Soil Carbon Sequestration Potential in Urban Soils

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World Class. Face to Face.

Urban Soils

- Cut, compacted, and filled
- Depleted in organic matter
- Increased risk of runoff
- Poor environment for plant growth

Soil Amendments

- **Traditionally added to:**
  - **Improve plant growth**
  - **Reduce runoff**
- **Added benefit:**
  - ***Carbon sequestration***

Soil Amendment Synergy

- Sequestration of some amendment C in soil
- Better plant growth following amendment application, yielding more C-rich residues
- Local “wastes” become C and N resources for urban soils

The Urban Potential

- Turf and landscape plantings are “no-till” environments, lending themselves to C sequestration
- Gardens are tilled, but their small size makes high amendment rates feasible
- Substantial opportunities on vacant land (average 15% of urban space in US cities)

Two Urban Scenarios

- **New Development**
  - Replace soil C lost during construction to improve landscape quality and water quality
  - Soils for Salmon; Washington State

- **Restoring urban vacant land**
  - Genesee Land Bank; Flint, Michigan

What is our potential for C sequestration ?

- Summarize four middle-term (7 -15 years) studies in western Washington
- Estimates of turfgrass C sequestration
- Estimates of urban soil restoration

Yard Waste Compost Incorporated and Woody Plants Established 2001

3-inch application – 224 Mg/ha

Compost: 22% C, 2% N

Biosolids Surface-Applied to Tall Fescue 1993-2002

7, 13, and 20 Mg/ha/year for 10 years, compared with inorganic N

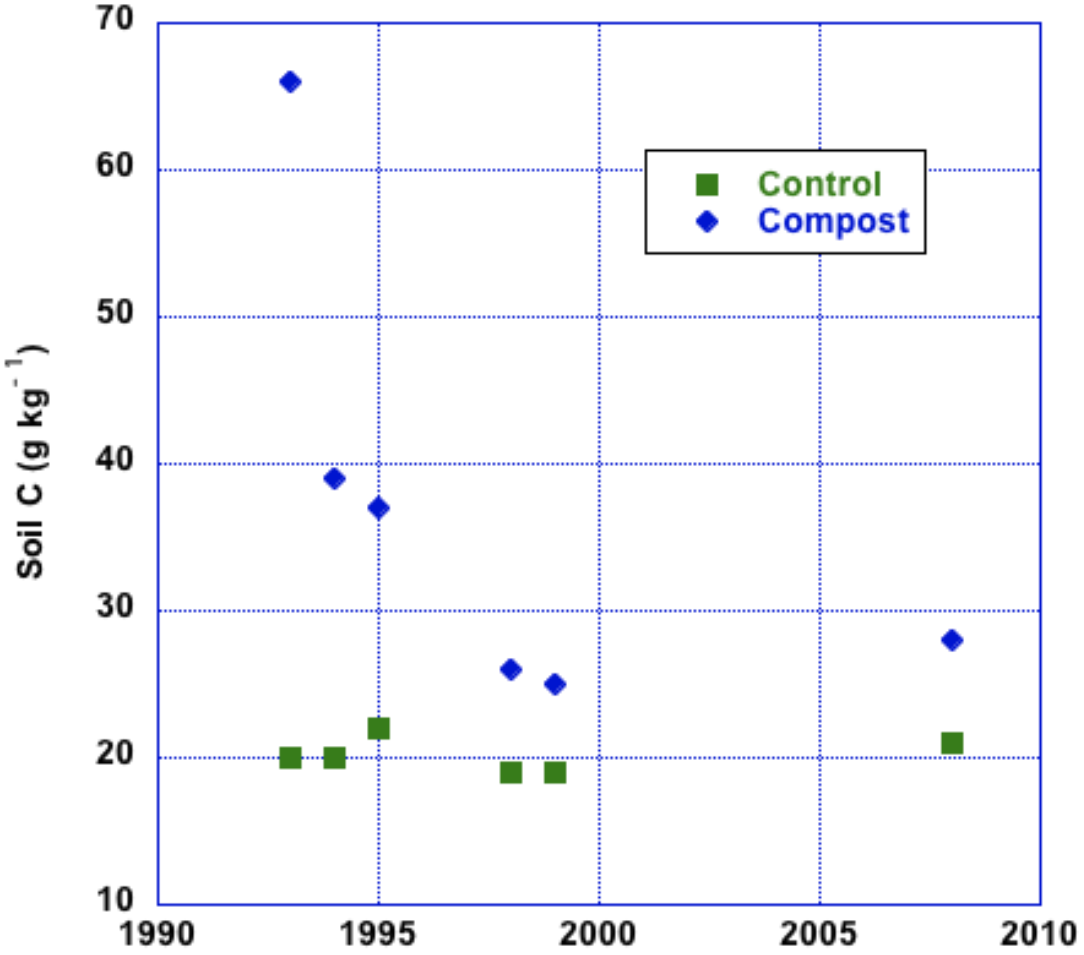
Biosolids: 32% C, 5% N

C sequestered 7-15 years after amendment applications

Material	Planting	Total Rate (Mg/ha)	Dates	Soil C increase (Mg/ha)	C sequestered (% of added C)
Biosolids *Surface applied*	Tall fescue	67-134	1993-2002	6-10	27
Food Waste Compost *Incorporated*	Tall fescue	157	1993	9	19
Yard Waste Compost *Incorporated*	Turfgrass	74-224	2000	2-20	25
Yard Waste Compost *Incorporated*	Woody landscape	224	2001	13	26

Food Waste Composts Applied 1993

Tall fescue planted; no tillage since 1993



Soil carbon remained steady since 1998

Potential for C sequestration from soil amendments

- **New development and redevelopment: "Soils for Salmon" approach**
- Incorporate 8 cm compost for landscape beds, 4 cm for turf establishment
- If 50% of area is in turf and landscape, mid-term (5-15 year) C sequestration potential is about 4 - 5 Mg C/ha

Potential for C sequestration from soil amendments

- **Vacant land restoration**
- Often involves management of existing turf and landscape
- Opportunity to renovate soil on footprint of demolished houses and pavement. Ideal niche for soil amendments

- If soil renovation zone is 20% of land area, and is amended with 8 cm compost, C sequestration potential is about 2 – 2.5 Mg C/ha
- Conversion to crop production increases amended area

Potential for C sequestration by turfgrass

- **Golf Course Fairways**
  - **0.9 – 1.0 Mg/ha/yr** average C increase for 25-30 years
  - Little change after 30 years
  - *Qian and Follett, 2002*
- **Model Estimates**
  - **1.06 Mg C/ha/yr** under high level of management
  - 16,380,000 ha in turf in US
  - *Milesi, et al., 2005*

- **Accounting for CO_2 produced by mowers**
  - **0.80 – 0.86 Mg C/ha/yr** after subtracting mower emissions
  - *Sahu, 2007*?
- **How much turf is still accumulating C?**
- **How much turf receives low-input management?**

C and N-rich organic matter from the city: The low-hanging fruit

- Biosolids, 60 lb/person/year
- Food waste, 60 lb/person/year
- Yard waste, 150 lb/person/year

Carbon sequestration potential of urban-derived organic matter applied to urban soils in the United States

US organic waste generation	Net compost generation	Mean C mass	Potential C sequestration
Tg/year			
57.6	**34.6**	**11.1**	**2.7**

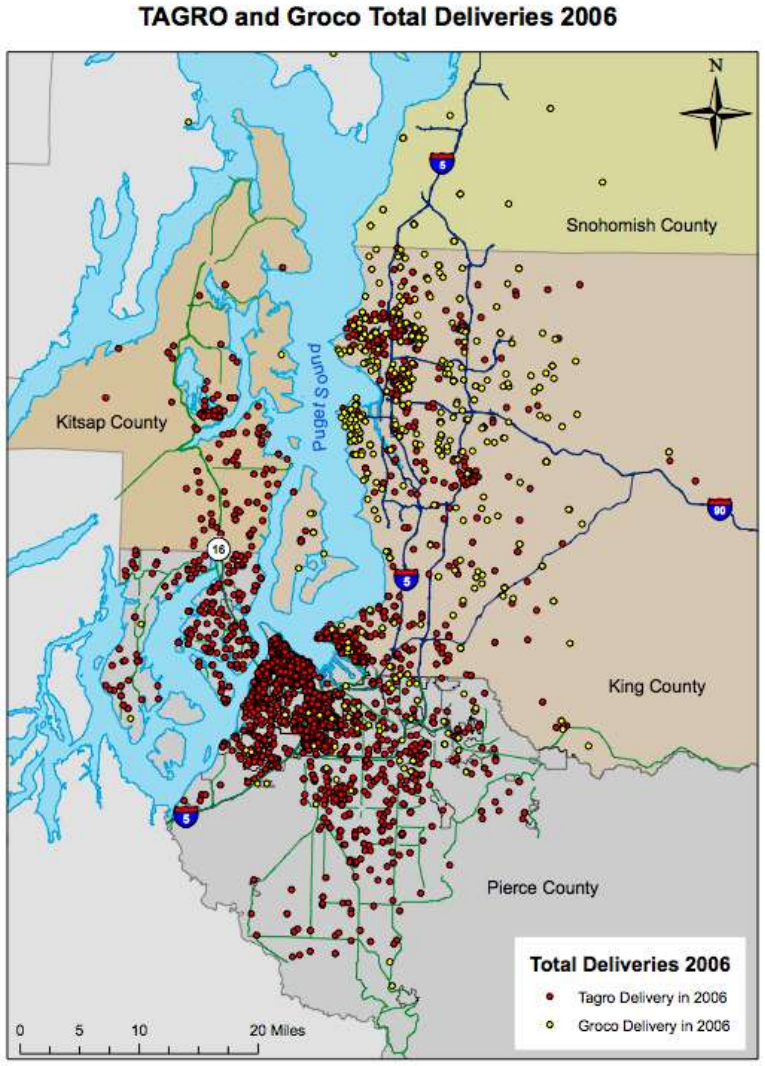
Obtaining the Raw Ingredients

Alameda County, CA: Engaging the public to practice food waste recycling

Marketing the Product for Local Benefits

Tacoma, WA: Community support of biosolids as valuable soil amendment

Parking strip garden amended with Tagro



Successful Use of Biosolids by Local Community to Improve Local Soils

- Must be Class A (composted or heat-treated)
- Must be in a user-friendly form
- Marketing is essential