



Benefits of Compost and Carbon on Soils

7 October 2019

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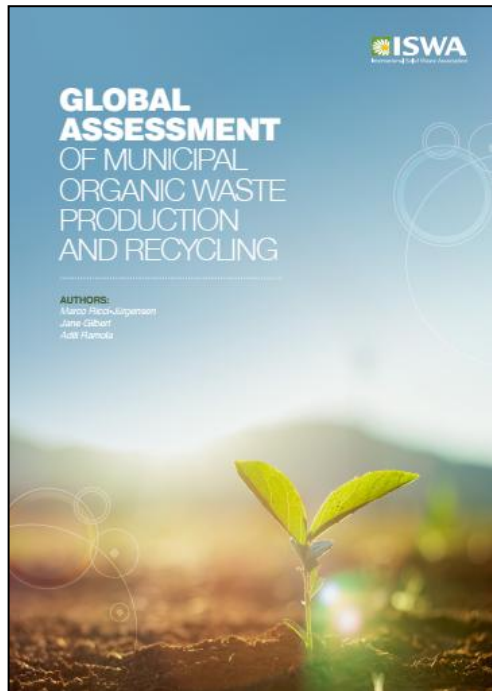
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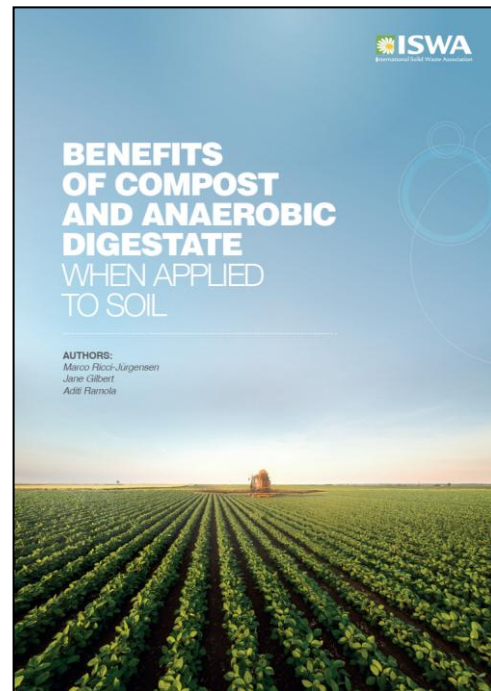
Introduction

- ISWA funded project:
‘Quantify the Benefit of Organic Matter in Compost and Digestate When Applied to Soils’
- Started in 2018 – Due for completion early 2020
- Team:
 - Marco Ricci-Jürgensen, CIC, Italy
 - Jane Gilbert, Carbon Clarity, UK
 - Aditi Ramola, ISWA, Austria
- Will be four separate reports

Project deliverables



October 2019

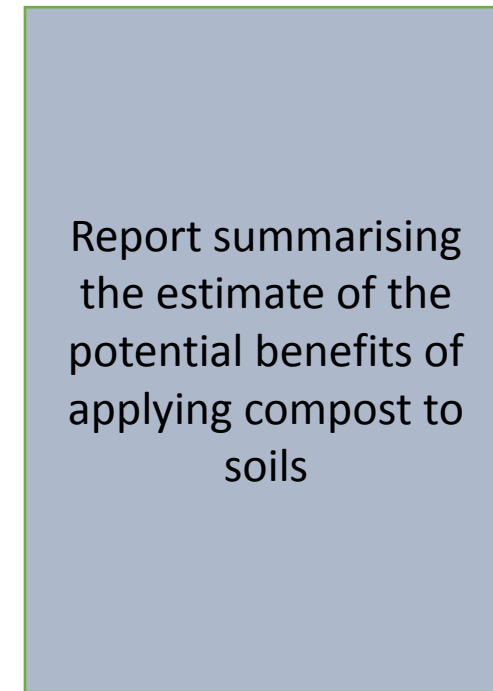


October 2019



Short report
summarising the
status of arable soils
in four different
geographic regions

December 2019



Report summarising
the estimate of the
potential benefits of
applying compost to
soils

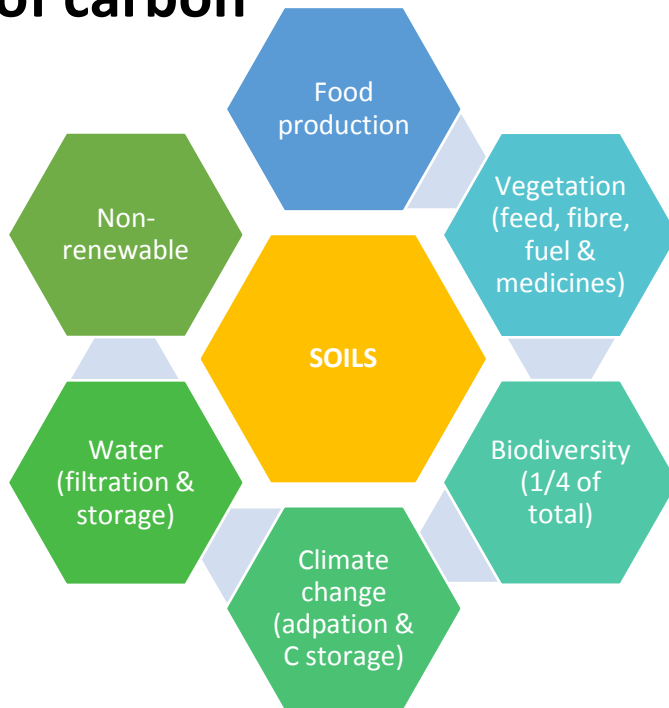
Q1 2020

Report 2

- ‘A Summary of the Benefits of Compost and Anaerobic Digestate When Applied to Soil’
- Comprehensive literature review during 2019
 - Peer-reviewed scientific papers
 - Governmental body reports (e.g. European Commission & FAO)
- Looked at effects of organic amendments (compost & anaerobic digestate) on soil properties:
 - Physical
 - Chemical
 - Biological

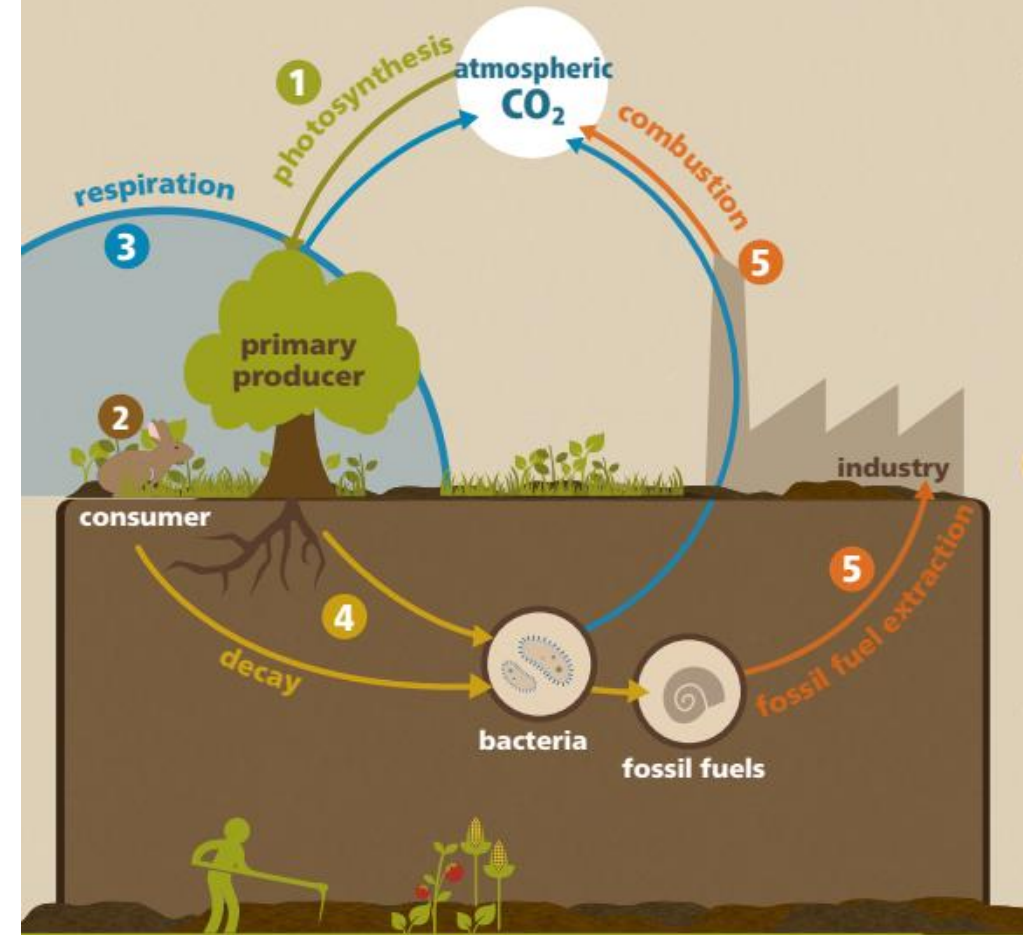
About Soil

- Source of **95% of our food**
- Holds about **three times as much carbon** as the atmosphere
- Globally, soils store about **680 billion tonnes of carbon**



Soils and the Carbon Cycle

The carbon cycle is the exchange of carbon (in various forms, e.g., carbon dioxide) between the atmosphere, ocean, terrestrial biosphere and geological deposits.

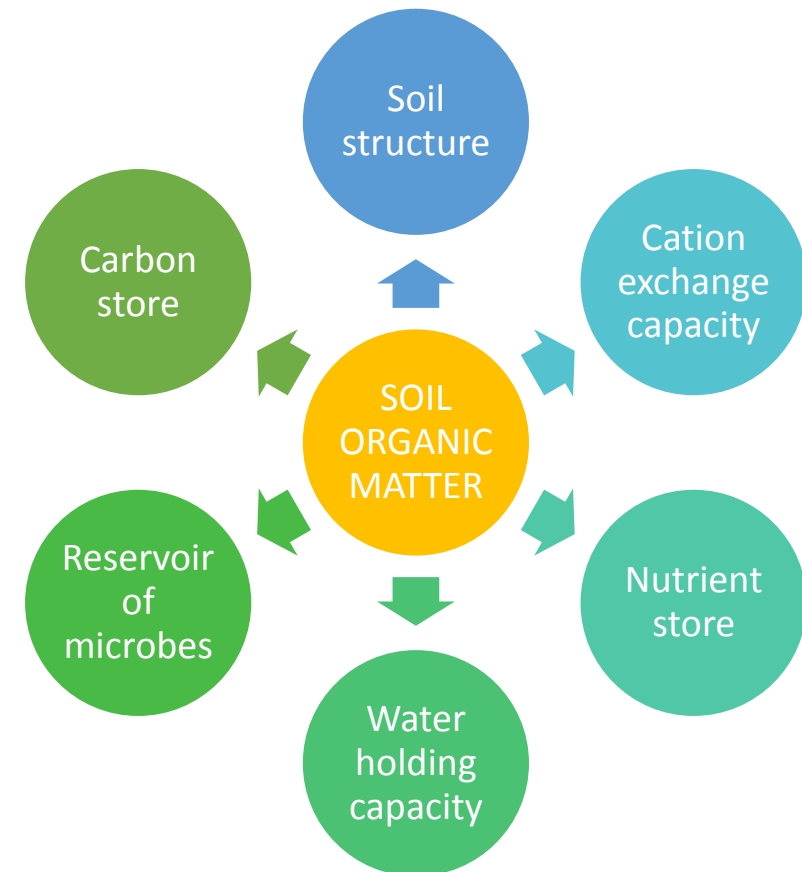


Our soils are under threat

Erosion

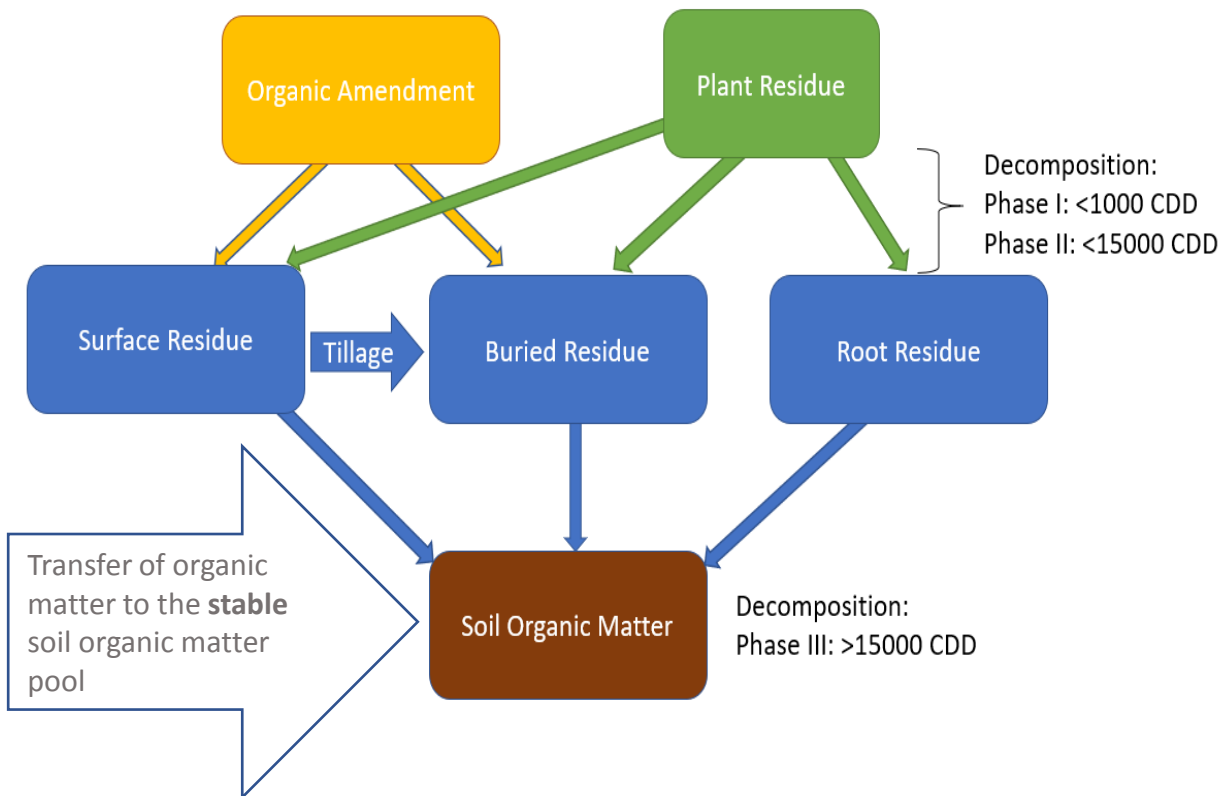
- 80% of the world's agricultural land suffers moderate to severe erosion
- 10 million ha of agricultural land are lost through soil erosion every year (~0.7%)
- Over last 40 years ~30% of world's cropland has become unproductive
- Loss of soil organic matter is a major factor
- "Soil is being lost from agricultural areas 10 to 40 times faster than the rate of soil formation imperilling humanity's food security"

Role of Soil Organic Matter

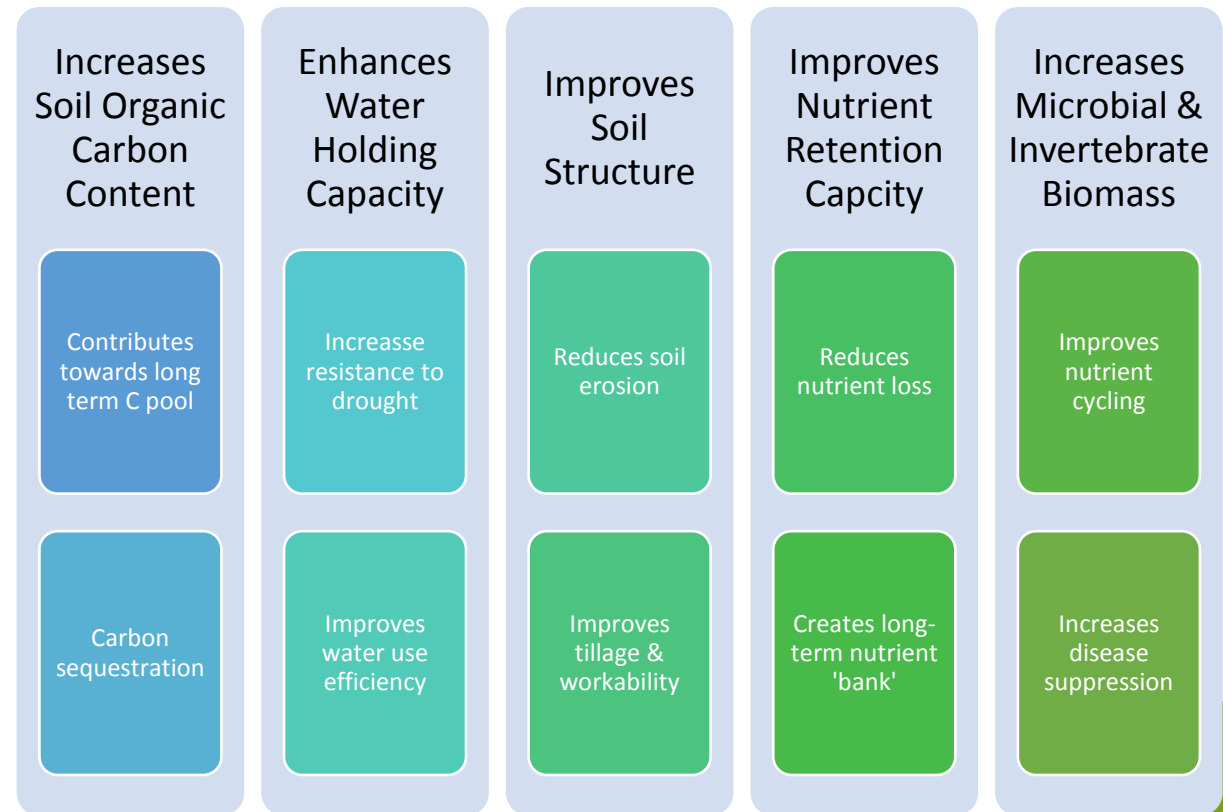


Adding organic amendments to soil

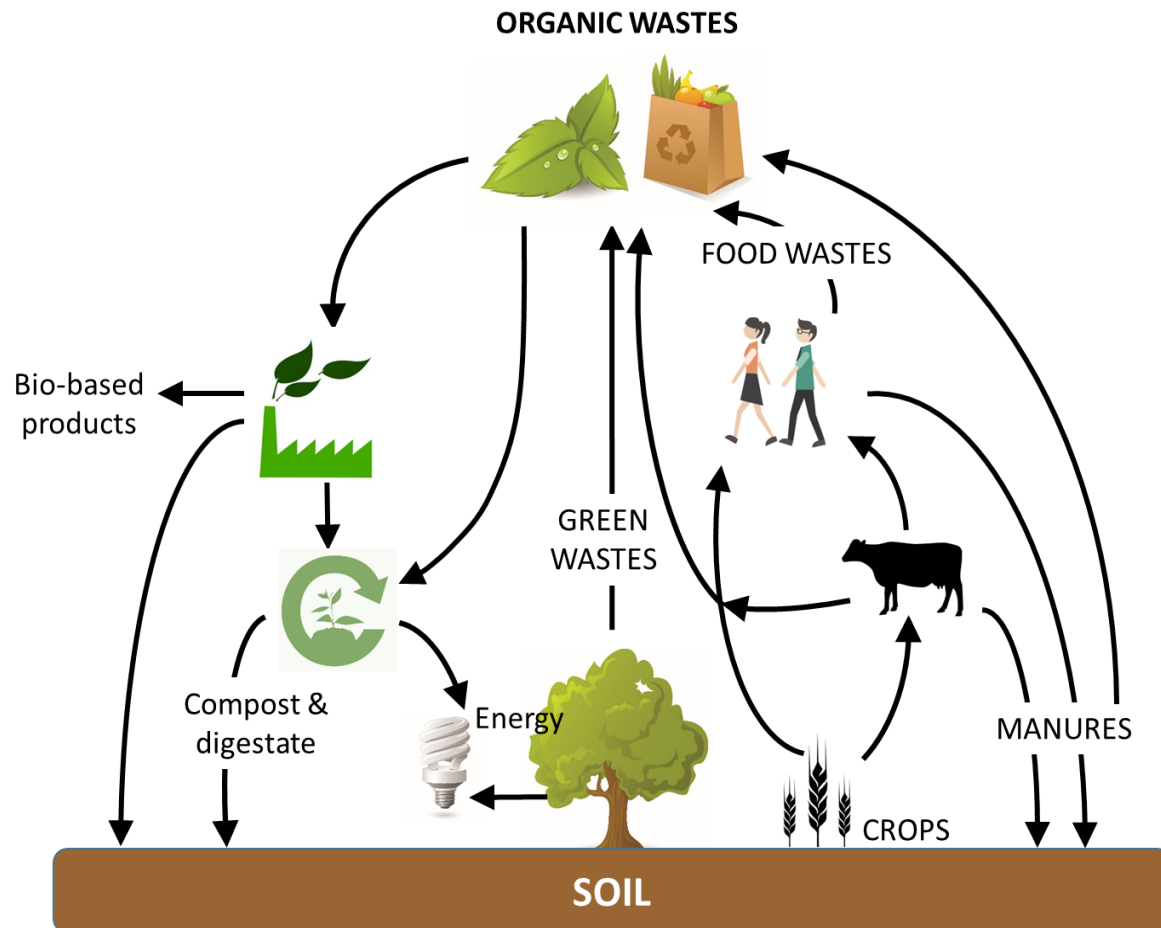
Three Phases of Decomposition



Benefits



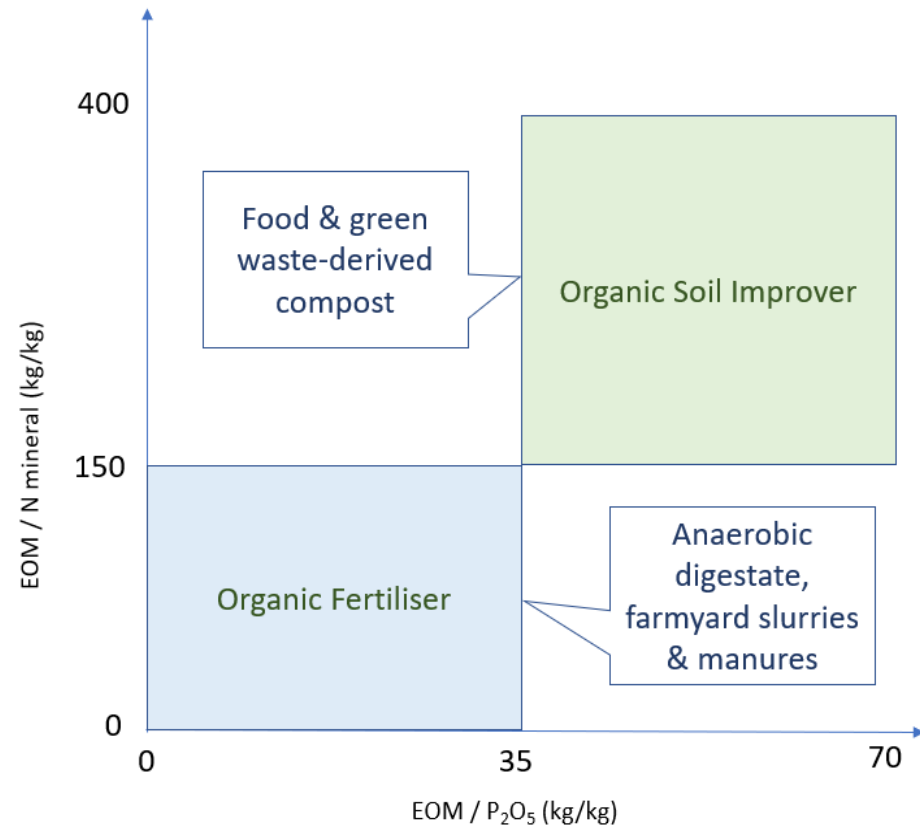
Sources of organic amendments



- Compost
 - Aerobic process
 - Bacteria & fungi
 - Lignins in wood transformed into humic substances
 - Source of stable carbon
- Digestate
 - Anaerobic process
 - Bacteria
 - Simpler carbon compounds
 - Methane & carbon dioxide
 - Little/no evidence of humification

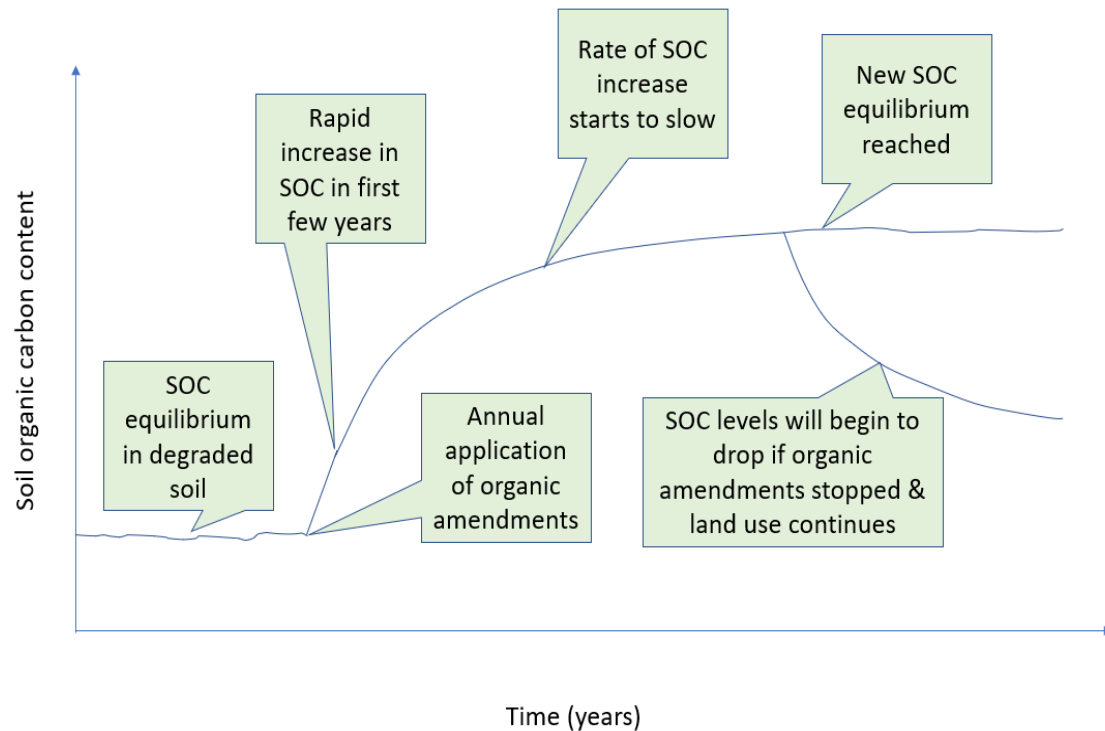
On the basis of their composition

- **Composts** can be classified as an **organic soil improver**
 - Source of stable carbon
 - Contributes towards increasing SOM
- **Digestates** can be classified as an **organic fertiliser**
 - High in plant available nutrients



*Classification of organic amendments as either an organic soil improver or organic fertiliser based on the ratio of EOM to nutrients (N & P)
(re-drawn from Veeken et al. 2017)*

Effects of organic amendments on SOC



Literature review suggested

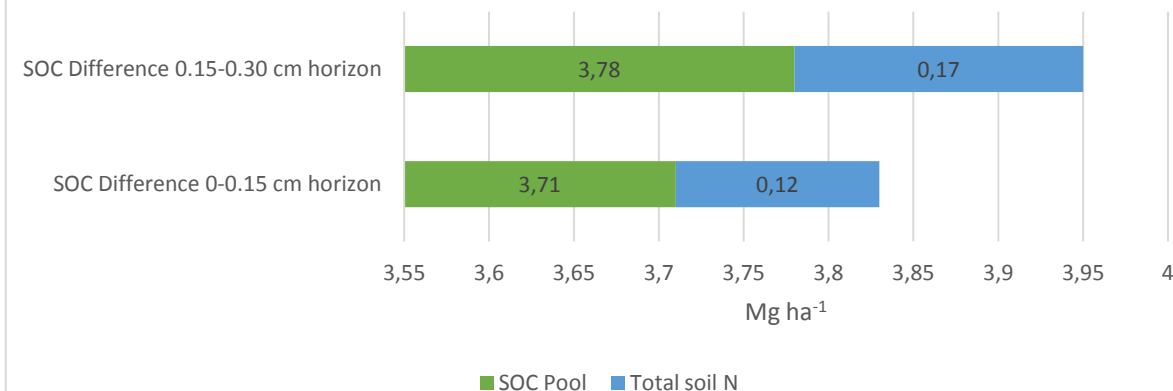
- Over a period of 4-12 years between **11% - 45% of the organic carbon** applied to soil as compost remained as **soil organic carbon**
- **Soil organic carbon** increases of between **50-70 kg C ha⁻¹ yr⁻¹ t⁻¹ dry solids** applied as compost are possible
- **1 tonne** (fresh mass) of green waste derived-compost applied to soil over one hectare (10,000 square meters) results in a net CO₂-eq saving of **143 kg/ha/year** due to the increase in SOM alone (excluding fertiliser offsetting)

Other benefits of compost

Soil physical & chemical properties

- Improve soil aggregation
 - Stability
 - Agregate size
 - Reduce soil bulk density
- Water holding capacity
 - a 1% mass increase in soil OC on average increased available water capacity by 1.16%, volumetrically

Changes in SOM & TSN Over 14 Years Relative to Control



Soil biology

- Increases of up to 100% in soil microbial biomass have been measured experimentally
- Increases in enzyme activities associated with carbon, nitrogen and phosphorus recycling have been measured
- Increases in earthworm densities have been recorded
- Green waste-derived compost can be effective in suppressing horticulturally significant soil-borne plant pathogens

Regular application of compost to soil can build up a pool of nutrients, especially nitrogen, which increases the soil's fertility and improves its ability to grow crops

Conclusions

- Literature review has highlighted benefits of compost on soil organic matter
 - Increasing SOC
 - Improving soil physical, chemical and biological properties
- Preliminary figures identified
 - Will be used as basis of calculations in future ISWA report
- Report currently in press; due for publication shortly