Climate Impacts

The climate impacts of land care practices.

The following contains some excerpts from NOFA Standards for Organic Land Care and Soil Carbon Restoration: Can Biology do the Job?, both published by the Northeast Organic Farming Association.

Organic land maintenance offers municipalities and local agencies a path to reducing emissions while contributing to the health and safety of residents. The impacts of human activity on the environment and climate change are well established. Efforts to reduce environmental pollution and mitigate climate change focus largely on reducing fossil fuel consumption and waste and increasing the use of renewable energy sources. The land care profession has an important role to play.

Energy Impacts of Pesticide Manufacture

Most pesticides are petroleum(oil)-based, and all commercial fertilizers are ammonia-based. Ammonia is produced from natural gas, a fossil fuel.

The following appears in a 2019 U.S. Department of Agriculture publication titled, "Energy Use and Efficiency in Pest Control, Including Pesticide Production, Use, and Management Options":

Petroleum chemicals, such as ethylene, propylene, and methane, are the source of many pesticides. The heating, distillation, stirring, and drying processes in manufacture also use electricity, natural gas, steam, and additional petroleum sources. Secondary and tertiary energy consumption occurs in the construction and maintenance of the manufacturing plant and equipment, consumption and handling of raw materials, disposal of waste, and other operations.

The USDA article includes the following table, which estimates how much energy is used for many of the pesticides commonly used in landscaping and agriculture.

Table 1. Estimated manufacturing energy inputs for various pesticides (BTUs/lb), typical application rates (lbs/A), and energy per unit area of use (BTUs/A) on an active ingredient basis. adapted from references: Helsel (7); Green (6).

PESTICIDE	BTUs/lb (x 1000)	Application Rate (lbs/A)	BTUs/A (x 1000)
Herbicides			
2,4-D	36.5	0.50	18.3
Alachlor	119.5	2.50	297.5
Atrazine	81.7	1.50	122.6
Bentazon	186.6	1.00	186.6
Chlorsulfuron	157.0	0.03	3.9
Dicamba	126.9	0.75	95.2
Diquat	172.0	0.50	86.0
Diuron	116.1	2.00	232.2
EPTC	68.8	4.00	275.2
Fluazifop-butyl	222.7	0.25	55.7
Glyphosate	195.2	1.00	195.2
MCPA	55.9	0.50	28.0
Metolachlor	118.7	1.50	178.1
Paraquat	193.5	0.50	96.8
Trifluralin	64.5	1.00	64.5
Fungicides			
Captan	49.5	3.25	160.9
Ferbam	26.2	8.00	209.6
Maneb	42.6	4.00	170.4
Insecticides			
Carbaryl	65.8	1.50	32.9
Cypermethrin	249.4	0.25	62.4
Malathion	98.5	1.25	123.1
Phorate	89.9	2.50	224.8

Synthetic Landscaping Chemicals Destroy Soil Carbon Storage Capacity

The use of synthetic agricultural chemicals is destructive of soil's natural carbon storage ability. Toxicants like pesticides are lethal to soil organisms, which play a crucial role in enhancing plant vitality and photosynthesis. Fertilizers have also been shown to deplete soil organic matter. In the Rodale Institute's Compost Utilization Trials, using composted manure with crop rotations for ten years resulted in carbon gains of up to 1.0 ton/acre/year. The use of synthetic fertilizers without rotations, however, resulted in carbon losses of 0.15 ton/acre/year.

The Morrow Plots at the University of Illinois were the site of one of the longest running controlled farm trials in history. Researchers analyzed 50 years of data on fields where a total of 90 to 124 tons of carbon residue per acre had been added, that also used synthetic nitrogen fertilization. Those plots actually lost almost 5 tons of soil organic matter per acre over the trial period.

One suggested cause of the negative impact of synthetic fertilizer on soil carbon is the fact that it tends to reduce the size and depth of plant roots since it is concentrated in a shallow layer at the soil surface rather than spread throughout the soil as would be nutrients from legumes, minerals or other natural sources. Another reason might be the impact on the plant of absorbing ammonium ions which causes it to release hydrogen ions, which acidify the soil. A third possibility is that the availability of free nitrogen causes the plant to exude less liquid carbon to obtain nitrogen from microbes.

Carbon Impacts And Fuel Powered Maintenance Equipment

The more obvious carbon impacts of land maintenance relate to fuel-powered land care equipment.

Fuel Consumption: Each year in the United States, lawn mowers alone consume more than 1 billion gallons of gasoline.

Greenhouse Gases: Each year in the United States, land care equipment produces more than 20 million tons of carbon dioxide, contributing to climate change.

Pollutants: In addition to greenhouse gases, exhaust from land care equipment produces millions of tons of toxic and carcinogenic compounds each year that pollute air, water, and soil. These compounds include volatile organic compounds such as benzene, 1,3 butadiene, and formaldehyde – all leading carcinogens; nitrogen oxide; carbon monoxide; and fine particulate matter. Ozone, formed by volatile organic compounds and nitrogen oxide in warm seasons, and fine particulate matter are well established risks for serious health problems, including heart disease, stroke, and cancer. Especially vulnerable populations include equipment operators, children, and seniors. Studies have also shown these pollutants adversely affect plant health. Reducing the use of fuel-powered equipment can improve the health of humans, pets, plants, and the environment.

Noise: Also considered an air pollutant, land care equipment can generate high levels of noise in ranges considered to be harmful to health and hearing. In general, noise from fuel-powered equipment is louder than electric-powered equipment.

Toxic and Non-Recyclable Solid Waste: Maintenance of fuel-powered land care equipment requires regular replacement of solid parts such as spark plugs, belts, and filters, and the use of toxic chemicals and solvents such as fuel oil, lubricants, detergents, and degreasers. Used products, containers, and chemical residues wind up in our soil, water, and landfills. Reducing the use of fuel-powered equipment means less energy is used to produce, transport, and dispose of maintenance products and fewer products are incinerated. Carbon dioxide emissions and environmental pollution are reduced.

Fuel Spillage: Spillage is a significant problem when using fuel-powered equipment, polluting soil and waterways. The US EPA estimates that 17 million gallons of gasoline are spilled each year from re-fueling lawn mowers alone; over 50% more than the amount spilled by the Exxon Valdez. The American Green Zone Alliance (Woodland Hills, CA)

estimates several million more gallons are spilled each year from re-fueling handheld equipment.

Organic Land Care helps meet GHG Reductions Required by Law

Many state and local agencies are increasingly focused on reducing Greenhouse Gas (GHG) emissions to protect public health and safety. In California, this focus is required to ensure agencies will meet local and state climate law.

CEQA, or the California Environmental Quality Act, is a statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible.

The following regulations have established additional regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions in California:

- SB 32, which mandates statewide GHG emissions reductions of 40 percent below 1990 levels by 2030.
- Executive Order S-3-05, which mandates statewide GHG emissions reductions of 80 percent below 1990 levels by 2050.
- Executive Order B-55-18, which mandates statewide carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions thereafter.

Organic land maintenance offers municipalities and local agencies a path to reducing emissions while contributing to the health and safety of residents - all while complying with the law.