



Chapter 12

Soil and the Environment

Mr. Dave Shiley
AGRIC 210 – Soil Science

We have learned how soil properties have been determined through the influence of climate, parent materials, organisms, topography over time.

But how do soils affect the environment during the present?

Further, how can soils be degraded?

How can we minimize soil degradation today?



Soils were formed or developed over many years.

Thousands of years

Tens of thousands

Even hundreds of thousands or millions





The general principle of soil care:

Use soils in a way that maintains their pre-use state or condition.

Dramatically changing the soil's condition can result in damage or degradation.



Soil condition should be monitored to prevent extensive damage, which could take many years to correct.

- Maintain surface cover as was present prior to our use of the soil.

- Maintain or enhance soil biodiversity, as found in its unaltered condition.

Maintain surface cover

Tillage systems

Crop residue management

Cover crops

Permanent cover or vegetation on highly erodible soils



Biodiversity – maintain or enhance

Planting one species, ie corn or soybeans creates a monoculture

Can result in pest buildup

Plant a diversity of species

- forage mixtures**
- crop rotations – corn-beans-small grains-forage**
- cover crops in the mix**



Soil ability to “purify” natural waste products

Microorganisms developed over time that decompose animal wastes

Synthetic wastes may not be decomposed in the soil

Risk of environmental impact – persistence in the soil and environment



The influence of soils on climate impacts

Absorb rainfall – reduce flooding

Absorb heat from the sun – moderate the daily temperatures

Absorbed heat available for geothermal technology

And allow perennial plant's root to continue to grow in the late fall and early winter

Soils can sequester carbon – influence carbon cycle



Wetlands

Soils that are saturated for several months are hydric soils

Wetlands are the ecosystems found in these soil types

Wetland benefits

Replenish groundwater

Slow runoff

Filter sediments

Cycle nutrients

Provide wildlife habitat



Soil Health

To maintain soil health, the Natural Resource Conservation Service-NRCS advocates:

- **Use plant diversity**
- **Minimize soil disturbance**
- **Keep growing plants year-round**
- **Maintain a cover over the soil**

Soil Degradation

1. Soil Structure Decline

Compaction

Sealing

Crusting



Soil Degradation

2. Leaching and Acidification

**Occurs in humid regions + precipitation
exceeds evapotranspiration**



Soil Degradation

3. Salinization

Accumulation of excess salts in the soil.

Occurs in arid or semi-arid regions

Low rainfall = salts are not removed from soil



Soil Degradation

4. Desertification

Most severe in north Africa

**Results from prolonged drought and
excessive grazing/use by humans.**



Soil Degradation

5. Soil Contamination

Fertilizer excess

High nitrate levels in water

High phosphorus levels in water

Pesticide persistence



Soil Degradation

6. Municipal Solid Waste

Solid waste-landfills

Open dumps or landfills until 1960s

Today the EPA has very specific regulations regarding landfill requirements

Soil Degradation

7. On-Site Sewage Disposal

Septic tanks, aerobic sand systems



Off-Site Effects of Soil Management

Wind movement of soil particles

Dust storms, human health, visibility

Water movement of soil particles

**Delta expansion, locally buried crops,
ditches, sedimentation of reservoirs**

Off-Site impacts on water quantity

Water Surplus

Low infiltration rates and reduced water holding capacity can increase flooding downstream

Impermeable surfaces in urban areas increase runoff

Water deficit

Sandy soils = low water holding capacity require drought tolerant plants or irrigation



Off-site impacts on Water Quantity

Water surplus increased runoff and flooding

Water deficit – soils require irrigation

Surface Water source

Groundwater source



Off-site impacts on Water Quality

Nutrient movement

Nitrate concerns in drinking water/livestock

Soil movement

Turbidity in surface water causes increased water temperatures, lower dissolved oxygen carrying capacity, impact on aquatic habitat



Off-Site impacts from organisms in water

E. coli

Cryptosporidium

Salmonella

Vegetable wash water must be tested on the farm

Livestock watering health concerns



Challenges to agriculture

Growing world-wide population to feed

Loss of productivity capacity

Soil fertility and soil quality changes

Topsoil loss

Agricultural land base is shrinking – conversion of land to other uses, ie urban area expansion



Questions



Richland
COMMUNITY COLLEGE

