Compost Use for Erosion & Runoff Control

Building healthy soils that perform

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Learning Objectives

Teaching new green based solutions to old problems

- Green Infrastructure
- Habitat Protection & Restoration
- NC Soils
- Improving Soil Quality
- Compost Quality
- Erosion & Sediment Control
- Stormwater Management
- Soil Restoration
- USGBC Sustainable Sites

Green Infrastructure

- *Green infrastructure is the physical environment within and between our cities, towns and villages. It is a network of multi-functional open spaces, including formal parks, gardens, woodlands, green corridors, waterways, wetlands, forest, and open countryside. It comprises all environmental resources.*

Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

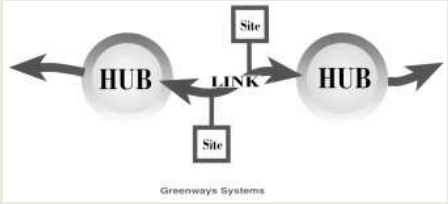
Green Infrastructure

- Successful land conservation in the future will have to be:
  - More proactive and less reactive
  - More systematic and less haphazard
  - Multifunctional, not single purpose
  - Large scale, not small scale, and
  - Better integrated with other efforts to manage growth and development. The key to accomplishing this is "*green infrastructure".*

Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

Hubs

HUBS anchor green infrastructure networks and provide an origin or destination for wildlife and ecological processes moving to or through it. Hubs come in all shapes and sizes, including:



• **RESERVES** — Large protected areas, such as national and state parks and wildlife refuges;
• **MANAGED NATIVE LANDSCAPES —** Large publicly owned lands, such as national and state forests, managed for resource extraction as well as natural and recreational values;
• **WORKING LANDS** — Private farms, forests, and ranches that are managed for commodity production yet remain in a predominantly open and undeveloped state;
• **REGIONAL PARKS AND PRESERVES** — Less extensive hubs of regional ecological significance; and
• **COMMUNITY PARKS AND NATURAL AREAS** — Smaller parks and other sites at the community level where natural features and ecological processes

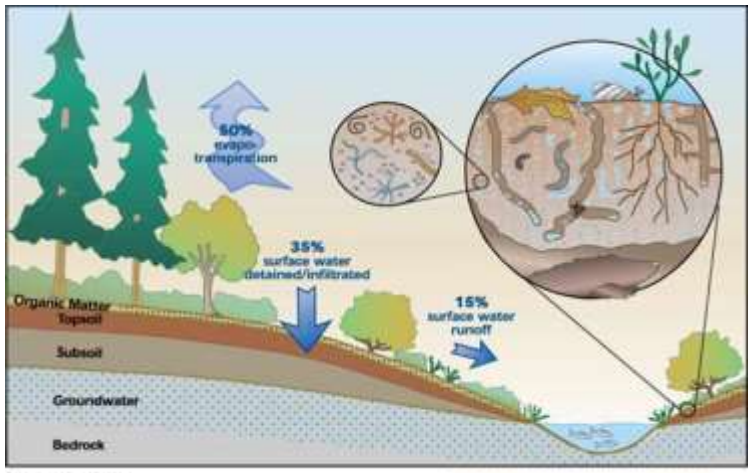
Source: Green infrastructure Planning Guide, C Davies, R MacFarlane, C McGloin, M Roe.

Links

LINKS are the connections that tie the system together and enable green infrastructure networks to work. They range in size, function and ownership, including:

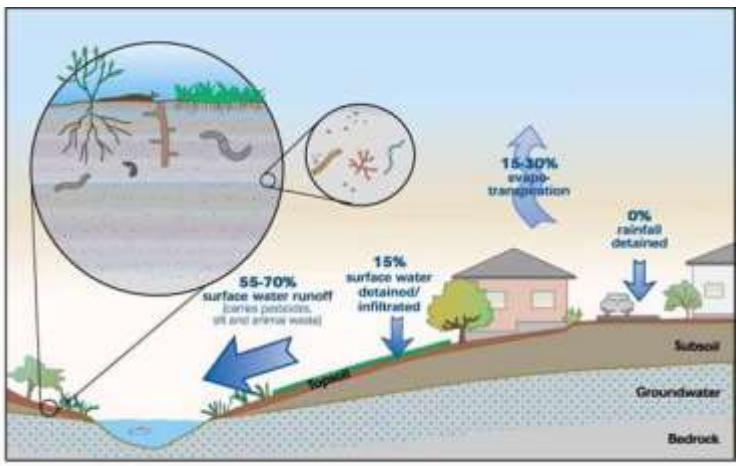
- **LANDSCAPE LINKAGES** — Large protected natural areas that connect existing parks, preserves, or natural areas and provide sufficient space for native plants and animals to flourish while serving as corridors connecting ecosystems and landscapes. Landscape linkages may also provide space for the protection of historic sites and opportunities for recreational use;
- **CONSERVATION CORRIDORS** — Less extensive linear protected areas, such as river and stream corridors that serve as biological conduits for wildlife and may provide recreational opportunities;
- **GREENWAYS** — Protected corridors of land managed for resource conservation and/or recreational use;
- **GREENBELTS** — Protected natural lands or working lands that serve as a framework for development while also preserving native ecosystems and/or farms or ranchland; and
- **ECOBELTS** — Linear woody buffers that can ease the zone of tension between urban and rural land uses while providing ecological and social benefits for urban and rural residents.

The Natural Cycle



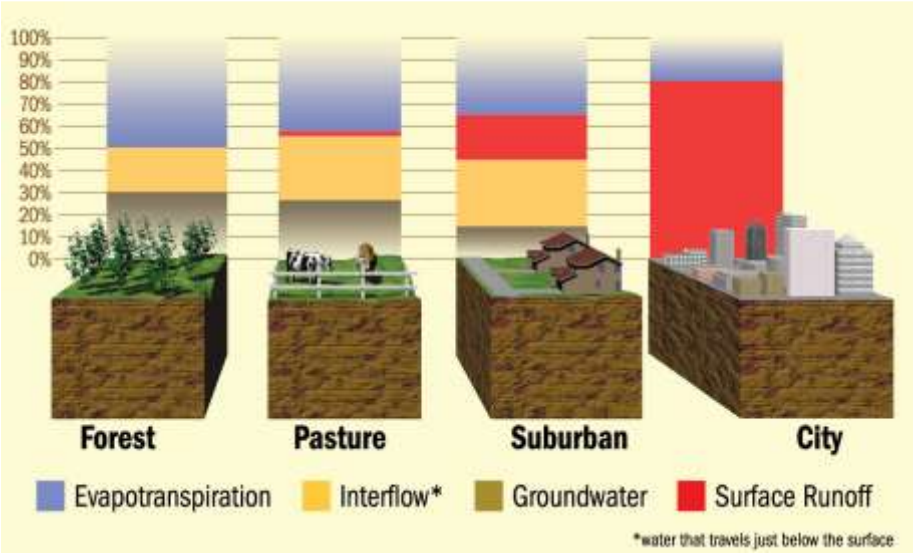
Native Soil

The Urban Environment



Disturbed Soil

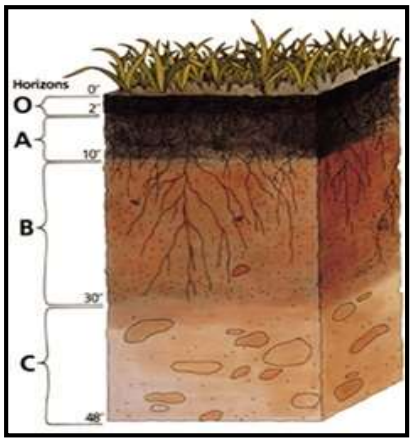
Stormwater Hydrology



Source: Sego Jackson -2001

The Soil Profile

- **Topsoil ("O" and "A" Horizons)**
  - **Major zone of root development for plants**
- **Subsoil ("B" Horizon)**
  - **Harder for plant roots to penetrate**
  - **Less reservoir of nutrients and moisture**
  - **Often less drainage (wetness)**
- **Plant growth defined by "Law of the Minimum"**
  - **Constrained by most limiting nutrient (water, N, P, K, microelements, organic matter)**



Native NC Soils

- These soils are called Ultisols.
- They are strongly leached, acid forest soils with low native fertility.
- Most have low percentages of SOM. (less than 1%)
- Our nation's most fertile soils have SOM readings in the 5-7% range
- A soil with insufficient organic matter may not hold water adequately or supply an environment for beneficial microbes
- These soils become quickly dependent on high levels of watering and multiple fertilizer applications and pesticides to maintain the appearance that our society expects

Soil Organic Matter-(SOM)

- Organic matter is the key to healthy soil and hence healthy plants.
- SOM is critical for the soil to function properly to support plant life naturally
- It provides structure and a place for water, air, and biological life to exist in soil

Compost Defined

- A humus-rich soil amendment made by the controlled biological decomposition of organic materials
- Made from organic wastes like yard trimmings, organic by-products, industrial residuals, food scraps, animal manures, biosolids
- Must go through an aerobic heating process to be biologically stable and mature
- Can improve biological, physical and chemical characteristics of soils

Compost – How is it made?

- Raw materials (feedstocks) are mixed together
  - Balance Carbon:Nitrogen ratio to 25-30:1
  - Balance moisture content to 50-60%
  - Balance structural porosity to 35-50%
- Primary composting – 21-120 days, depending on technology
  - Achieve time-temperature requirements of “Process To Further Reduce Pathogens” (40 CFR Part 503)
  - 131o F. for 3 consecutive days if aerated static pile
  - 131o F. for 14 cons. days if windrows
- Curing (aging) – 2-6 months or longer

Benefits of Compost Use to Increase SOM

Physical

- Provides organic matter
- Improves structure
- Provides moisture management

Biological

- Provides soil microorganisms
- Provides housing for microbes
- Suppresses plant diseases

Chemical

- Modifies and stabilizes pH
- Increases CEC
- Provides nutrients

Environmental

- Binds/degrades contaminants
- Binds nutrients
- Sequesters air-borne carbon

Compost Quality

Certified Compost™
STA | Seal of Testing Assurance
US Composting Council

What is good compost?

- Stable – low biological activity level
- Mature – aged for optimum plant growth
- Nutrient content – 0.5-2.5% N, 0.2-2.0% P and 0.3-1.5% K
- Organic matter content – 50-60%
- Moisture content – 40-50%
- Water holding capacity - > 100%
- pH – 6.0-7.5
- Soluble Salts - < 6 mmhos/cm
- Bulk density – 800-1,000 lbs/cy

Why Use Compost in Green Infrastructure?

- Increase water infiltration into soil surface
- Increase water-holding capacity of soil
- Reduce soil particle dislodging
- Reduce runoff and soil particle transport in runoff
- Establish new vegetation directly into compost
- Increase plant growth and soil cover
- Buffer soil pH – improve vegetation growth

Green Applications

- EROSION/SEDIMENT CONTROL
- STORMWATER MANAGEMENT
- SOIL RESTORATION

Using Compost in Green Infrastructure

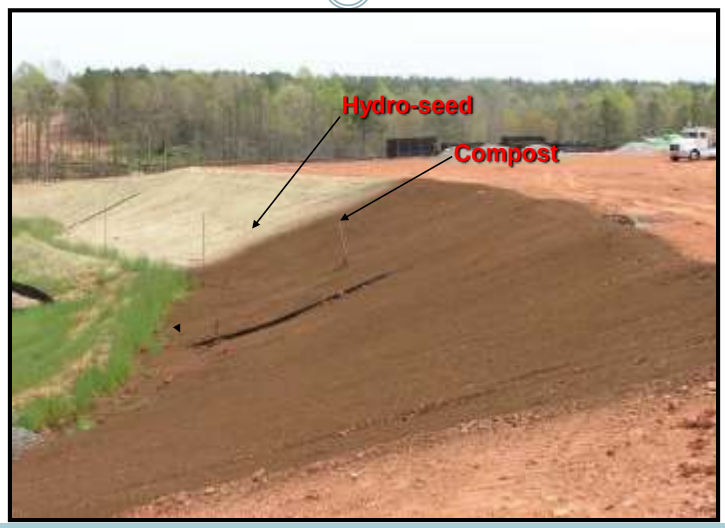
EROSION/SEDIMENT CONTROL

Compost Erosion Control Blankets

- Advantages
  - Intimate contact allows nearly 100% ground contact, eliminating puckering of other blankets
  - Intimate contact reduces sediment loss
  - Water infiltration increases, increasing germination from seed
  - Water discharge from slopes decreases, reduces potential sediment loss (Iowa State Study 2003)
  - Addition of organic matter improves slope ability to revegetate and establish a permanent erosion system

Soil Contact

Compost Blanket vs. Hydro-seeding



Compost Blanket vs. Hydro-seeding

One week later-One 3 inch rain event

Compost Sock & Blanket

Compost Sock-Blanket-Lock Down Net

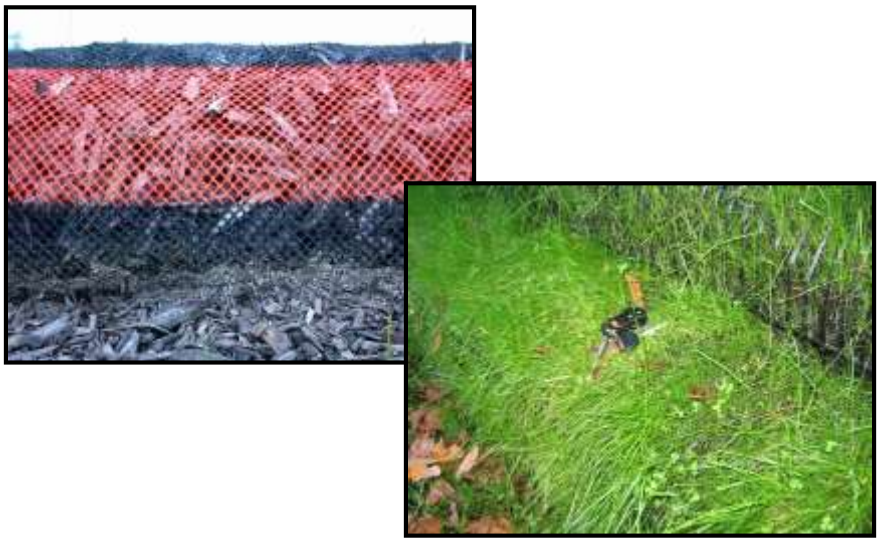
What are Compost Filter Socks?

- A mesh tubular product which is filled on site with a compost or composted media
- The product has the capability to be a continuous length, or cut to fit the application
- Only 2 Manufacturers
  - Filtrexx International
  - Envirotech Biosolutions

Compost Filter Socks

- Advantages:
  - Contained material reduces wash out
  - Weight of compost filter sock resist movement
  - Guaranteed volume/size from compost filter sock
  - Continuous Lengths means unbroken perimeter control
  - Three dimensional Filtration

Compost Filter Socks



Unique Features of Compost Filter Media

- Three dimensional Filtration
  - NOT a single membrane or piece of cloth
  - Compost Particles form a Filtration 'Matrix'

- Three way filtration
  - Chemical
    - Binding – a chemical reaction over time
  - Physical
    - Blocking/trapping soil gets caught in openings
  - Biological
    - Compounds degraded via reactions/

How the Product is Installed

Industry Approval

Minnesota	DOT
Montana	DOT
Nebraska	DOR
New Hampshire	DOT
New Mexico	DOT
North Carolina	DOT/NRCS/NCDEQ-DMLR
OHIO	EPA
Oregon	DOT
Pennsylvania	DEP
South Carolina	DOT
Tennessee	DOT
Texas	DOT / TNRCC / TCEQ

Section 6.18 & 6.66 of the NCDEQ-DMLR E&SC Manual

Perimeter Protection

Using Compost in Green Infrastructure

STORMWATER MANAGEMENT

Green Roof Media

- Extensive Mix
  - 20% STA Compost
  - 80% Expanded Shale 3/8 inch

Green Roof Media

- Intensive Mix
  - 15% STA Compost
  - 25% USGA Root Zone Sand
  - 50% Expanded Shale 3/8 inch
  - 10% Expanded Shale fines

Bioretention Media

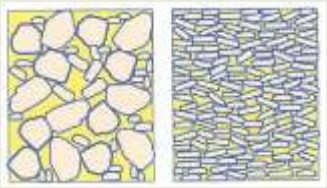
- 5-10% STA Compost
- 85-90% Expanded Shale

Using Compost in Green Infrastructure

SOIL RESTORATION

Disturbed Soils

- Heavy equipment compaction



Disturbed Soils

- Developer's removing and selling topsoil and leaving compacted subsoil

Disturbed Soils

Sod installed on disturbed soils

- No “O” or “A” soil horizon
- Poor root development
- Increases the need to water more
- Increase need for chemical inputs

Disturbed Soils

Tree installed on disturbed soils

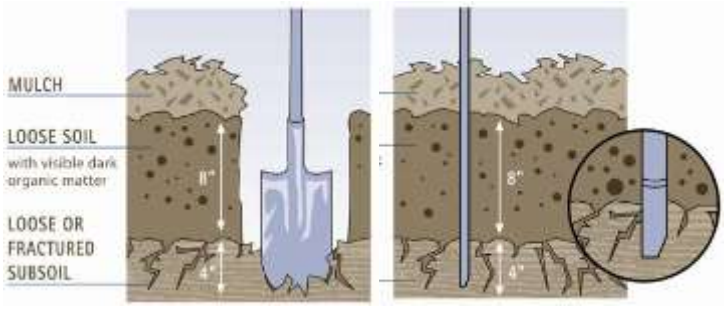
- Poor root development

Soil Restoration

• Soil quality is directly related to stormwater detention capacity, and so to the health of streams and aquatic resources. Soil quality also determines landscape success: plant survival, growth, disease resistance, and maintenance needs.

1. **Soil retention –** preserving existing site vegetation and soil, un-compacted by equipment, or
2. **Soil restoration –** correcting compaction to a 12-inch depth, and amending soils with compost or bringing in/reusing an amended topsoil to an 8-inch depth, plus
3. **Soil protection** – protecting restored soils from re-compaction, and mulching after planting to prevent erosion and support healthy plant growth.

Soil Restoration



Soil Restoration

Compost application
- Spreaders
- Pneumatic blowers

Water Savings

- A 10,000 square foot lawn would hold 18,800 gallons of plant available water that would otherwise not be held and made available
- A town of 5,000 residences each with 10,000 square feet of lawn could potentially save 94 million gallons of water a year as a result of increased organic matter content in the soil by 5%

Source: National Sustainable Agriculture Information Service-(ATTRA)

Model Ordinances

Greeley Colorado

- "Because soil amended with compost requires less water (as much as 30% less), the city of Greeley is requiring proof of compost to obtain a variance to water your new lawn."
- Minimum rate of 4 cubic yards per 1,000 square feet of area tilled into a depth of 6-8 inches

Model Ordinances

City of Leander Texas

- All new Landscapes (non-residential and residential) are required to have a minimum of six inches of soil depth in areas planted with turfgrass.
- The 6" minimum soil depth will consist of 75% soil blended with 25% compost. The soil/compost blend shall be incorporated into the top two inches of the native soil

Soil BMP Requirements

Washington

DOE Stormwater Manual BMP t 5.13 --Soil Quality and Depth

- Building permit requires achieving a post-construction soil standard to preserve and restore soil quality and meet new code requirements
- Four options
  - Leave native soil undisturbed and protect from compaction
  - Amend existing soil in place (pre-approved amendment rate of 2.5 " to a depth of 8 inches
  - Import topsoil mix with 8-13% organic matter content
  - Stockpile site duff and topsoil and reapply after grading and construction 8" minimum depth

Soil BMP Requirements

Delaware

BMP Standards and Specifications — Soil Amendments

14.0 Soil Amendments

Definition:

Soil Amendment (also called soil restoration) is a technique applied after construction to till compacted soils and restore their porosity by amending them with compost. These soil amendments can reduce the generation of runoff from compacted urban lawns and may also be used to enhance the performance of impervious cover disconnections and grass channels.

14.1 Soil Amendment Stormwater Credit Calculations

Soil Amendment does not receive a retention allowance. However, the use of soil amendments in accordance with this specification allows disturbed areas to receive a reduction credit for the annual runoff. The adjustment varies depending on the soil's Hydrologic Soil Group. Pollutant loads are assumed to be reduced by the equivalent reduction in runoff. **Table 14.1** summarizes the runoff and pollutant reduction credits for this practice. Soil amendments can also enhance the performance of other runoff reduction practices that rely on surface infiltration. Runoff and pollutant reduction credits for these types of applications are discussed in the respective specifications for those practices.

Soil BMP Requirements

Delaware

Table 14.3. Short-Cut Method to Determine Compost and Incorporation Depths

	Contributing Impervious Cover to Soil Amendment Area Ratio [1]			
	IC/SA = 0 [2]	IC/SA = 0.5	IC/SA = 0.75	IC/SA = 1.0 [3]
Compost (in) [4]	2 to 4 [5]	3 to 6 [5]	4 to 8 [5]	6 to 10 [5]
Incorporation Depth (in)	6 to 10 [5]	8 to 12 [5]	15 to 18 [5]	18 to 24 [5]
Incorporation Method	Tiller	Tiller	Excavation + Mixing	Excavation + Mixing

Notes:
[1] IC = contrib. impervious cover (sq. ft.) and SA = surface area of compost amendment (sq. ft.)
[2] For amendment of areas that do not receive off-site impervious cover runoff
[3] In general, IC/SA ratios greater than 1 should be avoided
[4] Average depth of compost added
[5] Lower end for A/B soils, higher end for C/D soils

Soil BMP Requirements

Pennsylvania

BMP 6.7.3: Soil Amendment & Restoration

Soil amendment and restoration is the process of improving disturbed soils and low organic soils by restoring soil porosity and/or adding a soil amendment, such as compost, for the purpose of re-establishing the soil's long-term capacity for infiltration and pollution removal.

Soil Restoration

- Amending soils with compost can restore soil functions:
  - Decreases surface water runoff
  - Increases water infiltration
  - Traps sediments, heavy metals and excess nutrients; and biodegrades chemical contaminates
  - Rebuilds the beneficial soil life
  - Improves plant health, with reduced need for additional water, fertilizer and pesticides
  - Aids deep plant root growth

LEED Credit Categories NC 3.0

- **Sustainable Sites**
- **Water Efficiency**
- Energy & Atmosphere
- **Materials & Resources**
- Indoor Environmental Quality
- **Innovation & Design Process**

LEED Credits: Compost Use

Sustainable Sites

- Construction activity pollution prevention – compost socks, berms
- Site development – revegetate
- Open space – landscape/community gardens
- Rainwater management – LID/Green Infrastructure

Water Efficiency

- Outdoor water use reduction – increase OM

Material & Resources

- Building product disclosure and optimization – local resources

Questions

NC Composting Council
STATE CHAPTER OF THE U.S. COMPOSTING COUNCIL

US Composting Council