21 November 2013
Issue 351

Subscribe to free weekly News Alert

Source: Rousk, J., Smith, A. R., & Jones, D. L. (2013). Investigating the long term legacy of drought and warming on the soil microbial community across five European shrubland ecosystems. *Global Change Biology.* Early online. DOI: 10.1111/gcb.12338.

Contact:
johannes.rousk@biol.lu.se

Read more about:
Climate change and energy, Soil

1.The INCREASE project is supported by the European Commission under the Seventh Framework Programme. See http://cordis.europa.eu/projects/rcn/90503_en.html

European Commission

Science for Environment Policy

Do warming and drought have lasting effects on soil ecosystems?

Despite the substantial impacts warming and drought can have on soil bacteria and fungi, these are not sustained if external conditions re-stabilise, a new study suggests. Small-scale experiements in five countries across Europe to show that even if warming and droughts continued for over a decade, there were no lasting effects on key properties of soils, such as growth rates, when the soils were allowed to re-stabilise in a laboratory over seven days.

Soils, and the microbes that live in them, regulate carbon storage and nutrient cycling, ultimately underpinning agriculture and climate change mitigation. Understanding how a changing climate will affect these processes is vital to understanding how these important ecosystem services will be affected as global warming progresses.

Climate change projections have predicted an increase in average temperatures as well as more frequent droughts. Previous research has shown that warming and droughts can both have substantial effects on soil ecosystems, affecting microbial biomass, growth and mix of species. However, there has been little research into whether such effects are irreversible or whether, given the right conditions, the ecosystem could return to 'normal'.

In this study, supported by the EU INCREASE project[1], researchers used five long-term experiments which had been running for between ten and thirteen years. These were situated in shrubland ecosystems in five different Member States (Denmark, Hungary, Italy the Netherlands and the UK).

In each country, scaffolding was built over three 4 x 5 m^2 plots (15 in total), allowing for a 0.5 m buffer around the edges. Each plot then underwent one of three treatments:

1. 'Drought', for which covers were placed on the scaffolding during rainfall for two to five months in the main growing season. This reduced the growing season rainfall by approximately 30%.
2. 'Night warming', for which a specialised cover designed to trap heat, was put up on the scaffolding at night. This cover was removed during rainfall to prevent overlap between this treatment and drought. This resulted in an average temperature increase of the soil by 0.6 °C.
3. The remaining plots were left without any covers to provide a point of comparison.

In 2012 soil samples were removed from each on-going experiment and taken to a laboratory where they were either tested immediately, or rehydrated (to 50% of their water-holding capacity) and kept at a temperature of 20°C for seven days and then tested.

The results showed that although there were significant effects on soil microbes during the treatments (e.g. at drier conditions), after the seven day stabilisation period, there were no lasting effects on growth rates, biomass or mix of species.

The sites used cover a wide geographical area, and included soils with very different properties, but nevertheless produced consistent results. However, this study focused only on bacteria and fungi which form a single part of the wider soil ecosystem. Investigations into the impacts of drought on invertebrates, such as worms and beetles, are also needed. Furthermore, although this study did cover long time spans, studies at larger spatial scales are also needed to truly understand the impacts of drought and warming at the landscape scale.