COMPOST USE FOR WATER MANAGEMENT & EROSION CONTROL

MN Composting Council
STATE CHAPTER OF THE U.S. COMPOSTING COUNCIL

WATER RETENTION & INFILTRATION * EROSION IMPACTS * COMPOST FOR CONSTRUTION & AGRICULTURE

COMPOST CONSERVES WATER

Compost helps to protect surface water quality and combat groundwater overuse throughout Minnesota. Using compost to amend soils increases organic matter content, decreasing stormwater runoff and reducing water application frequency and volume needed to irrigate lawns, gardens, crops, and more.

WATER RETENTION & INFILTRATION

Studies have shown that increasing soil organic matter by 5% with compost amendments can quadruple the water holding capacity of the soil (1). High water holding capacity allows soils to retain water through periods of drought and maximize water storage in extreme storm events. Lawns, landscaping, agricultural croplands, and other amended soils can catch, absorb, and utilize rainwater more efficiently than unamended soils. Amended soils require less groundwater irrigation for productive plant growth than soils with little or no organic content.

Organic matter in soils also allows soil structure and porosity to develop, which optimizes infiltration of water and reduces erosion caused by stormwater runoff. In high-intensity rain events, runoff water, which may have caused flooding, instead recharges groundwater.

BINDING SOIL

Erosion rates are affected by soil organic matter. Compost adds organic matter to soils, which is broken down into soil humus over time. Soil humus binds soil particles together and allows for soil structure formation, which holds soil in place and reduces the risk of wind and water erosion (2).

WATER SCARCITY

Over the last 60 years, Minnesota has rapidly transitioned to relying on groundwater instead of surface water. At present, 75% of Minnesotans use groundwater as a source of drinking water, while 90% of irrigation relies on groundwater (3). Minnesota has many aquifers to draw from, but only in certain parts of the state. Additionally, the metro area is at risk of consuming more water than aquifers can support at the current rate of use. Much of the groundwater supply across the state is also threatened by nitrate pollution, making it undrinkable (3).

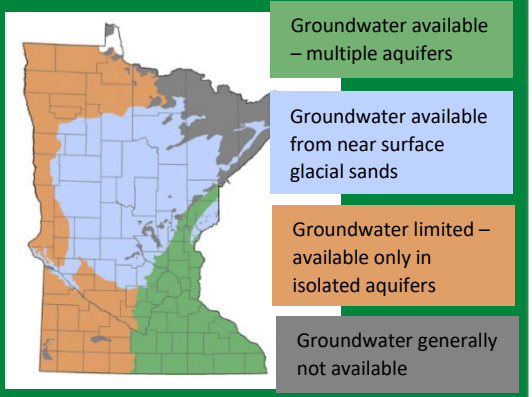

Figure 1. The State of Groundwater in MN (3)

EROSION IMPACTS

With an increase in intensive agricultural production, land use change, urban growth, and construction booms, soil erosion has increased across the globe. Soil erosion is the loss or movement of topsoil, which results in gullies and rills. Erosion primarily occurs through soil interactions with wind and water (7). An increase in erratic weather due to climate change will only further promote erosion.

WHY DOES EROSION MATTER?

Erosion causes increased sedimentation and pollution of aquatic environments, blocking streams and rivers, leading to flooding and decreasing fish populations. Erosion also decreases the nutrient content of the soil, which can negatively affect crops and other plant growth (7).

COMPACTION

Soils become compacted in high traffic areas like athletic fields and by heavy machinery on construction and agricultural sites. It is important to loosen soils to avoid flooding and surface runoff. Mixing in compost while loosening soils adds organic matter, keeps the soil loose while plants establish, and creates optimal conditions for soil structure to form over time. De-compacting soil restores water infiltration capacity, preventing runoff that may lead to erosion or flooding, and aids in the capture of water to help replenish aquifers (2).

POLLUTION MITIGATION

As of 2020, 56% of all waters in Minnesota, were categorized as impaired and did not meet one or more state water quality standard (4).

Pollutants affecting Minnesota waters come from a variety of sources including agricultural practices, urban areas, and industrial and commercial practices (5). The first and best step to pollution prevention is to discontinue pollutant use. The second is to trap or capture pollutants so they don't move into water systems through erosion or infiltration.

Compost can help trap pollutants in soils by binding to, immobilizing, and degrading these pollutants in the soil. Compost has been demonstrated to break down or trap many contaminants including solvents, pesticides, petroleum, lead and other heavy metals, and non-organic pollutants (6). Immobilizing metals makes them unavailable to plants, which can allow plants to grow in soil where they were previously unable to thrive.

Compost also reduces the need for chemical fertilizers and pesticides, which decreases the overall amount of potential pollutants entering the environment. Compost amended soil has the potential to decrease the number of pollutants entering waterways through erosion, improving aquatic environments and water quality.

COMPOST FOR EROSION CONTROL

Construction activities have potential environmental impacts on surrounding water bodies through sediment runoff. A variety of stormwater and perimeter controls can prevent the release of sediment and are needed for temporary soil cover and final turf establishment. Compost can be used on construction sites for many of these and other applications.

COMPOST SOCKS & BERMS

Compost socks and berms are commonly used for to control stormwater on construction sites. Most compost socks are manufactured in convenient lengths and shipped on pallets, but may also be manufactured on-site in continuous lengths using netting and a blower. At the end of a project, cleanup is made easy by cutting the synthetic netting and dispersing the compost as a soil amendment.

SPREADING COMPOST

Compost can also be used for erosion control simply by spreading by hand or using heavy equipment. To cover large areas without creating compaction, blower systems, where compost is fed into a truck-mounted blower and a long tube is used to apply the compost to the soil, are useful.

HYDROSEEDING

Hydroseeding uses a pump to spray a slurry of water, seeds, fertilizer (optional), tackifier (optional), and wood pulp or compost over the soil surface to prevent erosion and provide quality seed to soil contact. Compost that is applied also acts as a soil amendment holding water for the seeds at the surface and adding carbon and nutrients. The slurry can be sprayed from a truck-mounted cannon or using a long hose.

APPLICATION TO AGRICULTURE

The properties of compost are beneficial to agriculture. One of the most notable benefits is water holding capacity in amended soils, which keeps water available to plants in times of drought and maximizes water storage following heavy rain events. One study shows that for every additional 1% of organic matter content, the soil will hold 1.5 quarts of water per cubic foot (8). Another study found that compost amended soils can hold a two-week supply of water, helping crops during heat waves and droughts by reducing periods of water stress (8).

Additionally, amending agricultural soils with compost improves water infiltration rates and decreases stormwater runoff, minimizing soil particle and nutrient loss through erosion and maintaining soil quality. By improving overall soil health, water and nutrients remain in the soil to be utilized by plants.

Compost also optimizes crop uptake of essential nutrients and the formation of stable organic carbon compounds that many agricultural soils lack due to intensive farming practices. Compost amended soils optimize crop rooting depth and root size and provide a favorable environment for the formation of mycorrhizal networks (9). Improved soil health also increases the uptake efficiency of synthetic nutrients so less can be applied when needed. The healthier plants resulting from compost-amended soils suppress disease and pest growth.

SOURCES

1. Michigan State University Extension (2015). Compost increases the water holding capacity of droughty soils. https://www.canr.msu.edu/news/compost_increases_the_water_holding_capacity_of_droughty_soils.
2. Minnesota Pollution Control Agency (2018). 2018 Pollution Report. https://www.pca.state.mn.us/about-mpca/2018-pollution-report#:~:text=Runoff%20from%20rainfall%20and%20snow,challenges%20for%20prevention%20and%20cleanup.
3. Minnesota Pollution Control Agency (2020). Minnesota's Impaired Waters List. https://www.pca.state.mn.us/water/minnesotas-impaired-waters-list.
4. Minnesota Pollution Control Agency. The State of Groundwater. https://www.pca.state.mn.us/water/state-groundwater.
5. University of California Agriculture and Natural Resources (2015). Composting and Water Conservation. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=16800.
6. United States Composting Council. Benefits of Compost. https://www.compostingcouncil.org/page/CompostBenefits.
7. United States Environmental Protection Agency (1997). Innovative Uses of Compost: Bioremediation and Pollution Prevention https://www.epa.gov/sites/production/files/2015-08/documents/bioremed.pdf.
8. World Resources Institute (2020). The Causes and Effects of Soil Erosion, and How to Prevent It. https://www.wri.org/insights/causes-and-effects-soil-erosion-and-how-prevent-it.
9. Yang, W., Gu, S., Xin, Y., et al. (2018). Compost Addition Enhanced Hyphal Growth and Sporulation of Arbuscular Mycorrhizal Fungi without Affecting Their Community Composition in the Soil. Frontiers in Microbiology 9(169). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5808307/.