This is the eighth in a series of articles, prepared by Chevy Chase citizens using public sources, that address the growing risks associated with artificial turf playing fields. Hazards of excessive heat and increased injury have long been documented. New findings on the extreme toxicity of PFAS in artificial turf call into serious question its continued use. Maret School plans to install nearly four acres of artificial turf for its field development at the Episcopal Center for Children at Utah and Nebraska Avenues.

8. **From Carbon Sink to Methane Source**

Maret School proposes to replace nearly four acres of natural grass at the Episcopal Center for Children with plastic turf. That's the equivalent of three regulation-size football fields. From the climate perspective, both the addition of plastic and the subtraction of grass need to be considered.

Greenhouse gases are created during the process of manufacturing any plastic turf. More damaging gases are produced during the transportation of bringing the product to the field and installing it. Of course, natural grass needs to be mowed, with an attendant climate effect, although many commercial electric mowers are now available. But the most significant part of the climate equation is the actual effect on the environment of acres of plastic compared to acres of natural grass.

Plastics are made from petroleum, so it is not surprising that as they age and break down, they release hydrocarbons into the environment. A study published in August 2018 in *PLOS One* attempted to quantify the contribution of common plastics, including those commonly used in artificial turf, to greenhouse gas emissions under natural conditions. They looked at the release of methane and ethylene (which reacts with common molecules in the atmosphere to create carbon dioxide). Polyethylene, the most common plastic used in artificial turf, was found to be the most prolific emitter of both gases. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0200574&utm_medium=email&utm_source=GovDelivery#abstract0

Investigators found that some exposure to sunlight was needed to initiate the process, but that once begun, off-gassing continues even in darkness, and continues for the entire life of the plastic. The quantity of off-gassing is proportional to the surface area of the plastic "accelerating exponentially as the surface area of the plastic increases due to weather and fragmentation. For

example, LDPE powders offgas methane 488 times more than when the same weight of LDPE is in pellet form." https://www.mvtimes.com/2019/02/20/synthetic-turf-will-contribute-greenhouse-gas-problems/

An artificial turf field, with its millions of individual blades of grass, presents a vast surface area from which methane and ethylene are released. This surface area will continuously increase as the wear and tear of use increase fragmentation of the plastic blades. In addition, as breakdown and off-gassing are driven by increased temperature, the extremely high temperatures reached on artificial turf fields are likely to accelerate the process.

After 8-10 years of releasing methane and ethylene into the environment, the entire carpet, having reached the end of its life, is rolled up and trucked to an area landfill, where it continues to degrade, releasing yet more greenhouse gases.

Increasingly, studies have raised awareness of the sizable negative impacts of greenhouse gas emissions from artificial turf fields. As one site notes "Methane, 20 x more powerful at warming the atmosphere than carbon dioxide, is currently driving 25% of atmospheric warming. Today, artificial turf has a distinctly large contribution to climate change in comparison to other plastics." https://3littleplums.com/blog/chemical-exposure-in-artificial-turf-what-parents-need-to-know This new understanding is similar to how the dangers of PFAS, another worrying component of plastic turf, have only been revealed over time.

Given the explosion in plastics use, more scrutiny is being directed to the role of artificial turf and other plastics in global climate change. The study in *PLOS One* concludes, "Due to the longevity of plastics and the large amounts of plastic persisting in the environment, questions related to the role of plastic in the CH_4 [methane] and C_2H_4 [ethylene] global budgets should be prioritized and addressed by the scientific community."

But if the ECC fields are converted to plastic turf, not only is a source of greenhouse gases added to the environment, the benefits of nearly four acres of natural grass and soil will have been removed from the climate change equation. Both the grass itself, and the soil it is rooted in, play important roles.

Greenhouse gases are carbon gases. Efforts to address climate change have included research into ways to "scrub" carbon out of the atmosphere. The most natural and reliable method for removing carbon from the atmosphere is the process of photosynthesis. In photosynthesis, plants combine hydrogen from water with carbon from the air to create hydrocarbons, releasing oxygen back into

the air as a by-product. The reaction is driven by sunlight. The photosynthesis of acres of grasses will by itself help reduce greenhouse gases.

Equally important is the process whereby natural grass stores in the soil much of the carbon it has drawn from the atmosphere. As summarized in an article on recent research in *Yale Environment 360*, "Through photosynthesis, a plant draws carbon out of the air to form carbon compounds. What the plant doesn't need for growth is exuded through the roots to feed soil organisms, whereby the carbon is humified, or rendered stable. Carbon is the main component of soil organic matter and helps give soil its water-retention capacity, its structure, and its fertility." https://e360.yale.edu/features/soil_as_carbon_storehouse_new_weapon_in_climate_fight

"Carbon farming" is one strategy to fight climate change, "to pump carbon into what's called the pedosphere, the thin skin of living soil at the earth's surface. If adopted widely enough, such practices could, in theory, begin to remove billions of tons of carbon dioxide from the atmosphere, nudging us toward a less perilous climate trajectory than our current one." https://www.nytimes.com/2018/04/18/magazine/dirt-save-earth-carbon-farming-climate-change.html?searchResultPosition=6

Fossil fuels contain ancient carbon from dead vegetation. Current research focuses on the importance of the soil microbiome, and the crucial role of living plants. "Their rootlets are constantly dying, depositing carbon underground, where it's less likely to go airborne. And perhaps more important, as plants pull carbon from the air, their roots inject some of it into the soil, feeding microorganisms and fungi called mycorrhizae. An estimated 12,000 miles of hyphae, or fungal filaments, are found beneath every square meter of healthy soil. Some researchers refer to this tangled, living matrix as the 'world wood web.' Living plants increase soil carbon by directly nourishing soil ecosystems." https://www.nytimes.com/2018/04/18/magazine/dirt-save-earth-carbon-farming-climate-change.html?searchResultPosition=6

Many scientists looking at climate change see boosting the storage of carbon in soil as part of a win-win solution – not only does it draw carbon out of the atmosphere, but it also boosts fertility and improves drainage, reducing stormwater run-off.

In developing the ECC site, Maret could introduce the equivalent of three football fields of plastic into the neighborhood, which will release greenhouse gases into the air continuously throughout its lifetime, contributing to the warming of our planet. Or they could cultivate a comparable amount of organic, natural grass and soil, which will continuously pull carbon out of the atmosphere, safely sequestering it, creating a fertile, healthy soil ecosystem, and contributing to our planet's rescue. Which will Maret choose?

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