



THEME 1

Monitoring, mapping, measuring, reporting and verification (MRV) of SOC

4 for 1000 and Soil Carbon

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The French Government launched the “4 per 1000 Initiative: soils for food-security and climate”, because an average annual growth rate of 0.4% in the global soil carbon stocks would make it possible to stop the present increase in atmospheric CO₂.

Atmospheric CO₂ level are increasing at 2 ppm per year. The level of CO₂ reached a new record of 400 ppm in May 2016.

In order for the 4 per 1000 Initiative to achieve its objective to stop the present increase in atmospheric CO₂, agricultural systems would have to sequester 2 ppm of CO₂ per year.

Using the accepted formula that 1 ppm CO₂ = 7.76 Gt CO₂ means that 15.52 Gt of CO₂ per year needs to be sequestered from the atmosphere and stored in the soil as SOC.

The objectives are to use examples of agricultural systems that have published studies documenting their increases in SOC and to extrapolate the data to see how much CO₂ could be sequestered per year, globally to meet the aspirational goals of the 4 per 1000 Initiative to stop the present increase in atmospheric CO₂.

It is not the intention of this paper to use these types of generic exercises of globally extrapolating data as scientific proof of what can be achieved by scaling-up these systems.

These types of very simple analyses are useful for providing a conceptual idea of the considerable potential of agriculture to sequester CO₂ on a landscape scale.

Agricultural systems that use techniques such as longer rotations, cover crops, green manures, legumes, compost, organic fertilizers, organic agriculture, agro forestry, agroecology and intensively managed grazing systems can increase soil organic carbon (SOC)

These systems are starting to come under the heading of **Regenerative Agriculture** because they regenerate SOC.

Examples of Agricultural Systems

The Farming Systems Trial conducted by the Rodale Institute in the USA, showed that CO₂ was sequestered into the soil at the rate of 3,596.6 kg of CO₂ per hectare per year. Aguilera et al. 2013 found that the organic systems sequestered 3559.9 kilograms of CO₂ per hectare per year.

When extrapolated globally across agricultural lands, would sequester 17.5 Gt of CO₂ per year.

Total Agricultural Land:
4,883,697,000 ha. Source: FAO, 2010

$3,596.6 \text{ kg CO}_2/\text{ha}/\text{yr} \times 4,883,697,000 = 17.5 \text{ Gt of CO}_2/\text{yr}$

CO₂ was sequestered into the soil at the rate of 8,220.8 kg per hectare per year in the Rodale Compost Utilization Trial and extrapolated globally would sequester 40 Gt of CO₂/yr.

Machmuller et al. 2015: reported an increase of 29,360 kgs of CO₂/ha/yr. in three farms converted to management intensive grazing.

If these regenerative grazing practices were implemented on the world's grazing lands they would sequester 98.5 gt CO₂/yr.

Grasslands: $3,356,940,000 \text{ ha (FAO, 2010)} \times 29.36 = 98.5 \text{ gt CO}_2/\text{yr}$



The above examples show that there are agricultural systems that could sequester enough CO₂ and store it as SOC to meet the aspirational goals of the 4 per 1000 Initiative.

The key issues are:

1. Urgent research should be commenced to understand how and why these systems sequester significant levels of CO₂ and then look at how to apply the findings for scaling-up on a global level in order to achieve a significant level of GHG mitigation.
2. The signatories the 4 per 1000 Initiative, including governments and international organizations, should start programs training farmers in the regenerative agriculture systems that increase SOC.
3. Further research can improve the rates of sequestration.



The same soil under different management systems.

The soil on the left has more SOC than the soil on the right due to 16 years of organic agriculture. It is more stable, absorbs and holds more water and nutrients.

It has sequestered 57500 kgs per hectare of CO₂ in that time

Picture: Rodale Institute