Put more carbon in soils to meet Paris climate pledges

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Soils are crucial to managing climate change.

- They contain two to three times more carbon than the atmosphere. Plants circulate carbon dioxide from the air to soils, and consume about one-third of the CO2 that humans produce. Of that, about 10–15% ends up in the earth.

Carbon is also essential for soil fertility and agriculture.

- Decomposing plants, bacteria, fungi and soil fauna, such as earthworms, release organic matter and nutrients for plant growth, including nitrogen and phosphorus. This gives structure to soil, making it resilient to erosion and able to hold water. Typically, organic matter accounts for a few per cent of the mass of soil near the surface.

Increasing the carbon content of the world's soils by just a few parts per thousand (0.4%) each year

- would remove an amount of CO_2 from the atmosphere equivalent to the fossil-fuel emissions of the European Union1 (around 3–4 gigatonnes (Gt)).
- It would also boost soil health: in studies across Africa, Asia and Latin America, increasing soil carbon by 0.4% each year enhanced crop yields by 1.3% .

Eight steps

- The following practices would increase the amount of carbon held globally in soil:

1. Stop carbon loss.

- Protecting peatlands is the first priority for keeping existing carbon in the ground. These hold between 32% and 46% of all soil carbon (an estimated 500–700 Gt of approximately 1500 Gt) in an area about half the size of Brazil. Each year they take up about 1% of the global CO_2 emissions generated by humans.

2. Promote carbon uptake.

- Researchers need to establish a set of best practices for getting more carbon into soil. Proven techniques include making sure the soil is planted all year round, adding crop residues such as mulch and straw or compost, and minimizing tillage practices such as ploughing.

3. Monitor, report and verify impacts.

- Researchers and land managers need to track and evaluate interventions.
- It involves extensive field surveys that collect hundreds of samples per hectare, with laboratory analyses costing up to US$10 per sample.
- The Global Soil Laboratory Network (GLOSOLAN) is working to improve matters by harmonizing protocols and standards and setting up global training programmes in soil analysis.

4. Deploy technology.

- Advanced instruments make soil measurements cheaper, faster and more accurate.
- Portable infrared spectroscopes will soon be capable of tracking multiple chemical signatures in soil.
- Satellite imagery is also essential for scanning wide areas. Researchers should design automatic procedures and algorithms for assessing soil carbon content from space, or for predicting it from the characteristics of vegetation.

5. Test strategies.

- Computer models and a network of field sites need to be developed to test the effectiveness of, say, avoiding ploughing.
- Data on soil types and meteorological variables will also need to be collected.

6. Involve communities.

- The public should be made more aware of the importance of soil organic carbon and of their ability to improve it on farms, in private gardens and public areas.
- Citizen-science approaches to collecting data, which are widely used in urban planning, for example, should be extended to soils.
- A good example is the earthworm population survey conducted by farmers.

7. Coordinate policies.

- Political frameworks covering soils and climate change should work together. These include parties involved in SDG15 — the UN Sustainable Development Goal— and the UN Convention to Combat Desertification, which has targets and funding for stopping land degradation and managing land sustainably.
- Scientists should help countries to integrate soil carbon goals in their pledged emissions cuts to the Paris agreement.

8. Provide support.

- Policymakers should include soil carbon in emissions-trading schemes and carbon taxes.
- Crop insurance and other services can offer premiums to farmers who have improved soil carbon. Carbon credits or discounts could be given for lands that are at risk of soil-carbon loss.

What next? First:

- First, researchers, policymakers and land managers need to recognize that increasing soil carbon stocks and protecting carbon-rich soils is crucial for achieving the Paris climate targets and SDGs.
- This could be hosted by the 4p1000 initiative.
- Neighbouring countries should exchange experiences, develop common management strategies and make joint decisions on climate-change mitigation, adaptation and land degradation.

What next? Second:

- International funding agencies should set up a pool of several million dollars to address urgent research gaps, such as those identified by the 4p1000 initiative.
- These include: estimating the potential for soil carbon storage; developing targets and management practices; designing monitoring, reporting and verification strategies; and understanding basic soil-plant processes.