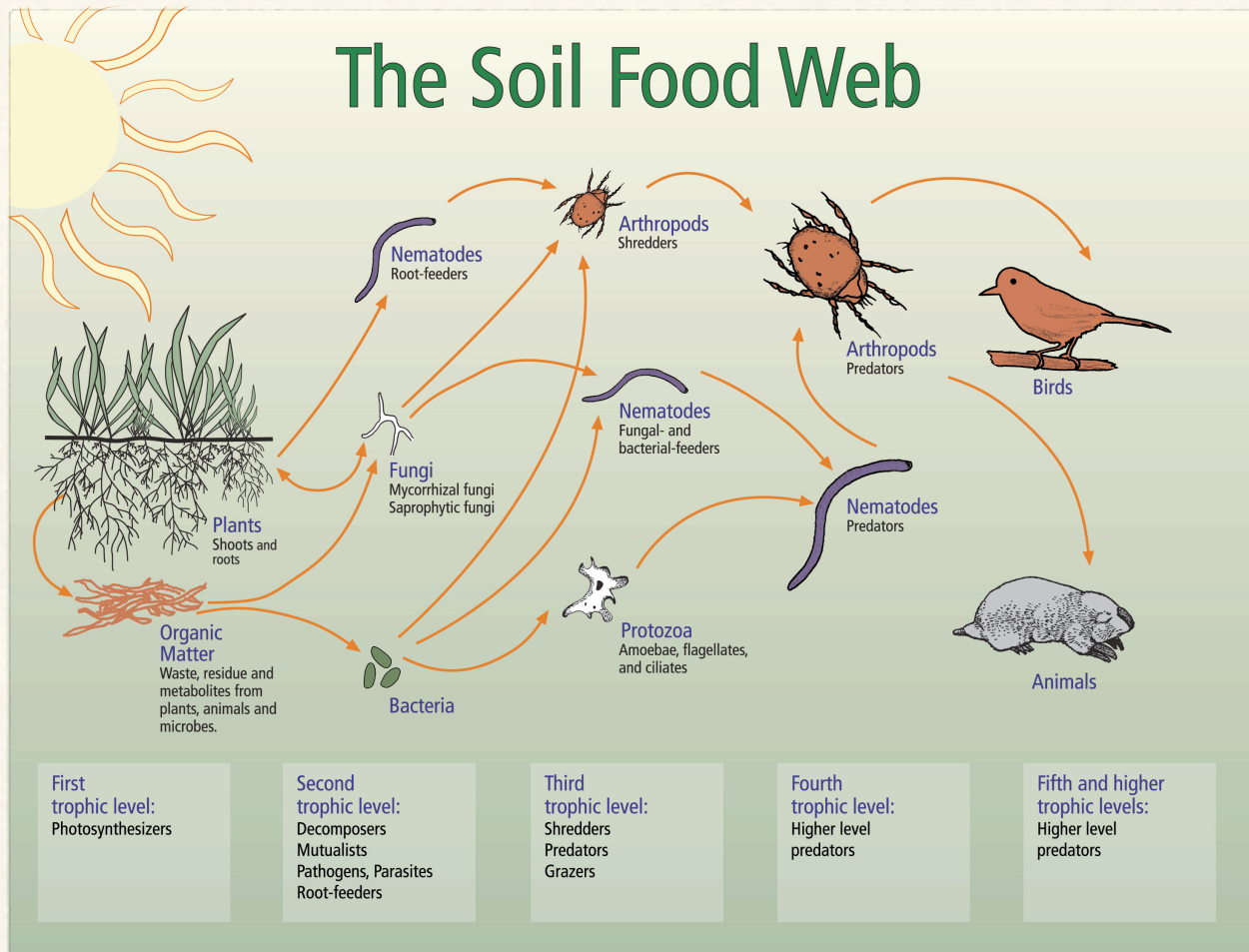




Building Healthy Garden Soil

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Source: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/?cid=nrcs142p2_053868

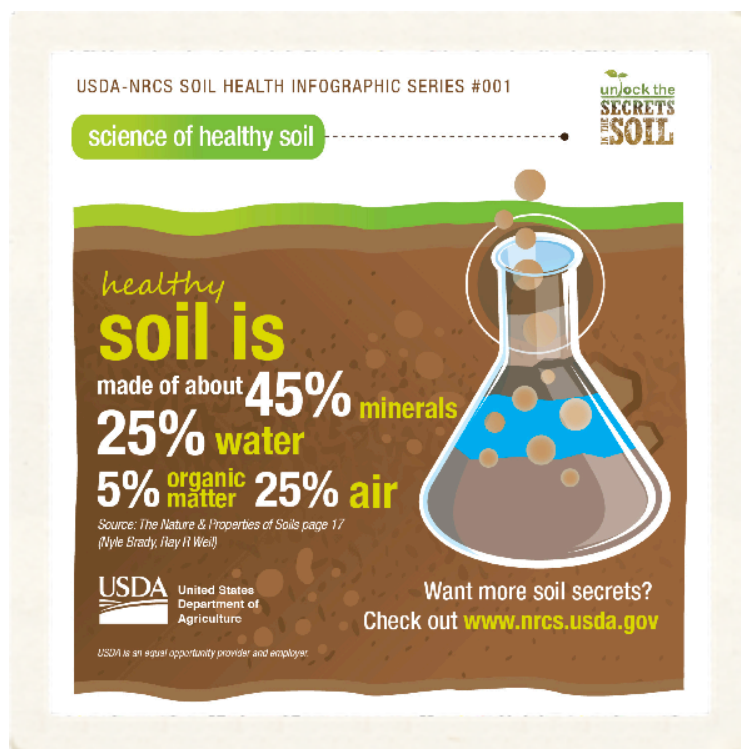
8 Steps to Improve Your Garden Soil Health

1. **Avoid Excessive Digging.** Every time the soil is disturbed through digging, surface- layer organisms are buried, threads of beneficial fungi are broken, earthworm tunnels and root paths that facilitate water absorption are destroyed, and soil aggregates are broken up, leaving little air space in the topsoil. Try to plant, weed and incorporate organic soil amendments with hand tools (trowel, cultivator, fork). Dig clay soils when they are slightly moist. Grab a handful of soil and form a ball -- if it readily does not break apart it's too wet for digging. When you dig into wet clay it forms clods that hinder growing!
2. **Enhance Soil with Organic Amendments.** Regular additions of organic matter (compost, manure) improve soil structure, enhance water and nutrient holding capacity, protect soil from erosion and compaction, and support a healthy community of soil organisms. To apply with the least

disturbance, place amendments on top of the soil and simply plant into it. This provides a mulch (for moisture retention/weed suppression), but will take longer for the amendment to improve the organic matter content of the soil. A good mulch calculator can be found online at:

<http://www.garden.org/calculators/index.php>.

3. **Keep Soil Covered.** The soil that erodes from the surface of your garden (topsoil) is the soil with the highest concentration of organic matter. One should always keep the soil covered with plants, cover crops/green manures (see Resources links), or at minimum, an organic mulch so the carbohydrate pipeline (to the soil food web) isn't shut off. Not only do cover crops/green manures provide a stable environment for microbes and earthworms, but as their roots decay, they leave channels for new plant roots. Organic mulch also dramatically increases the amount of rainwater that enters the soil and decreases the amount of water that runs off the garden soil surface.
4. **Diversify Your Garden.** Diversifying your garden not only reduces build-up of certain pests, but increases helpful micro-organisms/beneficial insects. An easy to remember 4-year rotation consists of planting leafy (1st year), fruit (2nd year), roots (3rd year) and soil builders (4th year), then repeat the cycle. Leafy: lettuce, mustard, chard; Fruit: eggplant, tomato; Root: onions, beets, daikon, sweet potatoes; Soil builders: legumes (bush/pole beans) or cover crops/green manure. Fill in borders of garden beds with dill, basil, and/or marigolds to bring in beneficial insects.
5. **Prevent Soil Compaction.** Soil compaction is difficult to correct, thus efforts should be directed at preventing it in the first place. Foot traffic is a major source of soil compaction. Raindrops and sprinkler irrigation also compact fine-textured clay soils. Raindrops averaging less than 1/8 inch in diameter hit the ground like a tiny bomb going as fast as 20 miles per hour. Raised bed gardening techniques, established walkways (boards/stepping stones), and mulches -- all help eliminate compaction in the garden bed.
6. **Manage the Use of Pesticides/Herbicides/Synthetic Fertilizers.** The cumulative effect of pesticides/herbicides/synthetic fertilizer usage is that it reduces the total number and diversity of soil organisms. Synthetic fertilizers don't kill many soil organisms directly, but plants are less likely to form beneficial associations with soil organisms, thus creating a dependency on the synthetic fertilizer to provide nutrients to the plant.



7. **Maintain Nutrient Levels.** Since the soil supplies most nutrients to plants, the best strategy for nutrient management is to enhance the levels of organic matter in soils. Add organic fertilizers based on a soil test (optimally) and observation. One of the drawbacks of organic materials is their variability and uncertainty timing-wise of nutrient release.
8. **Monitor Your Soil.** Monitoring your soil helps you understand what gardening practices are working or not working. Is the soil dark, loose and crumbly with a diverse number of soil organisms within a square foot of surface soil? Are plant roots branching and have fine root hairs? A lack of fine root hairs indicates oxygen deprivation, while sideways growth of roots indicates clay pan (a compacted layer). Grab a handful of soil and take a whiff. Does it have a fresh earthy (composty) smell? A sour, chemical, or putrid smell indicates poor drainage. Use a rod to test to see if soil is compacted or not.

Soil and Cover Crop/Green Manure Resources

- ▶ Hawaii Soils: <http://www.ctahr.hawaii.edu/site/extsl.aspx>
- ▶ Cover Crops and Green Manures for Hawaii: <http://www.ctahr.hawaii.edu/sustainag/Database.asp>
- ▶ Oahu RC&D Cover Crop Handbook:
http://oahurcd.org/wp-content/uploads/Cover-Crop-Handbook-Final_Oct-2011.pdf
- ▶ Oahu Home Gardener Score Card:
<http://www.ctahr.hawaii.edu/ougc/downloads/Oahu%20Home%20Gardener%20Soil%20Health%20Card.pdf>
- ▶ Unlock the Secrets in the Soil: Soil Health Awareness:
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/soils/health/>