Your environment

Canterbury

An environmental resource for schools

From the EDITORS

When it's spring, and summer is on its way the weather grows warmer, and perhaps like no other time of the year, we are particularly aware of the change in season. Trees and bulbs are flowering, bright green leaves are bursting from winter branches, and you find yourself pushing the old lawnmower much more than you would like! All this new life relies on having healthy soil. We sometimes forget that without healthy soil none of this life would be possible. This forgetfulness often leads to damaged soil which can have long-term consequences for all life. As always, your thoughts and comments are welcomed. Please contact us for further information. Our contact details are below:

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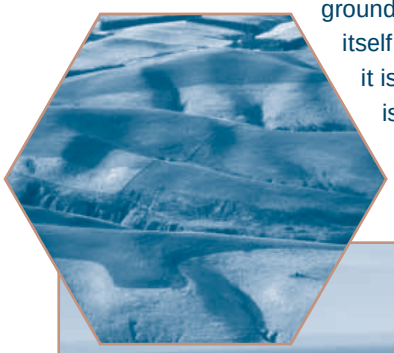
Get grounded!

Somewhere, beneath your feet, your house or even your bike tyre is the ground. The ground I'm talking about isn't concrete or tar-seal… it is land and soil. Sometimes, because soil is covered by so many things and because we can't see it, we forget it is even there. One thing is for sure, we should never forget what the land is really made of, because without good soil we can't survive… really!

Brown, dirty, hard, muddy, dusty, sandy, grassy – it really is vital stuff!

This issue of Your Environment, Canterbury delves into the ground, pulls apart the very soil itself to find out exactly why it is so important, how it is related to land use and why we should never take soil and land for granted.



in this issue...

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Environment Canterbury
Your regional council

Getting down to the dirt!

It's all in the making!

No type of soil is the same as another. Soil comes in all shapes and sizes. For example, it may be called clay, loam or volcanic soil. The thing is, the ingredients that make up the different types of soil are the same. What makes the difference is the amounts of each ingredient.

The ingredients for soil are:

- ground-up rock with minerals
- organic matter from rotting plants, dung and dead animals
- living organisms such as tiny bacteria and fungi, worms and grubs
- spaces filled with air or water.

Did you know...

...that glass is made from melted sand?

Soil may not seem very exciting stuff, but did you know that without it human survival would be extremely difficult, if not impossible? If you took a moment to think about all the ways we use and need soil every day, you'd be surprised. The list below will give you some idea of just how important it really is!

Soil provides us with:

- **food we eat**
  Meat, fruit, vegetables and grains
- **clothes we wear**
  Wool, cotton, hemp and linen
- **materials we need to build our houses**
  Wood, bricks, concrete and glass
- **oxygen we breathe**
  Produced by plants that live in the soil
- **water we drink**
  Stored, filtered and let go by the soil

How soil is formed?

No clicking of fingers or blink of the eye can create instant soil. Soil takes thousands of years to form. It begins as part of a mountain or rock, which is slowly ground down by the weather (rain, ice, wind and heat) into smaller pieces such as gravel, sand, and silt. This is called weathering. Soil is moved around by wind, rivers and glaciers. Once the soil settles in a place, plants such as mosses and herbs begin to grow. Plants use nutrients in the soil to grow but they replace what they take when they drop leaves and when they eventually die. This makes sure there are nutrients back in the soil for other plants to use. It also helps build up the soil and as the depth of soil increases larger plants can survive.

Alive and kicking!

Soil is actually alive and kicking. We couldn't live in soil, but many creatures do. Some you can see with the naked eye and these are called **macro-organisms**. Others are called **micro-organisms** and are so tiny you can only see them with the help of a microscope.

The big guys

There are a huge number of different types of insects that live in the soil and leaf litter (leaves and sticks that have fallen from plants to the ground). Worms, slaters, wetas and springtails are macro-organisms. They are herbivores (eat only plants) and eat decomposing (rotting) leaves. This breaks up the leaves into smaller pieces that micro-organisms can feed on. Other types of macro-organisms are predators, catching and eating other insects. Spiders, centipedes and harvestmen prey on wetas and slaters. If you dig down into the soil a bit deeper, you will find more macro-organisms such as grubs, which live by sucking nutrients out of plant roots.

Did you know...

Insects that feed on rotting leaves are called detritivours?

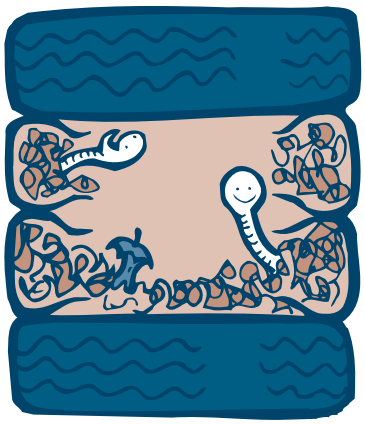
The little 'uns

Bacteria and some fungi are micro-organisms. Even though they are tiny, you'd be amazed at just how many there are in a little bit of soil. A teaspoon of soil can contain roughly "100 billion bacteria and 15 kilometres of fungal threads" (Molloy).

These tiny organisms are very important as they break down leaves and dung into nutrients which plants need to survive. The plants suck up the nutrients from the soil through their roots.

Worm Facts

- There are over 6000 species of worm in the world (200 in New Zealand).
- They can be divided into two basic categories:
  Composters – live and breed in organic rich environment, like food waste.
  Earthworms – prefer soil as their basic diet and burrow deep into the soil.
- Worms do not have teeth.
- Worms breathe through their skin so they require a moist environment for the exchange of air to take place.
- Composting worms will eat: fruit and vegetables, paper, leaves, coffee and tea bags, dirt, hair, dog and cat faeces, eggshells, shredded and soaked cardboard (pizza boxes are good).
- The average life-span of a tiger worm (composting worm) is one year. They can reproduce up to three times a week.



- Worms can consume more than their own weight in organic matter each day.
- Earthworms feed on dung, rotting plant and root material. They also eat soil as the burrow through it.

In the classroom

Valuing soil and land...

1. In groups of two or three, take a blank piece of paper and make a table of four columns.

   Head each column with one of the following:
   - Ecological values (plants and animals)
   - Maori cultural values
   - Economic values
   - Social and recreational values

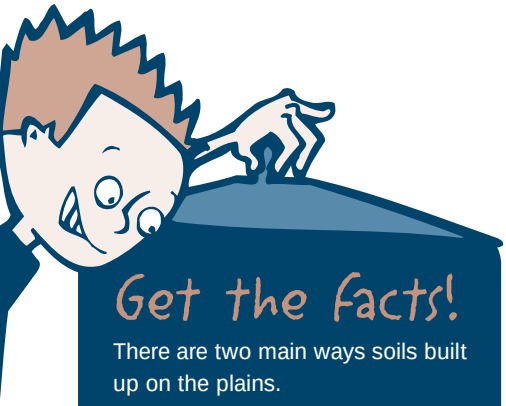
   Place everything from this list in the column you think is most appropriate:
   - tramping
   - animal, bird, plant habitats
   - wahi taonga
   - home gardening
   - soil conservation and protection
   - kai
   - outdoor experiences
   - groundwater protection (artesian supplies)
   - mauri
   - sustainable farming practices
   - kaitiakitanga
   - housing development
   - food production
   - tourism ("clean, green image")
   - clean drinking water
   - whenua
   - fishing
   - wahi tapu
   - hunting
   - riparian strips

2. On another sheet of paper, brainstorm all the activities you do in a day and all the things you use, eat or enjoy that are connected to land or soil.

   Add some of the things from your brainstorm to the lists of values.

Note: this activity is linked to the activity 'Where does your apple come from'? on page 10.

Canterbury soils



Get the facts!

There are two main ways soils built up on the plains.

Alluvium – some soil was deposited by streams and rivers during floods and this is called alluvium. Alluvium forms loamy soil, composed of a mixture of sand, clay, silt, and organic matter. Alluvial soils are generally very fertile.

Loess – dust and silt that gets picked up by the north-west wind in the mountains and blown eastwards across the plains is called loess. These soils tend to be shallow with low levels of organic matter, sitting on a base of gravel. This means that if left exposed (unplanted), it is prone to drought and wind erosion.

Did you know?

Limestone is sedimentary rock that originally comes from the sea. Sometimes, as the rock weathers ancient seashells emerge.

Canterbury is made up of different landforms such as the Southern Alps, Banks Peninsula and the Canterbury Plains. These landforms give Canterbury a unique identity and tell a story about how the region was formed. They also give us a clue to the types of soil. Greywacke is the rock base to most soil types in Canterbury. Over thousands of years this rock has been ground into shingle, sand and silt which has been washed down rivers and blown by the wind to create the first soils in Canterbury.

Remember the soil recipe? Although the soils have been formed from the same type of rock, the amounts of each ingredient, the climate, and the location create different types of soils.

The Canterbury Plains

The Canterbury Plains are the largest plains in New Zealand (80km long and up to 70km wide), but they weren't always this way. Even when you are driving across them in a car, or flying over in an aeroplane, the plains may appear to be flat, but they actually slope down from the mountains to the sea. They were created as shingle and sand eroded from the mountains and then flowed out to sea with the rivers. Some of the shingle was left behind as the rivers flowed, and this built up to make the plains. Big rivers such as the Waimakariri, Rakaia and Rangitata that made the plains, are actually still on the job today. Nothing stands still in nature!

Did you know Banks Peninsula was once an island? As soil built up on the plains, the land grew and eventually joined with the island and it became a peninsula.

Banks Peninsula

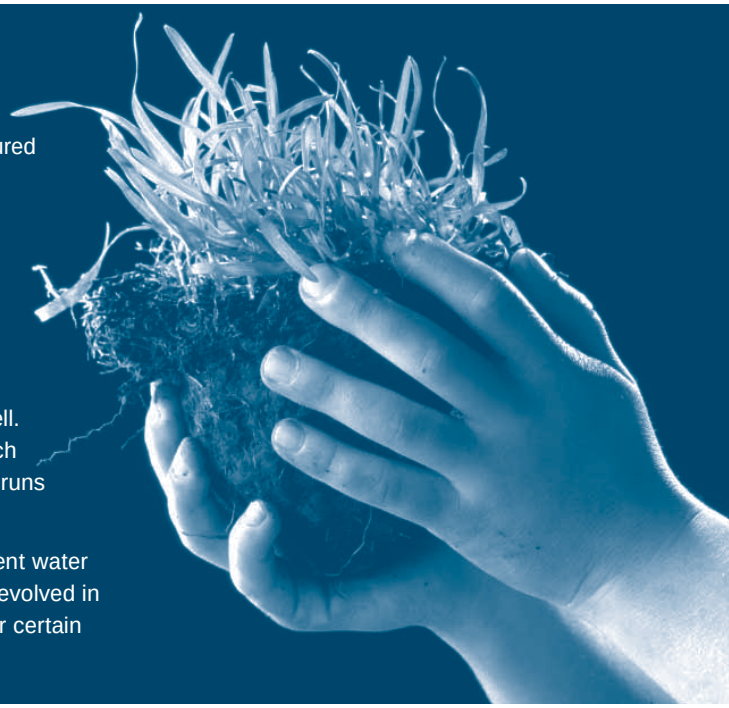
Bank Peninsula was formed by two very large volcanoes; one at Lyttelton, the other at Akaroa. They were active a long time ago (five to 12 million years) and over time the volcanic cones eroded and the sea filled the old craters. These craters are now Akaroa and Lyttelton harbours. The soils on Banks Peninsula are two different types, volcanic and loess.

The volcanic soils came from years of volcanic activity. They are high in iron and other minerals, which give them a strong reddish-brown colour. This type of soil tends to be found at higher levels (above 400m). In the past, before there was vegetation, loess was blown from the plains and settled on top of the volcanic soil. Sometimes, the loess is quite thick. Loess soils are much paler in colour. Strong winds, rain and the removal of trees on Banks Peninsula have caused erosion of both types of soil.

South Canterbury's downs and North Canterbury's coastal hills

The rolling hills of these areas are mostly made up of thick loess. While some of the land is fertile, it gets very dry as it often is well above the water table and not easily irrigated. On top of this, thick loess is not free-draining, so when it rains the water runs off the hills or sits on top of the soil for long periods, making the soil waterlogged. This land is mostly used for sheep and cattle farming, but in south Canterbury there are many deer farms, and, recently in North Canterbury, grapes have become a valuable crop.

Soil structure – it's a fine balance!



Good soil structure is really important as it helps provide a healthy environment for plants. Seedlings can more easily take root in well-structured soils, and the soil is less prone to wind and water erosion.

Soil with good structure is also able to store water and air. If the soil is made up of a mixture of different sized clumps of particles (aggregates), water can get in and can be stored in the spaces between the particles and the soil remains moist. Nutrients are stored in the same way. When the structure has too many large particles such as stony or sandy soils, water will run straight through the soil as it can't be stored. These soils become very dry and need to be constantly watered for plants to grow well. This is the case for many soils on the Canterbury Plains. Soil with not much structure is hard and compacted and water can't soak in at all! Any water runs straight off taking the valuable soil with it.

Improving soil structure can help the health of the soil for plants and prevent water and wind erosion, however, it is worth remembering that some soils have evolved in different areas under certain conditions, and are, therefore, not suitable for certain types of activities.

Healthy topsoil

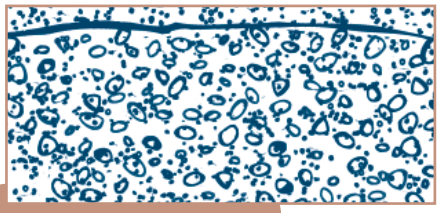
Topsoil is literally the top level of soil and it is very important for growing crops for animals and food for us. We hear more and more that to nourish plants and animals well, we need to 'grow' (look after) the soil. High usage of fertilisers may give short-term results (fast plant growth), but it is not sustainable for the land in the long term. The fertility of soil is a complex relationship between many different things, but at the end of the day, organic matter with good soil life (all those macro and micro-organisms) is the key to soil fertility. So…with so many different types of soil, how do we know which one is healthy? Here are a few things that we know help to make healthy topsoil.

Healthy fertile topsoil should:

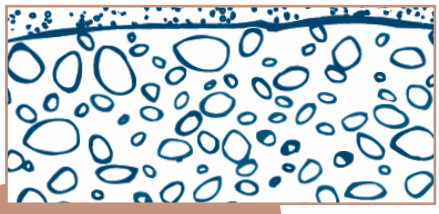
- **Have a pH of between 5.5 and 7.5.** But, remember that some soils are naturally very acid or alkaline and often whole plant communities have adapted to grow in these places and so the soil is healthy for that situation.
- **Have high organic content.** A healthy soil is often dark in colour as it has a high level of organic matter. This gives it more structure and provides nutrients that plants need to live.
- **Have good soil structure.** The best soil for plant growth has a loose, crumbly structure, which provides air spaces that allows rain to soak in and space for roots to grow.
- **Provide good habitat for bacteria and fungi (plural of fungus) and insects.** If there are good numbers of insects, bacteria and fungi then there will be lots of nutrients for plants.
- **Be free of pesticides, herbicides and other harmful chemical residues,** as some can kill soil organisms (insects, bacteria, fungi).

If you have all of the above, and the soil has a good cover of plants, it is likely to be fairly stable and erosion free.

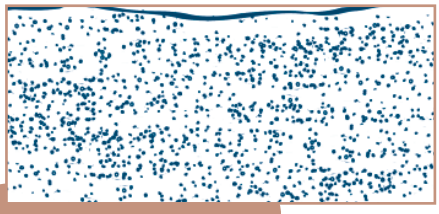
Soil structures



Good structure



Stony free-draining



Compacted

Give this a go!

Half fill a clear jar with a mixture of soil and stones. Pour in ¼ cup of water and record what happens. Fill another jar half-full with loess or fine-particled soil. Pour in ¼ cup of water. What happened? Which soil is more free-draining? Why?

Canterbury

Outside the classroom

You don't need to carry out fancy scientific tests to get a good idea if soil is 'in good heart' (healthy) and able to produce good quality food. We can get a good idea by sight and feel, and all it requires is for you to get up close and personal with a bit of dirt!

You will need:

- A spade
- Water
- Notebook and pencil
- Sack or plastic for soil sorting

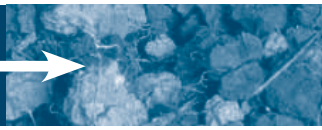
Dig up a spade of topsoil and place it on the sack or plastic so you can easily see your sample. Describe your soil following the steps below. After each step, tick the correct box on the recording table.

1. What macro-organisms are living in the topsoil? What insects can you see?
2. What colour is the topsoil?
3. How deep is the topsoil? Look at your spade sample and into the hole to see how deep the topsoil is.
4. What is the consistency of the topsoil like? To test this, wet your fingers a little and roll a bit of the soil into a ball. Squeeze it gently with your fingers to flatten it a bit. Does it crack?
5. What is the topsoil structure like? Has it stayed in a solid block, or does it break easily into smaller bits of soil (should not go to dust)?
6. What is the texture of the topsoil like?

Recording table

Macro-organisms	worms	grubs	beetles	centipedes	others
Topsoil colour	pale brown	light brown	brown	dark brown	black
Topsoil depth	1/4 spade	1/2 spade	3/4 spade	1 spade	more than 1 spade
Topsoil consistency	firm	sticky			
Topsoil structure	hard to break up	breaks up alright	Easy to breakup		
Topsoil texture	sandy	gritty	stony	crumbly	

Landforms influence soil type



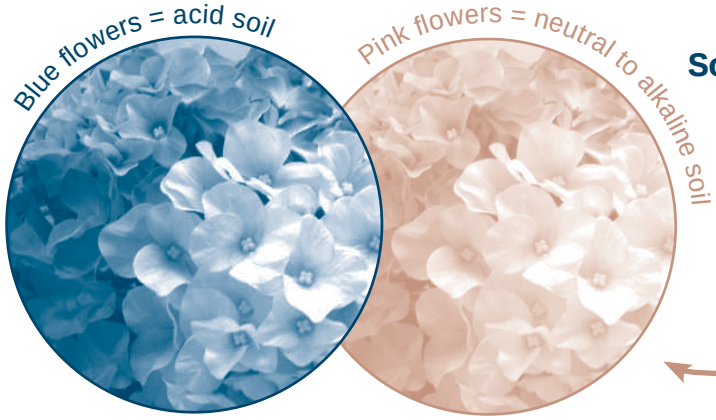
Shake it up baby now...

Put two heaped tablespoons of your soil into a clear bottle or jar. Half fill the bottle or jar with water. Put on the lid and shake vigorously. Watch what happens.

Clues *- Sand particles will separate quickly, and because they are heavy will settle on the bottom. Clay and silt particles are lighter and will take a few days before they settle.*

Soil health table

	Macro-organisms	Soil colour	Soil consistency	Soil depth	Soil structure	Soil texture
	Insects in the soil are an indicator of soil health. A variety of insects generally means good health.	Soil colour is often an indication of drainage. Exceptions to this basic rule are bog wetlands and peat soils, which are poorly drained but are often very dark in colour.	Soil consistency is important because it indicates how well the soil can absorb and retain moisture.	The more soil, the deeper plant roots can go and the more nutrients they can absorb. Deeper roots make larger plants more stable.	Soil particles bound together by organic matter and clay are called aggregates. Varying amounts of the ingredients change the shape of the soil and indicate stability.	Soil texture changes with differing proportions of sand, silt and clay. Soil texture depends on the parent material and the age of the soil.
Healthy	Many different sorts of insects (particularly worms) in the soil.	Darker coloured soils are rich in organic matter. This normally means they are well drained.	Firmer, less sticky soil will absorb water and retain moisture.	Deeper soil.	Softer soil, that easily breaks up, but not to dust.	Soil with smaller, finer particles.
Not so healthy	None, or only one type of insect in soil.	Soils that are pale in colour are generally poorly drained.	Sticky soil tends to repel water. This means that the soil does not absorb water well and will not hold moisture.	Shallow soil.	Hard, solid soil that is difficult to break up and stays in hard clumps.	Stony, gritty, sandy, dry soils.



Something extra!

pH is a test that checks out if soil is alkaline, neutral or acidic. The range is 1 to 14, with 1 being most acidic and 14 being most alkaline. This is important as most plants prefer neutral soil (pH=7). You can buy a pH testing kit from a garden centre and test your soil, or… you can be a detective! Some plants prefer either acidic or alkaline soils, for example strawberries like acid soils, whereas the herb rosemary thrives in alkaline soils.

If you have hydrangeas growing in your garden the colour of their flowers can give you a big clue to the pH of your soil.

Environment Canterbury

Our diverse landscape

Canterbury Plains

- Extensive plains made from intersecting gravel fans.
- Braided rivers with wide flood plains, spring-fed streams and estuary zones.
- Exposed to hot, dry nor'west winds.
- Major urban and rural settlements. Most human activity in Canterbury is on the plains.

Soft rock hill country and downs

- Limestone, sandstone, mudstone – smooth, rounded rolling land.
- Distinctive limestone features, escarpments and dip slopes.
- Grasses, tussock and shrublands.
- Valued for pastoral grazing and forestry.

Hard rock hill country

- Steep hill country, including eastern Southern Alps and foothill ranges.
- Main vegetation are grasses, forests and shrublands.
- Important recreational area – tramping, hunting, fishing.
- Also valued for pastoral grazing and forestry.

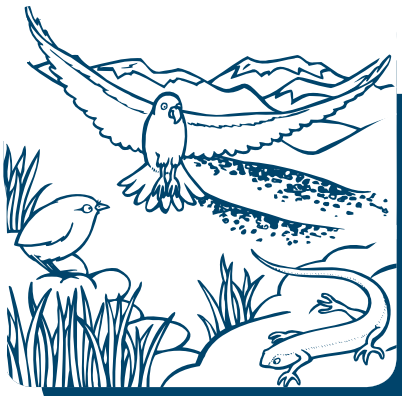
Kaikoura coastal zone

- Varied landforms – steep coastal hill country, rocky seascape, mountain ranges, plains and peninsula.
- Steep, faulted and unstable areas, subject to storms and land movement.
- Unique plant and animal types (e.g. Hutton's shearwater).
- Valued for dramatic scenery, flora and fauna, tourism, recreation and dairy and pastoral farming.
- Also valued for mahinga kai and wahi tapu sites.

Banks Peninsula

- Twin volcanic cones, indented coastline and deep harbours.
- Main vegetation – tussock and broadleaf forest.
- Mainly pastoral land with diverse speciality land uses.
- Major centre for Maori settlement – many wahi tapu and mahinga kai sites.
- Important recreational area.

Canterbury is made up of many different landforms. These landforms can be divided into eight types. Different areas of land have their own types of plants and animals that have adapted especially to that area. These are called ecosystems.

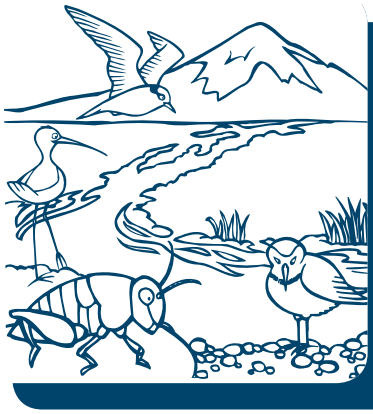


High country: dry mountain ranges

- Steep mountains, hills and block mountains with rounded summits.
- Low rainfall – some of the driest parts of Canterbury.
- Snow tussock (high up), short tussock and bare ground.
- Dramatic scenery – tourism values.
- Fine merino wool.

High country: moist mountain ranges

- Steep mountains, extensive bare rock, bluffs and scree on the highest slopes.
- Most dramatic mountain chain in New Zealand.
- Alpine herblands, scrublands, and grasslands on upper slopes.
- Snow tussock lower slopes, podocarp and beech forest below 1200m. Kea are at home here.
- Valued for its wilderness and naturalness, water yield, tourism and recreation and for its wairua (spiritual value).



Inland basins and river valleys

- Terraces, fans, moraines and floodplains, including matagouri shrublands, tussock grasslands and gravel fields, Beech forest on older terraces.
- The south and east basins are drier and the vegetation and soils are depleted here.
- Major lake systems with red tussock and raupo wetlands supporting native fish, insects and birdlife.
- Distinctive limestone country, e.g. Castle Hill.
- Valued for landscape, tangata whenua, hydro, recreation and tourism.

In the classroom

Create a map!

1 Use the GIS mapping system available on www.ecan.govt.nz. Open the website and click on mapping at the top of the page. Click on 'home version' and have a go at zooming in on one of Canterbury's unique areas. Using the information above, identify how many different landform types exist in your chosen area.

See if you can:

- plot on the rivers and waterways
- overlay an aerial photo or topographical map
- find out what soil types are in your area
- Find out what the land is used for. How does this compare with the types of soil?

2 On a clean sheet of paper draw a large map of Canterbury. Using the eight small maps provided in the resource, combine all the different land types and show them on your map. You will need to make a key to show each land type with a different colour or shade.

See if you can plot on:

- the plants and animals that live in and around the different land types
- the waterbodies – lakes, streams, rivers
- other distinguishing features, i.e. soil type, land use, etc.

What is happening to

Every day, soil is being damaged or blown out to sea, or high into the atmosphere and lost forever. If you take the time to stop… and think… it is a very scary thought.

Why? Because, when soil is lost, removed or damaged, we don't get any second chances. It is very hard to repair damaged soil, and it takes a very long time. What we lose today, can't be replaced in our lifetimes. We all need to take care of the land, thinking before we take actions that may cause harm to this precious resource.

Farmers, who rely on the land for their livelihoods, are often more aware than others about how important it is to have healthy soils. Healthy soils need nurturing and protecting, but in Canterbury we already have problems relating to soil health and use. Keep reading and find out about the issues, the solutions to date, and where we all need to do some more thinking!

The nor'wester (north-west wind)

The nor'wester is another unique feature of Canterbury that continues to change the landscape. The nor'wester starts on the western side of the Southern Alps. It rises up and over the alps losing most of its moisture (rain) in the mountains. As it tumbles over onto the eastern side, it picks up speed as it races down the mountains and onto the plains. This hot, drying wind mixed with the light stony soils of the Canterbury Plains, makes wind erosion of soil a constant risk.

Wind erosion

Erosion is a big concern for farmers and wind erosion is a particular problem for Canterbury because of the **nor'westers**. Given the chance, this warm wind will dry out the soil and pick up any loose topsoil, blowing it out to sea or into waterways where it will eventually reach the sea. Over the last 150 years or so, people living and working on the plains have managed to reduce wind erosion in a variety of ways:

Hedge windbreaks

1. Wind breaks

If you have ever flown over the Canterbury Plains, you will have noticed the neat patchwork of paddocks outlined by hedge windbreaks. These windbreaks are an essential part of Canterbury farming and were planted early on in Canterbury's European history with plants such as macrocarpa and gorse. These dense hedges break the wind which reduces its strength and drying power. The hedges also provide shelter for stock.

2. Increasing organic matter

Organic matter provides the food for insects, bacteria and fungi that live in the soil. Intensive farming such as cropping can quickly affect soil organic levels. Farmers have developed farming practices to reduce long-term effects by rotating paddocks between growing crops and pasture. The dung from grazing animals, and decomposing plants and roots help to build up organic matter in the soil. Soil with more organic matter is more stable.

Canterbury's soils?

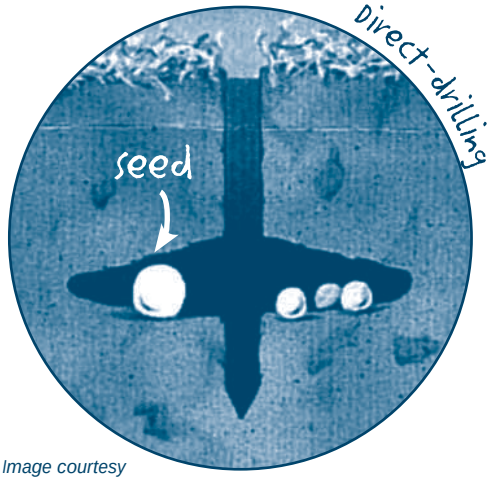


Image courtesy of Cross Slot No-tillage systems.

3. To ploughing or not to plough…

Many cropping farmers no longer plough their fields. Instead they sow their crops and pasture by direct-drilling. Repeated cultivation of soil destroys the structure, dries out organic matter and all those useful worms get eaten by seagulls! Direct-drilling reduces the loss of soil to wind-blown erosion as the surface of the soil remains intact, acting like a skin which stops the wind from picking up the soil particles and blowing them away. The roots from the plants also help to bind the soil together.

4. Grazing

An obvious way to protect soil from wind erosion is to keep it covered by vegetation and anchored to the ground by plant roots. Overgrazing a paddock can expose bare patches of soil. These areas are then at risk of being eroded away by strong winds.

Hey… can you work this out?

In the past, the soil across Canterbury has been eroded at an average rate of 1mm per year. The average depth of topsoil is 30-40cm. If this continued, how many years would it take to effectively lose the remainder of our topsoil?

And did you know?

Erosion is not the only problem. Some soil is also losing its quality so that it can no longer support life (seeds can't grow). This can happen through contamination or poor farming practices. It's a vicious cycle… erosion can decrease soil depth and poor soil quality can cause erosion if vegetation is removed or reduced. Life really is about chain reactions!

Is our use of land always wise?

Towns and cities

Did you know that only four percent of Canterbury soils are naturally good enough to grow crops and vegetables?

These soils can be used for cropping and horticulture because they have excellent soil structure which holds both moisture (water) and nutrients. These soils are very valuable, but the trouble is, many areas with these types of soil are in land which is close to cities and towns where people want to live. We end up using this land to build houses or factories on, or it gets chopped up into lifestyle blocks. This means that the good land can no longer be used to grow large quantities of food, so instead we grow our food on land that is not naturally as fertile.

These areas generally have soil with poorer structure and they require a lot more water and fertiliser. This has many flow-on effects, as the need for water is higher because the soil can't hold the water, and nutrients in the soil and those added by fertiliser don't stay in the soil and easily get washed away with the water as it drains through the soil. This means that these added nutrients may get into Canterbury's groundwater, which is where we get our drinking water from. Growing food crops requires more cultivation and this exposes the soil to wind erosion. New techniques, such as direct-drilling have come about to try and prevent wind erosion in these areas.

We know that high quality soils are an extremely precious and limited resource. We need to consider the land and soil quality when we plan towns and cities. We need to be asking such questions as:

- Is this the best use for this land?
- What else could be done on this land?
- Is this land being used in a sustainable way?

It's all about smart thinking for the future!

Where possible it is best to use less fertile soil and land for buildings and settlements.

These questions do not just relate to town and city planning, but also to types of farming on different types of soil and land.

Farming

Until very recently, most farms on the Canterbury Plains grew sheep and crops (wheat, oats, peas, etc.) This has changed, and today many of the farms are dairy farms. Cows require a lot of food and water to make milk. Their food is grass (green or hay) and grass also needs a lot of water to grow. Growing this amount of grass on the Canterbury Plains is no mean feat. It means two things: lots of water and lots of fertiliser!!

As with all things, when we change one thing, other things change as well. A lot of water is needed from Canterbury's rivers, streams and aquifers to support dairy farming on the plains. Lots of nitrogen and phosphate-based fertilisers are also used to make the grass grow quickly. This can upset the natural chemical balance in the soil, and these chemicals can also find their way into waterways and aquifers due to the free-draining soil and run-off.

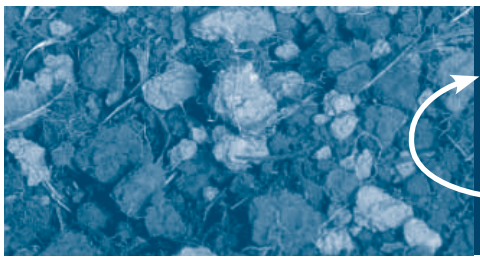
Taking a lot of water and adding lots of fertiliser can affect the environment by:

- lowering groundwater levels (also affected by season and climate)
- lowering river and stream levels (less space for aquatic life and increased water temperatures)
- reducing soil fertility on stony soils as nutrients are removed (leaching) from the soil as the increased amounts of water flow through it
- increasing the chance of added nutrients (from fertiliser) getting into waterways and aquifers through the free-draining soils.

Dairy farming is prosperous for many people (many of us love milk, cheese and ice-cream!!) and contributes to the region's economy, but like all things it is about finding the right balance between people's needs and the environment.

It's all about smart thinking for the future!

Where possible, choose a type of farming that is best suited to the land and soil type where you want to farm.



The health of the soil determines the health of the vegetation.

The health of the vegetation determines the health of the soil.

Activity

The problem – just how are we losing our good soils?

Try this three-way match up! Read through the descriptions and solutions to see if you can match them to the list of different types of erosion and soil quality.

Erosion

- **WIND EROSION**
- **WATER EROSION**
- **FREEZE-THAW EROSION**

Soil quality

- **POOR SOIL QUALITY**
- **FARMING TECHNIQUES**
- **CONTAMINATION**

Problems

- Fine particles of soil are lifted in the wind and can be carried as far as the sea. Cultivation breaks up the soil into fine particles and the nor'west wind blows it away.
- In the high country, the land freezes in winter and the water in the soil expands. As it thaws out the soil breaks up into small particles. These small particles can be carried away by the strong winds.
- Has a structure that is unable to hold nutrients and water, or plants firmly in the ground.
- Different farming practices such as ploughing, spraying and irrigating can affect soil quality.
- The land can be harmed by toxic waste or chemicals. These can come from industrial activities, farming practices or from a rubbish dump.
- On sloping land, heavy rain can cause loose soil to wash downhill or the water can get into cracks below the soil and cause slips.

Solutions

- Planting trees and keeping slopes covered in vegetation can prevent erosion.
- Keeping the land moist or planted. Only cultivate the land when you really need to and choose calm weather conditions.
- Soil needs to be properly cared for if farmers and gardeners want good crops and healthy animals. This means not over-watering or over-spraying with herbicides and pesticides, and providing good organic matter.
- Dispose of chemicals at refuse stations and places that have the correct facilities. Don't put unnecessary chemicals onto land.
- Vegetation cover reduces freezing. Native plants have adapted over hundreds of years to the harsh climate.
- Choose farming practices that suit the land, climate and soil type.

Prevention is always better than cure!

Land and soil are very precious and valuable. Soil takes a long time to form and is not easily replaced. It is also very difficult to 'fix' once it is 'broken' so we need to take all possible care to protect land and soil from unnecessary damage, by using it wisely. While there are things in life that we have no control over, we can take steps to ensure that we make good decisions about our activities that could affect land and soil.

Things that you can do:

- Think before you pour chemicals (e.g. paint, oil, soaps, etc.) onto the ground. Ask yourself; will this contaminate the land? Will this kill creatures living in the soil? Where would be a better place to dispose of these chemicals?
- Take your chemicals and rubbish to a refuse and recycling centre. Find out what can be reused or recycled so it doesn't get sent to landfill.
- Make a compost bin or worm farm in your back garden. Put all suitable food scraps into the compost or worm farm and then use the well-rotted compost and worm-juice to improve the nutrients in your soil. Your plants (and soil creatures) will LOVE you for it!
- Walking, running, sliding and biking are all fun and healthy things to do. But it is even better when they are done in a way that does not harm the land and environment. Take care to stick to tracks and areas where plants and animals won't be damaged or disturbed.

Hey...

Pick a few leaves from your mint plant and put them in a glass of fruit juice. Let them sit in there a few minutes and then drink the juice. Mmmm... the taste is divine!

Reap what you sow

So... your worm farm has been producing the 'good oil' (worm-juice) and/or your compost pile is well-rotted and ready to do its stuff. Finally, it's time to see them work their magic... it's time to grow some food!

Setting up your own small veggie patch.

1. Talk to someone about the best place in the garden to grow vegetables. It is important to choose the right spot with good light and shelter. (If you don't have space you can use pots, tubs or old tyres.)
2. Dig over the soil and mix in some of your special home-grown compost or worm juice. Make sure the soil is nice and crumbly, just perfect for roots to find a space and grow.
3. Sow your seeds, plants or tubers (root vegetables). Make sure you follow the instructions on the seed packet, or seedling plant container that tell you how deep and far apart you should plant them. Each plant needs its space to grow well.
4. A good combination of plants are potatoes and mint. Mint is a herb which is very fast growing (watch those roots!). Potatoes take longer, as you need to wait for the tubers to sprout and grow, then you need to wait until the leaves start to die, but then...you get to dig up the new potatoes that have grown. It is a bit like hunting for Easter eggs... you never quite know how many potatoes are going to be under the soil!
5. Spring is a really good time to plant potatoes, as they will be ready to harvest for Christmas dinner or New Year's celebrations. There really is nothing quite like eating what you have grown yourself.

Activities

Where does your apple come from?

Choose one thing (food or other object) from your brainstorm list (page 3 'In the classroom' activity) and trace it all the way back to the land. Make a diagram starting with you at the top and include all the things it has been through to get to you. Include people, shops, factories, orchards, transport, etc.

Your place

Map out the area of land your house is on. Show all the different uses of land in your patch, e.g. space for the house, concrete area or paving, gravel, garden area, grass, garage, trees, paddock, etc.

See if you can do the same for your neighbourhood (choose one or two blocks near you) and show how much is housing, farm, park, shopping, pavement, roads, stream, garden, etc.

Can you work out what percentage of area is under developed structures (e.g. housing, pavement, etc) and what percentage is usable soil (grass, gardens, etc.)

Do you think your neighbourhood has used the land wisely? Can you see any areas that could be improved?

Word Scramble

splotio
This is the top layer of soil.

osrenoi
The loss of soil from wind or land slides.

rateh
Our planet.

enwhau
Maori word meaning both land and placenta.

rafmer
The name of a person who makes a living from the land.

uretnsnit
This is what plants need in the soil to grow.

adcplnsae
This is the shape of the land.

otmntoniaianc
When land has been affected by chemicals or toxic substances.

erset
Something to plant to help keep the land stable.

glopugnhi
Turning over the soil.

dreanger
Someone who plants and cares for a garden.

Answers: topsoil, erosion, earth, whenua, farmer, nutrients, landscape, contamination, trees, ploughing, gardener.

Curriculum Links

These suggested links are only a small selection.

Social Studies

Place and Environment

Level 3: How different groups view and use places and the environment.

Level 4: How places reflect past interactions of people with the environment.

Level 7: Why and how people regulate the use of places and the environment.

Resources and Economic Activities

Level 3: How and why people manage resources

Level 4: How and why people view and use resources differently

Science

Making Sense of Planet Earth and Beyond

Level 2: Investigate physical features and patterns (landforms, rocks, soil)

Level 4: Investigate a local environmental issue

Level 5: Research a national environmental issue (soil erosion)

Level 6: Report on an important natural resource in New Zealand (soil)

Health

Strand D – Healthy Communities and Environments

People and the Environment

Level 7: Students will analyse ways in which the environment and well-being of a community are affected by population pressure and technological processes

Level 8: Students will critically analyse the interrelationships between people, industry, technology and legislation on aspects of environmental health

Your environment

Canterbury

Your Environment – Canterbury is free to all schools/teachers in the Canterbury region.

canterbury mudfish

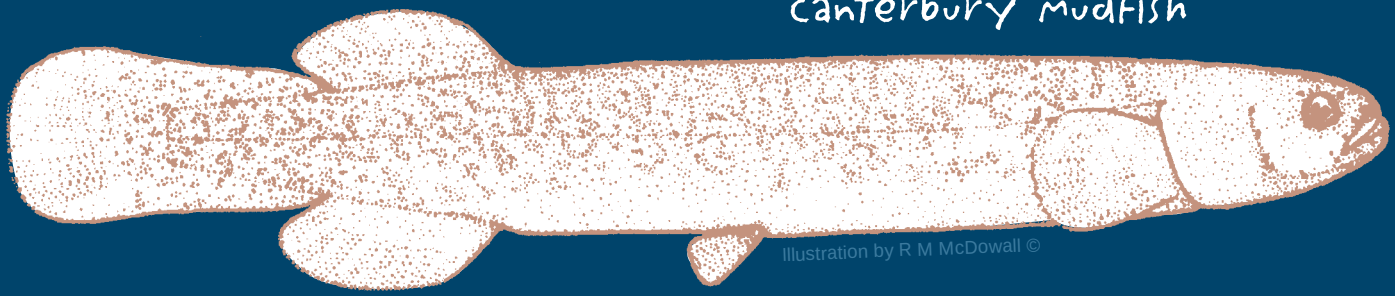
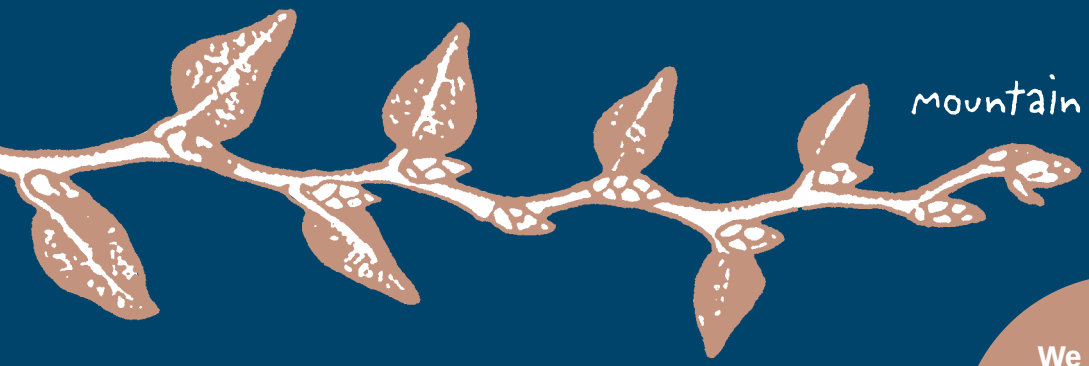


Illustration by R M McDowall ©

mountain beech



We welcome your comments or suggestions for what you would like to see in future issues.

We offer a range of facilitated school programmes and environmental education resources on natural resources and their sustainable management. Environment Canterbury also produce general information and resource material, such as pamphlets, brochures and booklets, many of which are free.

If you would like to receive a 'Key to Canterbury' environmental education pack contact:
Environment Canterbury education staff on (03) 365-3828
or customer services on 0800 EC INFO (0800 324 636).

If you are not on the mailing list for Your Environment, Canterbury, or you would like to receive extra copies of this resource, please contact Environment Canterbury education staff at the Christchurch office.

Environment Canterbury is your regional council.

We manage 12 activities for the Canterbury region.

- Air quality
- Coastal environment
- Emergency management
- Energy
- Hazards
- Land
- Navigation safety
- Pests and biosecurity
- Public passenger transport
- Regional land transport
- Waste, hazardous substances & contaminated sites
- Water quality, quantity and ecosystems

Environment Canterbury offices

58 Kilmore St, Christchurch
Phone: (03) 365 3828

75 Church St, Timaru
Phone: (03) 684 0500

73 Beach Rd, Kaikoura
Phone: (03) 319-5781

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