Soil Health Practices in the Landscape

Salvatore Mangiafico

Rutgers Cooperative Extension
Environmental and Resource Management Agent

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In this session...

Benefits of healthy soils in the landscape

Plant Health

- aeration for roots,
- water holding capacity of soil,
- advantage to desirable plants vs. weeds
- chemical / physical / biological

(Jim Murphy will cover)

Image: Neal et al. Landscaping at the Water's Edge. New Hampshire Cooperative Extension

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In this session...

Benefits of healthy soils in the landscape

Hydrology and Ecosystem

- decreasing storm water runoff
- limiting soil erosion
- increasing infiltration and groundwater recharge
- filtering pollutants in runoff

(Sal will cover)

Image: Neal et al. Landscaping at the Water's Edge. New Hampshire Cooperative Extension

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In this session...

Benefits of healthy soils in the landscape

Soil Testing in Laboratory and Field

(Stephanie Murphy will cover, with Sal and Jim, and then we'll go outside later for demonstrations)

Image: Neal et al. Landscaping at the Water's Edge. New Hampshire Cooperative Extension

In this session...

Benefits of healthy soils in the landscape

With a focus on practices in the landscape

Image: Neal et al. Landscaping at the Water's Edge. New Hampshire Cooperative Extension

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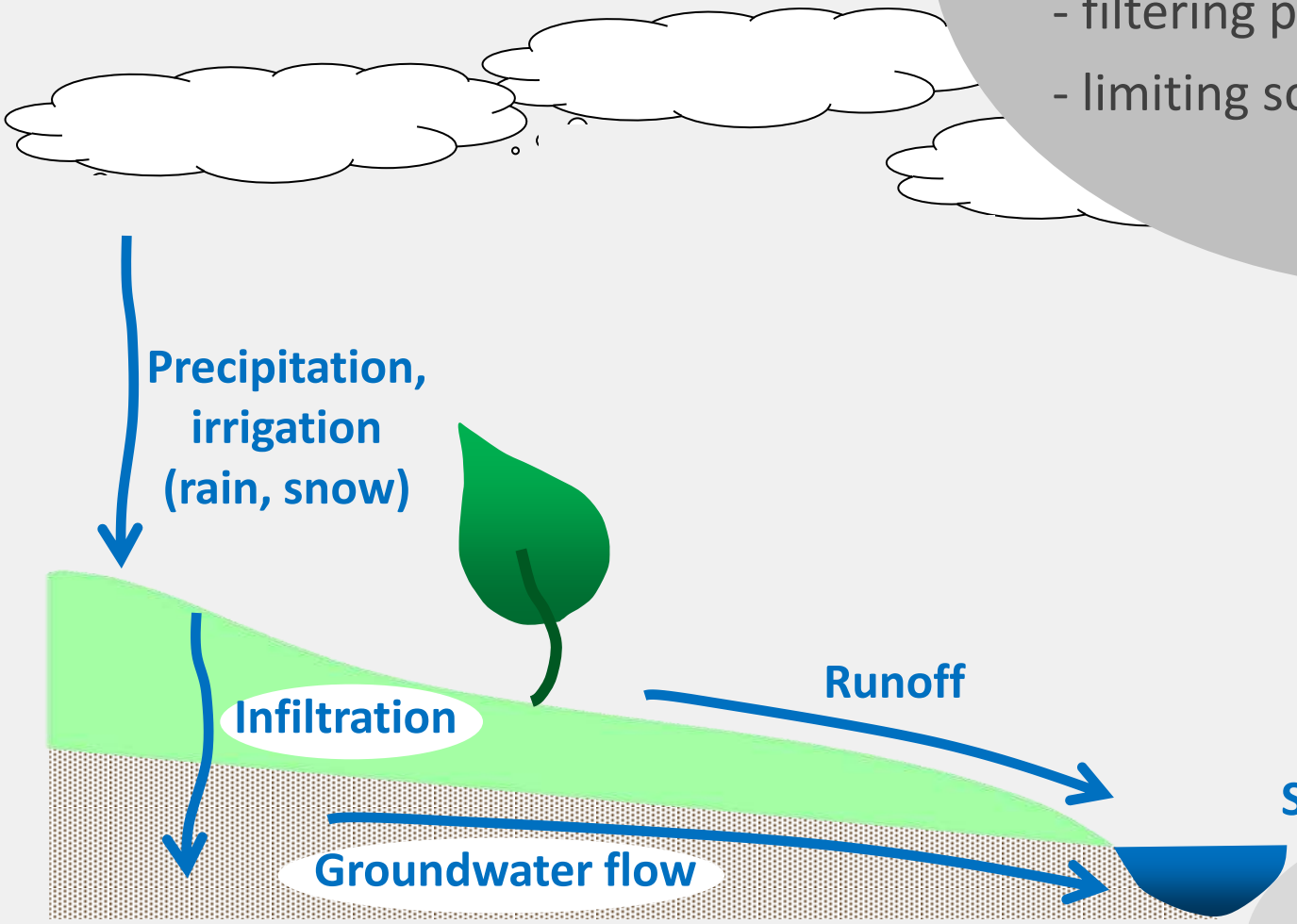
Simplified hydrologic cycle for pollutant transport

- increasing infiltration and groundwater recharge
- decreasing storm water runoff
- filtering pollutants in runoff
- limiting soil erosion



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The idea of non-point source pollution: many sources of pollutants, each may only contribute a little bit

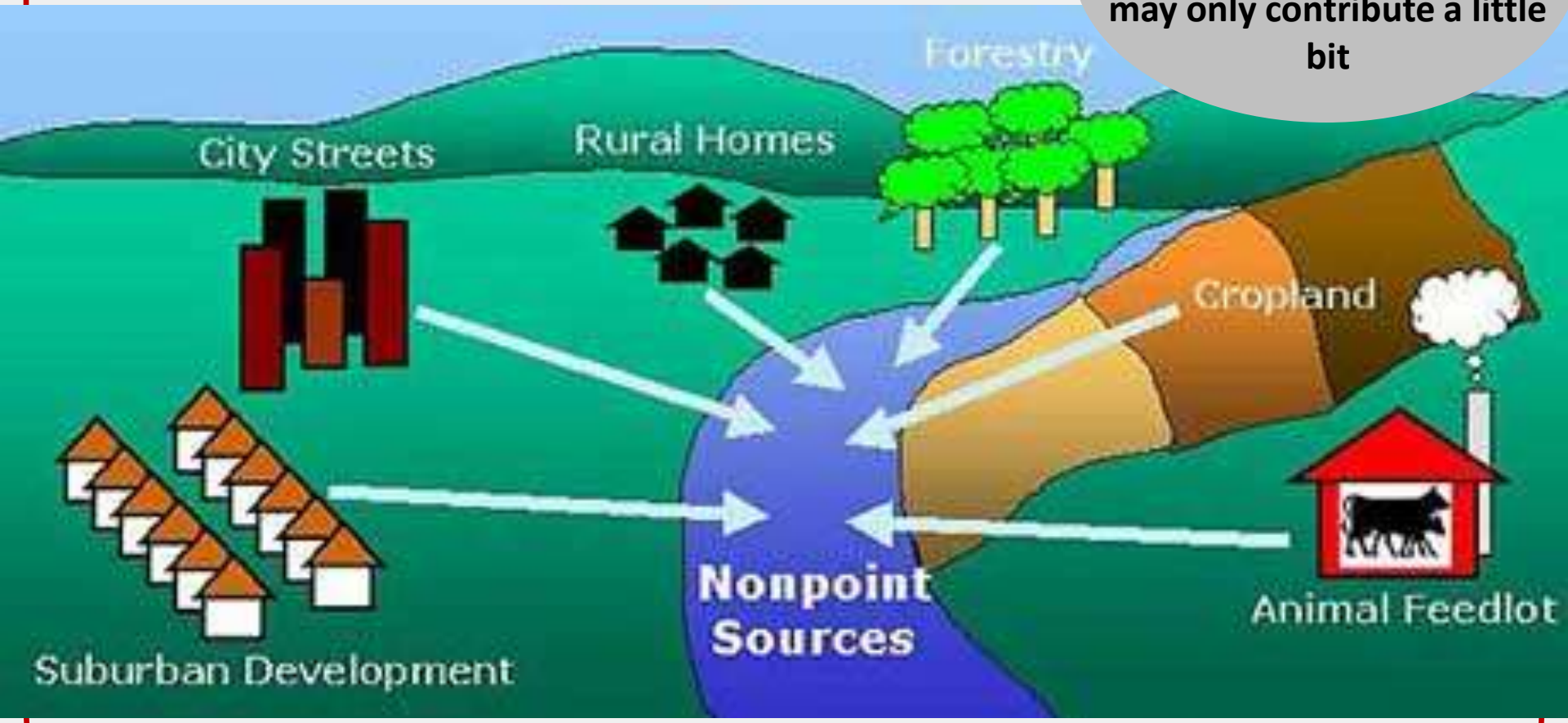

Image: NOAA Ocean Service Education, http://oceanservice.noaa.gov/education/kits/pollution/04nonpointsource.html.

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Images: Sal Mangiafico, Rutgers Cooperative Extension

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Soil degradation...

Human activities can positively or negatively affect a soil's properties.

Good management can improve slightly degraded or marginal soils, but heavily degraded soil may not be able to be easily restored.

Image: Sal Mangiafico, Rutgers Cooperative Extension

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Soil degradation...

Mechanisms of soil degradation:

- ***Soil compaction***

– common in urban, suburban, agricultural, forest environment

– soils are sometimes intentionally compacted during construction

– inadvertent compaction: vehicle traffic, foot traffic, working of wet soils

Image: Sal Mangiafico, Rutgers Cooperative Extension

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Soil degradation...

Mechanisms of soil degradation:

- ***Topsoils are sometimes stripped*** from construction sites to be stored and later returned to the site.
  - A problem if the returned soil is thin or of low quality

Image: Sal Mangiafico, Rutgers Cooperative Extension

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Soil compaction and stormwater management

Compacted soils have decreased infiltration capacity

- Increased runoff, stream flows, and erosion
- Compacted soils will make low impact development structures—infiltration basins, swales, and rain gardens—less effective
- The combination of poor vegetative cover and more runoff can lead to increased erosion and water pollution

Image: Sal Mangiafico, Rutgers Cooperative Extension

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Natural variations in soils

- There is a wide natural range in soil properties.
- Soils which are naturally very clayey may have low water infiltration capacities (unless they are amended with organic materials)
- Naturally sandy soils may have a high infiltration capacity but a lower ability to store water or remove pollutants from water.

NJ NRCS. New Jersey State Soil - Downer. http://www.nj.nrcs.usda.gov/technical/soils/downer.html

Natural variations in soils

- Other soils may have naturally low organic matter or be shallow to bedrock.
- Not every soil will perform all the horticultural and ecosystem services that may be desired.

NJ NRCS. New Jersey State Soil - Downer. http://www.nj.nrcs.usda.gov/technical/soils/downer.html

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Assessing soil compaction

- ponding water after rainfall
- sparse plant cover.
- certain weeds may be indicative of compacted soil conditions — prostrate knotweed and goosegrass, among others.
- but also, other common weeds such as crabgrass may be able to outcompete turf species whenever growing conditions are poor.

Image: Robin R. Buckallew, USDA-NRCS PLANTS Database

Assessing soil compaction

- Soil compaction can be measured more precisely using a penetrometer
- We'll talk about outside

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Soil infiltration capacity

- A soil's ability to conduct water may decrease below the surface, particularly if there is a subsurface compacted layer from human activity or a natural dense layer.
- We'll talk about outside.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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The extent of the problem in residential areas

- Scientific studies suggest that soil compaction or degradation is relatively common in residential areas.
- Even with natural differences in soil texture and structure in a given area, the effects of disturbance during development and compaction are evident.
- Some studies suggest that more newly-developed areas may have more impacted soils. This might be explained either because the action of roots and weather has ameliorated impacts in older areas, or because new construction techniques may impact soils more intensely.

(Hamilton and Waddington 1999, OCSCD 2001, Mueller and Thompson 2009, Woltemede 2010)

The extent of the problem in residential areas

Images: Sal Mangiafico, Rutgers Cooperative Extension

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Preventing and alleviating soil compaction in residential settings

- Avoid foot and vehicle traffic on wet soils, particularly if soils are fine textured, “heavy”, or clayey. Wait until the soil has dried before driving or walking on it.
- Limit the areas subjected to heavy foot and vehicle traffic. Use designated drive lanes or garden paths. Covers like stone, mulch, or pavers can be used to direct traffic and reduce soil compaction.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing and alleviating soil compaction in residential settings

- Have the chemical and physical properties of the soil tested.
- Clayey soils with low calcium levels can suffer from poor soil structure. If the calcium levels are below optimum, the soil should be amended with lime or gypsum according to soil test recommendations.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing and alleviating soil compaction in residential settings

- The organic matter amount is important in developing soil structure in soils.
- Organic matter sources, like compost, should be incorporated into soils when possible.
- Soil organic matter can also be increased over time by establishing a perennial vegetative cover like turfgrass .

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing and alleviating soil compaction in residential settings

- Consider “subsoiling.”
- Commercial landscaping machines are capable of cultivating soil to a depth of 8 to 10 inches

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing and alleviating soil compaction in residential settings

- Treating soil compaction may be difficult in urban or suburban areas because it may be difficult to get equipment into small lots, there may be buried utility lines, and there may be significant perennial vegetation like trees.

Preventing soil compaction during construction

- The degree of soil compaction capable with heavy construction equipment can limit the root growth of landscape plants.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

Practices occurring during construction activities that may lead to compacted or degraded soils include:

- clearing large areas
- excessive traffic heavy construction equipment or using heavy equipment on moist soils prone to compaction
- the movement of wet soils—particularly fine textured, “heavy”, or clayey soils—with equipment

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

- soil left bare for long periods of time and subjected to erosion
- removal of good native topsoil and replacing it with a thin layer of topsoil or with low-quality soil

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

Practices occurring during construction activities that may prevent compacting or degrading soils include:

- use of travel lanes for equipment so that less area of the site is compacted
- retaining topsoil or replacing stripped top soil with a high-quality soil of sufficient depth
- stabilizing areas subject to erosion, such as slopes or erodible soils

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

- use of berms, erosion control blankets, and silt fences to contain eroded sediment onsite
- establishment of vegetative cover on soils as soon as possible

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

- It may be difficult to establish turf and landscape plants if soils are compacted, of low pH or low fertility.
- Furthermore, some inexpensive “contractor’s mixes” of turf seed may predominantly contain turfgrass species that do not grow well under the conditions of the site or may use inferior varieties.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Preventing soil compaction during construction

- Mixes with a high proportion of annual ryegrass may not produce lasting vegetative cover. While this grass germinates and provides vegetative cover quickly, it may not survive well in either cold winters or hot dry summers in New Jersey.

Image: Salvatore Mangiafico, Rutgers Cooperative Extension

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Salvatore Mangiafico

County Environmental and Resource Management Agent

Cooperative Extension of Salem County

51 Cheney Rd, Ste. 1

Woodstown, NJ 08098

856-769-0090

mangiafico@njaes.rutgers.edu

http://salem.rutgers.edu/nre

& search for “compaction” – a presentation and a factsheet

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