

Farming: Conventional and Sustainable Practices

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Outline

Resources for Agriculture

Soils are Complex Ecosystems

Soil

6 Components of Soil

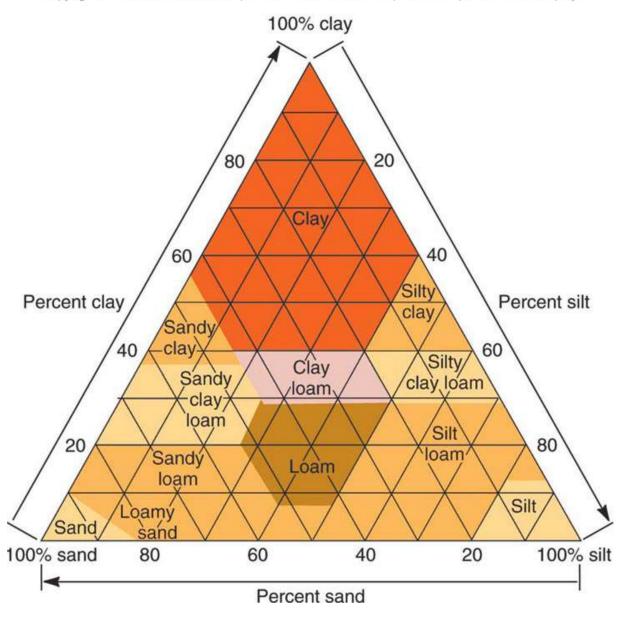
Sand and gravel
Silt and clay
Dead organic material
Soil fauna and flora
Water
Air

Variation in Soil Composition

Loam

Soil Texture Pyramid

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Grassland vs. Tropical Rainforest Soils

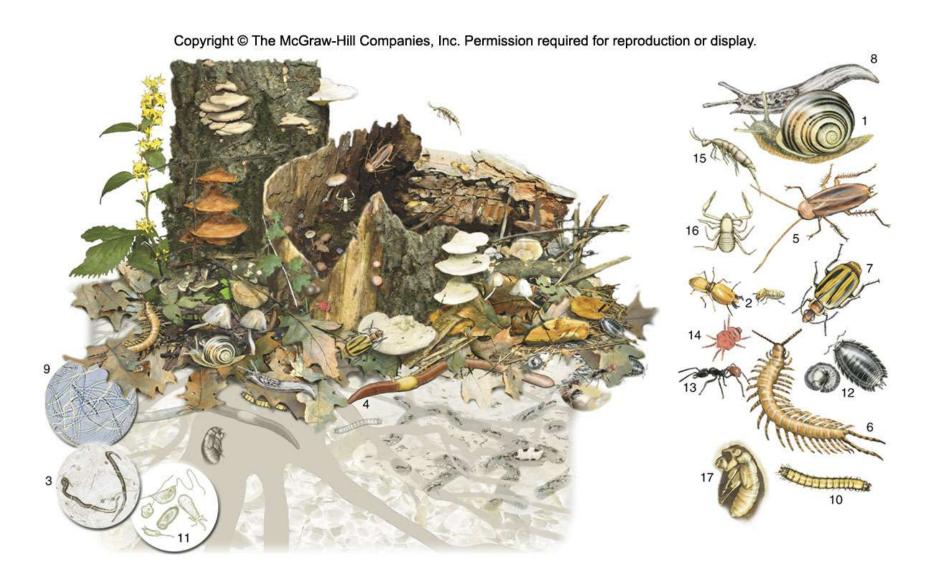
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Soil Fauna Determine Fertility

Micorrhizal symbiosis,

Soil Ecosystems



Soils are Layered

soil

horizons

soil profile

- O Horizon

- A Horizon

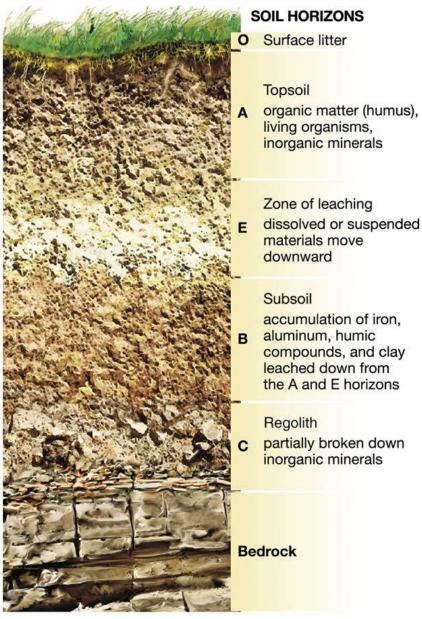
Soil Profiles

- E Horizon

- B Horizon

- C Horizon or regolith

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Food Comes from the A Horizon

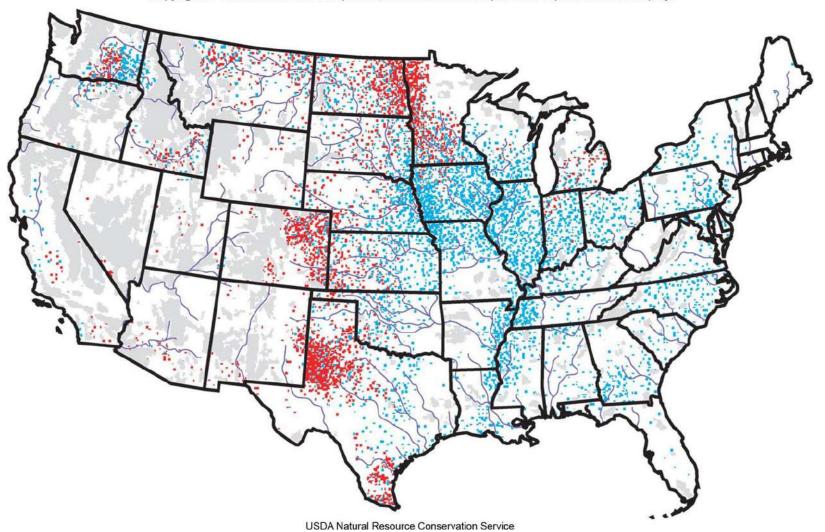
mollisols

Ways We Use and Abuse Soil

Arable Land Unevenly Distributed

Distribution of US Cropland

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Soil Losses Cut Farm Production

Water Moves Soil in Various Ways

Sheet Erosion - thin layer of surface removed
Rill Erosion - small rivulets of running water gather
together and cut small channels
Gully Erosion - rills enlarge to form bigger channels
too large to be removed by normal tillage
Streambank Erosion - washing away of soil from
banks of streams and rivers

Wind Moves Soil Also

Desertification

Deserts are Spreading

Desertification

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(a) Sheet and rill erosion
Photo by Lynn Betts, courtesy of USDA
Natural Resources Conservation Service



(b) Gullying

Photo by Jeff Vanuga, courtesy of USDA

Natural Resources Conservation Center



(c) Wind erosion and desertification
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Other Agricultural Resources

All Plants Need Water to Grow

- Waterlogging
- Salinization

Plants Need Fertilizer Also

Farming is Energy Intensive

Pests and Pesticides

Biological Pests

Pesticides

Use of Pest Controls is Not New

Pros and Cons of Modern Pesticides

Pros and Cons of Modern Pesticides

Worldwide Pesticide Use

Pesticide Types

Organophosphates

Pesticide Types

Chlorinated Hydrocarbons

Atrazine, Paradichlorobenzene (mothballs) and DDT are examples.

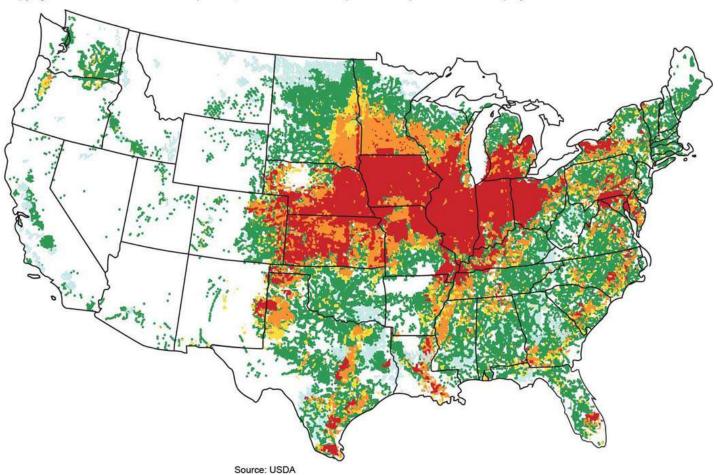
Persistent and concentrate in food chains

Fumigants

Used in fungus control on strawberries or to prevent insect/rodent damage to stored grains. Extremely dangerous to workers and restricted or banned in some areas.

Map of Atrizine Usage in US

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no estimated use

0.001 - 0.36

0.36 - 2.15

2.15 - 9.86

9.86 - 32.77

≥ 32.77

Pesticide Types

Inorganic Pesticides

Natural Organic Pesticides

Pesticide Types

Microbial Agents and Biological Controls

Bacteria such as *Bacillus thuringiensis* kill beetles. Parasitic wasps such as *Trichogramma* kill moths. Ladybugs are used to control aphids

Environmental Effects of Pesticides

Non-Target Species

Up to 90% of pesticides never reach intended target and instead kill beneficial organisms. Honey bees are one such example

Pest Resurgence

a few resistant pests survive the pesticide and survive to repopulate the area with more resistant pests. Resistant pests require finding new pesticides

Persistent Organic Pollutants

Persistent Organic Pollutants (POP's) -

They can travel far from the point of dispersal.

Stored in fat and tend to bioaccumulate

High levels have been detected in predators at the upper levels of food chains

POP's accumulate in polar regions by the "grasshopper effect"; they evaporate from warm regions and condense in cold regions.

Environmental Persistence and Mobility

Human Health Problems

Organic and Sustainable Agriculture

Health Hazards of Pesticide Usage

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Organic and Sustainable Agriculture

Organic Produce

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Careful Management Can Reduce Pests

Behavioral Changes

Biological Controls

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IPM Uses a Combination of Techniques

Integrated Pest Management

Crop Vacuum Removes Insect Pests

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Alternative Pest Control Strategies

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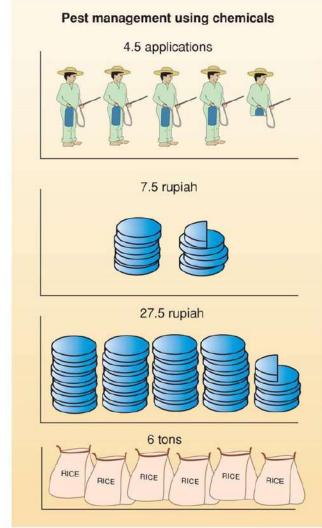
Alternative Pest Control Strategies

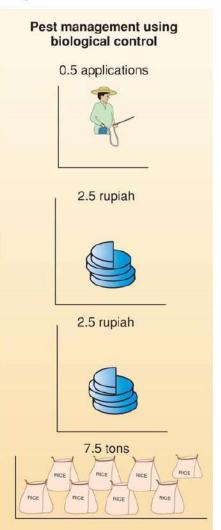
Number of times insecticide used in rice season

Cost to farmers per hectare

Cost to government per hectare

Rice yield per hectare





Soil Conservation

Managing Topography
Contour Plowing - plowing across slope to slow flow of water
Strip Farming - planting different crops in alternating strips along land contours
Terracing - shaping land to create level shelves of earth to hold water and soil
Plant perennial species.

Contour Plowing

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Photo by Lynn Betts, courtesy of USDA Natural Resources Conservation Service

Terracing

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Ground Cover Protects Soil

Methods of Providing Ground Cover

Reduced Tillage Leaves Crop Residue

- Reduced Tillage
 - **❖**Minimum Till
 - **❖**Conserv-Till
 - **❖**No-Till

Low Input Sustainable Agriculture

Consumers' Play and Important Role

locavore