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*

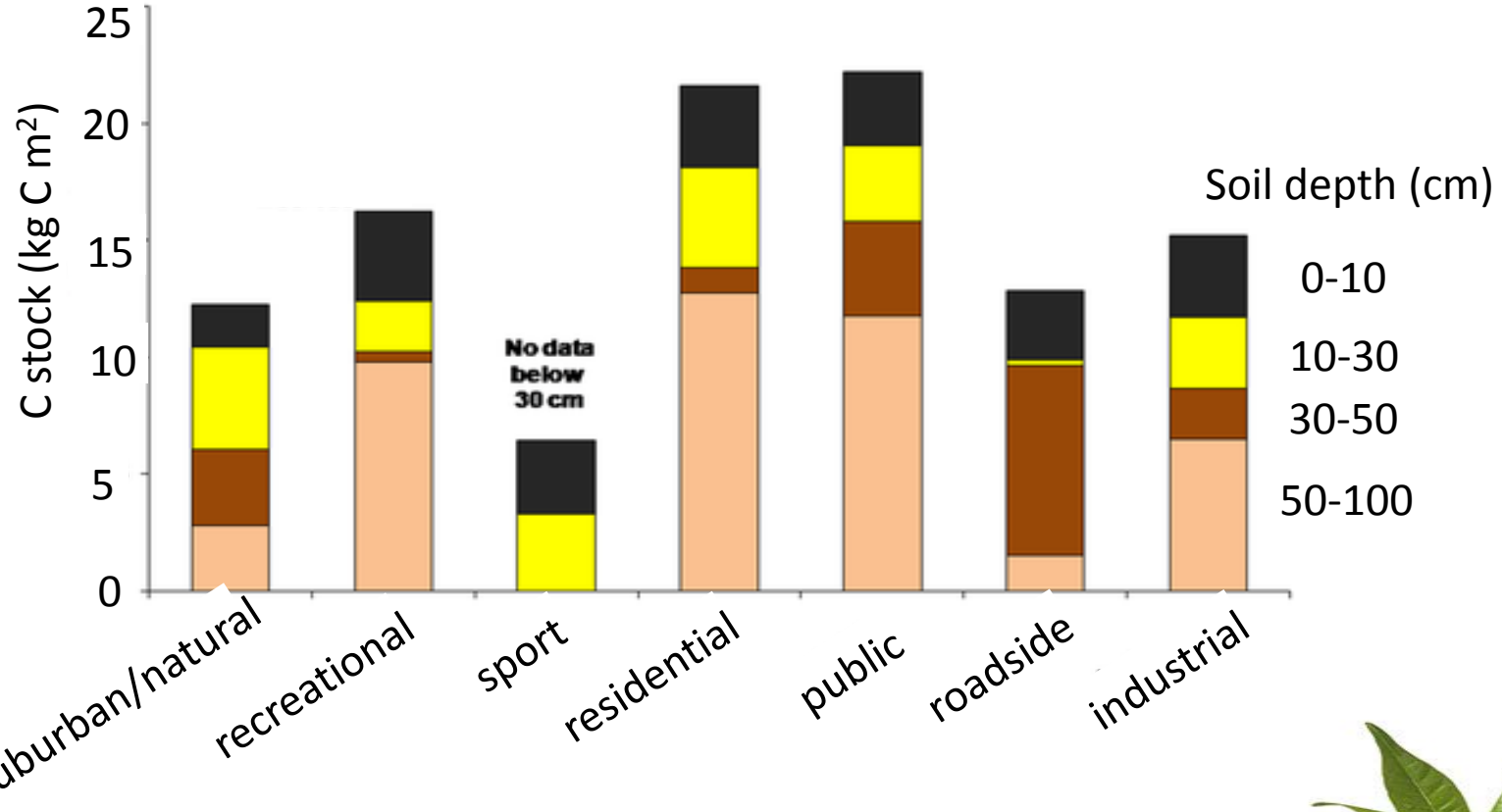
Increasing importance of Urban environments

- 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

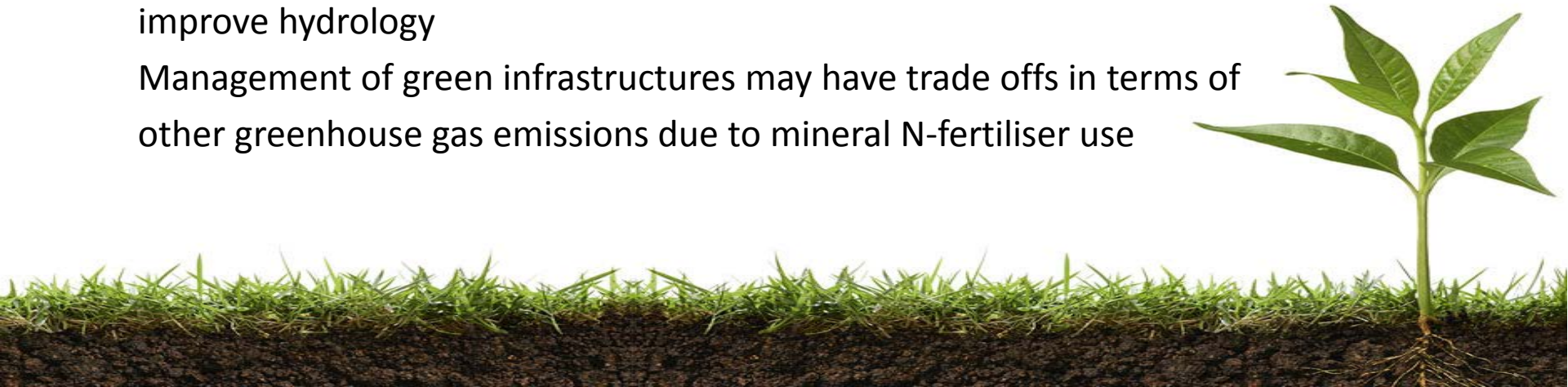
Green infrastructures

- 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

Waterfootprint due to irrigation

Barriers:

- poor promotion/understanding of their utility
- High maintenance costs

Green roofs alleviate huge ecological foot print 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

Aestetic 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

Dependance of food security on urban agriculture is growing especially in developping countries

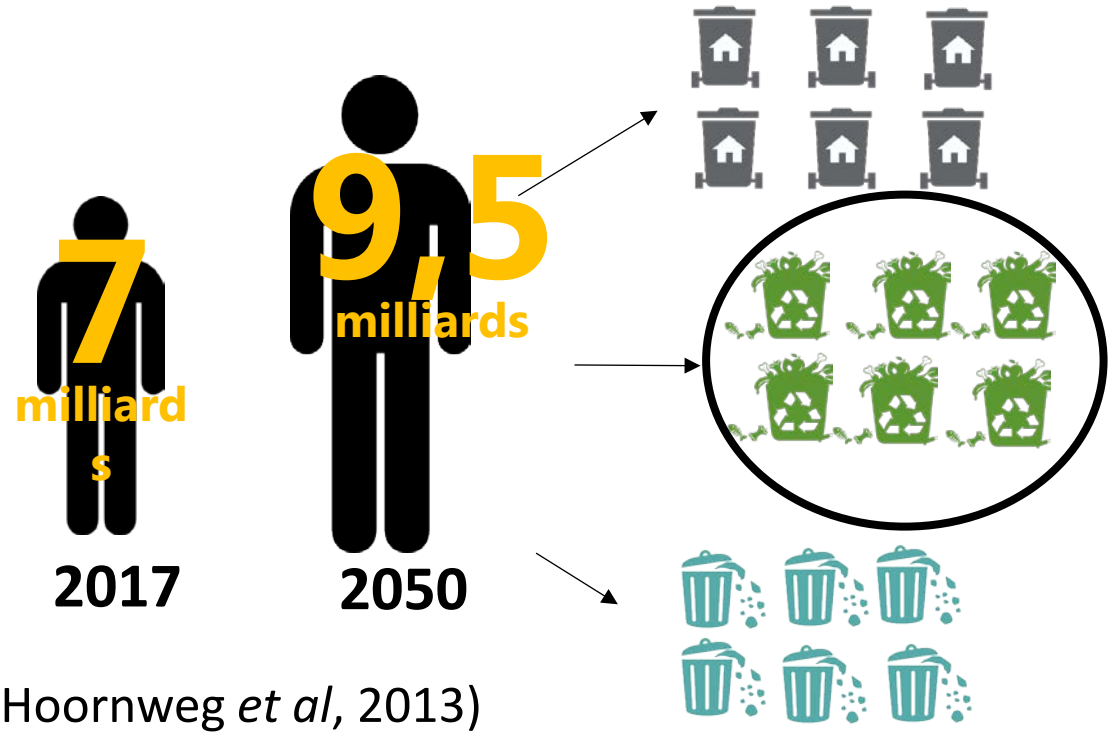
Old concept, popular in war times; gained importance after the 2008 economic crises

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

Organic matter management in this context extremly 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



30% in temperate regions

50% in tropical regions

Can be recycled

Paris: 40 kg /yr/ citizen

(Hoornweg *et al*, 2013)

Need to be encouraged by good governance/public awareness

For use within cities or outside

Recycling of organic waste materials

Waste recycling techniques:

- Composting
- Vermicomposting

→ Organic soil amendments

To improve environmental stability of amendents 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

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

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

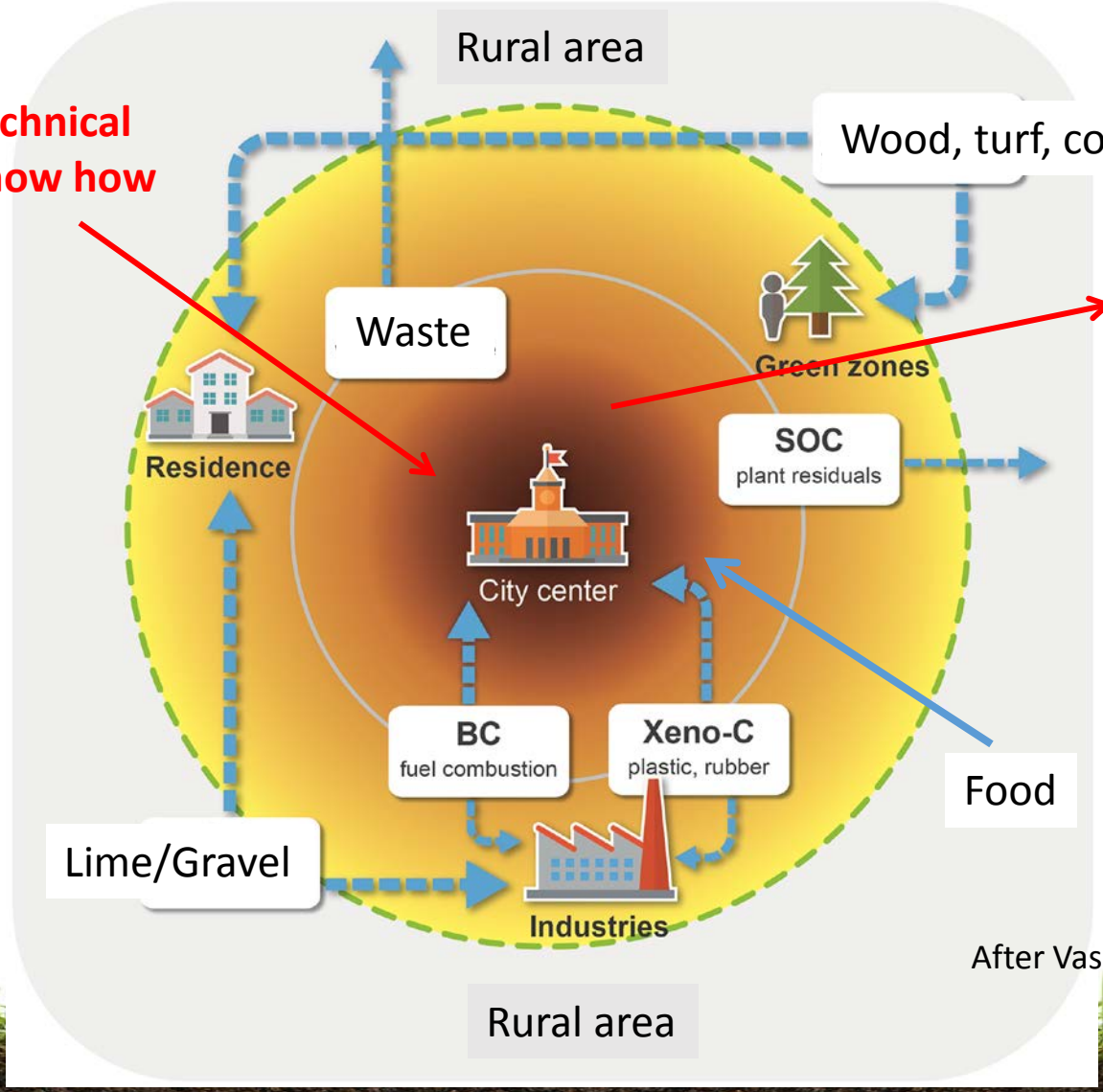
- Raises awareness
- Improves interaction between community members

Government initiatives (laws)

California - Integrated Waste Management Act
Europe – selective sorting

- Reduce food waste
- Prevent recyclable waste from going to land fills

Carbon flows between cities and rural areas



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