Soil Carbon

For food security and climate change mitigation

Sydney Institute of Agriculture
Global Carbon Stocks & Fluxes

**Fluxes**


<table>
<thead>
<tr>
<th>Year</th>
<th>Fossil fuels and cement</th>
<th>Land-use change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980</td>
<td></td>
<td></td>
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<tr>
<td>2000</td>
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</tbody>
</table>

**Terrestrial Stocks**

- Vegetation: 550 + 100 Gt C
- Soils: 2400 ± 500 Gt C

Vegetation: 550 + 100 Gt C

Soils: 2400 ± 500 Gt C
Annual Global CO$_2$ emissions from fossil fuels: 8.9 giga tonne C

Organic carbon stored in the soil globally (up to 2 m): 2400 giga tonne C

\[
\frac{8.9}{2400} = 4\% \text{ of CO}_2\text{ emission}
\]

Adapted from Ademe, 2015
Global soil OC stock (0-30cm, t C ha$^{-1}$)
Areas in the tropics below critical level
Country/Region | Total Soil organic C stock 0-30 cm (Gt) | Agricultural Area (Mha) | Soil C stock in Agricultural land (Gt) | Potentials | Challenges
---|---|---|---|---|---
Australia | 25 | 455 | 12.76 | Large agricultural land area, optimization of crop rotations, and retention of crop residues, improved grassland management. | Lack of water, zero or minimum tillage has been implemented almost 80% in the grain cropping areas.
Auditing Soil Carbon

University of Sydney
Nowley experimental station

Topsoil C prediction

Uncertainty of map
Sampling design

Auditing Soil Carbon

Table 2: Statistics of C sample data from Nowley farm, based on the Ospats stratification with 10 strata and 5 samples per stratum

<table>
<thead>
<tr>
<th>Strat.</th>
<th>Relative size</th>
<th>Mean</th>
<th>St. error estimated</th>
<th>St. error predicted</th>
<th>Optimal sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.52</td>
<td>11.56</td>
<td>0.83</td>
<td>3.34</td>
<td>11</td>
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<td>2</td>
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<td>11.27</td>
<td>1.27</td>
<td>3.08</td>
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<tr>
<td>3</td>
<td>12.48</td>
<td>11.70</td>
<td>1.16</td>
<td>2.64</td>
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<td>4</td>
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<td>1.44</td>
<td>2.55</td>
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<td>1.25</td>
<td>2.99</td>
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<tr>
<td>6</td>
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<td>17.06</td>
<td>2.13</td>
<td>2.75</td>
<td>20</td>
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<tr>
<td>7</td>
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<tr>
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<tr>
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<td>3.34</td>
<td>6</td>
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<tr>
<td>Farm</td>
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<td>14.82</td>
<td>0.62</td>
<td>0.90</td>
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</table>

Mean C stock = 14.82 ± 0.62 Mg C ha⁻¹
Land Managers/ Farmers

Practices
Minimum Tillage
Residue management
Improved Grazing
Crop rotations

For the benefits of:
• Increased Yield
• Soil Conditions
• C credits

Scientists
Measurements, sensing
Modelling
Digital soil mapping
Auditing C
SOC functioning
SOC Persistence

Policy Makers
4 per mille
Kyoto Protocol
EU Soil Thematic Strategy
Carbon Farming Initiative
Global Soil Partnership

Marketeers
C trading
Natural capital
Product supply chains

Innovation
Compliance
Climate Change

Confidence
Facilitation
Soil Carbon

- Food Security, Climate change mitigation, Improving soil structure