Dillo Dirt
Hornsby Bend Biosolids Management Plant

Turning Urban Wastes into Restoration Resources
• Urban settlements are part of their surrounding ecosystem – inputs and outputs
“Sustainability”

“meets the needs of the present without compromising the ability of future generations to meet their own needs.”

- The Brundtland Report
Ecosystem Cycles
[Biogeochemical Cycles]

- Carbon cycle – yard waste
- Nitrogen cycle – sewage
- Phosphorus cycle – sewage
- Other trace minerals and metals
- Water cycle – wastewater

[Short-circuiting Cycles]

Recycling?

Figure 5.1. Climate and life are linked by a complex web of interconnected cycles. Life on earth depends on the cycling of nutrients through air, water, soil, and living things. The climate mediates the flow of materials through these global cycles. Solar energy degrades to heat at each stage of the cycling process and is eventually returned to space as infrared radiation. The composition of the earth's atmosphere regulates the radiative balance on earth between absorbed solar energy and emitted infrared energy, which, in turn, controls the climate.

Source: Schneider and Morton 1981.
City “Inputs”

- Food
- Water
- Air (oxygen)
- Wood
- Paper
- Fuel and electricity
- Etc…
City “Outputs”

- Carbon dioxide
- Air Pollution
- Water Pollution
- Water
- Trash
- Sewage Sludge
- Organic wastes
Inputs - drawn from soils – food, landscaping

Outputs - nutrient rich “wastes” and carbon “wastes”

Urban sustainability?
Ecosystem Cycles

- N cycle - sewage
- C cycle – yard trimmings
- Water cycle
- Short circuiting cycles
- Recycling?
Why Carbon and Nitrogen?

- Carbon: carbohydrates from photosynthesis
- Nitrogen: amino acids, proteins, nucleic acids
The Carbon Cycle

- CO₂ in Atmosphere
- Diffusion
- Photosynthesis
- Decomposition and Respiration
- CO₂ in Biomass
- Fossil Fuel Burning
- CO₂ in Oceans
- Aquatic Biomass
- Calcareous Sediments
- CO₂ in Lithosphere
- Coal & Oil
- Limestone & Dolomite
- Soil Organic Matter
The Nitrogen Cycle
Nitrogen in atmosphere ($N_2$)

Plants

-assimilation

Denitrifying bacteria

Nitrates ($NO_3^-$)

Decomposers (aerobic and anaerobic bacteria and fungi)

Nitrifying bacteria

Nitrites ($NO_2^-$)

Nitrification

Ammonification

Ammonium ($NH_4^+$)

Nitrogen-fixing soil bacteria

Nitrogen-fixing bacteria in root nodules of legumes
Bacterial cells on clay particles; from Soil Science Soc. of America
## Populations of Soil Organisms

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Number/ yd²</th>
<th>Number/ oz</th>
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<tbody>
<tr>
<td>Bacteria</td>
<td>Trillions</td>
<td>Millions +</td>
</tr>
<tr>
<td>Actinomycetes</td>
<td>Trillions</td>
<td>Millions</td>
</tr>
<tr>
<td>Fungi</td>
<td>Billions</td>
<td>Thousands +</td>
</tr>
<tr>
<td>Algae</td>
<td>Billions</td>
<td>Thousands</td>
</tr>
<tr>
<td>Protozoa</td>
<td>Billions</td>
<td>Thousands</td>
</tr>
<tr>
<td>Nematodes</td>
<td>Millions</td>
<td>Tens +</td>
</tr>
<tr>
<td>Earthworms</td>
<td>30 – 300</td>
<td></td>
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</tbody>
</table>
City “Outputs”

- Carbon dioxide
- Air Pollution
- Water Pollution
- Water
- Trash
- Sewage Sludge
- Organic wastes
Austin Water Utility
Hornsby Bend Biosolids Management Plant

Biotechnology for Recycling and Reuse
- Working with Ecosystem Cycles

• Biosolids
• Yard Trimmings
• Tree Trimmings
All of Austin’s Sewage Sludge – 1 million gallons per day
Yard Trimmings
10%+ of Austin’s Solid Waste
Curbside Yard and Tree Trimmings
100,000+ cubic yards per year
HORNSBY BEND BIOSOLIDS MANAGEMENT PLANT

GOVALLE

ORNL

WALNUT CREEK

SOUTH AUSTIN REGIONAL

EQUALIZATION

BELT THICKENERS

MIXING/BLENDING

ANAEROBIC DIGESTERS

DEWATERING

BENEFICIAL REUSE THROUGH ON-SITE AGRICULTURAL LAND APPLICATION

CLASS B BIOSOLIDS

BULKING AGENTS:
YARD TRIMMINGS

COMPOSTING

CLASS A COMPOST
"DILLO DIRT"

PONDS

AQUATIC GREENHOUSE

ON-SITE IRRIGATION

BENEFICIAL REUSE THROUGH DISTRIBUTION AND MARKETING

SLUDGE
SLUDGE
SLUDGE
SIDESTREAM
SIDESTREAM
SLUDGE
SLUDGE
EFFLUENT

SIDESTREAM TREATMENT PLANT
Water - Treatment Ponds  185 acres

• Water moves by gravity
• Pond Ecosystem treats water
• All water recycled
Water - Aquatic Greenhouse

- 5 acres
- Zero discharge
- Water recycled for irrigation
Irrigation
all water from treatment

Hay Production
Recycles nutrients from biosolids and water
Solids - Anaerobic Digesters

- habitat for anaerobic bacteria
- 90% + pathogen reduction = Class B
- Treated sludge = biosolids
- By-product Biogases
Biogas reuse

• 875 kW cogenerator
• Electricity and Heat
• Net Zero energy facility
Biosolids Land Application

Onsite 600 acre farm
Composting
“Dillo Dirt”
Composting:
nitrogen  carbon  water  air
Composting – aerobic process – 130 - 170 degrees F
Kills pathogens, weed seeds, breaks down chemical compounds

“Scarab”
windrow turner
Composting – 130 - 170 degrees F

Kills all pathogens, weed seeds, breaks down chemicals

Dillo Dirt safe for unrestricted use
COMPOSTING

Curing 3-6 Months

First Biosolids Composting Program in Texas 1987
Twice honored with EPA National First Place Award
Sales to Area Vendors
Impoverished Soil Ecosystems of Texas

- Farmland
- Rangeland
- Wild land / Greenspace
- Urban
Restoration Tools

Compost – urban soils and wild lands
Restoration Tools

Land Application – farmland, rangeland and forest
Benefits of Compost

- Increase organic matter
- Increased water penetration
- Increased water holding capacity
- Mulching effect
- Long break-down time
Uses of Compost

Moisture Holding Capacity

75% to 200% by weight

United States Compost Council
Soil Mixes

- 10 to 50% compost
- 20 – 30% compost most common

United States Compost Council
Turf Establishment

- 1 to 2 inches compost
- Incorporate in top 5 to 7 inches

United States Compost Council
Planting Bed Establishment

- Apply 1 to 2 inches compost
- Incorporate in top 6 to 8 inches of soil

United States Compost Council
Top Dressing Lawns

- ¼ inch compost
- Don’t smother grass
- Aerate if possible
General Compost Use Guide

Per 1,000 square feet

- $\frac{1}{4}$ inch layer = $\frac{3}{4}$ cubic yard (34 yards/acre)
- 1 inch layer = 3 cubic yards (134 yards/acre)
- 2 inch layer = 6 cubic yards (269 yards/acre)
The Center for Environmental Research

MISSION
• Urban Sustainability and Ecology
• Research and Education

PARTNERS
• The City of Austin Water and Wastewater Utility
• University of Texas
• Texas A&M University
Hornsby Bend
Land Management and Research
Research – Riparian Ecology
Research – Riparian Restoration
Hornsby Bend Bird Observatory
A cooperative partnership promoting the study and understanding of birds in Central Texas
Funded by the Travis Audubon Society
Citizen Science

- Bird Survey
- Bird Monitoring
- Hawkwatch
- Bird Banding
- Workshops
- Classes

HBBO Web – www.hornsbybend.org
Hornsby Bend Ecological Mentorship Program – UT Academic Internships

• Environmental career mentoring
• Individual-team research projects
• University of Texas - Undergraduates
PLANT OPEN TO VISITORS SUN UP TO SUN DOWN
GATES WILL BE CLOSED DURING OTHER HOURS
NO UNAUTHORIZED PERSONS ARE ALLOWED ON THE GROUNDS AT NIGHT
Dillo Dirt in Landscaping

• Grass Establishment  \( \frac{1}{2} - 2” \) incorporated
• Grass Maintenance  \( 1/10 - \frac{1}{4}” \)
• Shrub and Tree Planting  \( \frac{1}{2}” - 2” \) (surface)
• Shrub, Tree Maintenance  \( 1/10 - \frac{1}{4}” \) (surface)
• Potting mixes – no more than 1/3 by volume
How To Become a Dillo Dirt Vendor

Sign up online for free at

http://www.austintexas.gov/department/dillo-dirt-vendor-information

Dillo Dirt is currently $12.65 per cubic yard
Helpful Contact Info

Jody Slagle, Compost Manager
(512) 972-1954
jodyslagle@austintexas.gov

• Hornsby Bend receptionist 972-1950
### DILLO DIRT CONSTITUENTS

2012

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Max Measured</th>
<th>Avg Measured</th>
<th>“Unrestricted Use”#</th>
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<tbody>
<tr>
<td>N</td>
<td>2.80%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.91%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>0.55%</td>
<td>-</td>
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</tr>
<tr>
<td>Arsenic</td>
<td>5.2 Mg/Kg</td>
<td>4.4 Mg/Kg</td>
<td>41 Mg/Kg</td>
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<tr>
<td>Cadmium</td>
<td>0.85 &quot;</td>
<td>0.70 &quot;</td>
<td>39 &quot;</td>
</tr>
<tr>
<td>Chromium*</td>
<td>17.8 &quot;</td>
<td>14.8 &quot;</td>
<td>1200 &quot;</td>
</tr>
<tr>
<td>Copper*</td>
<td>235 &quot;</td>
<td>204 &quot;</td>
<td>1500 &quot;</td>
</tr>
<tr>
<td>Lead</td>
<td>23.6 &quot;</td>
<td>20.7 &quot;</td>
<td>300 &quot;</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.57 &quot;</td>
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<td>17 &quot;</td>
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<tr>
<td>Molybdenum*</td>
<td>12.9 &quot;</td>
<td>6.65 &quot;</td>
<td>-</td>
</tr>
<tr>
<td>Nickel*</td>
<td>14.1 &quot;</td>
<td>12.7 &quot;</td>
<td>420 &quot;</td>
</tr>
<tr>
<td>Selenium*</td>
<td>5.9 &quot;</td>
<td>4.7 &quot;</td>
<td>36 &quot;</td>
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<tr>
<td>Zinc*</td>
<td>466 &quot;</td>
<td>422 &quot;</td>
<td>2800 &quot;</td>
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</table>

*(These elements are known to be micronutrients for plants and/or animals)*

#(“Unrestricted Use” is an “Exceptional Quality” biosolids product considered safe enough even for vegetable gardens if desired. The City of Austin recommends its use primarily for lawns and flower gardens.)