

one thousand springs



The microbiology of geothermal hot springs in New Zealand

The goal of the 1000 Springs research project is to collate the physical, chemical, and microbial diversity of 1000 geothermal hot springs in New Zealand.



Why?

Geothermal ecosystems are globally rare and iconic features of the New Zealand landscape. Yet, little is known about the unique populations of microorganisms (Bacteria and Archaea) that inhabit these environments or the ecological conditions that support them.

This New Zealand Government funded research programme (2012-14; Ministry of Business, Innovation and Employment, Environment Research Fund) seeks to fill this knowledge gap on geothermal microbial biota.

This new knowledge will allow New Zealand to assess the conservation, cultural, recreational and resource development value of the microbial component of geothermal ecosystems, and enable future microbial ecology research and biodiscovery.

What is an extremophile?

Extremophiles are microorganisms that thrive in harsh environmental conditions - where temperatures can be as high as 122°C, the pH can range from highly acidic to strongly alkaline, and there are elevated concentrations of salts and/or heavy metals.

Geothermal environments are home to a very diverse range of extremophiles.

What does the project involve?

Researchers are collecting and analysing samples from New Zealand hot springs.

Step 1: Sample Collection

We select springs that span the known pH ranges (pH 0-9) and temperature ranges (20°C-99°C) or have unusual geochemical or geophysical profiles. Those sites with high cultural or conservation value are also included. In the field, we measure the temperature, pH, conductivity, turbidity, dissolved oxygen and the redox potential of each spring, as well as taking photographs and other metadata. Samples are filtered and prepared for analysis.

Step 2: Processing and Analysis

We are using the latest technological advances to extract the total DNA of each sample and this is analysed (via tag-based amplicon sequencing of the SSU rRNA gene) to determine the microbial species present in each hot spring.

The chemistry of the samples is analysed for dissolved gases and soluble chemical components using a range of techniques.

Step 3: Archiving

The total genetic content (environmental DNA) of each hot spring is being extracted and archived for long-term access at GNS Science and the University of Waikato.



What do you do with the data?

The data is being assessed via a set of criteria that ranks ecosystem 'uniqueness'. This metric is the first step in developing environmental indicators for ranking microbially-significant or priority ecosystems for sustainable resource management and/or biodiscovery.

This wealth of information will be accessible to everyone online as it is collected. A smart phone app is also being developed to allow greater access to the data.

Who is this research useful for?

The new information generated pertains to indigenous natural resources that:

- (i) landowners and/or Māori may wish to sustainably develop and/or protect,
- (ii) companies might wish to utilise for novel biotechnology applications,
- (iii) tourists and the New Zealand public wish to explore and understand,
- (iv) central and regional government agencies are charged with managing and conserving, and
- (v) the scientific community seeks to understand.

How exciting is geothermal microbiology?

Very, very awesome! Discovering new microorganisms and how they interact with the environment is a frontier of science.

Did you know that microorganisms make up more than half of the global biomass but their micron size (1 to 5/1000ths of 1 mm) often makes them an 'unseen' component of an ecosystem. Microorganisms represent the lion's share of genetic diversity of life and their interactions with the environment are critical to an ecosystem's health, look and function.

We estimate there are over 15,000 geothermal features in New Zealand, and each of them will have a distinct microbial community and often include many undiscovered species. New Zealand celebrates and protects its novel ecology and species richness – what if one of these microbes is the microbial equivalent of a kiwi or kakapo?

Find out more:

Visit our website: www.1000springs.org.nz

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