Soil Health in Urban Areas

Clare Lindahl

Conservation Districts of Iowa

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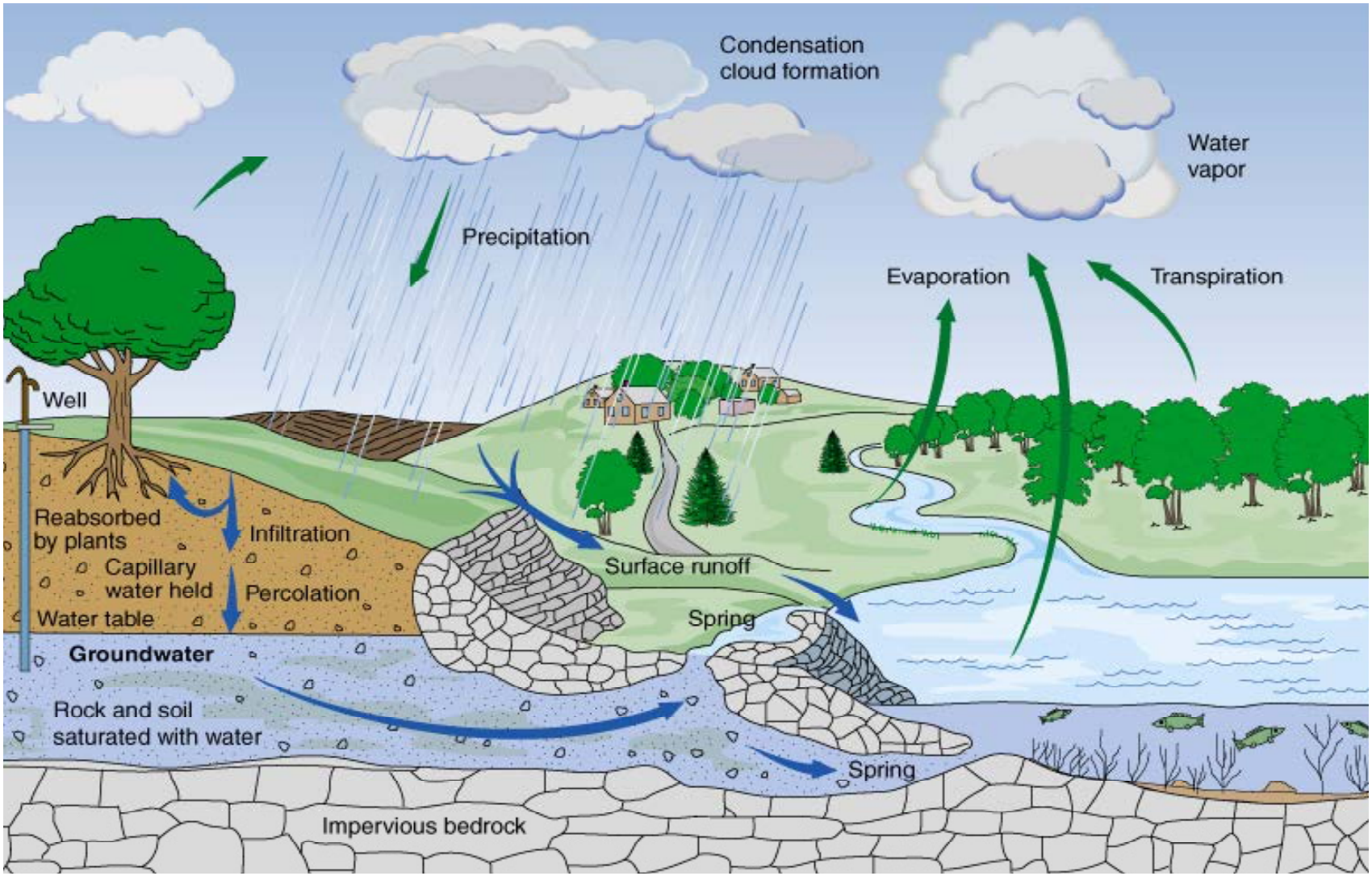
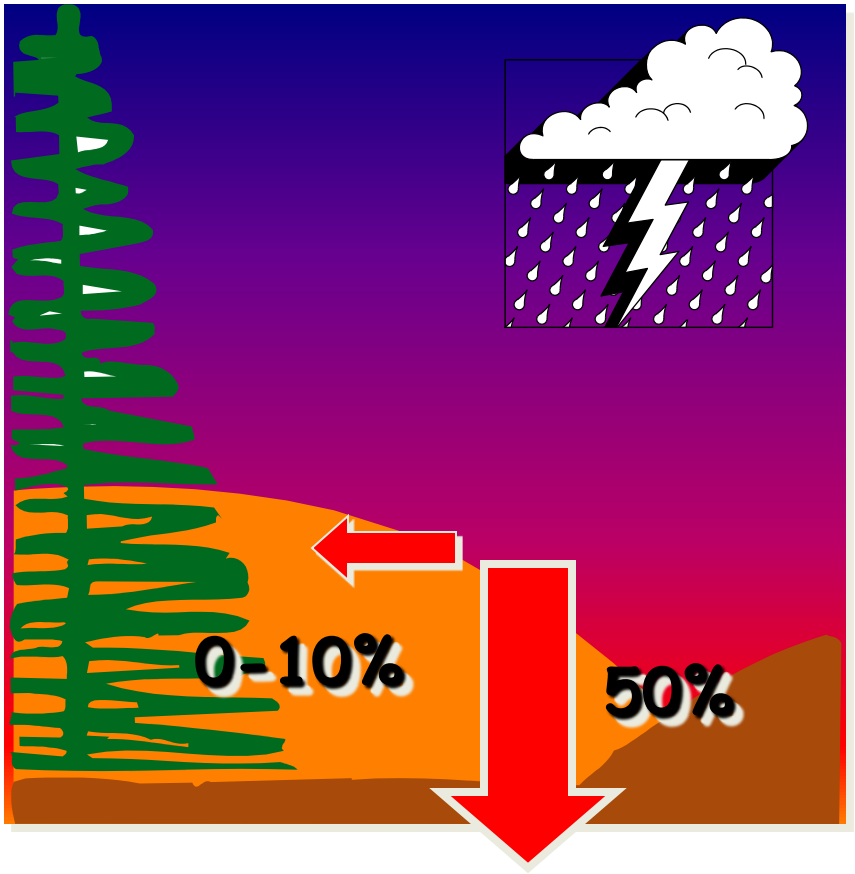
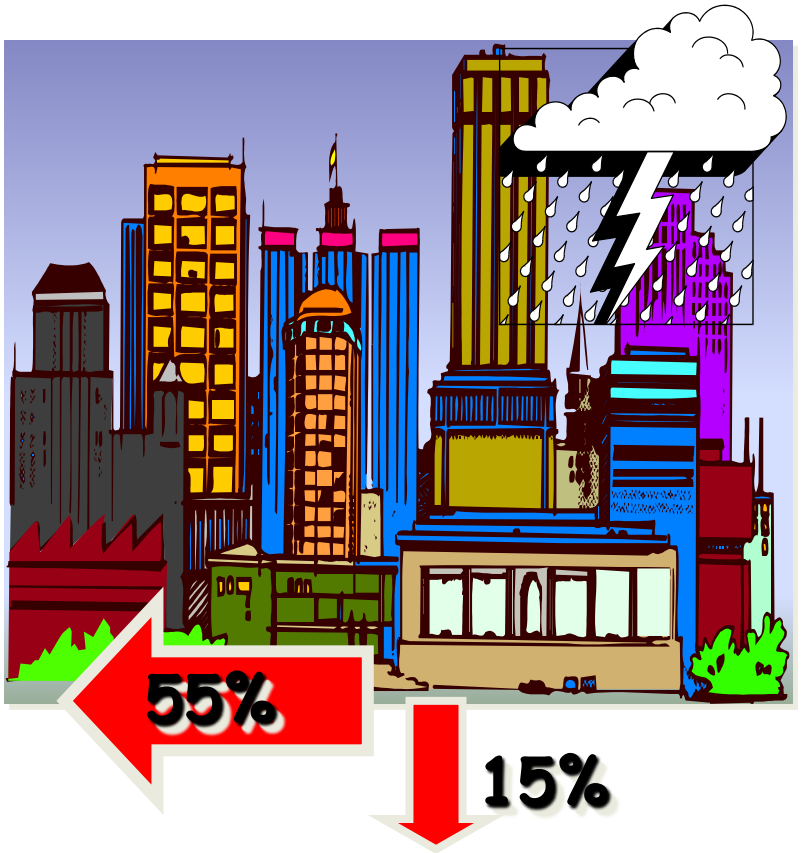
Iowa Department of Agriculture and Land Stewardship-Division of Soil Conservation

Water Cycle

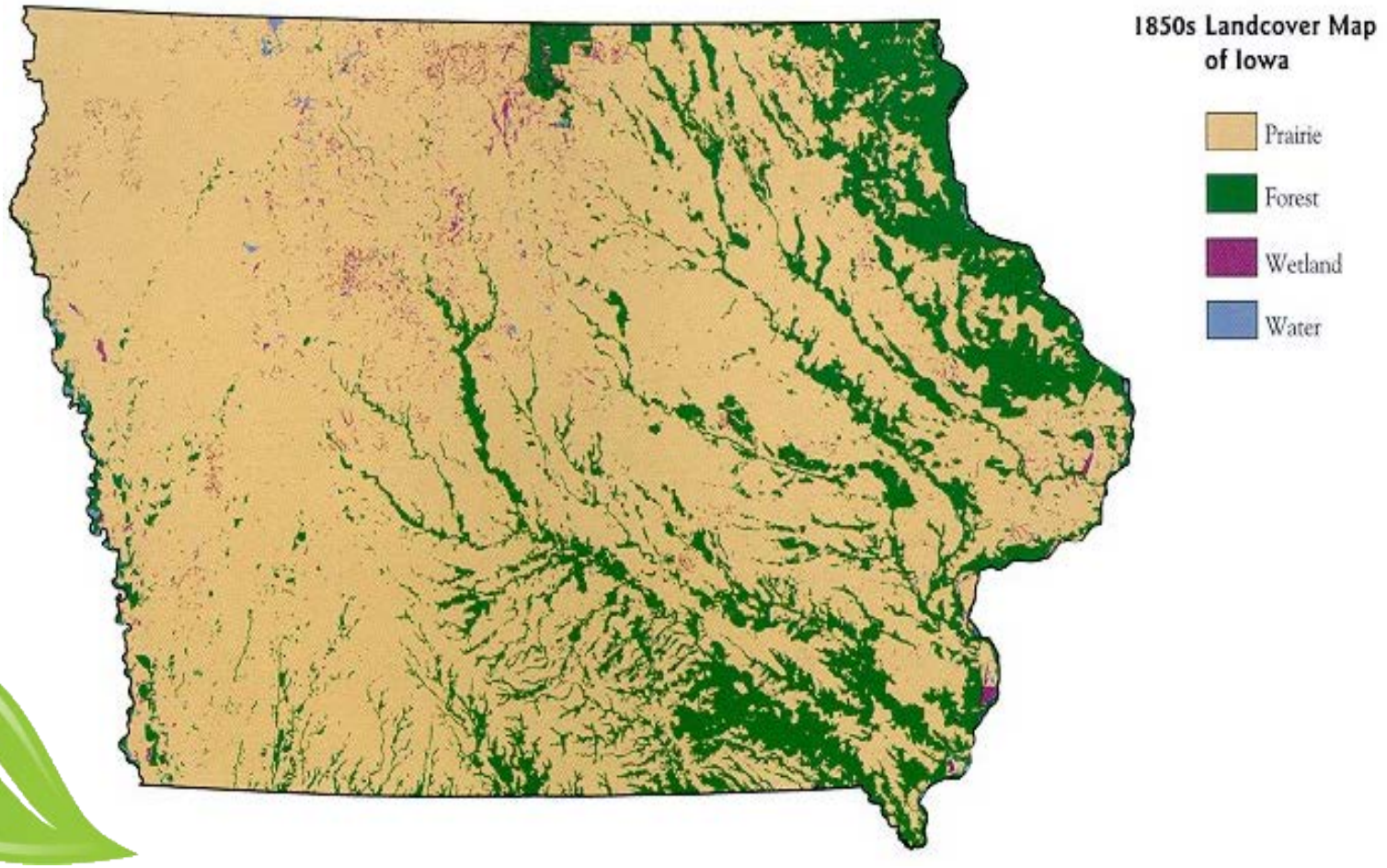

Condensation
cloud formation
Water
vapor
Precipitation
Evaporation
Transpiration
Well
Reabsorbed
by plants
Infiltration
Capillary
water held
Percolation
Water table
Surface runoff
Spring
Groundwater
Rock and soil
saturated with water
Spring
Impervious bedrock

Historic Hydrology vs. Modern Hydrology (the native ecosystem model)

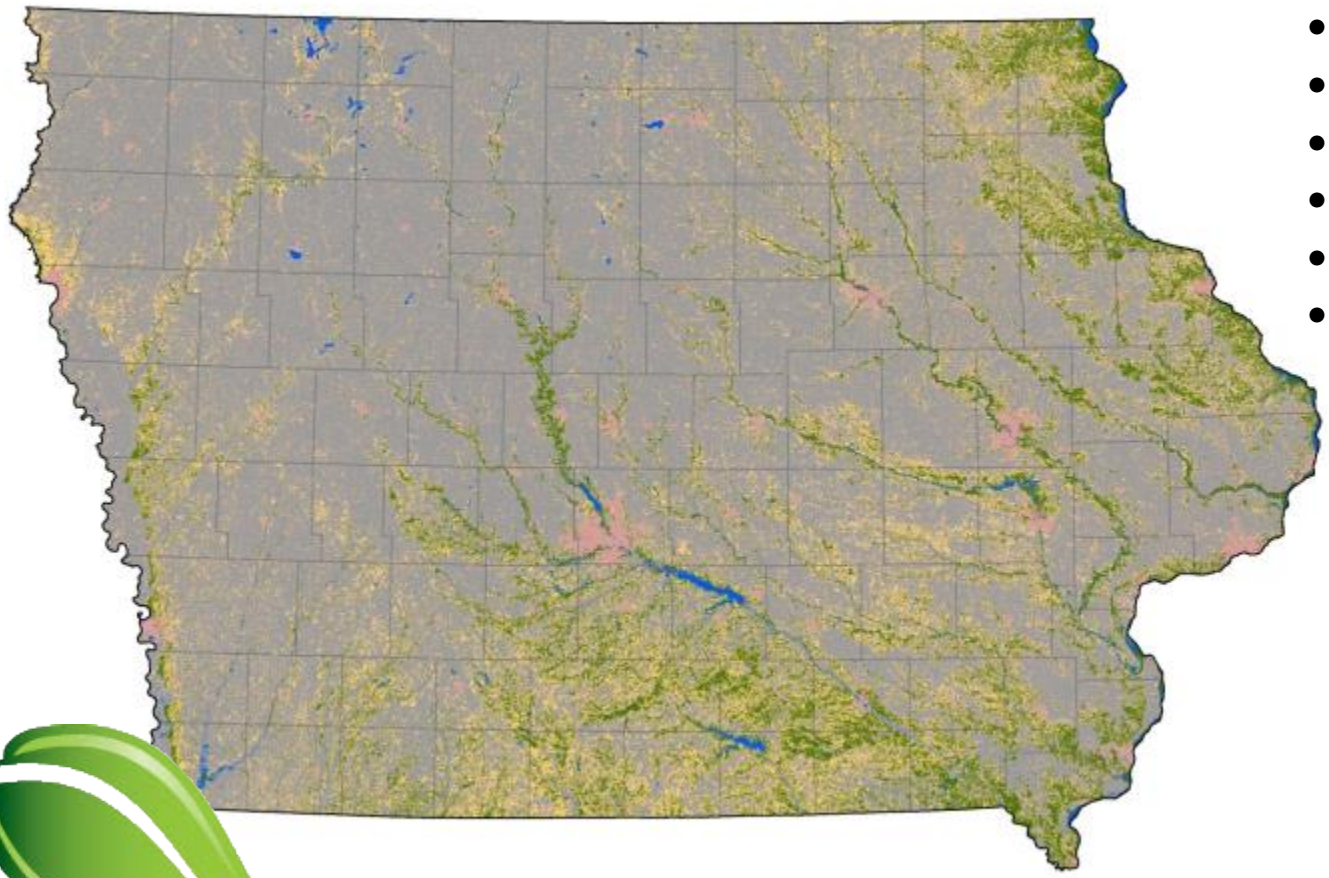




Iowa Vegetative History 1850's

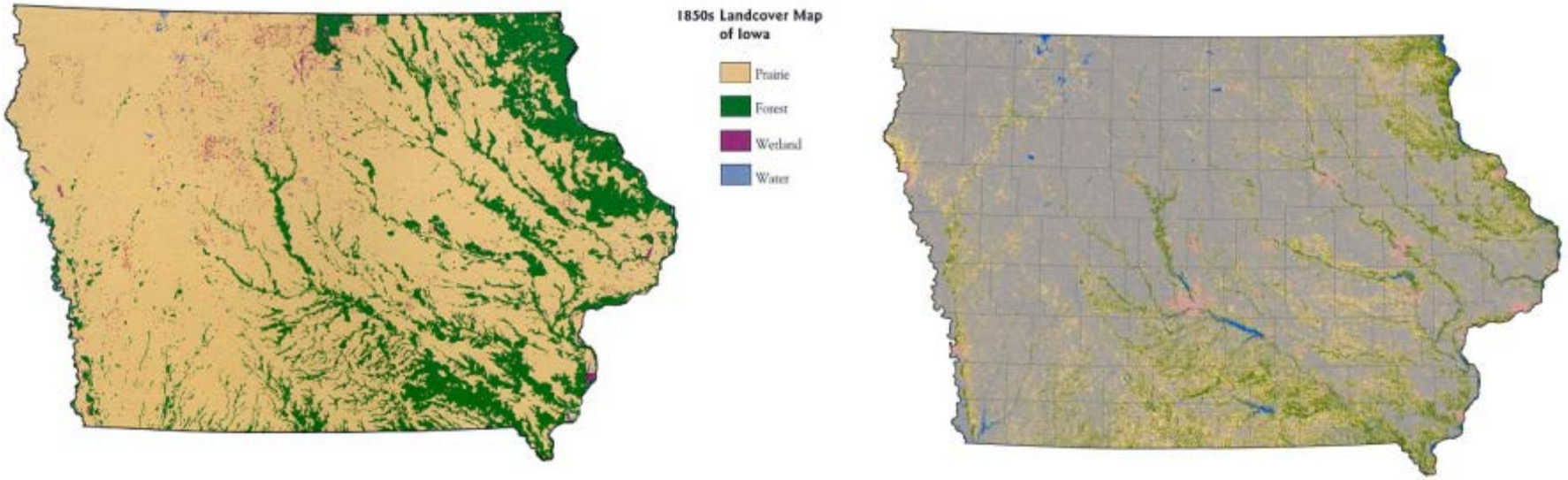


Iowa Land Use 2012



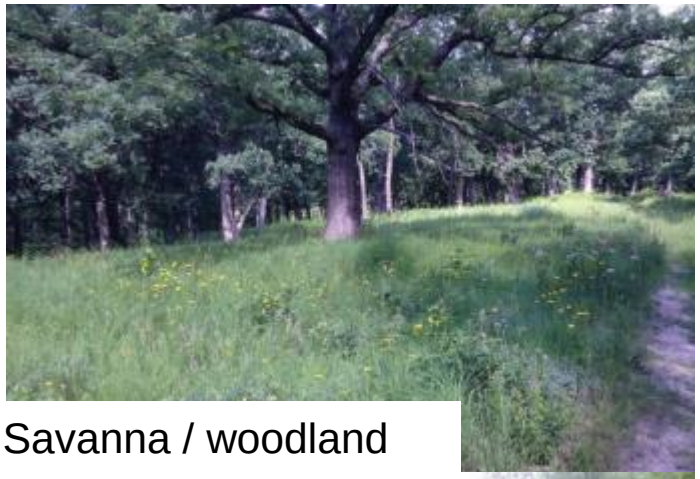
- Row Crop 63%
- Grassland 18%
- Forest 10%
- Urban/Roads 7.4%
- Water 1.7%
- Barren 0.1%

A Nearly Complete Conversion



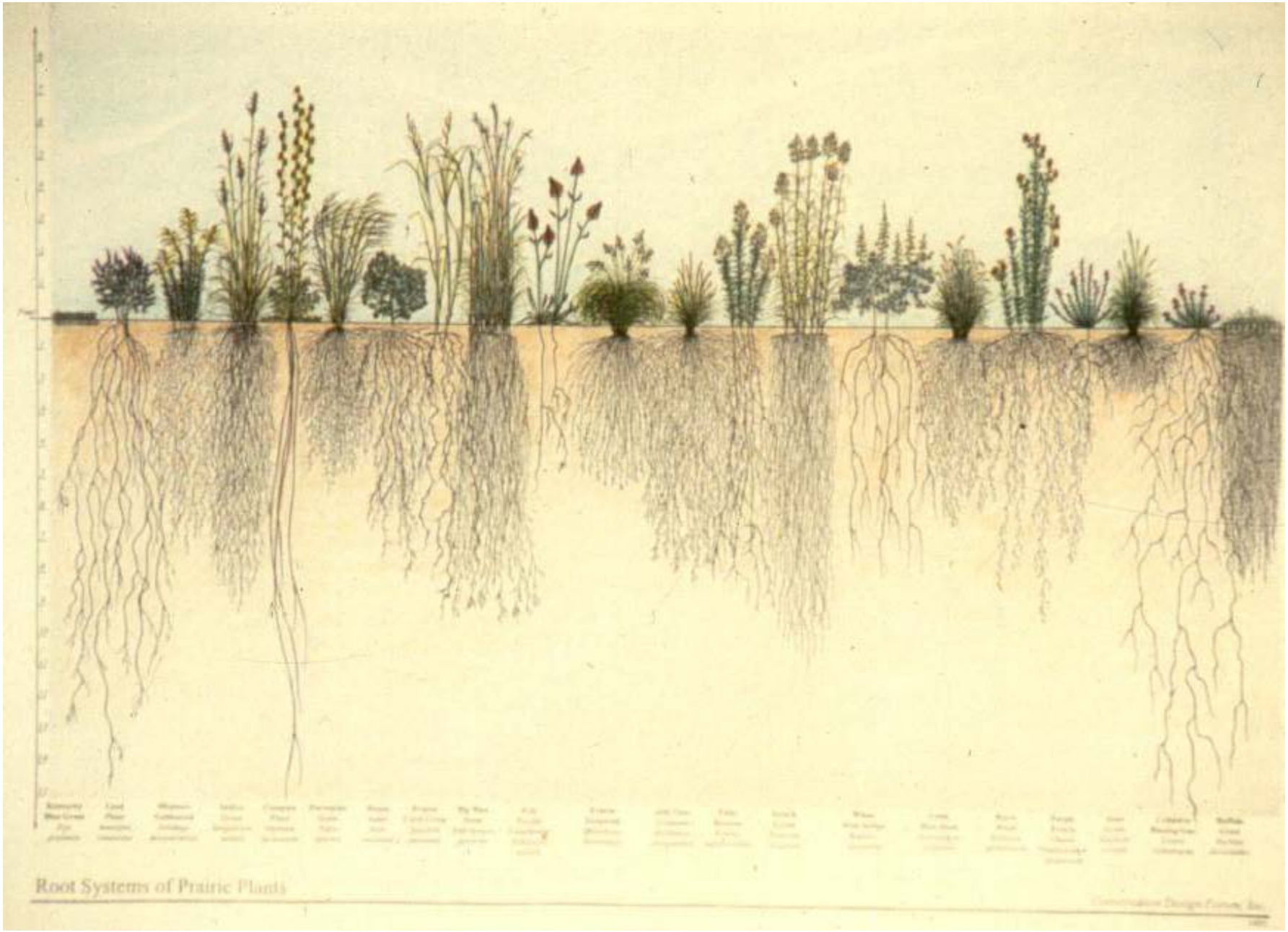
Iowa's Native Ecosystems

Prairie



Savanna / woodland

Surface waters


Root Systems of Prairie Plants

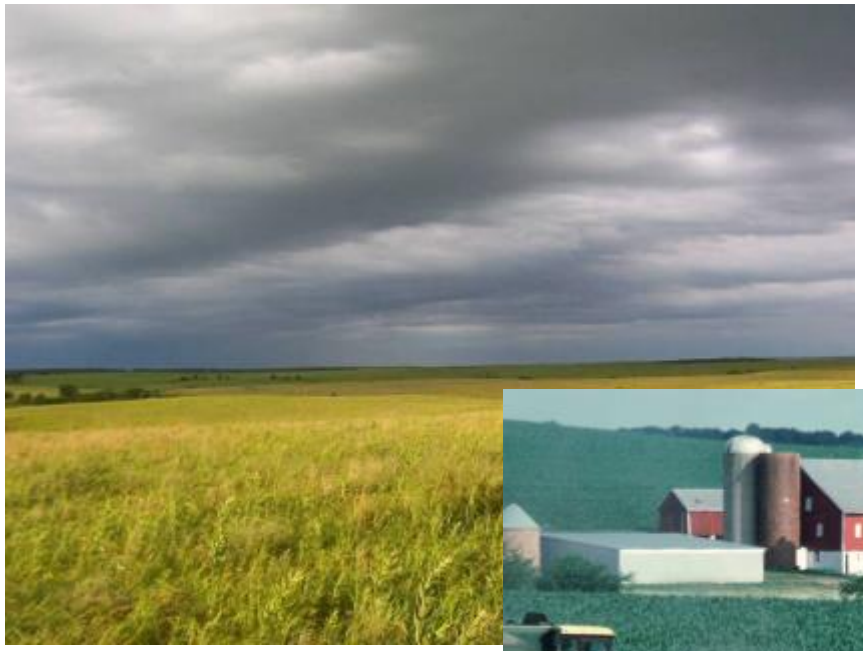
Historic Landscapes

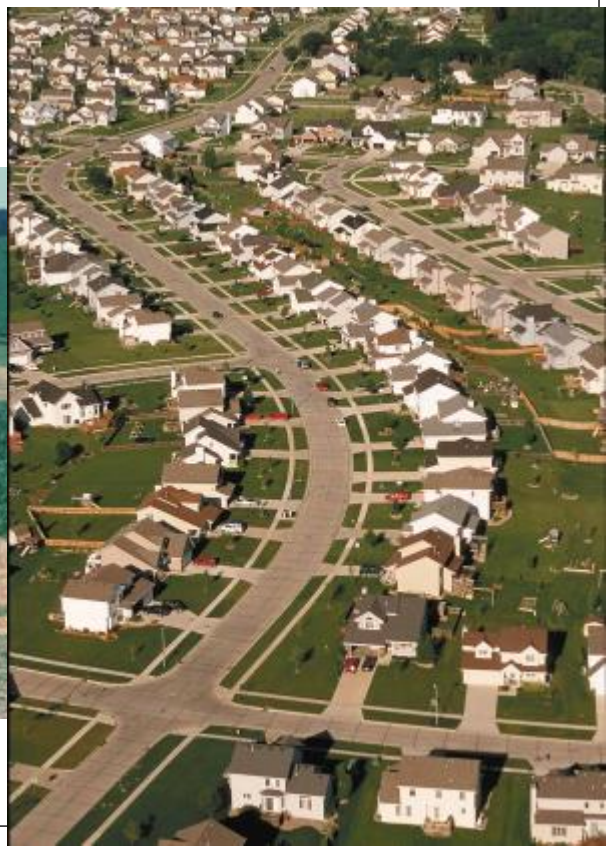
- Prairie soils had 8-10% organic matter content and 45% pore space
- Now soils have < 4% OM
- Even less organic matter on construction sites
- Bulk density has increased – less pore space
- Soils have lost 60-80% of their ability to absorb and infiltrate rainfall events

Soil Quality

- 0.6" of rain is absorbed per % of OM (potentially up to 6" absorbed on the prairie without shedding runoff)
- A healthy 3-foot soil profile has the potential capacity to store 5.4 to 7.2 inches of rain (100 year storm)
- At 2% OM runoff can begin after ~1.2 inches of rain

A Changed Landscape



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Impacts of Iowa's Land Use Changes

- High OM to Low OM
- High porosity to higher bulk density
- Pervious to impervious

- Effects include:
  - Less infiltration
  - Less groundwater recharge
  - More runoff
  - Flashy stream flows
  - More erosion
  - Water quality degradation
  - Increased flooding

Soil Health


USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service
unlock your farm's potential
www.nrcs.usda.gov
Soil Health Management Systems can:
• OPTIMIZE inputs,
• PROTECT against drought and
• INCREASE production.
Learn how to unlock the secrets in YOUR soil today!
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USDA is an equal opportunity provider and employer.
unlock the SECRETS IN THE SOIL

Urban Soil Quality

- Soil significantly altered by agriculture land uses, organic matter reduced to less than 2% from tillage based agricultural practices

Urban Soil Quality

- During urban development, topsoil is often completely removed and remaining subsoils are heavily compacted from urban construction activities

Urban Soil Quality

- **Left with…**
  - High clay content
  - Little to no organic matter
  - Heavy compaction

- **Which causes…**
  - Rain water to runoff lawns similar to the manner in which it runs of other impervious surfaces
  - Carry pollutants (fertilizers, herbicides and insecticides used on lawns, landscapes and gardens; bacteria, nutrients and disease causing pathogens from pet waste; salt from driveways and sidewalks; metals from roof materials, etc.) into surface waters

Soil leaching from under sod, Davenport, Ia. 2010

Soil Quality Restoration

- Reducing Compaction

&

- Increase Organic Matter

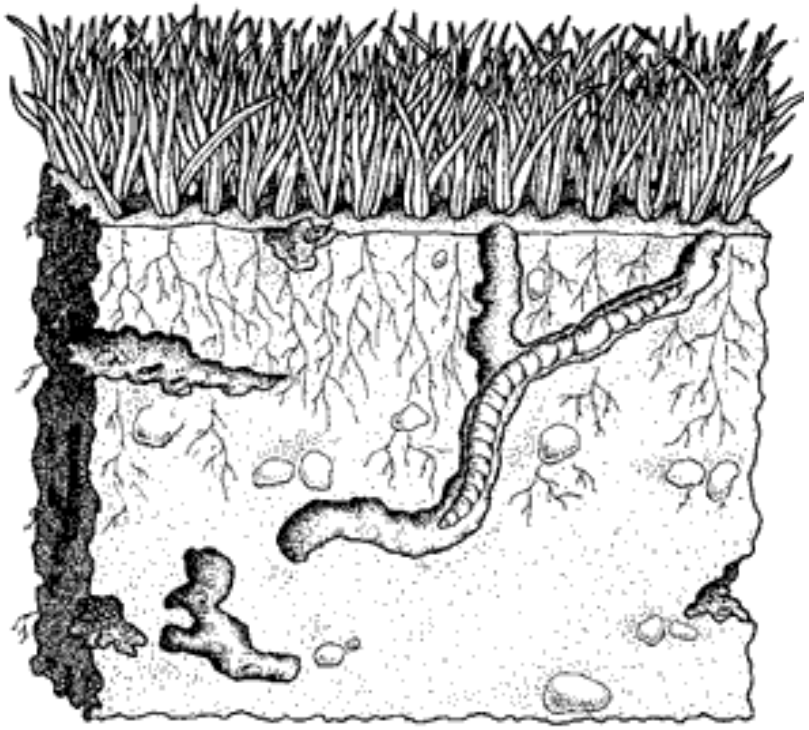
Soil Quality Restoration
Environmental Benefits

- Urban equivalent to no-till & cover crops on ag land, one practice we can implement in the shortest amount of time, most comprehensive manner and least cost
- Hydrologically functional green spaces
- Reduce compaction through aeration
- Bring organic matter up to 5%-10% through compost application
- 2" of compost will elevate organic matter percentages to 5% (Wayne Petersen, Urban Conservationist, Iowa Department of Agriculture and Land Stewardship)
- Every 1% of organic matter, the soil can hold .6" of rain (Scott, H.D., L.S. Woods, and W.M. Miley, 1986. Publication No 125. Pg 39)

- **Soil Quality Restoration allows lawn to infiltrate runoff**

Soil Quality Restoration
Environmental Benefits

- Assists in establishing a healthy population of soil microbes and other species of soil dwellers
- A healthy microbial population will break down and utilize most pollutants



- Bacteria
- Fungi
- Acitinomycetes
- Algae
- Protozoa
- Nematodes
- Arthropods
- Earthworms

Soil Quality Restoration

Benefits to Lawn and Resident/Customer

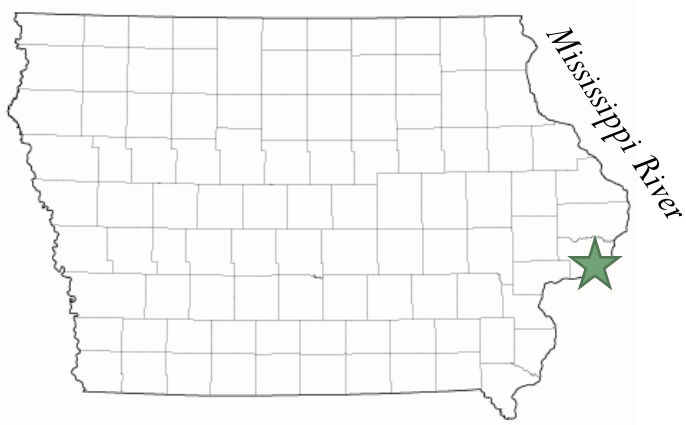
- Requires less water and fertilizer
- Eliminates standing water and dry areas
- Greener, more vigorous lawn

Soil Quality Restoration
Economic Benefits

- Opportunity for local contractors to provide services

Scott County SWCD Urban Cost Share
Program Details

- Technical and financial assistance to residents for the installation of urban infiltration practices
- Program began in 2008
- Cost share 50% up to $2,000 per practice



Funding

IOWA DEPARTMENT OF AGRICULTURE AND LAND STEWARDSHIP

DNR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Riverboat Development Authority

IOWA AMERICAN WATER

Scott County SWCD Urban Cost Share Practices

Soil Quality Restoration

Residential **Permeable Paving** Driveway, Davenport, Iowa

Genesis Hospital **Green Roof**, Davenport, Iowa

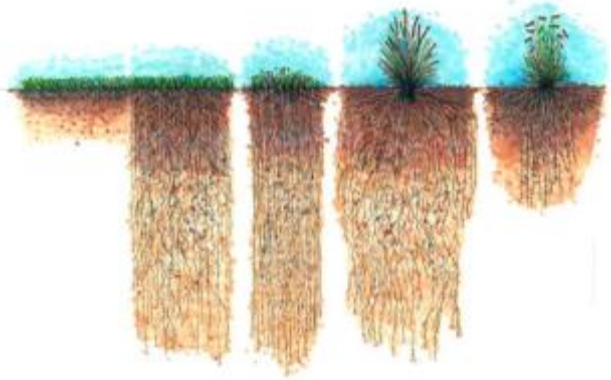
Scott County SWCD Urban Cost Share Practices

Residential **Rain Garden**, Davenport, Iowa

City of Davenport Public Works
Bioretention Cells, Davenport, Iowa

Scott County SWCD Urban Cost Share Practices

Blue grama, sideoats grama, and buffalo grass diagrams + grasses growing

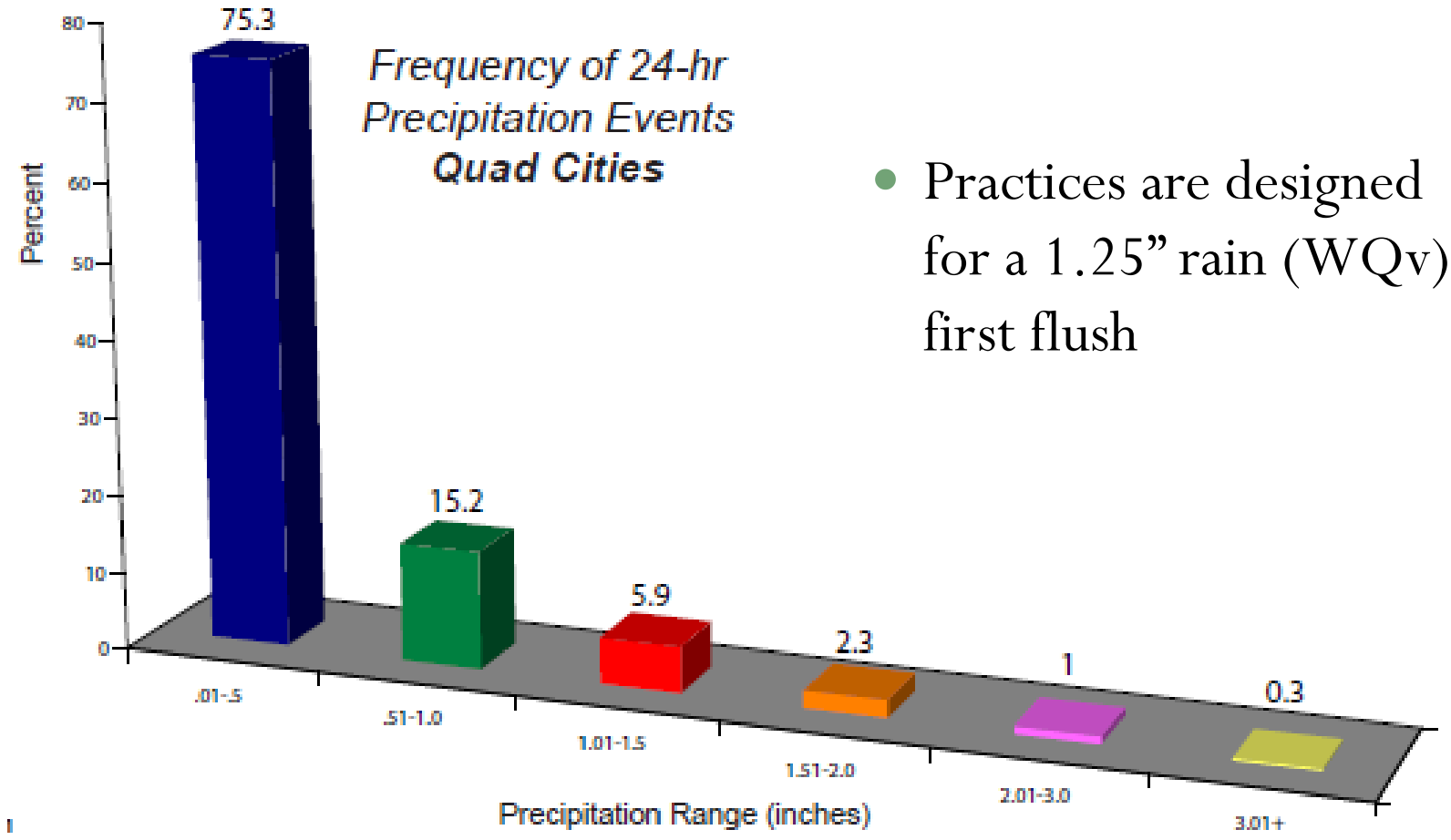


Native Turf

Native Landscaping

Scott County SWCD Urban Cost Share

WQv



- Practices are designed for a 1.25" rain (WQv), first flush

Soil Quality Restoration:
Prior to Lawn Establishment

- **Specifications:** 3" of compost, incorporated 6"

Soil Quality Restoration:
Prior to Lawn Establishment

- **Advantages:**
  - More compost can be added and incorporated deeper (3" of compost, 7.5% OM, 4.5" of rain)
  - Moisture retention & warmth of compost generates rapid germination of seed
  - Done prior to fence and some utility installation if on a new build

- **Limitations:**
  - Done with larger equipment that may not fit in certain areas

- **Cost:**
  - $0.40 per square foot

Runoff from residential construction site w/SQR, Davenport, Ia. 06.08.2010

Runoff from residential construction site w/SQR, Davenport, Ia. 06.08.2010

Runoff from conventional residential construction site, Davenport, Ia. 09.26.2011

Soil Quality Restoration:
w/Existing Lawn

- **Specifications:** Aeration with a piston driven machine with at least 6" tines, application of ½ " compost

Soil Quality Restoration: w/Existing Lawn

- Aerator machine

Soil Quality Restoration: w/Existing Lawn

- Spreading Compost: Top Dresser

Soil Quality Restoration: w/Existing Lawn

- Spreading Compost: Blower Truck

Soil Quality Restoration: w/Existing Lawn

- **Advantages:**
  - Applicable to urban areas with existing structures, landscapes etc.

- **Limitations:**
  - Less compost can be applied (.5" of compost, 1.25% OM, .75" of rain)
  - Often still requires removal of fence panels
  - Certain utilities can still be in the way (irrigation heads, invisible fences)

- **Cost:** $0.12 per square foot

Compost

- Compost : City of Davenport Compost Facility
  - Est. 1995
  - Since 1995, 1.5 million cubic yards of yard trimmings and nearly 575 million cubic yards of biosolids have been diverted from the landfill for composting
  - Compost is piled and reaches temperatures of >145 degrees Fahrenheit, destroying weed seeds and pathogenic (disease causing) organisms

Soil Quality Restoration Workshop/Demo Habitat for Humanity Homes 09.23.2010

- Funding from Iowa American Water & in kind donations to conduct Soil Quality Restoration/Rain Garden Workshop/Demo at two Habitat for Humanity Homes
- 26 attendees (landscape contractors, environmental professionals, local government staff, Habitat for Humanity staff and Scott County residents)

Images from Quad City Times Newspaper

Soil Quality Restoration Workshop/Demo Habitat for Humanity Homes 09.23.2010

Soil Quality Restoration Workshop/Demo Habitat for Humanity Homes 09.23.2010

- As a result of the workshop:
  - 2 Soil Quality Restoration and 4 Rain Gardens were installed at 2 Habitat for Humanity Homes
  - 4 attendees installed soil quality restoration
  - A contractor in attendance sold Soil Quality Restoration and Native Landscaping to a new homebuilder, also a QCHBA board member
  - An attendee installed 2 rain gardens, soil quality restoration and native landscaping
  - 4 others residents aerated conventionally and applied compost after seeing the photos in the newspaper

Projects to date

- Since the program began in 2008,the following practices have been installed:
  - **63** Soil quality restorations
  - **14** rain gardens
  - **13** bioretention cells
  - **8** permeable paver systems
  - **4** native landscaping projects
  - **1** green roof
  - **1** infiltration trench
- Projects approved for funding and ready for installation:
  - **10** soil quality restorations, **5** rain gardens and **1** native landscaping

Land & Water Magazine Sept/October 2011

- "Making Amends with Soil Quality"
- Article about Soil Quality Restoration & The Scott County Soil and Water Conservation District's Soil Quality Restoration Program

SOIL AMENDMENTS

Making Amends with Soil Quality

Runoff from construction site during heavy rainfall September 2011.

A compacted, nutrient poor soil causes many problems for homeowners while increasing the volume of runoff and degrading water quality.

Land and Water

For more information…

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