Healthy Soils Save the World!

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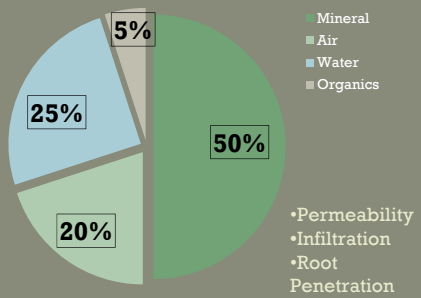
Soil Health—Physical Characteristics

- Do no harm to soil pore spaces;
- **Minimize compaction;**
  - Mulch to minimize foot traffic.
- **Minimize tillage;**
- Increases air penetration;
- Reduces oxidation/burning of organic matter;
- Increases water infiltration.

4 Steps to Healthier Soil

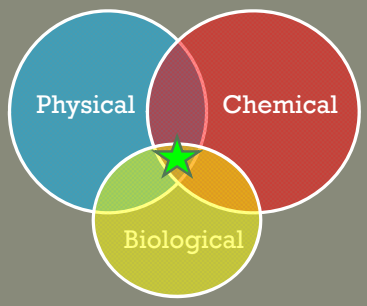
1. Keep the soil covered;
2. Keep a living root in the soil year round;
3. Minimize tillage/disturbance;
4. Increase plant diversity (crop rotations + cover crops)

Soil Components by Volume



- Permeability
- Infiltration
- Root Penetration

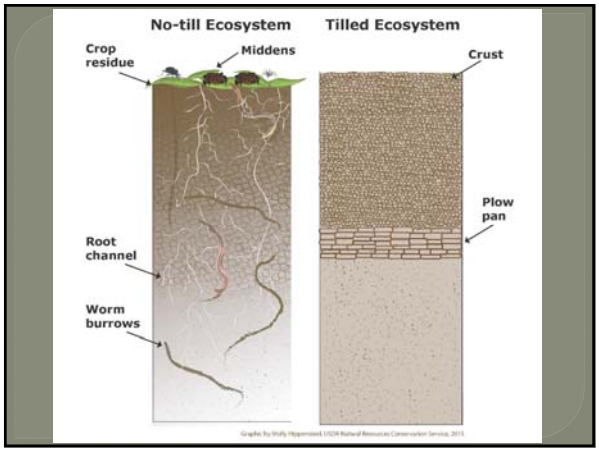
Healthy Soils



Inceptisols

- Good profile development;
- Visible plow layer;
- Developed under primarily deciduous forests.

Paxton Fine Sandy Loam



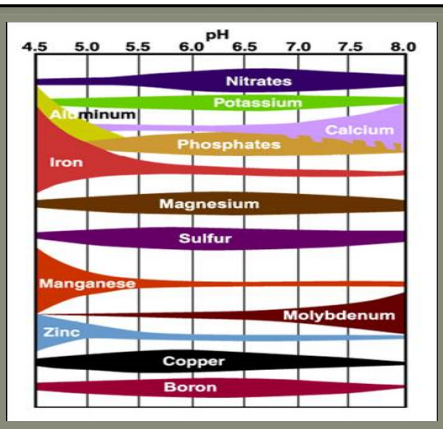
Soil Chemistry—Test the Soil

- Protect YOU & the environment;
- Best management tool;
- Improve yields and plant health;
- Save money (don't buy fertilizer that the plants won't use);
- UMass Soil Testing Lab ($21 for nutrients and $55 for heavy metals)

Urban Gardens

Soil Chemistry Goals

- Optimize soil pH for optimal plant nutrition;
  - Deciduous material--pH 6.0—7.0
  - Conifers, Hardwoods--pH 5.5—6.0
  - Broadleaf evergreens--pH 5
- SUFFICIENT nutrients;
- Percent Base Saturation @ pH 6.5;
  - Potassium (K^+) 2-5%
  - Magnesium (Mg^{2+}) 10-15%
  - Calcium (Ca^{2+}) 60-70%



Heavy Metals

Results

Analysis	*Value Found*		*USEPA Heavy Metals Thresholds **
Lead (Pb)	85.9	mg/Kg	400 mg/kg
Nickel (Ni)	15.1	mg/Kg	1600 mg/kg
Cadmium (Cd)	0.1	mg/Kg	39 mg/kg
Chromium (Cr)	16.4	mg/Kg	100 mg/kg
Zinc (Zn)	88.8	mg/Kg	23,600 mg/kg
Copper (Cu)	18.7	mg/Kg	Not Available

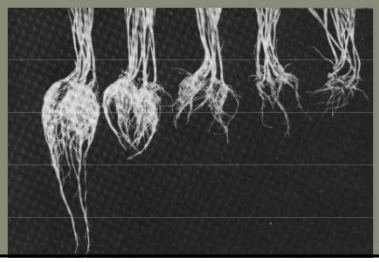
** This information is for general guidance. The threshold values are based on toxicity characteristic leach potential (TCLP). It should be noted that the degree of environmental risk could be influenced by soil characteristics. Contact your local Environmental Protection Authority for specific recommendations.*

Effects of Soil Acidity

Aluminum Toxicity Reduces Root Growth

Barley Roots

pH 7.2 6.6 5.2 4.7 4.4



Results

Analysis	*Value Found*	*Optimum Range*	*Analysis*	*Value Found*	*Optimum Range*
Soil pH (1:1, H2O)	6.2		**Cation Exch. Capacity, meq/100g**	21.6	
Modified Morgan extractable, ppm			**Exch. Acidity, meq/100g**	5.6	
Macronutrients			**Base Saturation, %**		
Phosphorus (P)	10.6	4-14	Calcium Base Saturation	61	50-80
Potassium (K)	75	100-160	Magnesium Base Saturation	12	10-30
Calcium (Ca)	2654	1000-1500	Potassium Base Saturation	1	2.0-7.0
Magnesium (Mg)	311	50-120	**Scoop Density, g/cc**	0.89	
Sulfur (S)	24.2	>10			
*Micronutrients **					
Boron (B)	0.3	0.1-0.5			
Manganese (Mn)	7.3	1.1-6.3			
Zinc (Zn)	7.7	1.0-7.6			
Copper (Cu)	0.5	0.3-0.6			
Iron (Fe)	6.7	2.7-9.4			
Aluminum (Al)	34	<75			
Lead (Pb)	5.7	<22			

* Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.

Soil Test Interpretation

Nutrient	Very Low	Low	Optimum	Above Optimum
Phosphorus (P):				
Potassium (K):				
Calcium (Ca):				
Magnesium (Mg):				

Lead in Soil—UMass Soil Lab Ranges

Extracted Lead (PPM)	Lead Levels and Risk
Less than 43	Low
43—126	Medium
127—480	High
Greater than 480	Very High

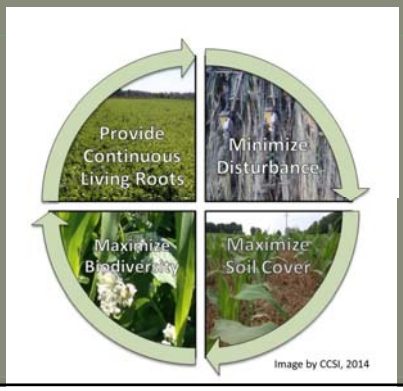
Lead in Soil—UMass Soil Lab Ranges

Lead Levels and Risk	Recommendations
Low	Follow good gardening practices;
Medium	Grow fruiting crops; Avoid leafy greens and root crops;
High	Grow only fruiting crops; Create raised beds; Practice container gardening; Replace top soil;
Very High	Replace top soil.

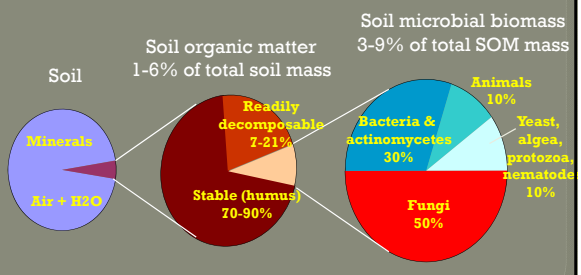
Lead in Soil—Good Gardening Practices

- Locate gardens away from old painted structures and busy roads;
- Preference to fruiting crops;
- Incorporate organic materials;
- Lime soil to pH 6.5—7.0;
- Discard outer leaves of leafy crops and peel root crops;
- Mulch soil surface to keep dust to a minimum.

Soil Biology Characteristics



Soil Organic Matter House—Food—Consumers



"Building Soils for Better Crops", Magdoff and van Es, 2000

Hadley, MA--Fine Sandy Loam

Conventional Tillage, cover crop tilled in

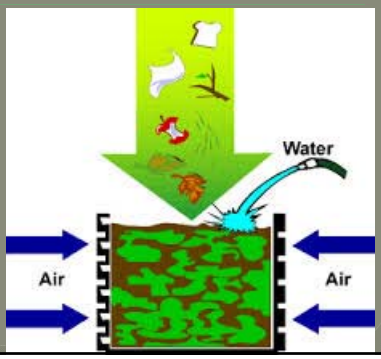
No-till, cover crop left on surface

Soil Structure

- How the particles are glued together.

Adding Carbon via Compost

- Mixture of green and brown materials;
- 30:1 C:N ratio;
- 50% moisture;
- Air!!!



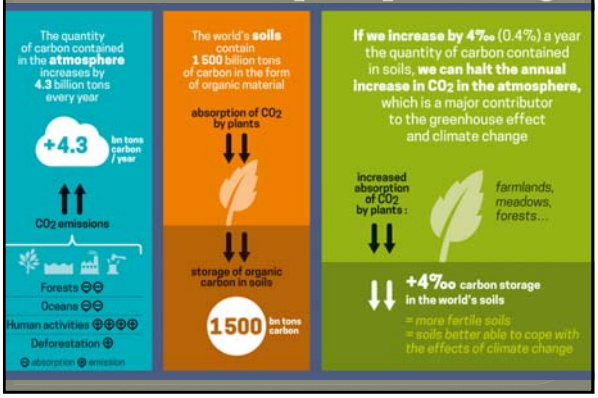
Soil Aggregate Stability Indicator of Soil Health

Adding Carbon to the Lawn

Illustration courtesy of Viking-Mulch-mowers

Recycling and Fertilizing!

http://4p1000.org



Mulching Leaves


Photo courtesy of Lewis Ginter Botanical Gardens, Richmond, VA


Peas & Oats—Early Spring
Cornell University Organic Cropping Systems Project


Questions?