail the oats and peas, then sell it on to other farmers. You make a tidy profit, but you haven't achieved your original goal of improving soil nutrients and increasing organic matter.

Most of the nutrients and organic have been shift off-farm in the forms of bails. There is the remaining crop stubble with the roots protecting and holding the soil, while slowly decomposing and adding some organic matter back into the soil. You decide to increase the soil nutrients by spraying a seaweed fertiliser. You now have soil high in organic matter.

Because it was harvest by machinery you were able to choose the right weather conditions and the soils wasn't chewed up by machinery.

-1

Go to 21

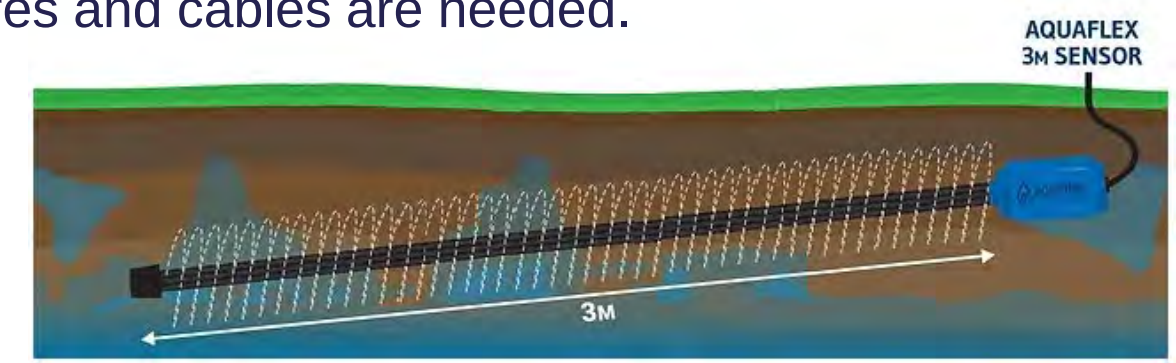
20

You have managed to improve the levels of nitrogen in the soil. Long term you just need to top up the nitrogen as plants will consume it. This is called maintenance nitrogen, and your fertiliser needs are medium.

There is some irrigation infrastructure on the farm which you get serviced by an irrigation field technician.

They mention you might want to look at installing technology called an Aquaflex soil moisture sensor that provides data on soil moisture and temperature at different depths. A solar telemetry system sends the data, so no wires and cables are needed.

Do you want to contact their irrigation consultant, who helps design systems, to learn more?



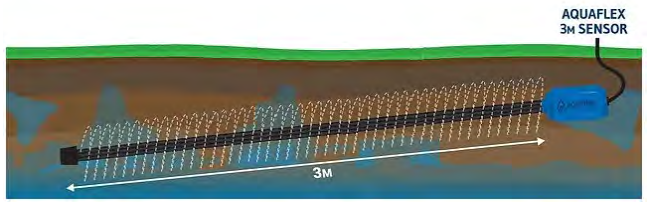
If you choose:

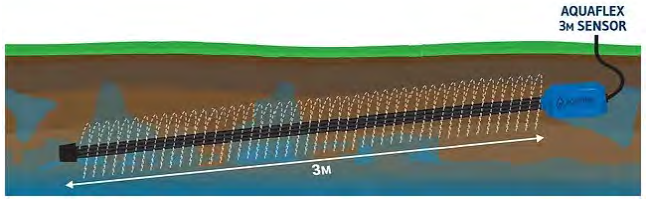
Install Aquaflex soil moisture sensors	Go to 22
Don't install the technology	Go to 23

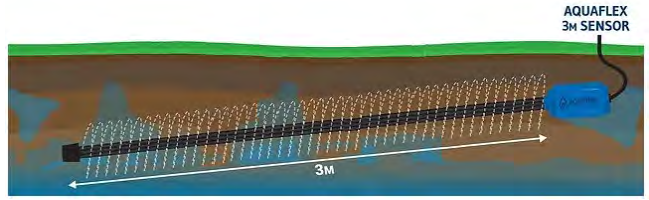
21

You install three Aquaflex sensors, one for each type of soil on your farm. This is a requirement to keep your consent for water. This allows you to provide ideal conditions for plant growth and not waste water.

By installing the sensors, you save money on pumping costs. The savings cover the cost of the sensors in the first year.







Your consent is up for renewal and a resource consents officer who works for the Regional Council comes for a site visit and discuss minimum requirements and best practice. Your consent renewal is approved.

+3

Go to 24

22

Your policy of turning on the irrigation for 3 hours a day isn't efficient. When it is too dry it is not enough water. The ground either hardens so the water can't be absorbed or only the top layer is wet which causes shallow roots to develop and makes them prone to failure.

When it is too wet you are wasting water, blocking soil pores that supply air to the soil microbes and plant roots, and increasing the occurrence of pugging.

Your consent is up for renewal and a resource consents officer who works for the Regional Council comes for a site visit and discuss minimum requirements and best practice. To keep your consent to use the water you will have to install Aquaflex sensors.

-6

Go to 22

23

A soil scientist wants to use the data and collect more data to investigate how the increase frequency of floods and droughts, caused by climate change, is affecting the soil so we can continue to grow food. This will be beneficial for the future.

Looking at the information you have collected about the soil, what do long term you think the land use should be long term?

- pasture,
- an orchard
- vegetables?

+2

If you choose:

Pasture	Go to 25	An orchard	Go to 27
Vegetables	Go to 26		

24

Pasture

The soil conditions are ideal with good fertility and organic matter (which you improved), high levels of soil organisms, medium drainage and the pH being 6.

Well done on seeking good advice and information along the way. You have a lot of options around what animal you would like to farm. Healthy soil results in healthy plants, a healthy environment and healthy animals. Careful management and information is key. Luckily, you have a great network and community of people around you.

+3

- Write your land use decision in the box.
- Each correct career title with description earns you a bonus +1 soil point. Add that to your soil health score to get the total.

25

Vegetable Growing

The soil conditions are almost ideal. However, you only have medium drainage soil and not high drainage soil. You will need to do more work to improve the drainage, but compaction will be an ongoing issue.

Lime will need to be applied regularly, and due to the high demands of vegetables there is a lack of organic matter, and nutrients. So, you need to add organic matter and nutrients to ensure the health of soil, and a productive vegetable growing business.

-2

- Write your land use decision in the box.
- Each correct career title with description earns you a bonus +1 soil point. Add that to your soil health score to get the total.

26

Orchard

The soil conditions are ideal with good fertility and organic matter (which you improved), high levels of soil organisms, medium drainage and the pH being 6.

Well done on seeking good advice and information along the way. You can also seek advice from an orchard consultant who can help design your orchard set up to maximise the number of plants, infrastructure and growing conditions within the orchard.

+3

- Write your land use decision in the box.
- Each correct career title with description earns you a bonus +1 soil point. Add that to your soil health score to get the total.

27