

Soil Carbon Sequestration Potential in Urban Soils



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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)**



Three Urban Scenarios

- **New Development**

- Replace soil C lost during construction to improve landscapes and water quality
- Soils for Salmon; Washington State



- **Restoring urban vacant land**

- Genesee Land Bank; Flint, Michigan



- **Roadside Renovation**

- Soil amendments for roadside landscaping



What is our potential for C sequestration ?

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



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



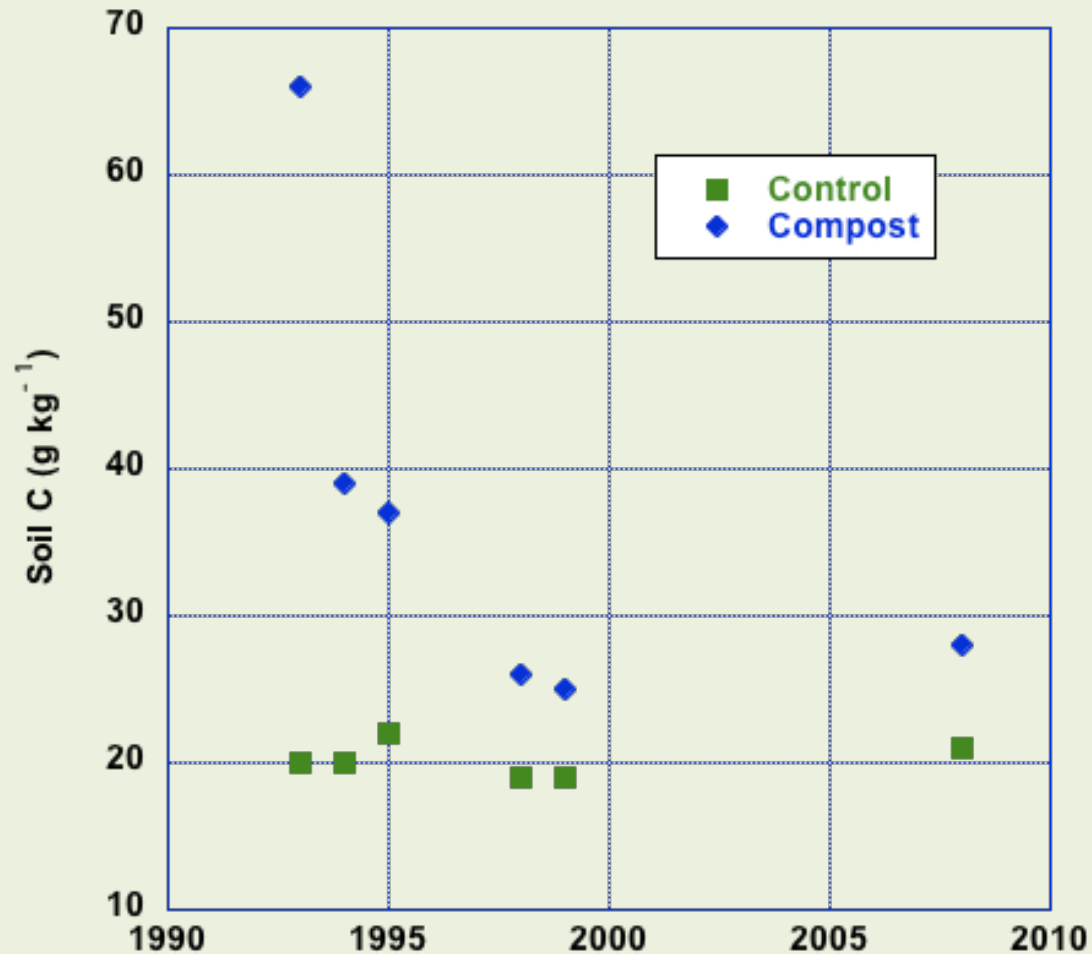
7, 13, and 20 Mg/ha/year for 10 years, compared with inorganic N
Biosolids: 32% C, 5% N

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 <i>Surface applied</i>	Tall fescue	67-134	1993-2002	6-10	27
Food Waste Compost <i>Incorporated</i>	Tall fescue	157	1993	9	19
Yard Waste Compost <i>Incorporated</i>	Turfgrass	74-224	2000	2-20	25
Yard Waste Compost <i>Incorporated</i>	Woody landscape	224	2001	13	26

Food Waste Composts Applied 1993

Tall fescue planted; no tillage since 1993



Soil carbon has 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 accumulation 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 CO₂ 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 high-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



Obtaining the Raw Ingredients

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

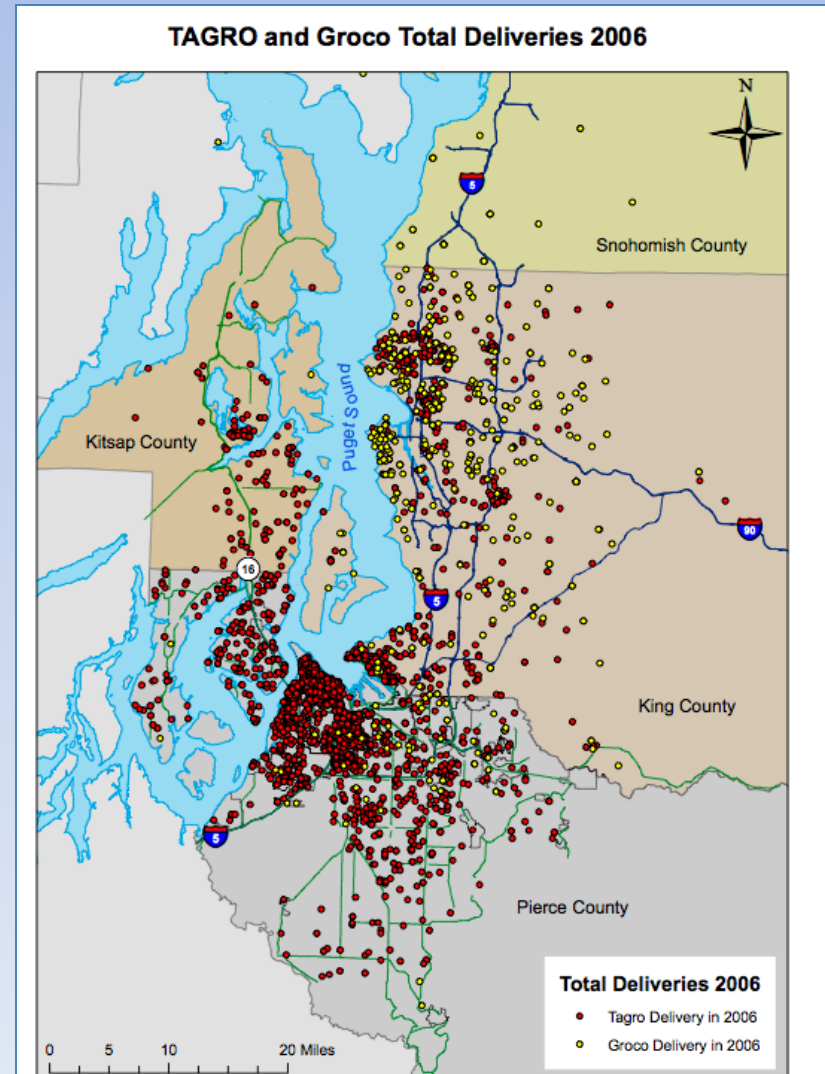


Marketing the Product for Local Benefits

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 Urban Soils

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



Support from Funding Agencies

- Washington State Department of Ecology
- Northwest Biosolids Management Association
- King County, Washington
- City of Seattle

