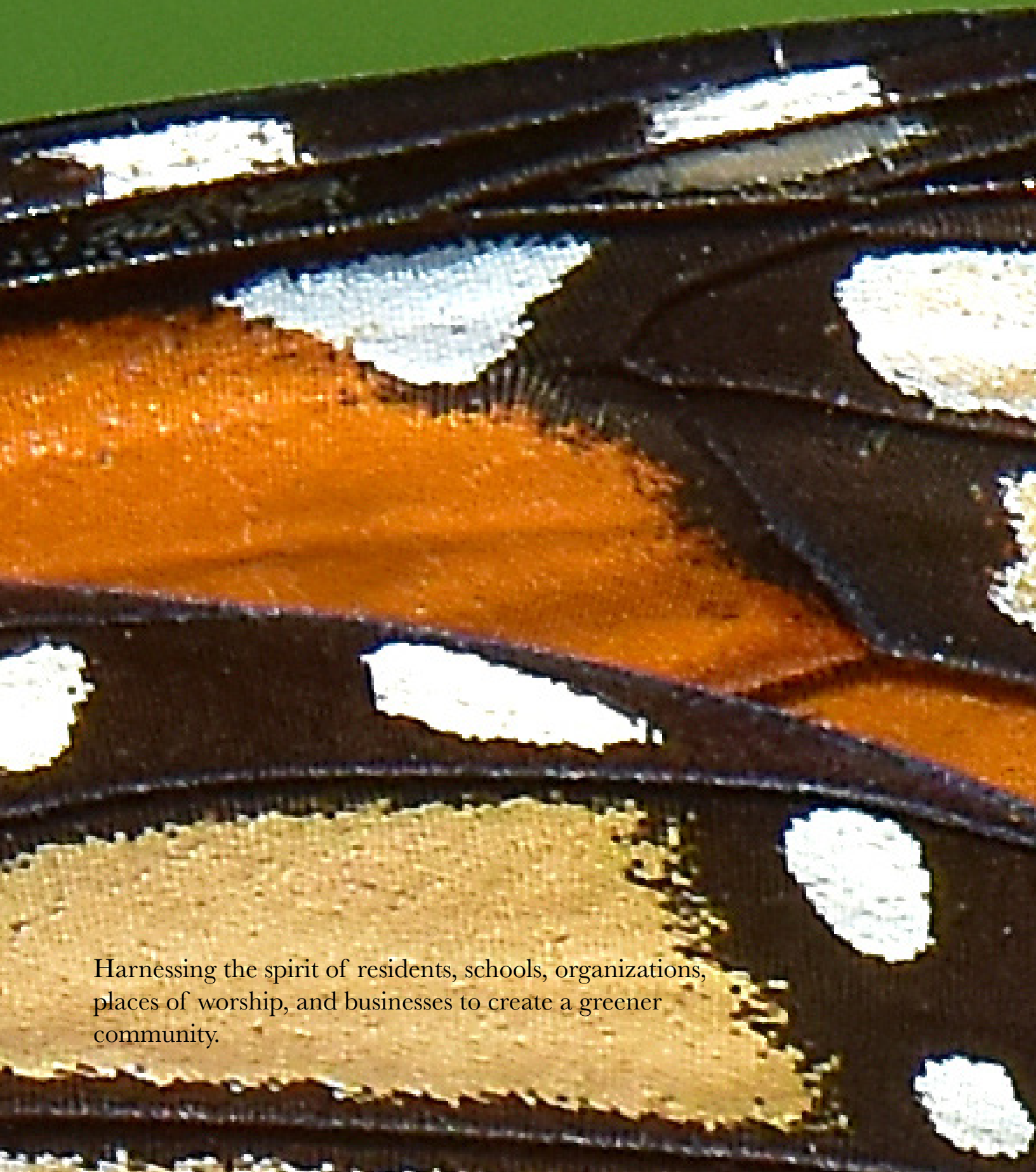
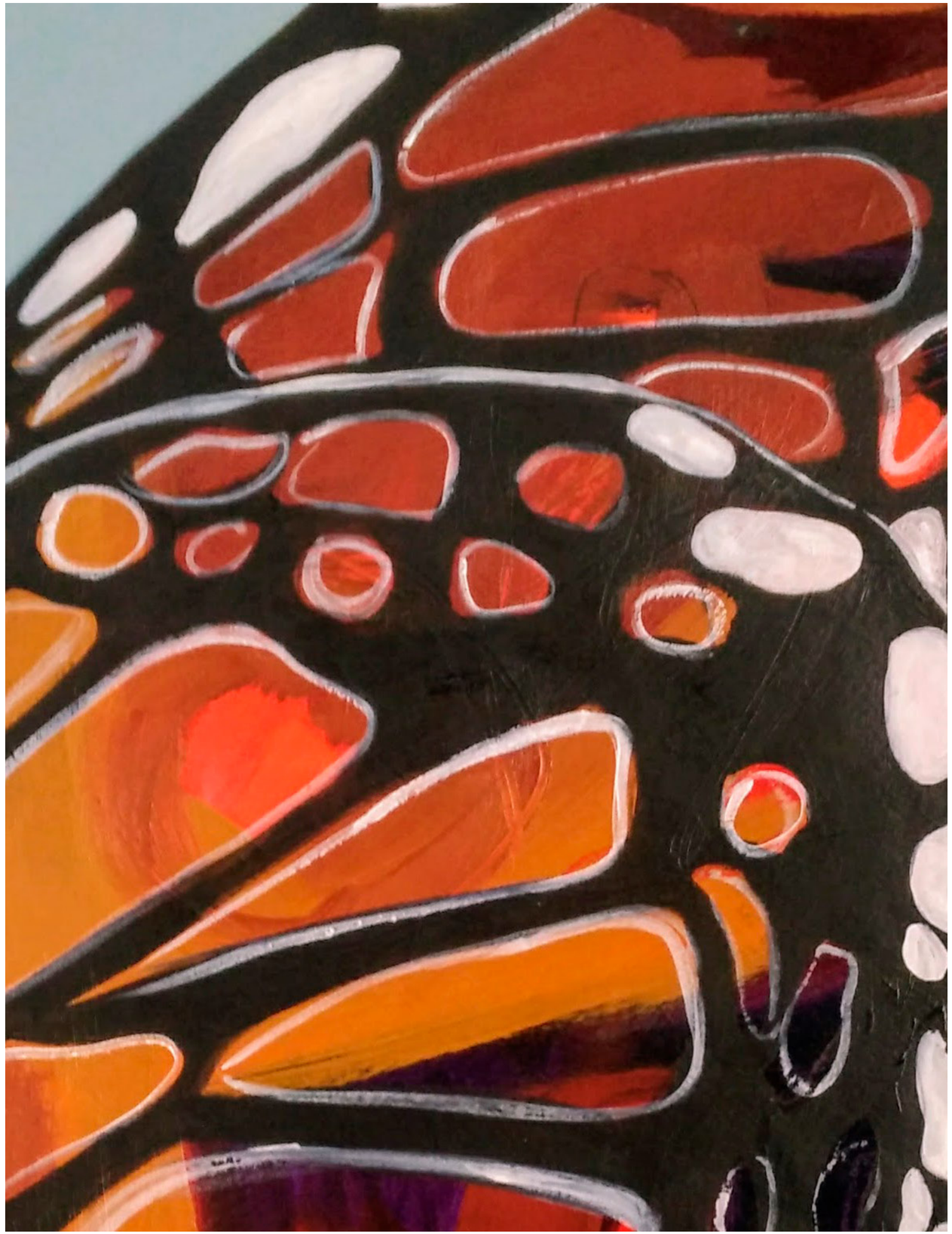
The Butterfly Effect

Vol. 4, No. 2



Harnessing the spirit of residents, schools, organizations, places of worship, and businesses to create a greener community.



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Cover: "When I was looking closely at an image that I had taken in late August of a monarch wing, I could detect a texture in the wings that looked a bit like a thumbprint. As I zoomed in further, the 'scales' became more recognizable as squarish shapes that reminded me of the pixels that make up a digital image." –Nature photographer, Travis Bonovsky
Left: "There is nothing like a walk outside, through a park or next to a river, on a sunny day. I like to take time to breathe and appreciate the beauty of nature, from the large trees to the monarch butterfly who greets me in the spring. As an artist, I find much inspiration during my daily walks. I think there is something to be found everywhere: you just need to take the time to slow down and look." –Butterfly wing painted by artist Mari Marks Mondanelli

The Eastern Meadowlark

“It is increasingly difficult to find ‘grassland’ birds, such as meadowlarks, within metro areas. Empty fields are typically seen as opportunities for more urban development. But, I discovered a particular area adjacent to I-35W north of Minneapolis/St. Paul that surprisingly hosted several Eastern meadowlarks: their flute-like calls mixing with the noise of busy freeway traffic. As I sat on the trail in the hot sun I noticed more than one bird come out of the grass and walk right across the bike trails, proudly holding its head high as many birds in the blackbird family do.”

According to the Cornell Lab: “Eastern Meadowlarks will breed in many kinds of grassy areas as long as they can find about 6 acres in which to establish a territory…. According to “The State of the Birds 2011” report, more than 95 percent of the Eastern Meadowlark’s distribution is on private lands, meaning farmland conservation practices are vital to the survival of this species.”

–Nature photographer, Travis Bonovsky

One Route to a Sustainable Home

by Dave Crawford

“My wife and I recently fulfilled our goal of building a planet-friendly home for our golden years. Sustainable energy consumption and aging in place were our “must-haves.” Low environmental impact materials, good water management, and wildlife-friendly landscaping were additional goals. We also wanted the home to serve as an inspiration—a demonstration of sustainable construction and low-impact landscaping.

We had our home designed to meet the rigorous standards of The Passive House Institute. The end result is a home that is certified as Passive House Plus—only the second home to achieve this certification in the U.S. The primary energy source for the home is our rooftop solar array. During the summer, we expect to sell as much excess production to our electric utility as we buy during the shorter days of winter.

The house is super-insulated with 18-inch thick walls and is extremely airtight to prevent unwanted heat loss or gain. A heat and humidity recovery ventilation system provides indoor air quality. Heating and cooling are provided by an air source heat pump.

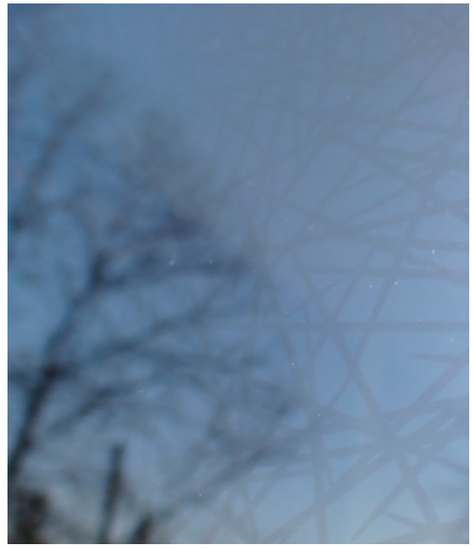
An on-demand plumbing loop brings hot water to faucets and returns standing cold water to the water heater, eliminating the need to run cold water down the drain until hot water arrives. Heat captured from waste water helps preheat cold water entering the water heater. All water supply lines—hot and cold—are insulated to preserve water temperature and control condensation.
We wanted ample natural light throughout the house. Large windows on the south also provide heat gain in winter via captured sunlight. Adjustable exterior sun blinds block heat gain when it’s not wanted. All windows and exterior doors are triple glazed and have insulation barriers in the frames to minimize heat transfer. The magenta trim was a visual offset to the green siding—choosing “lively” over “boring.” The design team initially thought the color choices might be too bold. But, ultimately, the “spring cherry trees in bloom” theme turned out to be a perfect fit for the home.

Previous spread: Expanses of glass allow solar heating benefits from winter’s low-angle sunlight, as well as great views and interior illumination. A covered patio and second floor balcony create “outdoor rooms.” **Left:** The ground floor features open sightlines from kitchen to dining area to living room and generous window light for views, warmth, and future house plants.

To reduce bird window collisions, our largest windows feature bird safe glass with an imprinted mesh pattern, visible only at ultraviolet wavelengths. Humans can't see this imprint, but birds see it and avoid it.

The framing and sheathing are a mix of sustainably produced lumber, certified by the Forest Stewardship Council or the Sustainable Forest Initiative. Our home's foundations incorporate a high percentage of fly ash instead of pure concrete in order to reduce the embodied carbon cost of conventional concrete. The siding is a combination of steel, a long-life material that can be fully recycled at the end of its life span, and heat-treated ash from trees killed by the Emerald Ash Borer. Flooring is a mix of ceramic tile, and cork and linoleum made from renewable materials. Wall and roof insulation is dense-pack cellulose made from recycled newspaper.

Rain gardens capture all of the runoff from the house and garage roofs, the driveway, and a substantial portion of the lot. A grant from our local watershed district—the Capitol Region Watershed District—offset a portion of the construction and planting cost. We used native species selected for pollen and nectar production for locally native insects.



Right, clockwise from top left: The bird-friendly glass used for large windows has an imprinted web-like pattern of ultraviolet pigment. Birds see it easily, but to humans it's visible only at a limited reflection angle from outside the window; A close up of the web pattern; Adjustable blinds outside east, south, and west windows block heat on summer days. Slats can be adjusted to allow views while screening unwanted heat.

To accommodate aging in place, all entries are at grade level. Rooms and hallways are sized for ease of use with wheelchairs. The master bath has a roll-in shower. All faucet handles, door and cabinet handles, and light switches are ADA compliant. An elevator supplements the stairway and is currently used when we have guests with disabilities.

We're still in our first year of occupancy. The appreciation we have for the home's energy performance, design efficiency, and comfort is already rewarding, and we expect further experience to continue to raise our satisfaction.

We hope to offer tours when that becomes practical again. For further details, please visit the designer's web page as well as a comprehensive visual review of the project.

About the Author. Dave Crawford has dreamt of having a home designed for energy sustainability for most of his life. He's also landscaped with native plants at his various homes since the 1980s. Recently retired from a career as an environmental educator and landscape restorationist with the Minnesota Department of Natural Resources, he continues to live out his dreams with his wife and share them with those who are interested. Readers can follow his ongoing efforts and wildlife observations on his Facebook page.

Right, clockwise from top left: A new American Gothic. Dave Crawford and Diane Peterson stand in front of their Passive House Plus certified home; A trench drain carries rain and melt water from the driveway to rain gardens via underground drain tiling. This approach manages runoff with less expense and maintenance compared to a permeable driveway; The native plant gardens (including four rain gardens) are works in progress. Each year should show increasingly lush growth and a greater yield of floral resources for pollinators.

Homegrown National Park

"What if each American landowner made it a goal to convert half of his or her lawn to productive native plant communities? Even moderate success could collectively restore some semblance of ecosystem function to more than twenty million acres of what is now ecological wasteland. How big is 20 million acres? It's bigger than the combined areas of the Everglades, Yellowstone, Yosemite, Grand Teton, Canyonlands, Mount Rainier, North Cascades, Badlands, Olympic, Sequoia, Grand Canyon, Denali, and the Great Smoky Mountains National Parks. If we restore the ecosystem function of these 20 million acres, we can create this country's largest park system—I suggest we call it Homegrown National Park."

–Douglas Tallamy, Ph.D., from his book, *Nature's Best Hope: A New Approach to Conservation that Starts in Your Yard*.

Digging into Soil Health

by Kassie Brown

All winter long I dreamed of spring planting. I purchased countless seed packets with big plans to grow organic soybeans to make tempeh, tomatoes to can, blue corn for cornmeal, cabbage for sauerkraut, and dry beans to last our small family throughout the next cold season. I ordered 125 fruit and nut trees from the county tree sale and another 25 berry shrubs from an online planting stock store. We picked up seed potatoes, onion sets, and various crowns as we came across them. We drew maps of flower gardens and vegetable patches. We made calendars for succession planting. We planned. But deep in winter dreaming mode, we set aside the fact that as it was our first full growing season on our new 10-acre homestead, we had a lot of pre-planting work to do before any seeds could touch the earth.

We moved to this small farm in the early summer of 2019. The property is home to a large tobacco shed full of history, two sloping pastures thick with various agricultural grasses, goldenrod, invasive multiflora rose, and a good handful of other plant species alongside a steep bluff of overgrown woods. After many field walks, we determined that our main garden would have to go on the flattest section of a sunny, slightly sloped pasture north of the house. But before the crops could go in, we'd have to tackle the well-established pasture grasses.

Adventures in Creating Planting Spaces

As anyone who has ever tried to make a new garden bed where sod exists knows, creating new growing spaces is usually more of a job than anticipated. For us, the challenge of working tough sod was exacerbated by our goal to do as much by hand as possible. We did not want to till due to our knowledge of the connection between soil fungi—and the billions of diverse microscopic creatures who make their homes inside soil aggregates (clumps of dirt)—and healthy soil.

We had made two 3' x 30' rows the previous fall using a deep mulching technique popular in the permaculture world. To do this, we first mowed the grass, spread a thin layer of compost, and topped two layers of cardboard with a mixture of hay/straw/wood shavings and goat manure from our barn. The plan was to smother existing vegetation while creating a nutritious in situ compost for our crops of choice the following season. Unfortunately, due to our relatively heavy clay soil and rainy climate, the sheet-mulched beds became water-logged and did not look like the friendliest environment for baby plants come spring. If we were going to become successful homesteaders and get our corn, beans, potatoes, and squash planted, we were going to need throw in the towel and do some digging.

Left: Soil fungi and decomposing organic matter bind soil particles together to form aggregates. Aggregation in soils creates structure that allows air and water to penetrate deep into the soil profile.

Choosing Not to Till

Tilling the earth is a common practice in our culture. It's mostly regarded as a necessity and considered good for the soil. It "fluffs" the soil and "lets the air in," some say. Many farmers claim that tillage helps the soil warm up faster in the spring. Others just know how hard it is to deal with unwanted plants without a sharp blade and some horsepower. True as these things may be, tillage is a type of combustion, and just like other forms of combustion—such as the burning of wood, coal, and gas burning—it blows off large amounts of carbon.

Within soil, carbon is the queen of the food chain. Through photosynthesis, plants suck carbon dioxide out of the air, and then transform it into food (carbon being the backbone of all sugar, carbohydrate, and protein molecules). Significantly, a lot of the "carbon food" produced by plants is pumped underground through their roots, leaked out into the soil, and fed like a delicious restaurant buffet to billions of beneficial underground creatures such as fungi, bacteria, and their food-chain predators, protozoa and nematodes. Collectively, these microorganisms "pay" for their carbon buffet by offering the plant soil nutrients like calcium, magnesium, and phosphorus—nutrients that the plant would otherwise be unable to access without these tiny, hungry microbial partners. From this perspective, it's easy to understand plants for what they truly are: high-tech carbon pumps transferring atmospheric carbon below ground to feed a vast and complex soil microbiome. Since microbes survive on the carbon-food buffet provided by plants' roots. Keeping a plant thriving is the #1 job of soil microbial communities. An intact soil ecosystem makes our jobs as farmers and gardeners so much easier.

In this microscopic circle of life, after being eaten by plant-partnering microbes, carbon becomes part of the soil food chain locked inside the bodies of fungi and bacteria until they are eaten by larger organisms like protozoa and nematodes. Carbon is also stored in massive molecules condensed by fungi and bacteria, called humic and fulvic acids. Once in the soil, carbon becomes humus, the component responsible for a soil's "good tilth." It helps the soil hold water while also promoting good drainage through its resistance to compaction. As humus, carbon acts like a magnet for soil micronutrients and also houses the beneficial creatures that partner with plants to ensure the health of entire ecosystems.

Unfortunately, tillage causes carbon to be burned off from the soil and released back into the atmosphere through a rapid injection of oxygen (aka, combustion). Tilling soil also rips and shreds the beneficial microbes that plants desperately need in order to obtain full health. Tillage creates bare soil, which is prone to compaction by rain and erosion by wind and water, which further destroys habitat for these tiny plant partners.

Right: A plant root with soil particles attached as seen under the microscope. Plants pump out carbon-based foods through their roots to attract soil microbes such as a diverse range of bacteria and symbiotic fungi. These microbes exude sticky "glues" that help hold soil mineral and organic matter particles together. Living plant roots are critical for soil health and are key to preventing soil erosion.

Back to our first-year garden beds. I desperately did not want to till them. But I also saw little choice if we were to get our seeds in the ground. We ended up purchasing a broadfork which is a strong, human-powered tool that pries up sod without the added impact of a gasoline engine. It's hard work, but it allows me to observe the impact of my tillage. As I remove clumps of grass, I can see the delicate white strands of mycorrhizal fungi intertwining with the grasses' root systems in an ancient exchange of carbon and earth elements. I can create a garden bed but leave some soil clumps as a reservoir for microbes. Hopefully, after this one event of soil destruction, I can plan a rotation of cover crops that will be winter-killed in order to leave a relatively clean bed for spring planting.

Compost: The Bedrock of Sustainable and Organic Agriculture

Tilling or broadforking one time in the creation of a garden from sod has one benefit: It allows me to work in high quality compost. *Compost is the bedrock of sustainable and organic agriculture*; it's the starting point in any conversation around food as medicine. Compost is the bridge between death and new life. When made well, it is rich in humic acids (condensed carbon-based molecules full of earth elements). Good compost is chockful of diverse microorganisms engaged in a constantly cycling micro-food-chain that produces an abundance of plant-available nutrients, and even plant growth hormones.

A common misconception is that compost is compost is compost. We have just one word to describe an incredibly complex process of recomposition. The quality of compost is determined by many factors: starting materials, water quality and quantity, oxygen availability, pile size, temperature, etc. In my opinion, despite these variables, compost is always best when made close to its source and end point. In a backyard or even porch setting, small batch compost can be made with a tumbler or by an ambitious person with a pitchfork. Good compost needs a delicate balance of carbon and nitrogen, commonly referred to as "browns" (carbon) and "greens" (nitrogen). The general idea is that smelly things—like food scraps or fresh grass clippings—should be surrounded by non-smelly things like brown leaves, wood chips, or cardboard. Good compost is made with enough water, but not too much. Compost should never be dripping, but it should also never be dry. It requires plenty of oxygen, which is why turning is so vital. Experimentation is key when it comes to producing your own backyard compost. The finished product should be fluffy and crumbly with a color that matches a bar of chocolate with 70 percent cacao. And it should never smell bad. Bad smells are always a sign that your pile needs more oxygen, and/or more carbon.

Across the Earth, from farm field to backyard, our soils are in need of some TLC. There is a whole universe below-ground. We are just scratching the surface of our understanding. No matter how much soil you have to work with, building healthy soil is one of the most important things we all can do to support biodiversity, pull climate-changing carbon from the atmosphere, better infiltrate water, and scale back the use of chemical inputs. Incorporating well-cared for, "70 percent cacao," forest-scented compost to new garden beds is the best way to create a thriving soil biome that will support your plants for years to come. Get growing!

Clockwise from top left: Pip, the couple's pet pig, helps siphon food waste from the compost pile; Mushrooms in the garden or lawn are excellent indicators of soil health. They break down organic matter and feed plants through the mycelium-root connection; All of the animals at Potter Ridge Farm—such as the farm's "strong-willed" goats seen here—are pets. Although goats are technically browsers, they also enjoy grazing the fresh grasses and weeds around the farm. The farm's animals also provide a key ingredient for healthy compost: manure.

Important things you can do to build soil, whether it's in your gardens, your raised beds, or your lawn:

Cherish organic matter. Organic matter is anything made of carbon: leaves, grass clippings, wood chips, straw, etc. These are essentially natural fertilizers. When you mow the lawn or rake your leaves in the fall, don't send this valuable material to a dump. Let it lie in place, use it to mulch garden beds, or even better, make some good compost to reapply to the soil in a couple months.

Embrace diversity. Every plant feeds different types of sugars, carbohydrates, and proteins to the soil microbes surrounding their roots. Embracing plant diversity not only supports above-ground pollinator communities, but it also enriches the soil microbiome and therefore is a positive feedback loop for plant health. Next time you see a dandelion, think about all of the beneficial creatures it is feeding through its long taproot with uncountable root hairs leaking out carbon-food produced from what was previously just atmospheric carbon dioxide.

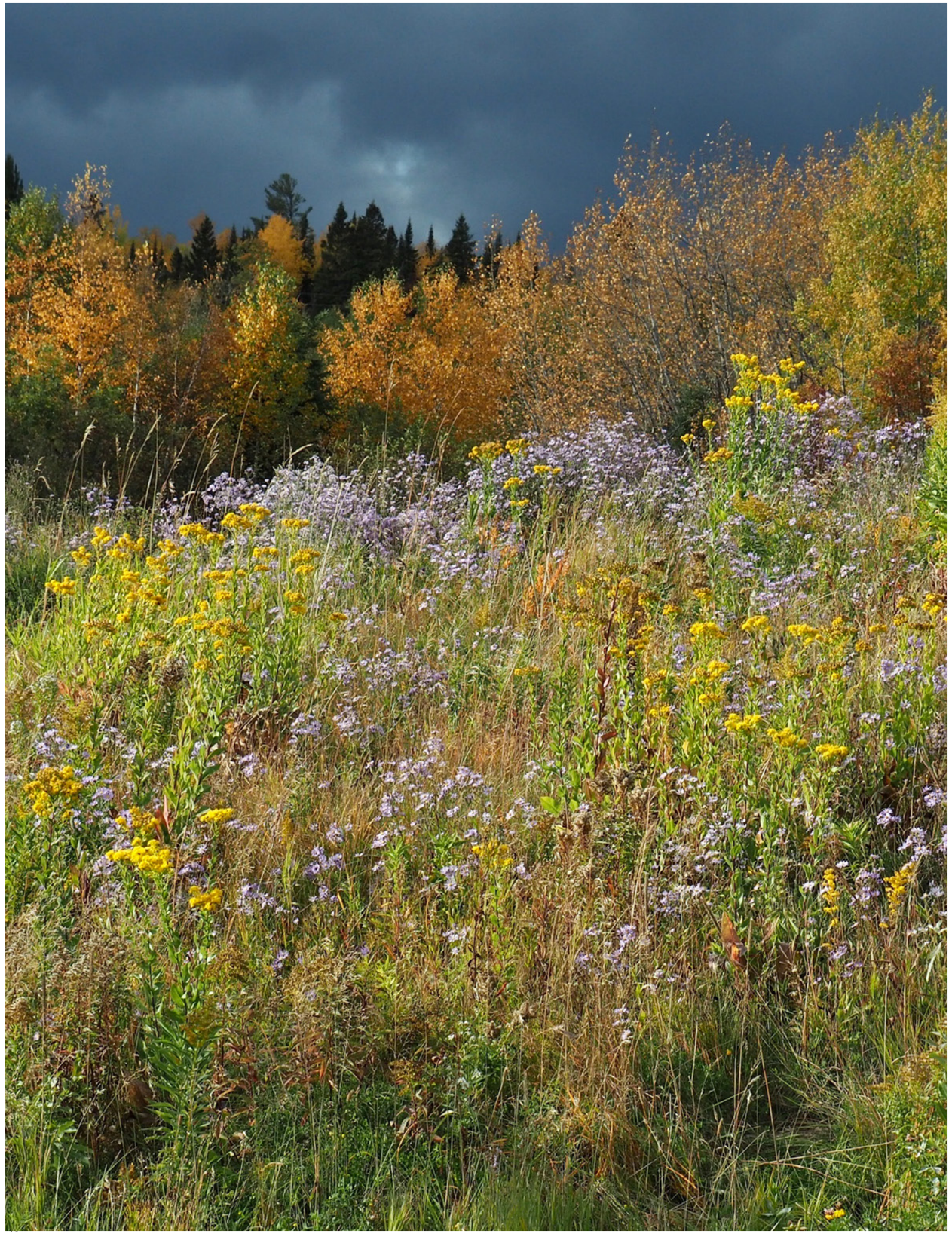
Keep the soil covered. This is probably the most important thing you can do for soil health. When soil is left bare, even a small rain event can cause unwanted compaction, which forces essential oxygen out of the soil and kills the microbes that need it to breathe.

Reduce tillage, eliminate chemicals. Tillage causes compaction by destroying soil aggregates, takes carbon out of the soil, and destroys vital soil microbes. Similarly, any chemical meant to kill weeds or bugs causes unfathomable damage to soil microbial communities, and therefore undoes any attempts at growing healthy soil.

Use cover crops and deep-rooted plants to break up compaction and replenish soil nutrients. After your tomatoes are finished, sprinkle some rye, radish, and pea seeds so your soil microbe partners don't go hungry over the winter. The rye's deep roots will draw up nutrients from deep below the soil surface; the radish will break up compaction; and the peas will bring essential nitrogen to benefit next season's crop. There are numerous variations of this style of cover-cropping plan and they can add a whole new dimension to your garden.

About the Author. Kassie Brown lives on a small plot of land within the territories of the Sauk, Kickapoo, Meskwaki, and Ho-Chunk people in the heart of the Driftless region of southwest Wisconsin. She has a Bachelor of Science degree in community and environmental sociology from the University of Wisconsin-Madison and has completed soil food web training with soil microbiologist Dr. Elaine Ingham. Kassie enjoys making compost, growing mushrooms, and gardening alongside her wife, two kittens, four goats, 15 chickens, one pig, and the billions of microbes who share their land.

Right: A rainbow arcs brightly over Potter Ridge Farm. Solar panels were mounted on top of the old tobacco barn. The barn's timber rafters used for hanging tobacco to dry are still in place. The new solar panels give this historic structure a warm welcome into the 21st century. The panels provide all of the couple's energy needs during the day and feed the grid with extra electricity produced.



"You are capable of more than you know. Choose a goal that seems right for you and strive to be the best, however hard the path. Aim high. Behave honorably. Prepare to be alone at times, and to endure failure. Persist! The world needs all you can give."

– E.O. Wilson, venerated scientist, biologist, researcher and founder of the Half Earth Project: a "moonshot" attempt to preserve half of Earth's biodiversity in order to prevent a mass extinction.

Left: September's asters and goldenrod. **Photo credit:** Vicki Bonk.

Notice Nature Everywhere

A Willowy Experience

by Alan Branhagen

Willows are one of the last of our shrubs and trees to lose their leaves in autumn. They turn shades of yellow—anywhere from greenish-yellow to whitish-yellow. As earlier fall colors start to paint our landscapes, the willows offer a decidedly green contrast in a diversity of shades depending on the species. They can be gray-green as with the sage willow (*Salix candida*), to bicolored, with some species showing stunning glaucous blue-green leaf undersides. The pussy willow (*Salix discolor*) fits this bill, but if you live around the Great Lakes the blue-leaved willow (*Salix myrticoides*) shows this to a tee.

In late summer and fall, our willows are alive with the billion-plus birds that make the amazing trek from taiga to tropics. Willows host an amazing array of insects: dozens of moth species alone, as well as the monarch mimic, the viceroy (whose bird-dropping-like caterpillars continue the species' mimicry).

Each spring, willows are the earliest to leaf out and flower, though blooming is in procession, depending on the species, from late winter's pussy willow to mid-summer's sandbar willow (*Salix interior*). Here again they invite a plethora of pollinating insects and hosts and are teaming with bird life on the return trek from tropics to taiga. Plant several species for an extended bloom time.

Previous spread: Male pussy willow, male flowers. **Left:** Woodbine/grape creeper (*Parthenocissus vitacea*) in sandbar willow.

I learned the amazing diversity of willows a long time ago. Now they are enjoying a long overdue renaissance as sustainable gardening discovers how important they are to a healthy landscape. If you take time to observe when willows bloom, where they grow, what type of plant they are—short shrub, suckering thicket, or tree—they become easier to identify. All have catkin-type flowers and are either male or female. Males with their pollen-rich flowers offer a bounty of protein-rich food for their pollinators, while female catkins produce nectar and then the capsules burst forth with cottony seeds. Yes, there are bee species that will feed their young no other food source!

Willows are easy to grow, too. Once the leaves drop you can bury cut stems and then stick them in the soil; come spring they will root. You can also cut stems before they leaf out and root them in the ground, or in pots that are an equal mix of pea gravel and compost.

Open your eyes to our wonderful world of willows. Insert them into your home gardens and landscape. I guarantee they will enrich your year with their beauty and the village of creatures they provide for.

About the Author. Alan Branhagen is a naturalist and plantsman specializing in botany, birds, and butterflies, and is the author of Timber Press' *The Midwest Native Plant Primer* and *Native Plants of the Midwest*. Alan has bachelor's and master's degrees in landscape architecture and is the director of operations at the Minnesota Landscape Arboretum.

Right: Slender willow (*Salix petiolaris*). "I love the gorgeous stem color contrasting with the fine leaves," says Branhagen. Note: The Audubon Native Plant database is a great resource to search for native willow species by region. Type in the key word "willow" to find native willow species by specific zip code.

Little Bee. Big Bee.

A small sweat bee visits a native wild strawberry in bloom while a queen bumble bee in the background searches for a good spring nesting spot. Flora and fauna species diversity in the native plant landscape is the key to a well-functioning ecoscape.

–Photo credit: Vicki Bonk

About This Journal

In mathematical chaos theory, the butterfly effect is the concept that a ***very small difference in the initial state of a physical system can make a significant difference to that state at some later time.*** What can this theory offer to the communities in which we live? We think it offers a lot. The cumulative effort of individual actions can positively impact the local ecosystems that comprise our lakes, streams, wetlands, yards, gardens, recreational areas, open spaces, roadsides, schools, and places of worship, and much more.

Neighborhood Greening, a non-profit organization dedicated to environmental education and stewardship, publishes *The Butterfly Effect* twice per year. In the journal, we celebrate community successes, examine small but impactful changes we can make to become better stewards of our local ecosystems, and tell the stories of those who are striving to green their neighborhoods. By harnessing the spirit of community, we believe focused efforts will make our neighborhoods better places to live for both humans and wildlife. There is much we can do together to positively impact our shared environment. House by house. Block by block. Neighborhood by neighborhood.

We hope you enjoyed *The Butterfly Effect* and that you look forward to receiving this free publication in your inbox twice per year. If you haven't already done so, you can sign up by clicking here. Be sure to connect with Neighborhood Greening on Facebook to keep learning how to help green your neighborhood throughout the year.

Do you have a story or idea to share about how you or someone you know is making your neighborhood greener, more environmentally sustainable, or wildlife friendly? Please send your ideas to Green@neighborhoodgreening.org. Want ideas to green your neighborhood year round? Be sure to check out "42 Ways to Green Your Neighborhood" on Neighborhood Greening's website.

Please consider making a small donation to Neighborhood Greening to help harness the cumulative environmental impact of indivdual actions.

Thank you to this issue's contributors: Carole Arwidson, Vicki Bonk, Travis Bonovsky, Alan Branhagen, Kassie Brown, Dave Crawford, Mari Marks Mondanelli, and Nel Pilgrim-Rukavina. Editor: Leslie Pilgrim.