Protecting Local Water Resources by Amending Soil with Compost

Communities can protect water resources by instituting minimum requirements for organic matter in soil. Compost, much of which is generated locally, when incorporated into soil improves water holding capacity and soil quality. By incorporating compost into soil for establishment of lawns and landscape plantings, water used for irrigation is conserved and the potential for groundwater contamination is reduced.

Background

The need for clean and ample water supply is well understood and widely recognized. Less recognized is the effect that soil quality can have on water quality and supply. During droughts, typically in the summer month's, water supply is low and in many communities bans are issued on outdoor irrigation. Lawns in residential and commercial areas have a high summer irrigation demand and consume large volumes of water. The amount of water consumed can vary greatly depending on soil quality. Since landscapes in urban and suburban settings primarily consist of turf, paying attention to soil quality where new turf is established makes good environmental sense in terms of protecting local water resources.

Commercial and residential development that includes large lawn areas continues. Projections for future growth are surprisingly large in many areas. Developers, who are trying to minimize costs, are interested in beautiful lawns initially, but are generally not concerned with long-term aesthetics, maintenance requirements, and soil quality. Typically, they will import and place a thin layer (less than 1") of degraded, but screened "soil" that has been stripped from another construction site and has unknown characteristics relative to supporting plant life. This practice creates a condition in which low organic soil with little water-holding capacity exists necessitating frequent watering particularly in the warmer months.

The result of low water-holding capacity in soil is significant in terms of its impact on local water resources. Excessive amounts of water are used unnecessarily, thereby threatening the supply. In addition, there is potential for increased use of fertilizers, pesticides, and herbicides that may leach into local groundwater sources or run-off into nearby surface waters. As a direct result of poor quality soil being used for new lawn construction, lawn maintenance costs are high and the cost to the environment is potentially even higher.

The Role of Organic Content in Soil

Organic content is a key component of healthy soil and is critical to its functioning properly to support plant life naturally. Organic matter provides structure and a place for water, air, and biological life to exist in soil. A soil with insufficient organic matter may not hold adequately water or supply an environment for beneficial microbes. These soils become quickly dependent on high levels of watering and multiple fertilizer applications and pesticides to maintain the verdant appearance that our society expects.

In many parts of the United States, soils are low in organic content requiring the addition of an amendment to increase the organic content. Peat and compost are two commonly used amendments that are high in organic matter. However, peat does not supply nutrients and beneficial microbes that compost does and peat is a limited natural resource while compost is a recycled product. Additionally, in most of the country, compost is more economical to use as a soil amendment because of its price and availability. By incorporating compost during installation, it is possible to add life—microbial activity and organic matter to the soil. Adding life to the soil will replicate native soil systems where shrubs, trees and grasslands thrived without fertilizer or pesticides.

Communities in many states have taken measures to increase organic matter in soils. For example, Redmond, WA has issued guidelines for landscaping with compost-amended soils. The Texas Natural Resource Conservation Commission has worked with other in-state agencies and communities to advance composting and the utilization of compost. The Washington Organic Recycling Council is very active in promoting the use of compost in soils and has established the "Soils for Salmon" program to protect rivers. The United States Department of Agriculture (USDA) and Appropriate Technology Transfer for Rural Areas (ATTRA) provide considerable technical information showing the important role that compost has in maintaining healthy soils and water resource protection.

The Benefits of Compost

Compost is the product from the thermophilic, aerobic decomposition of organic residues under controlled conditions. It can be made from a variety of feeedstocks such as green waste, food waste, biosolids (municipal wastewater treatment plant solids), clean wood waste and other environmentally safe organic materials. Compost should meet all EPA and state environmental agency requirements governing chemical contaminants and be processed at high temperatures necessary to destroy weed seeds and potential pathogens. Producers of compost should provide a laboratory compost analysis.

Compost has a high organic matter content relative to most upland soils. By incorporating compost into soil, Soil Organic Matter (SOM) is increased making the soil healthier. The benefits of increasing SOM by adding compost are many and fall under four categories: biological, physical, chemical, and environmental.

Organic matter provided from compost promotes the growth of beneficial micro-organisms. A teaspoon of healthy soil or compost can have millions of bacteria, miles of fungi, hundreds of thousand of protozoa, and hundreds of beneficial nematodes. These groups of living organisms create a diversity of life in a healthy soil and serve a critical function not only metabolizing nutrients but also suppressing soil borne pathogens.

The physical benefits of increased SOM include improved soil aggregation or structure, lessening of compaction and surface crusting, increased infiltration and aeration, and improved water holding capacity. Improved soil physical properties results in both improved plant growth and soils that absorb water and hold nutrients more efficiently.

The chemical benefits of increased SOM are enhanced cation exchange capacity, which helps make nutrients more available to plants, and chelation of metallic micronutrients, which binds trace elements so that they can be released slowly and made available as needed for plant uptake. Compost provides a balanced source of slow release nutrients necessary for healthy plants.

The environmental benefits of increased SOM by adding compost are carbon sequestration, which helps reduce global warming, adsorption of toxic metals, adsorption and microbial degradation of toxic organic compounds such as pesticides, and decreased soil erosion.

The organic matter content of compost (or soil) can be easily measured by using Loss on Ignition (LOI) method. LOI involves drying a sample, weighing it, putting it back in the oven to burn off the organic matter and weighing it again. It is therefore possible to determine how much SOM is increased depending on the organic content of a particular compost.

Conserving Water Supply

The percentage of organic content directly relates to water-holding capacity in soil. Soil scientists report that for every 1% of organic matter content, the soil can hold 16,500 gallons of plant available water per

acre of soil to one foot deep. (source: ATTRA) That is roughly 1.5 quarts of water per cubic-foot of soil for each percent of organic matter.

A typical sandy soil needs an increase in organic content of approximately 5% to bring it up to a level that would maximize water-holding capacity. This would add 7.5 quarts or 1.88 gallons of water for each cubic-foot of soil. This means that a 10,000 square foot lawn would hold 18,800 gallons of water that would otherwise not be held and made available to plants. A town with 5,000 residences each with 10,000 square feet of lawn could potentially save 94 million gallons of water as a result of increased organic matter content in the soil by 5%.

Protecting Water Quality

The protection to water quality which increased organic content in soil provides is significant. Organic matter is critical to healthy soil because it helps the soil natural processes work better by retaining nutrients and decomposing potential pollutants such as pesticides. Organic matter provides the structure for a diversity of microbes that metabolize nutrients and break down potentially harmful pesticides that could leach into groundwater. As Arthur Allen, Certified Professional Soil Scientist, stated in the December 2001 issue of the Association of Massachusetts Wetland Scientists newsletter: "One of the major components of a quality soil is organic matter (AKA humus). Soil organic matter (SOM) improves soil structure, provides essential plant nutrients and plays an important role in pollution prevention and groundwater protection."

The most notable example of groundwater contamination from pesticides is described in the Attorney General of New York's study that linked pesticide use on golf courses with groundwater contamination and the resulting health effects. Cornell University is currently conducting a study to reduce pesticide use on Long Island golf courses by using compost as a means of biological control for turfgrass diseases that are typically controlled with fungicides. Research has shown that certain composts can achieve over 70% reduction in common turfgrass diseases. The goal is to substantially reduce fungicide use.

Closing the Loop on Local Leaf & Yard Waste Recycling

Much leaf and yard waste and other organic residues are no longer disposed of in landfills and is instead recycled. The local end product (compost) is suitable for increasing organic content in soil. Where possible, putting as much of the leaf and yard waste generated by a community back into the community's own soil as compost is the most economical and environmentally sound approach to local water resource protection.

Making screened compost available to residents is a key component. Another is for highway departments to use compost on roadsides to minimize leaching of potential contaminates into groundwater and nearby reservoirs. Finished compost can also be made available to parks and public works departments, who should use it at proper rates on public lawns, particularly where irrigation is present.

The Need for a Soil Specification

Local authorities that establish basic specification requirements for soil can make significant improvements in water resource conservation and protection. This can be done in local ordinances by simply requiring an organic content of 6% to 8% in the top 6 inches of soil for all newly constructed and renovated lawns or by inserting a basic soil specification for new or renovated turf. A definition for renovated turf would need to be developed, should an authority want to include this activity as well. Local authorities should provide oversight that requires owners to conduct a soil test before and after construction. Soil tests are inexpensive and uncomplicated to perform.

In conclusion, local authorities can take a simple step to aid in water conservation and improve water quality by incorporating a minimum organic content requirement for new lawn construction.

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COMPOST AMENDED SOIL

Compost amended soil shall be free of refuse, stones, lumps, roots and weeds or similar objects larger than two inches in diameter. Compost amended soil will be uniformly mixed to meet the final requirements listed below.

A.

Parameters	**Range**
pH	5.5 - 8.0
Moisture Content	30% - 55%
Soluble Salts	2.0 mmhos (dS)
Organic Matter	6% - 8%
Foreign Matter	<0.5% (by weight)

B. Particle Size

- 100% (by volume) must pass through a 2-inch screen.
- 95% (by volume) must pass through a _-inch screen.

Compost amended soil shall meet the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05 - 2.0 mm dia. range)	45-75	60
Silt (0.002-0.05 mm dia. range)	15-35	25
Clay (less than 0.002 mm dia range)	5-20	15