

Soil formation

Understanding how a soil was formed can help us make better decisions on how to use it. There are five soil forming factors - parent material, climate, topography, organisms and time. The key process is called "weathering" - this is a chemical and physical process that transforms the parent material into forms that plants can use for support and nutrients. The wide range of soils we see comes from the different combinations of soil forming factors.

Parent material

What was it before it was soil? This has a major influence on soil properties. Most New Zealand soils formed in several places and were brought together by water, wind and gravity. The chemical make up of the parent material determines which nutrients will be present in the soil. The main sources of parent material in New Zealand are:

- Bedrock (papa, limestone, granite)
- Organic debris (swamps)
- Particles moved by water (flooding)
- Particles moved by wind (loess)
- Volcanic materials- ash is almost everywhere but lava is more local

Climate

The main climate influences are temperature and water. Warmth and water are needed for chemical reactions. Water can move weathered particles in and away from the soil. Too much leaches nutrients away but not enough can cause salt buildup. Ice can break up rock particles (water expands as it freezes). Climate also influences which organisms are present.

Organisms

Organisms break up and rearrange the soil. Earthworms are a good example of this - they produce mucus that helps to clump soil particles together into aggregates. Organisms also add and remove nutrients. Nitrogen fixing bacteria are very important. The remains of soil organisms are an important soil ingredient - organic matter.

Topography (landscape)

The landscape affects water movement,

microclimate and the chances of receiving or losing material.



In the example of Esk sand above, the position in the landscape meant that this site received a lot of water-borne material. The layer of sand on top is good for growing grapes, and also allows us to judge the risks of using the land- such as from flooding. Photo courtesy of Elwyn Griffiths.

Time

The older a soil is, the more complete the weathering will be. Most New Zealand soils are relatively young because during the ice ages the ice sheets removed soil but the most productive New Zealand soil is middle aged. Very young soils are not especially fertile as they are not very weathered. However, long periods of weathering result in nutrient loss. The nutrients left behind are mostly iron, aluminium and silica and the soil becomes very acidic, so old soils are not very fertile either.

Very old and very young soils have advantages- if you are in control. The chemical properties must be managed very carefully, but if you can do that these soils can have good physical properties and be very productive.

'Te Pānui Tips' are simple fact sheets that cover topics designing organic crop production systems on the East Coast.

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