Management of organic matter in an urban context and its link with rural areas

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Based on the chapter 3.7 of FAO manual on recommended management practices and actions for preservation and/or enhancement of SOC:

Rumpel, C., Yeboah, E., Nartey, E., Luu, P., Staudhammer, C., Marques-dos-Santos Cordovil, C., Urban areas, to be published 2019
Increasing importance of Urban environments

- In 2007: first time more people living in cities than in rural environment
- Increasing share of urban population: increase to 66% in 2050 amounting to 6.4 billion people (UN, 2017)

Problems related to urbanisation:

- Soil sealing – impermeable surfaces
- Road construction – topsoil removal
- Heat islands
- Stormwater flow
- Contamination
- Air quality
- No food production – everything must be imported
Soil organic carbon stocks in urban environments

- Urban soils accumulate SOC at high rates due to upward growth (50 cm a⁻¹)
- SOC is part of urban infrastructure, designed for addressing problems related to urbanisation

Vasenev and Kuzyakov, 2018, LDD
Green infrastructures

- Gardens, parks, lawns, street trees
- Urban agriculture
- Urban forestry
- Green roofs
- Bioswales

Remediate problems related to urbanisation

Man-made green infrastructures often constructed with the aim to improve hydrology

Management of green infrastructures may have trade offs in terms of other greenhouse gas emissions due to mineral N-fertiliser use
Green infrastructures

Green roofs

**Benefits**
- Amenity
- Water use efficiency/recovery
- Isolating capacity
- Carbon storage potential
- Reduce heat island effect
- Biodiversity

**Trade-offs**
- Carbon footprint
- Water footprint due to irrigation

**Barriers:**
- poor promotion/understanding of their utility
- High maintenance costs

Green roofs alleviate huge ecological footprint of cities. Higher C storage potential if built with organic (waste) materials.
Green infrastructures

Bioswales

Benefits
- Reduced stormwater runoff
- Promote water cleaning and infiltration
- Carbon storage
- Aesthetic improvement
- Air quality

Trade-offs
- High loads of N and P
- Carbon footprint due to construction and maintenance

Barriers
- Bad public acceptance (dirty....)
- High maintenance costs
Urban agriculture

Practiced by 800 million people producing 15-20% of the world’s food

Dependence of food security on urban agriculture is growing especially in developing countries

Old concept, popular in war times; gained importance after the 2008 economic crisis.

Food production near to consumer reduces the carbon footprint of food production

Organic matter management in this context extremely important:

- Many growth media are depleted in SOC
- Rather than importing soil from rural areas, urban agriculture often relies on artificial soils (rooftop agriculture)
Recycling of organic waste materials

2017: 7 milliard $
2050: 9.5 milliards

30% in temperate regions
50% in tropical regions
Can be recycled

Paris: 40 kg/yr/citizen

Need to be encouraged by good governance/public awareness

For use within cities or outside

(Hoornweg et al, 2013)
Recycling of organic waste materials

Waste recycling techniques:

- Composting
- Vermicomposting

To improve environmental stability of amendments and SOC storage potential:

- Co-composting and Co-vermicomposting procedures with mineral material
- Thermal treatment with energy production

Selective sorting should be established

Need for incentives and capacity building
Katowice 13th December 2018 – 3rd FORUM of PARTNERS

Measures to improve organic matter recycling in urban areas

« Cambio verde » - a program in Curitiba, Brasil

Organic and recyclable waste collection in slums and exchange against food surplus of local farms

- Reduces waste
- Combats malnutrition, hunger and poverty
- Raises awareness

Urban farming initiatives

- Raises awareness
- Improves interaction between community members

Government initiatives (laws)

- Reduce food waste
- Prevent recyclable waste from going to landfills

Detroit, US – community driven
Ghana, Flagship program ‘Planting Food for Job’

California - Integrated Waste Management Act
Europe – selective sorting
Carbon flows between cities and rural areas

- Waste
- Lime/Gravel
- Wood, turf, compost
- Organic amendments
- Green zones
- Technical know how
- SOC plant residuals
- BC fuel combustion
- Xeno-C plastic, rubber
- City center
- Residence
- Industries
- Food

After Vasenev, V., Kuzyakov, Y. (2018), LDD
Conclusion

- Organic matter management practices should rely on ecological concepts including ecological engineering approaches.
- Organic matter management in urban areas should address all material produced in cities, including its waste.
- Circular economy within the city itself or outside the city to equilibrate energy and carbon flows.
- In order to limit C loss to the atmosphere, innovative organic waste transformation and application strategies should be developed.

**Good governance**
- Communication
- Education
- Planning

Positive interactions with local communities in rural and urban areas is necessary.