

Ethiopia is making maps to help improve soil health

By [Ermas Betemariam](#)

5 Dec 2019

Healthy soils are vital to human survival. They play a pivotal role in feeding global populations - after all, food is grown in soil. Healthy soils grow more crops and allow for nutrients to be better absorbed by the crops. That's why it's important to understand exactly when there might be a problem with the soil of a particular area, and what's causing it. Without a precise diagnosis, soil can't be successfully treated.



Soil health maps can help smallholder farmers make better decisions on improving their yields. Rod Waddington/Flickr

Soil health is a matter of striking the right combination of chemical, physical and biological properties. Soil is made up of mineral particles including sand, silt and clay; organic matter – such as plant and animal residue – air and water. By looking at these we can determine how healthy, or unhealthy, soil is – for example, whether it is able to retain water, store carbon and resist erosion.

In Ethiopia, poor soil health is [making it difficult](#) for farmers to grow staple food such as teff, wheat, maize, sorghum, and barley and eke out a living.

This declining soil health has been [caused by](#) unsustainable farming practices – such as the use of too much fertiliser or farming on slopes – overgrazing and erosion caused by deforestation, meaning tree roots aren't holding soil in place. In addition, state ownership of all land in Ethiopia [means that](#) farmers are insecure about their tenure and less inclined to invest in the land's health.

Fortunately, if soils are degraded or starved, they can be treated to restore their balance. But to treat soils, it's important to first diagnose the soil's health to ascertain what's lacking.

To better understand what it would take to increase crop yields in Ethiopia, my colleagues and I [set out](#) to get to know the country's soil. This is part of the [Ethiopia Soil Information Service](#), established with support from [World Agroforestry](#) and the [CGIAR Research Program on Water, Land and Ecosystems](#).

Since its inception in 2012, the project has gathered and catalogued over 100,000 soil samples. From our findings we are able to put together maps which show where there are soil fertility issues and whether (and which) nutrients are missing. This means we have information that better informs land management practices and what fertilisers are needed to fill nutrient gaps.

Healthy, more nutritious soil means that farmers can grow a greater variety of crops. It also puts an end to over-use and degradation: when soil is healthy, farmers no longer need to expand into previously untouched land when their original plots become exhausted.

Diagnosing soil health

The first step towards diagnosing soil health is understanding what's wrong.

[Soil spectroscopy](#) – a new, light-based technology – makes it easy, fast and cheap to analyse very large numbers of soil samples. By measuring how infrared light, at different frequencies, is absorbed by a soil sample, we get a snapshot of the soil's organic and mineral contents.

From our analyses, we found that the health and fertility of soil vary greatly across the country.

We now know that 96% of Ethiopian soils are either acidic or alkaline – [this affects](#) the nutrient levels in soils because a neutral pH is desirable. Acidic or alkaline soils are caused by human factors such as the of the wrong type of fertilisers, and natural processes – some soils are naturally acidic and need to be amended.

The data has also corrected some misconceptions. For example, analyses have shown that soils in some parts of the country are lacking potassium, despite [previous beliefs that this nutrient was generally abundant](#). Potassium [encourages plants](#) to grow healthily. It's associated with the regulation of water within the plant and with the control of water loss from the leaves. It is particularly important in plants that store large amounts of sugar and starch – such as potatoes.

Soil data maps

Our soil data is used to create soil property maps, which show where soil fertility issues exist and whether (and which) nutrients are missing. With this information, decision-makers – such as extension officers – can help farmers decide where to restore and better manage soil as well as where, what kind and how much fertiliser to use.

[So far](#), soil fertility status and fertiliser recommendation atlases have been published and handed over to the Amhara, Harari, Southern Nations, Nationalities, and People's Region, Tigray regions and Dire Dawa administration. Maps for 300 woredas (districts) of Oromia regional state and the Benishangul-Gumuz and Gambella regions were also completed. The Afar and Somali regional state maps are under production.

Ethiopia is not the only African country building up a picture of its soil. It's part a continent-wide effort to gather and analyse soil data under what we call the [Africa Soil Information Service \(AfSIS\)](#). Under this, Tanzania, Ghana, Nigeria and

Rwanda have all worked to develop their soil information systems, conducting nationwide soil health surveys and developing digital soil resource maps for targeted interventions like sustainable land management practices.

More African countries could do it, but they lack resources, notably manpower. Capital investment in this technology is also a constraint, so is how to make decisions based on data coming out of this technology.

But it's worth the investment. Governments can use the maps to better target sustainable land management interventions, and smallholder farmers can consult them to [make informed decisions](#) on improving their soils.

The ultimate aim is to arm thousands of African farmers with the exact insights that will help them fight soil and land degradation.

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