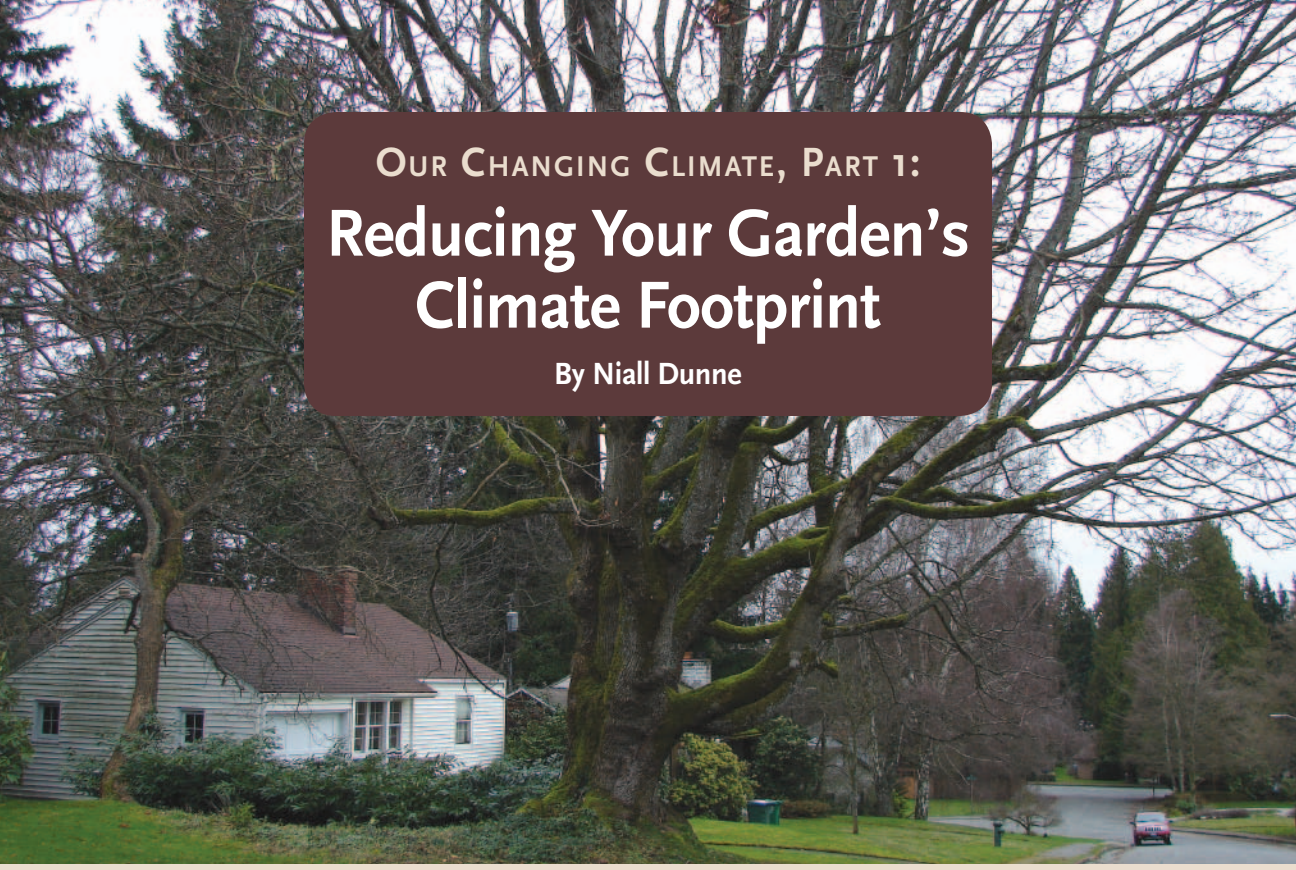

Our Changing Climate, Part 1:

Reducing Your Garden's Climate Footprint

By Niall Dunne

It's been a banner year for heat in the Northwest! And it's been a particularly tough summer for many plants, from the not-drought-tolerant-enough shrubs and perennials in our gardens to the forest trees burning in the Paradise fire at Olympic National Park. Though human-induced climate change may not have caused our unusual warm weather (NOAA has linked it to a persistent and seemingly natural expanse of warm water in the Northeast Pacific, nicknamed "the blob"), climatologists are warning that this year's heat is a taste of what's to come.

What is predicted for the Northwest? By the end of this century, our average annual temperature will increase by three to 10 degrees Fahrenheit, depending on future greenhouse gas (GHG) emissions. Summers will be hotter and drier, leading to increased forest fire risk, drought stress in plants, and attacks by plant pests. Winters will be warmer and wetter, and winter precipitation will fall more as rain than snow, reducing snow pack and summer stream flow, and impacting forest communities, salmon habitat, and water supply. Winter storms will be stronger, causing more flooding, stream erosion, landslides, and windstorm damage. Other bad stuff is predicted, too. For instance, rising temperatures will increase air pollution in urban areas, directly impacting human health.

To reduce the severity of climate change, we need to make dramatic alterations to the way we live our lives—from our consumption of energy to the way we farm our food. Gardeners can significantly reduce their GHG footprints by employing a number of basic practices of sustainable horticulture. The good news is that many of these practices—such as planting more trees—will also make our homes and neighborhoods healthier and more beautiful.

Reduce Fossil Fuel Consumption

Burning of fossil fuels such as oil and coal releases carbon dioxide into the atmosphere,

ABOVE: Big leaf maple (*Acer macrophyllum*) in a Seattle neighborhood. Deciduous shade trees help reduce energy use by cooling homes in summer and letting sun warm them in winter. (Photo by wedgewoodinseattlehistory.com)

where it traps solar radiation and warms the planet (the so-called "greenhouse effect"). Reducing the consumption of fossil fuels—such as by increasing energy efficiency—is a key strategy for combating climate change. Here are some key ways to reduce energy consumption around your home and garden.

Use shade plants to cool your home in summer. According to the EPA, strategic planting of trees and shrubs can save you up to 40 percent on your energy bill. Growing trees on the south, west, and east sides of your house will help shade it from the hot summer sun. Growing tall, large-leaf deciduous trees such as maples works best because they provide a high-spreading canopy but also lose their foliage in fall and allow warming winter sunlight to hit your home. Set trees close enough to your home to cast shade but far enough away, about 15 feet, to avoid foundation damage from roots.

Use conifers to deflect cold winter winds. If you live in an area that's bombarded by cold winter winds, you can plant a windbreak composed of coniferous trees and shrubs to reduce the chill. Windbreaks are most effective when planted at a distance from your home (about two to five times the distance of the mature height of the tree), but even on small urban lots, a dense hedge of conifers planted several feet from your home perpendicular to the prevailing wind can help keep it warmer and reduce energy use.

Use green roofs for insulation and cooling. Vegetation on your roof is not only good for reducing stormwater runoff, it also adds an extra layer of insulation, helping bring down winter heating costs. In summer, a green roof can provide a cooling effect through evapotranspiration.

Cut back on or eliminate the use of power tools. Gasoline-powered gardening equipment such as lawnmowers and leaf blowers release carbon dioxide and emit high levels of carbon monoxide and other air pollutants. Switching to electric-powered equipment is more sustainable, but using old-fashioned push mowers, rakes, and other tools cuts out the carbon and also provides you with some healthful exercise.

Choose natural products over synthetics. The manufacturing of synthetic fertilizers and pesticides is highly energy intensive. Avoiding the latter also results in a more wildlife-friendly garden. Natural fertilizers and other products generally are safer and have less embodied energy, but you should avoid natural products that require mining (e.g. perlite in soil mixes) or other unsustainable practices.

Reduce irrigation. Water scarcity in the Northwest may be a seasonal phenomenon, but conserving water always makes good environmental sense. That's because the business of treating and pumping water has a large carbon footprint. Plant drought-tolerant plants in your garden; use more efficient irrigation systems; and irrigate at night or early in the morning to reduce water loss through evaporation.

Grow low-maintenance plants and reduce your lawn. Grow tough, well-adapted native and non-invasive exotics and your garden will require fewer inputs. Reduce the size of your lawn or replace turfgrass altogether with less needy plants. If you can't let go of your lawn, make sure to leave your clippings when you mow (with your push mower!) to reduce the need for supplemental nutrients.

Plant a diverse garden. A diverse mix of plants creates a healthier, more resilient garden ecosystem that's less susceptible to pest outbreaks.

Minimize hardscape and use recycled materials. Construction materials such as rocks, concrete, and lumber come with a heavy carbon

Climate Change and Seattle City Light

Seattle boasts one of the greenest electrical utilities in the country because it uses hydroelectric resources for 90 percent of the power it provides. However, climate change presents a challenge to these green credentials, as reduced snow pack and melt-off will impact Seattle City Light's ability to generate the electricity it needs to serve its customers in summer.

burden—so limit their use and grow more plants instead. Use recycled materials whenever possible. Avoid cement, which requires very high heat to produce. If in doubt, choose wood, which generally requires less energy to produce than other common construction materials.

Avoid potting mixes. These are typically loaded with synthetic fertilizer and peat moss, which is an unrenewable resource harvested from critical carbon sinks in Canada. Use homemade or locally produced compost instead.

Purchase locally grown plants. Plants shipped in from out of state have a higher carbon footprint.

Grow your own food, organically. Gardeners who grow their own grub cut down on the energy required to transport, store, and package food. Use organic methods, including campanion planting to help reduce the need to manage pests and weeds. Permaculture gardens maximize diversity and productivity and also focus on perennials, which require fewer inputs.

Cut Back on Methane and Other GHGs

Gardeners need to be aware of other powerful greenhouse gases that they may be emitting in their everyday practices besides carbon dioxide, particularly nitrous oxide and methane.

Avoid fast-release nitrogen fertilizers. Excessive amounts of nitrogen in the soil—whether from synthetic fertilizer or fast-release natural fertilizer, such as fish emulsion—can lead to emissions of nitrous oxide, a greenhouse gas that is more than 300 times as powerful as carbon dioxide at trapping heat. The use of slow-release organic amendments such as compost, should supply adequate nutrients for most garden situations.

Manage your compost pile. Wet, low-oxygen conditions in your compost pile favor anaerobic bacteria that release nitrous oxide and another powerful GHG, methane, which has 21 times the heat-trapping potential of carbon dioxide. Simple management practices such as regularly turning your pile and shredding your organic material before adding it to the pile will help minimize these emissions.

Practice composting. Composting diverts huge amounts of organic material from landfills, where it would otherwise decompose under anaerobic conditions and release methane into the atmosphere. If you live in Seattle and would rather not compost, the City's public utility will do it for you—and recycle your kitchen and garden waste into black gold.

Capture Carbon in Plants and Soil

In addition to reducing the amount of carbon you emit into the atmosphere, you can help the planet by storing, or sequestering, carbon dioxide in the tissues of your plants and the organic matter of your soil (which is about 58 percent carbon). Biotic carbon sinks such as forests and soils are temporary—the carbon eventually decomposes and returns to the atmosphere. But they are nonetheless very significant.

For instance, soil contains almost twice as much carbon as Earth's entire atmosphere and all its aboveground living organisms combined. A third of this carbon is bound up in carbonate minerals, such as calcium carbonate, but two-thirds is tied up in organic matter, which includes the living fauna of the soil food web, decomposing plant and animal matter, and

ABOVE: Compost is a dark, crumbly, humus-like substance produced when organic materials are are piled together and allowed to decompose. Although 50 to 70 percent of the carbon in compost raw materials is lost as carbon dioxide during decomposition, compost is nonetheless a rich source of relatively stable carbon, and using it is an easy way to sequester carbon in soil.

OPPOSITE: The UW Farm teaches students the importance of sustainable agriculture and growing your food locally. The farm supplies organic food to campus restaurants and is also a place for students to engage in volunteerism and conduct field research. (Photo by Sarah Geurkink)

humus—the dark, spongy, end product of decomposition and the cornerstone of good soil structure and fertility. Humus is quite resistant to microbial decay—some humic substances can last in soils for hundreds of years. Mean residence time of humus in cultivated soils is lower, and usually measured in years and decades.

Avoid disturbing soil. Tilling or digging planting beds erodes soil, harms beneficial soil organisms, and exposes stored carbon to the soil surface, where it is rapidly oxidized (combined with oxygen) by microbes and vented into the air as carbon dioxide. Don't disturb your soil any more than is necessary for planting.

Practice no-till vegetable gardening. Retire the rototiller, and instead mulch layers to control weeds, prepare planting beds, prevent erosion, conserve water, and feed the soil organisms.

Use compost to rebuild and retain historical levels of organic matter. It's estimated that plow-based agriculture depleted organic matter in temperate climate soils by as much as 60 percent. Test your soil to see how much organic matter it contains and to find out its natural carrying capacity. Use a compost mulch to restore organic matter levels, and continue to add mulch each year in order to replenish the portion of the carbon supply that's naturally cycled back into the atmosphere.

Ensure an adequate supply of nutrients in the soil. Humus formation if more efficient when adequate nitrogen, phosphorus, and sulfur are present. A fertile soil is also more productive, resulting in more plant residue entering the soil carbon pool. Avoid over-fertilizing with nitrogen as this not only releases nitrous oxide but also stimulates loss of carbon from soil.

Plant more trees. Plants fix carbon from the atmosphere in their tissues through the process of photosynthesis. Carbon—in the form of simple sugars and polymers such as cellulose—comprises, on average, about half of a plant's dry matter. Plant species vary in their ability to accumulate and store carbon, but because of their relatively large size and long lives, trees are the champions of biotic carbon sequestration. Planting trees in your garden will help offset some of the carbon dioxide you produce each year.

Protect and plant large, long-lived trees. Large, long-lived trees with dense wood sequester more carbon over their lifetimes than smaller, rapid-growing trees. In one California study, a common hackberry (*Celtis occidentalis*) sequestered five tons of carbon over its 100-year lifespan, whereas a crape myrtle (*Lagerstroemia indica*) only managed to store 1/8 ton of carbon dioxide over its 30-year lifespan. (Note: the average North American generates 20 tons of carbon dioxide per year, so tree planting is just one tool among many for mitigating your climate impacts.)

Mimic the vertical layers of a forest. This technique will help you pack in as many plants—and store as much carbon—as possible. Diversity also increases resilience against disease, which will extend the storage life of your garden.

Provide trees with enough room to reach maturity. That goes for above and below ground. And grow a mix of plants of different ages to ensure continuous carbon storage over time.

Part 2 of this article will focus on adapting your garden to the coming changes in our climate.

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