

## ENVIRONMENTAL STEWARDSHIP COMMISSION MEETING

February 12, 2020

### Attendance

Members Present: Sarah Stankorb-Taylor, Patrick Walker, Caroline Ammerman, Chris Babb, Katie Stock, Katie Lawrence, Sarah Flem, Dennis Healy

City Staff: Terry Huxel (Staff Representative)

Guest: Bobbi Strangfeld, Member, Urban Forestry Commission

### Approval of November 13, 2019 Meeting Minutes

The January 8, 2020 meeting minutes were approved with no changes.

### Introduction of Bobbi Strangfeld

- Bobbi, a member of the Urban Forestry Commission, updated ESC members on the upcoming activities of the Urban Forestry Commission. These activities include:
  - Workshop on September 12<sup>th</sup> to present information on stormwater and native plants. Jen Eismeier will discuss stormwater issues; Kurt Goldick, Conservation and Parks Manger of Glenwood Gardens, and Deb Beck, landscape architect, will discuss native plants. The workshop will wrap-up with a question and answer period with the speakers. Bobbi provided an article on native plants. (attached)
  - The annual clean-up of the rain garden at Wyoming High School will be on May 9<sup>th</sup>.
- Members of ESC who would like to help with these activities should email Bobbi at: [Hello.bore013@gmail.com](mailto:Hello.bore013@gmail.com)
- Bobbi provided information on Ohio Native Plant Month, which is April (attached)

### Wyoming Recycling Rate Update

- Terry provided an update of Wyoming's recycling rate. The City's recycling rate for 2019 was 50.71%, which includes all waste. (Please see the attached Recycling Rates Table for 2019)
- ESC discussed the elimination of the city-wide Spring Trash Day. It was agreed that this event should be phased out due to its cost to the city (\$18,000) and its adverse environmental impact. Patrick Walker drafted an email which discusses the expense of Trash Day and the amount of trash which is dumped in the landfill rather than repurposed, recycled, or upcycled. He will read this email to Wyoming City Council on February 24,

2020 and ask Council to consider the elimination of this service. This email also will be Eblasted before this year's Trash Day to inform Wyoming residents of the costs and environmental consequences of this service.

### **Green Your School Mini-Grants**

- Chris Babb and Sara Stankorb-Taylor met with the school principals and gave them the mini-grant posters to display in the schools and the mini-grant forms.
- Additional posters will be displayed in the Pastry Shop and other locations around Wyoming to generate interest in the program.

### **Green Business Awards**

Sarah Flem will send the brochure regarding the Green Business Awards to Wyoming businesses by email using the list generated by Katie Stock.

### **Compost Bins**

Sarah Stankorb-Taylor presented an update on the compost bins at the schools and Community Gardens. Hamilton County representatives recently visited the bins and were impressed with them. Several restaurants (Tela and Gabby's) have used the bins at the Community Gardens and are cutting their garbage significantly and saving money.

### **Reusable Straws**

Dennis Healy has the reusable straws that were left over from Fall Festival. Sarah Stankorb-Taylor will provide some of these straws to Gabby's to encourage them to provide them to customers rather than use plastic straws.

### Recycle Rates 2019

RRI  
50.71%

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
<b>TOTAL</b>	328.43	242.39	236.66	306.26	336.04	285.67	300.12	317.69	271.46	300.57	279.25	348.39	3552.93
<b>RECYCLE</b>	84.76	69.45	58.86	69.54	73.26	64.75	73.47	71.02	63.43	66.71	69.97	97.78	865.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
shredder	0.00	0.00	0.00	4.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.38
drop-off	1.85	1.76	1.70	2.01	2.00	1.82	1.90	1.40	1.52	1.85	1.75	1.89	21.45
simple recycle	0.13	0.35	0.32	0.47	0.43	0.43	0.37	0.17	0.02	0.35	0.24	0.00	3.28
<b>WASTE</b>	241.69	170.83	175.78	229.86	260.35	218.67	224.38	245.10	206.49	229.66	207.29	248.72	0.00
<b>RECYCLE RATE</b>	<b>26.41</b>	<b>29.52</b>	<b>25.72</b>	<b>24.94</b>	<b>22.52</b>	<b>23.45</b>	<b>25.24</b>	<b>22.85</b>	<b>23.93</b>	<b>23.59</b>	<b>25.77</b>	<b>28.61</b>	<b>25.17</b>
city junk/waste	0.00	16.20	3.66	0.00	11.72	10.27	76.43	99.80	123.37	162.22	15.60	57.61	
city yrd waste	6.93	46.25	55.20	0.00	107.24	42.44	32.59	16.89	14.64	18.14	5.59	6.34	
rumpke yrd waste	3.86	11.05	17.55	29.21	34.95	49.88	35.26	52.06	62.34	25.53	16.22		
special yrd waste				83.35									
special junk				89.19									
xmas trees	10.49												
leaf collection	18.48		31.02	21.12						187.44	753.72	460.02	
golf course			29.80										
<b>RECYCLE RATES</b>													
average	29.3	29.6	28.0	27.7	26.7	26.9	25.7	26.9	27.6	27.9	29.5	30.6	28.0
2018	27.4	27.0	26.0	26.0	24.9	23.1	22.4	25.3	23.1	25.6	24.7	28.5	25.3
2017	26.7	23.72	24.85	26.74	27.25	24.80	26.11	27.20	25.70	23.68	29.3	30.9	26.4
2016	30.2	27.6	28.8	25.1	26.8	25.6	27.0	27.1	25.9	24.2	25.6	27.9	26.8
2015	32.0	31.3	31.7	28.8	29.6	27.9	27.7	30.8	29.2	29.8	30.9	33.8	30.3
2014	31.8	32.4	29.8	28.9	27.6	25.9	26.7	29.0	31.0	31.0	33.2	37.8	30.4
2013	29.4	27.8	29.1	30.7	29.3	29.3	28.4	30.3	30.2	29.9	31.6	34.3	30.0
2012	31.1	31.9	30.1	33.3	27.1	31.1	30.0	29.4	32.2	31.1	31.4	30.5	30.8
2011	31.7	31.2	29.8	31.5	30.7	30.2	31.0	29.4	29.8	31.0	31.6	33.4	30.9
2010	29.9	30.6	27.4	28.9	27.7	25.9	23.1	28.0	26.7	28.0	31.3	31.5	28.3
2009	31.1	26.6	23.8	24.9	26.0	24.1	23.5	27.4	26.6	27.2	29.9	30.8	26.8
2008	29.9	29.9	24.7	25.6	23.8	24.9	22.5	22.2	24.2	25.6	27.2	28.9	25.8
2007	23.3	30.2	24.9	24.1	23.2	24.7	20.9	22.9	26.2	24.9	26.7	29.2	25.1
2006	28.5	33.4	29.0	27.7	25.4	23.1	23.6	26.3	27.1	27.8	24.3	26.3	26.9
2005	30.4	31.2	30.4	28.9	28.7	29.0	26.3	25.8	27.4	28.0	29.7	32.7	29.0
2004	25.1	29.0	27.6	24.7	25.1	24.9	24.1	22.8	29.4	27.4	30.2	28.3	26.6
2003	27.7	32.7	29.2	27.5	26.3	28.6	25.7	27.3	27.8	28.8	30.1	28.8	28.4
2002	27.6	28.6	27.7	24.1	25.1	27.3	25.1	24.1	27.3	29.1	30.8	31.1	27.3
2001	30.4	29.0	28.8	29.4	25.6	29.7	25.6	28.0	26.6	29.8	29.8	28.6	28.4
2000	31.6	28.9	28.7	26.9	22.4	26.1	22.4	26.6	25.2	27.1	28.8	27.6	26.9
1999	30.6	29.7	27.3	30.1	30.9	31.5	30.9	27.5	30.0	28.8	32.5	30.2	30.0



April is  
**Ohio Native  
Plant Month**

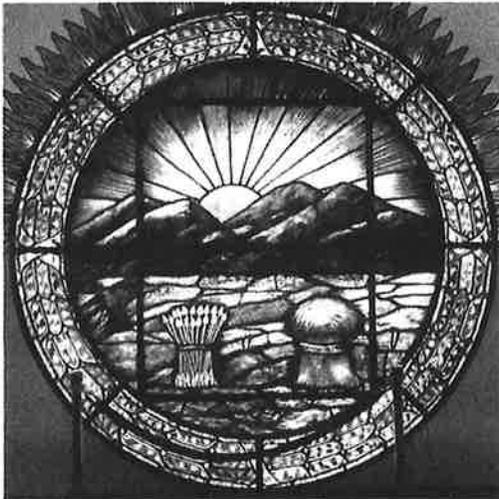
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Seal of the State of Ohio

**State Tree:** The Ohio Buckeye (*Aesculus glabra*) was designated by the Ohio legislature as the state tree in 1953. The name “buckeye” comes from the nut’s resemblance to a deer’s eye. The Ohio State University uses Brutus Buckeye as it’s mascot, and residents of Ohio are often referred to as Buckeyes.

**State Flower:** The Red Carnation (*Dianthus caryoph*) was selected as the Ohio State Flower in 1904 to honor President William McKinley, who was assassinated in office in 1901. He often wore a red carnation in the lapel of his jacket.

**State Wildflower:** Used in our logo, the State Wildflower is the Great White Trillium (*Trillium grandiflorum*). Found in all counties of Ohio, this woodland wildflower became the state flower in 1986.

**State Fruit:** Since the late 1800's, the tomato has gained in popularity in Ohio, and today Ohio is one of the largest tomato producing states in the country. Tomato (*Solanum lycopersicum*) is Ohio's state fruit.

**State Native Fruit:** Since the tomato, a non-native plant, was already the state fruit, it was decided that Ohio needed a state *native* fruit. In 2009 the Pawpaw (*Asimina triloba*) was designated as Ohio's native fruit. Growing throughout most of the Eastern United States, pawpaw fruits were have been enjoyed since the 1500's.

POWERED BY SQUARESPACE



*April is*  
**Ohio Native Plant Month**

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**April 2020 is a Very Special Month!**

- The 50<sup>th</sup> Anniversary of Earth Day
- 50<sup>th</sup> Anniversary of the Passage of Ohio's Natural Areas Act
- **And, the first, official Ohio Native Plant Month!**

**In recognition of this important month, *PLEASE* participate in a Native Plant Activity this April! Ideas include:**

- Plant a native tree in your yard
- Donate a tree or trees to your community
- Plant a native plant(s) for pollinators
- Hold or attend a native plant sale
- Attend a native plant workshop or other educational event
- Remove invasive plants from your yard or community
- Participate in a Spring wildflower walk
- Plan a joint activity with a school or other group

**As soon as you know what you are going to do, please let us know! We would like to list ALL activities, for individuals and organizations, on our website.**

**Name:** (as you would like it to appear): \_\_\_\_\_

**Email:** (will *not* be included): \_\_\_\_\_

**What you are planning to do in April** (one short sentence): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Ohio Region:** \_\_\_\_\_ Northern, \_\_\_\_\_ Central, \_\_\_\_\_ Southern  
(Check one)

Please email the above information to: [NancyLinz13@gmail.com](mailto:NancyLinz13@gmail.com)

Our New Website: <http://www.ohionativeplantmonth.org/>

## CHAPTER 9

# Flipping the Paradigm: Landscapes That Welcome Wildlife

by Douglas W. Tallamy

NOT LONG AGO a prominent horticulturist was interviewed in the *Wall Street Journal* about her garden designs in various Manhattan landscapes. The article celebrated the way her traditional use of color and texture brightened drab city plots that others had deemed unsalvageable. When asked why she did not use plants native to the Northeast, she bristled, "I will not be pressured into the latest fad." The irony of that statement still gives me heart palpitations. Have we really traveled so far down the road of contrived landscaping that we consider plant communities that evolved in concert with their region, its weather, and the mind-boggling diversity of life they support a "fad"? Has the pursuit of artistic expression so completely twisted our per-

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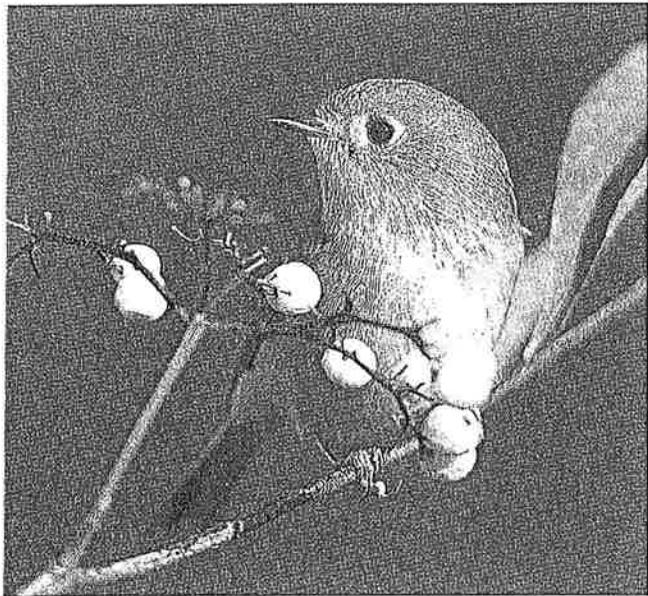
Nearly all the plants in this yard belong to a native plant community. Very little space is devoted to lawn or heavily mulched beds. The result is a beautiful, highly functional landscape in which nature is happy.

ception of reality that we believe the plants that have thrived here for millennia no longer have a place in our landscapes?

For better or worse, I often use my wife as a sounding board. One day, when I was ranting about the relegation of native plants to fad status, she turned, met my eyes with her it's-time-to-listen look, and said slowly and clearly, "Horticulturists are artists, and their medium is the garden. Their goal is to paint the landscape with beautiful plants, and they have a larger palette to work with if they use plants from all over the globe." What a polite way of suggesting that I dismount my high horse long enough to consider another point of view! Quite so. Horticulturists are indeed artists, and there is no question that when the landscape is viewed as a canvas that exists solely for our creative expression, a large plant palette will produce a more effective result than a small palette. And let's face it: it's easier to paint a picture on a blank canvas than on one already filled with existing plant communities. No won-

der Step #1 in landscaping so often is to remove the natives and start from scratch.

But surely this approach to landscaping is based on a myopic view of what landscapes are, of what they do for us every second of every day, and of what they should be. Landscapes are not art constructs to be arranged solely for our pleasure, and the plants in our lives are not mere ornaments. Instead, plants are the foundations of our ecosystems. Neither we nor any other animal can live without them. As unfortunate for our freedom of expression as it might be, it is a biological fact that plants are only able to run ecosystems well when they re-



Plants are the foundations of our ecosystems. Neither we nor any other animal can live without them. Ruby-crowned kinglet on gray dogwood (*Cornus racemosa*).

main within the ecosystems in which they evolved. When a plant is removed from its evolutionary history, its indispensable role in supporting food webs disintegrates. In the coming pages we will explore why this is so, and how our wholesale replacement of native plant communities with disparate collections of plants from other parts of the world is pushing our local animals to the brink of extinction—and the ecosystems that sustain human societies to the edge of collapse.

### Plants matter

Many people feel that I am given to outlandish statements, like “We wouldn’t be here today if it weren’t for native plants, and we won’t remain long without them.” Maybe, but allow me to defend myself. What may appear apocalyptic at first glance has been supported without controversy by thousands of ecological studies since the late 1950s. My claim simply recognizes plants as the foundation of all the food webs on earth (with the minor exception of sulfur-based food webs near volcanic vents at the bottom of the ocean). What does that mean? It means that, in addition to producing oxygen (something I still view with relief), in addition to removing carbon dioxide from our carbon-laden atmosphere, in addition to moderating our weather systems, and in addition to cycling, cleaning, and holding water on the land—all vital ecosystem services, to be sure—it is plants, and only plants, that harness energy from the sun and lock it in

the carbon bonds of simple sugars and carbohydrates. That is, it is plants that make the food that allows us and our fellow creatures to exist. Think about it. Plants enable us to eat sunshine! I am convinced that if we truly internalized this remarkable fact, we would never again cut down a tree because we have grown tired of raking its leaves. Bulldozing a forest to erect another strip mall, or logging thousands of square miles of the great boreal forests of North America to make toilet paper and newspaper inserts, would not be rational options. We would never again risk importing a devastating plant disease like chestnut blight, or an alien insect like the hemlock woolly adelgid, so that we can garden with beautiful plants from elsewhere. If we acknowledged the essential role of plants in our lives, we would know that every time we add another member to our human population we need to add enough plants to our ecosystems to support that person. Instead, we do the opposite: we invariably respond to each additional soul by removing more plants from the earth in order to produce more stuff for that person—the quintessential example of unsustainable behavior. And when we reduce the amount of plant life in an area, we lower that area’s carrying capacity.

### Carrying capacity

You may be thinking that I am referring only to agricultural plants—the plants we humans eat directly—when I talk about the value of plants as food sources. I am

not. Surely our corn, wheat, rice, and soybeans are the base of the simplified food web that feeds humans, but they do not support the millions of other animal species on earth. Rather, it is native plant communities all over the globe that harness the energy that permits the existence of other animals. In fact, humans have been competing with other animals for the energy fixed by plants ever since we learned how to farm. We have been competing, and we have been winning. Every new acre of land that is put to the plow creates more food for humans but reduces the amount of food available for local animals. And lately—that is, in the last hundred years or so—we have even worked hard to transform nonagricultural land from what it wants to be to what we want it to be. Picture your neighborhood, for instance. Chances are, the diverse native plant communities that once thrived there have been replaced with expansive lawns dotted with sparse plantings of ornamentals from Asia or Europe. If that is true, your neighborhood is no better than an Iowan cornfield at supporting local animals.

So what, exactly, do I mean when I talk about an area’s carrying capacity? Carrying capacity is an ecological term that describes the amount of life that can be supported sustainably in a given place—that is, without degrading the life support systems of that place. Because plants make all the food and much of the shelter that animals need, we can use the amount of plant life in an area as a rough measure

of that area's carrying capacity. For example, an eastern deciduous forest has a very high carrying capacity compared to a suburban lawn because it has a much greater amount and diversity of plant life.

It may help to think of carrying capacity as the principal in an ecological bank account. Do you remember when we used to have bank accounts? They used to generate interest that we could live off of as long as we didn't touch the principal. If we withdrew some of the principal in our account, the account generated less interest and we could not live as well as we did before. The same is true for the carrying capacity of your yard. If you have many plants (your

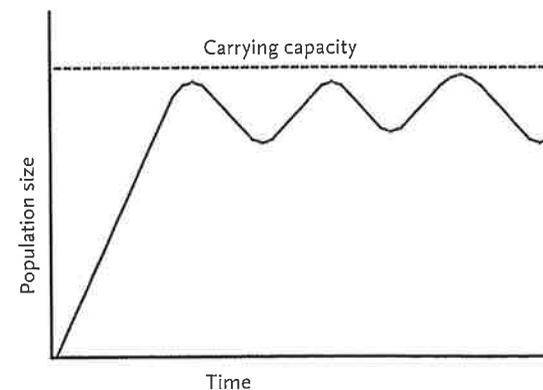
ecological principal) making much food and shelter (your ecological interest), your yard will have a high carrying capacity and be able to support lots of birds, butterflies, and other creatures. But if your yard is largely lawn, it has almost no principal and consequently generates very little interest; a yard that is largely lawn supports very little life.

Understanding the carrying capacity of human-dominated landscapes is critical if we are interested in the future of other species. This is because we have converted nearly all the natural areas in the United States for our own use without making an effort to share those spaces with other creatures. We have made no effort to share because for most of our history there was so much undisturbed nature out there that no one thought to worry about it. Those days, however, are long gone. As of 2007, 40.8 percent of the land area in the lower forty-eight U.S. states had been converted to some form of production agriculture ([www.ers.usda.gov/StateFacts/US.htm](http://www.ers.usda.gov/StateFacts/US.htm)). All but 5 percent of the rest of the land is now a giant matrix of urban, suburban, and exurban landscapes (Rosenzweig 2003). Only 3.6 percent of the United States is protected within the National Park Service ([www.nps.gov/aboutus/quickfacts.htm](http://www.nps.gov/aboutus/quickfacts.htm)). We have turned five times the area of New Jersey into 4 million miles of paved road surfaces (Hayden 2004) and another eight New Jerseys into manicured lawns (Milesi et al. 2005).

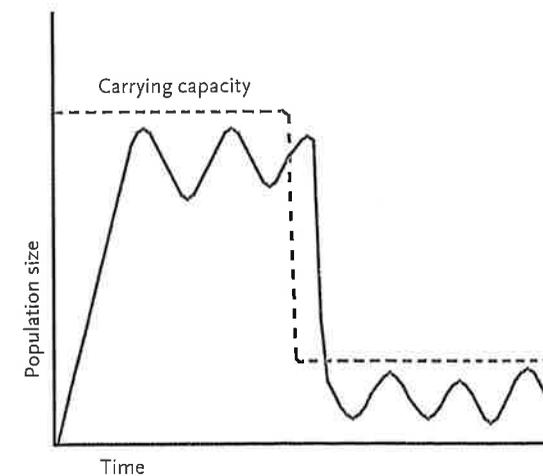
And we have great plans for the future.

In the next fifty years we are projected to develop 75 million acres of forestland in the United States, an area equal to sixteen times the size of New Jersey (Little 2009). I am not talking about building houses on farmland from which forests were removed two hundred years ago, but on land that is currently home to healthy, mature forests. Why? Because we are still adding 5,647 people to the United States every day, with no recognition of ecological limits ([www.census.gov/popest/national/NA-EST2008-01.html](http://www.census.gov/popest/national/NA-EST2008-01.html)). In short, we have converted almost all the natural areas that once defined the United States into the cities, suburbs, and farmland that we need in order to live as we do.

What has happened to the species that depend on those natural areas? Exactly what you would predict would happen. Plants whose habitat is paved or plowed have disappeared, and so have the animals that depend on those plants for food. These species may not be globally extinct—not yet, anyway—but local extinction is rampant. To appreciate just how widespread local extinction is these days, look out your front window and count how many species you see. Now imagine how many species of plants and animals lived in the area you are looking at before your property was cleared and your house was built. If you counted even 1 percent of the original flora and fauna, I will be surprised. "Oh, they live in the park down the street," you say. I hope you are right, but experts at our State Natural Heritage centers across the coun-



Because plants provide all the food and much of the shelter for animal life, we can estimate the carrying capacity of an area by measuring how many plants it contains (orange line). Here animal populations (green line) can cycle forever on the resources (food and shelter) produced by those plants, as long as they don't reduce the amount of plants in the area.



If the amount of plants in an area (the basis of the carrying capacity) is reduced (orange line), the amount of food and shelter in that area will also be reduced, and so there will be fewer animals that can survive there (green line).



Plants are the foundation of nearly all the food webs on earth. Here a hairy woodpecker (left) and red-bellied woodpecker search for insects on a young sycamore tree.

try have been busy measuring the conservation status of all the species in that park down the street, and they are not as optimistic as you are. They estimate that as many as 33,000 species of plants and animals have not only disappeared from our yards, but also from so many parks and preserves across the country that these species are “imperiled”—no longer common enough to perform their roles in their ecosystems (Stein and Davis 2000; Wilcove and Master 2005). Yes: 33,000 species are now considered to be functionally extinct in the United States.

Lest you think it's only ugly insects and weeds that are in trouble, consider the 2009 results of a comprehensive survey of bird health in the United States. Data were collected by competent people in the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the American Bird Conservancy, the Cornell Lab of Ornithology, and participants in the National Audubon Society's Christmas bird count, among others. The report's unhappy conclusion was that nearly a third of our eight hundred bird species are endangered, threatened, or in significant decline ([www.stateofthebirds.org](http://www.stateofthebirds.org)). If this is not a wake-up call, I don't know what is.

### Who cares?

“Well, too bad for plants and animals! Too bad for our natural heritage! We humans have to eat, and we need places to live and work. Who cares about animals, or the plants that feed them, anyway?” That,

of course, is strictly a human perspective, and a commonly held one at that. So, for argument's sake, let's stick with what is best for humans. Do humans need other species? Do humans need nature? Will our quality of life improve if we increase our own population to the point that no resources are left for anything else?

Although you wouldn't know it from listening to the evening news, we do, in fact, need nature and *all* its components to continue our journey on Spaceship Earth far into the future. Why? Because it is nature that runs our ecosystems. Perhaps everything you need can be found at the mall, but everything in the mall comes from a functioning ecosystem. A great deal of research has shown that ecosystems are more stable (they will not collapse as easily), more productive (they make more oxygen, clean more water, sequester more carbon, filter more pollution, pollinate more plants, and buffer extreme weather systems better—that is, they deliver more ecosystem services for humans) and are less susceptible to invasion by foreign organisms when they are built from more species of plants and animals than when they are species-poor (Duffy 2009). And so, for our own well-being, it behooves us to be good stewards of the species that run our ecosystems.

Do ecosystems ever really collapse? Indeed they do, whenever the resources generated by an ecosystem are used up faster than they can be produced—that is, whenever the carrying capacity of an ecosys-

tem is exceeded. If you are interested in a highly detailed accounting of when and why carrying capacity of various ecosystems has been exceeded in the past, I refer you to Jared Diamond's book, *Collapse* (Diamond 2005). Ecosystem collapse is not just an unhappy event that occasionally overtook pre-industrial societies. What we call “political unrest” or a “failed state” today is often just a symptom of ecosystem collapse. This is particularly true in sub-Saharan regions of Africa, like Darfur and Somalia, where low rainfall makes plant communities and everything that depends on them too fragile to support large human populations. But ecosystems also collapse at home. The fifty-five ecological communities that once made Manhattan Island a sustainable home for six hundred people have all been replaced by pavement, steel, and concrete. Manhattan's carrying capacity is now nearly zero (Sanderson 2009). People can live in Manhattan only by importing resources created by ecosystems that have not collapsed elsewhere. What will happen to the inhabitants of Manhattan, or Philadelphia, or Atlanta, or Denver, or all our great cities if we do allow their support ecosystems to collapse?

### Restoring suburban food webs

If human societies need healthy ecosystems to remain healthy themselves, and if species-rich ecosystems are better at sustaining humans than species-poor ecosystems, it is clear that, from a selfish perspective alone, we need to do a better job of

sharing the spaces in which we live, work, and farm with as many other organisms as we can. The best way to do this at home is to raise the ability of our yards to support life by increasing the amount and diversity of our landscape plants. Is that it? Is it really that easy to bring nature back into our lives? Well, yes, but there is a catch. We have to put the *right* plants back into our yards, or our best intentions won't work. Remember our goal: we are trying restore the carrying capacity of the spaces we have taken for our own needs by rebuilding the food webs required to support the natural world. Yes, it is plants that support food webs, but unfortunately, all plants are not equal in their ability to provide food for the life that needs it. If all plants were



Populations of neotropical migrants like this black-throated green warbler have declined precipitously in the past two decades.

equally good at supporting food webs, we could move them around the world with impunity, and global food webs would remain intact. One plant species would work as well as any other in providing food and shelter for our fellow creatures. But this is not the case.

Although plants harness energy from sunlight and pass it on to animals in the form of food, they do so reluctantly, if I may anthropomorphize just a bit. Plants want to save the energy they have captured for their own growth and reproduction. In fact, they go to great lengths to protect their photosynthetic products from ani-



Not all plants are equally good at supporting food webs. Native plants, like these featured at the University of Delaware's Lepidoptera Trail, support larger, more diverse, and more complex food webs than do plants that evolved elsewhere.

mals that eat plants by loading their tissues with bitter chemicals like cucurbitacins, or toxic chemicals like cyanide and nicotine, or digestibility-reducing compounds like tannins. Larger herbivores are further discouraged by thorns, spines, trichomes, or dense hairs on leaves. In short, nearly all plant leaves are protected by elaborate chemical and physical defenses that effectively discourage most creatures that would otherwise eat them.

Despite these defenses, all herbivores have found a way to eat at least some species of plants. Ungulates like deer and goats, for example, have enlisted the help of symbiotic bacteria that ferment plant tissues in a complex series of stomach chambers until the chemical defenses have been destroyed. Insects have taken a different route. Rather than evolve ways to circumvent all phytochemical defenses, insects have made the job easier by specializing on just one, or a few, types of chemical defenses (Berenbaum 1990). The monarch butterfly is a perfect example. Over eons, monarch larvae have developed enzymes capable of detoxifying cardiac glycosides, the defensive compounds in milkweeds. They also have evolutionarily "discovered" how to eat milkweed leaves without triggering the flow of the milky latex sap that gives milkweeds their name. These physiological and behavioral adaptations enable monarchs to reduce competition for food by specializing on a plant that is toxic to most other animals. The down side of specialization, however, is that the monarch is

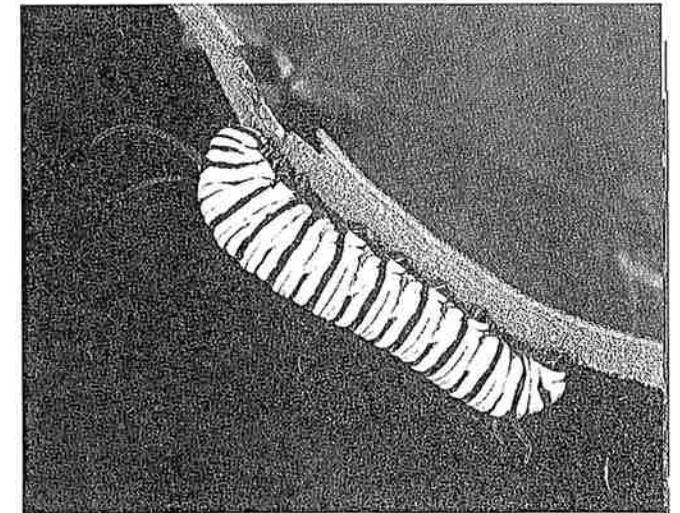
now restricted to eating only milkweeds. If you mow down your milkweed patch, the monarch larvae cannot crawl over to the nearest violet, or aster, or oak tree, and resume eating. They will starve. The same is true for 90 percent of the insect herbivores in the world (Bernays and Graham 1988): without the host plant lineage with which they co-evolved, they will disappear.

### Insects are key

Most of us have been taught from childhood that the only good insect is a dead insect. In fact, one of the traits we have favored when selecting our landscape plants is that they be "pest-free." We should hardly be surprised that we now live in landscapes with very few insects. Since the late 1800s, we have been busy replacing the native plants on which insects develop with plants that evolved outside of our local food webs—plants that our local insects cannot eat. We have been wildly successful at creating the gardener's dream: a land without insects. Unfortunately, like the tragic costs associated with W. W. Jacob's monkey's paw, our wish for insect-free landscapes has come with an enormous unanticipated price: it has created a landscape without nature.

Why can't nature be happy without those pesky insects? Like it or not, insects are an essential part of every terrestrial ecosystem because they are the primary way most animals get their energy from plants. Plant tissues typically contain very little protein, and so most creatures do not

depend directly on plants for their nutrition. Instead, they eat the insects that converted plant tissues to protein for them. In contrast to plants, insects are a superior source of protein and fat (DeFoliart 1992). Birds provide an excellent example of animals that are heavily dependent on insects for protein. Ninety-six percent of the terrestrial birds in North America rear their young on insects (Dickinson 1999). No insects, no baby birds. People think of birds as seed- and berry-eaters, and many birds do eat seeds and berries during the fall and winter. But when they are reproducing, birds need the high-quality protein and



Insects that specialize on one plant often are no longer able to eat other plants. This monarch butterfly larva has become adapted to detoxifying the cardiac glycosides in milkweed plants, but those adaptations prevent it from eating anything but milkweeds.

energy-rich fat bodies produced by insects to succeed. Bottom line: if you want birds, or toads, or salamanders, or countless other species in your yard; if you want your kids to develop an emotional connection with the wonders of nature (Louv 2008); if you want your landscape to do something, rather than just look like something, you must put the plants that support your local insects back in your yard.

### Build a balanced community

There are many misconceptions about using native species as landscape plants, but one of the most pervasive is the fear that natives will be defoliated by the very insects we are trying to attract with them. After all, that's one of the reasons "pest-



Our wish for insect-free landscapes has come with an enormous unanticipated price: it has created a landscape without nature.

free" plants from Asia and Europe appeared to be the logical choice. No gardener wants favorite plantings to be riddled with insect damage. It may seem paradoxical, but planting natives that are part of local food webs is the best way to prevent insect outbreaks. It is true that native plants attract more species of insect herbivores than non-native ornamentals—fifteen times more species by some measures (Tallamy and Shropshire 2009). What we must remember, however, is that all those insects attract a diversity of predators, parasites, and diseases that keep their populations in check. To have a diverse community of natural enemies present in your yard at all times, you must have a diversity of prey available at all times. When one prey species becomes too uncommon to support a predator, other species will be present for it to eat and will therefore prevent the predator from leaving the area. The key to controlling insect outbreaks is to nip them in the bud. This can only happen if natural enemies are ready to pounce whenever an insect becomes too numerous.

We run into trouble when we landscape with plants that support very few herbivores, because then there usually is not enough food to keep insect predators and parasitoids, as well as hungry birds, nearby. When there is an outbreak of one of the many insects we have imported along with our Asian ornamentals—insects like the Japanese beetle or euonymus scale—there are not enough natural enemies to control

them. This helps explain why as much as four times more pesticide by weight is applied to suburban landscapes than to the agricultural landscape in the United States (Pimentel et al. 1991).

Hearing that a diversity of native plants will create an ecological community in your yard that will keep the abundance of herbivores and their enemies in balance is one thing, but I know for a fact that many of you are from Missouri and won't believe it until you see it. That is one reason I convinced Erin Reed, one of my graduate students at the University of Delaware, to study insect damage in native and non-native plantings. Erin compared the amount of damage sucking and chewing insects made on the ornamental plants at six suburban properties landscaped primarily with species native to the area and six properties landscaped traditionally. After two years of measurements Erin found that only a tiny percentage of leaves were damaged on either set of properties at the end of the season (1.5 percent of the leaves had sucking damage while 4.5 percent had chewing damage). Earlier studies have shown that homeowners do not notice and react to insect damage until about 10 percent of the leaves are damaged (Sadof and Raupp 1996), so the damage levels in Erin's study were well below the aesthetic injury level in both native plantings and traditional plantings. Erin's most important result, however, was that there was no statistical difference in the amount of damage on either landscape type. If Erin's study

proves to be the rule and not an exception, you need not worry that your native plants will be eaten to a nub. Your bluebirds and chickadees, parasitic wasps and toads, assassin bugs and ladybird beetles, fireflies and hover flies, lacewings and ground beetles—all will keep your plant-eating insects in check before they cause perceptible damage to your beautiful landscape.

### Flipping the paradigm

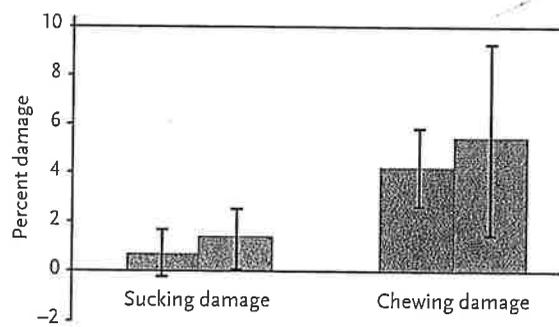
If you are convinced that the benefits of landscaping with native plants far outweigh the costs, then you are ready to start restoring the functional aspects of your property. There are two things that you can do that will enable you to raise the carrying capacity of your property successfully: in-



Ninety-six percent of our terrestrial birds rear their young on insects and the spiders that eat insects. No insects means no baby birds!

crease the percentage of plants in your yard that contribute to local food webs; and, increase the amount of plant life on your property. Increasing the percentage of native plants is easy. You can replace non-natives with more functional natives that are similar in habit, flower type, and fall color by digging up the old and putting in the new, or you can simply replace your plants from Asia and Europe as they die.

Increasing the amount of plant life on your property without losing control of your landscape is a bigger challenge. Perhaps the best way to accomplish this is to flip on its head the landscaping paradigm that has dominated our culture for the past century. The traditional approach to landscape design has been to clear the land of most or all existing vegetation (properties built on farmland have already been



The percentage of leaves damaged by insects on ornamental plants is no greater in yards landscaped primarily with native species (green bars) than it is in yards landscaped traditionally (red bars). Both landscapes maintain damage well below the aesthetic injury level of 10 percent.

cleared), plant the entire property in lawn, and then carve out small spaces for flowerbeds. This approach renders most of the property an ecological wasteland. But if we do the opposite, we can use lawn as it should be used, while turning most of our property into a vibrant landscape. Instead of designing where our plantings will go in a sea of lawn, our new approach will be to carve out necessary lawn spaces from a property that is otherwise entirely planted.

Where do we need lawn? The cool season European grasses that make up our lawns are ideal for walking spaces because they can bear our weight without being crushed to death. So start by deciding where you will need grass paths to allow movement from one place to another: a path to the backyard vegetable garden, paths on either side of the house to allow passage from the front yard to the back, and so on. Next, decide where you would like spaces for small social gatherings. These are often positioned in a private, cozy space near the house in the backyard, but can just as easily be placed in the front or side yard, depending on your property size and shape and on your personal preference.

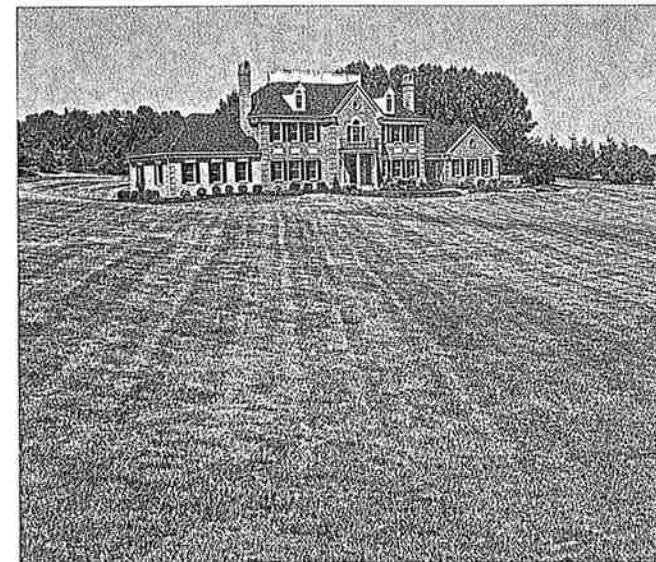
The biggest change in our new approach to landscaping will occur in the front yard. Today it is almost universally accepted that the front must be entirely lawn. Real estate agents will tell you that you need to see the entire house from the street to preserve curb appeal. Knowledgeable landscapers say hogwash to that notion. Your property can have curb appeal whether you can see

all, part, or none of your house from the street, if you use your plantings to direct the eye to the most aesthetically pleasing parts of your yard. That may be your front door, your front flowerbed, or a magnificent oak off to the side of your house. Less appealing areas of your property can be screened with dense plantings of natives. Where these plantings are placed will be defined by where you build a view (a landscape “window,” if you will) with lawn. Your lawn will no longer be your landscaping default—what you do with your yard when you don’t know what else to do—it will become a useful landscaping tool that helps you define the use of various parts of your property.

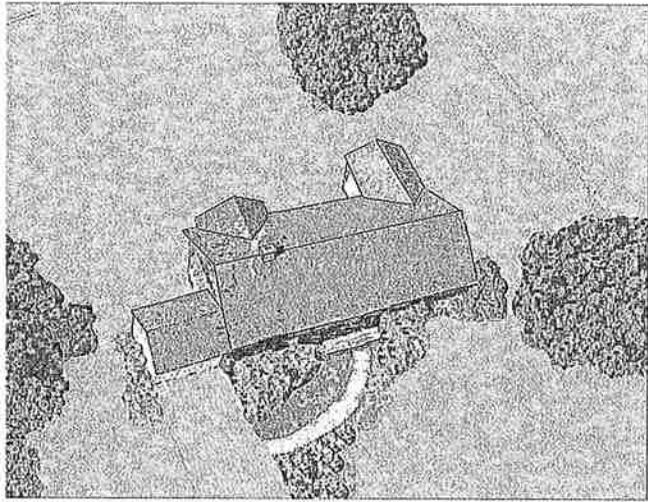
What should we do with all those spaces that are no longer lawn? If you are lucky enough to build on property that already has native plant communities, take care to protect those communities from the start. You may want to reshape them when you have designed your lawn spaces, but that’s okay. At least you don’t have to start from scratch. Most yards already exist, however, and most are already lawns, so you will need to replace those with the plant communities that once thrived there. Planting large areas can be daunting tasks, so I recommend making your restoration a long-term project. Move from one manageable area to the next, as time and resources permit. You will start to reap the benefits of your new plantings almost immediately as you look forward to your future designs.

My research has shown that, in areas of

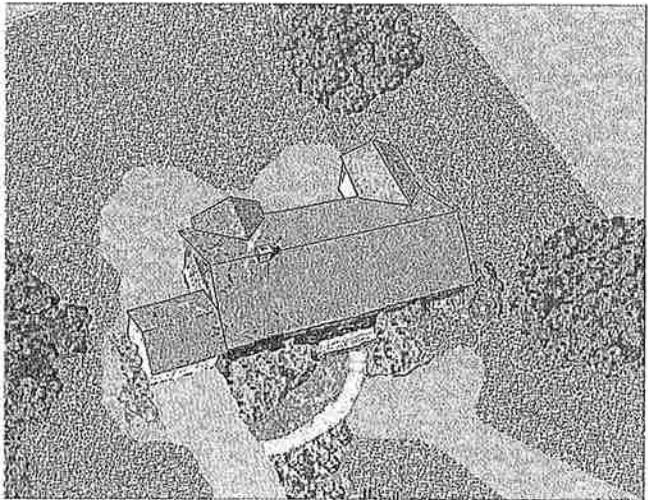
the country where there is enough water to support them, woody plants like trees and shrubs serve as hosts for many more species of Lepidoptera (moths and butterflies) than herbaceous plants and in doing so provide more types of food for birds and other insect-eaters. Supplying birds with the caterpillars they need while they are nesting will bring just as many birds to your yard during the spring and summer as a bird feeder does during the winter. You can find a complete list of all plant genera in the Mid-Atlantic states, ranked by their potential to support nature, at <http://copland.udel.edu/~dtallamy/host/index.html>.



It’s not just the *type* of plants we use in suburbia that is killing nature, it is the *amount* of plants in our landscapes as well.



The traditional approach to landscape design is an ecological wasteland.



In this schematic of the new approach, lawns are used for social spaces and paths for movement; the rest of the property is planted with productive native plant communities.

### Plant densely

We are so used to landscapes nearly devoid of the plants that support life that dense plantings such as those typically found at forest edges may seem too “wild” for many homeowners. But remember: the more plants you put in your yard, the more food and shelter you are creating for other living things. A garden that requires yards of mulch and constant weeding is one that wants more plants. When you are restoring nature in your yard, keep your focus on the animals that will come to your plants, not on the individual plants themselves. This means that all trees don’t have to be treated as specimen trees, isolated from other trees by seas of grass. Trees planted close enough to create a closed canopy are exactly what most of our charismatic animals prefer. Garden beds edging your property should be so packed with high-value plants that you cannot see the ground. This reduces maintenance effort by leaving little room for weeds in your beds, protects the ground from the extremes of summer heat and winter cold, prevents the soil from drying out, and allows a complex community of soil organisms to flourish.

### Leaf litter is the best mulch

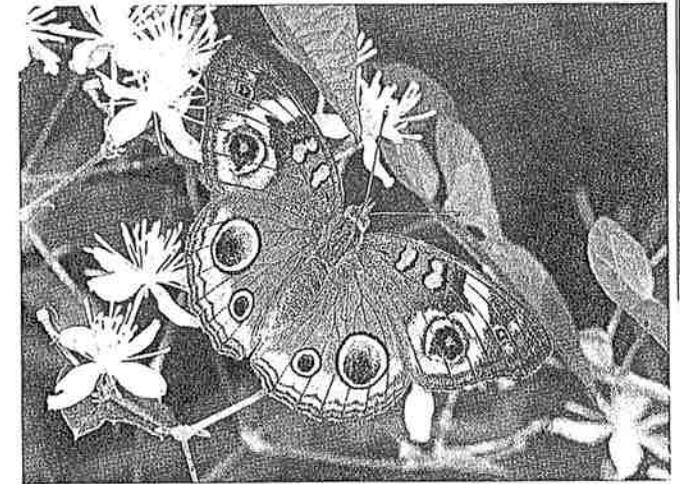
As with many parts of nature, we have demonized the leaves that fall from deciduous trees every year. We rake them up, stuff them in bags as if they were garbage, and put them out for the trash man. Then we go to Home Depot and buy fertilizer to

replace the nutrients we have just thrown away, mulch to protect the plant roots we have just exposed, and hoses to water our plants after the bare soil dries out. We engage in this curious practice because leaf litter is not compatible with grass, and because of the fear that some of our leaves might blow onto the neighbor’s lawn. But if you convert much of your lawn into trees, shrubs, and flowering plants, you now have a home for those leaves each fall. Mulch all your expanded beds with leaves from your trees. Healthy forest floor is built from layers of dead leaves, and the arthropods that live in it are the primary food for our thrushes and several warblers. Did you know that our terrestrial birds get most of the calcium they need to build eggshells from the shells of land snails they find in leaf litter (Graveland and van Gijzen 1994)? You can make your yard a haven for breeding birds by mulching your beds with leaves. (If your beds are too small for the amount of leaves that fall in your yard, you need bigger beds!)

### Plant a butterfly garden

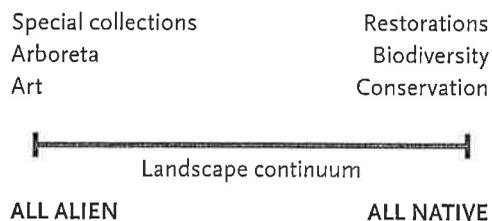
Butterfly gardens are one of the easiest and most effective ways to incorporate more natives into your landscape. When you are planning your garden, remember that butterflies need two kinds of plants: plants that produce nectar for the adult butterflies, and plants that serve as food for the larvae. Many people plant only nectar plants in their butterfly gardens, but with-

out larval host plants, they are not making any new butterflies. One of the most interesting things a butterfly garden offers to young and old alike is the opportunity to observe all stages of metamorphosis. Kids are fascinated by the process of a single individual transforming from egg to larva to chrysalis to adult, something they will miss if you do not include larval hosts in your garden. Many people assume that butterfly larvae eat the same plants that provide nectar for the adults. This is true in some cases, such as the pearl crescent on black-eyed Susan or the monarch on milkweed. More often than not, however, butterfly larvae develop on woody plants that don’t supply any nectar. Black



Butterfly gardens are a wonderful way to bring beauty into your yard and your life. Here a buckeye nectars on *Clematis virginiana*.

cherry, for example, is the host plant for tiger swallowtails, coral hairstreaks, and red-spotted purple butterflies. Native willows are hosts for the viceroy and morning cloak. Avoid planting butterfly bush (*Buddleia*). It is a good nectar plant, but it is not recorded as the larval host for any butterfly species in the United States, and it has joined the long list of ornamental plants that have escaped our gardens and invaded our natural areas. Also, remember to mass your larval host plants. If you have only one milkweed plant in your garden, a single monarch larva may eat all its leaves before reaching its full size. This leaves you with a bare stalk and the larva with nothing to eat. But if you have thirty milkweed plants, you won't even notice that you have a larva on your plants unless you look carefully—and your milkweed patch will thrive.



The percentage of native plants in your landscape depends on what you would like your gardens to accomplish. If you are not constrained by the needs of a special collection, consider using more natives to restore the food web that once thrived in your yard.

### Are natives for everyone?

The indelible connection between native plants and the health of nature herself is often troubling to horticulturists at all skill levels because it creates a conflict between the two things many of us like most about gardening: the challenge of growing new and beautiful plants from all over the world (and the status associated with succeeding) versus the ability to share our landscapes with the life that was once common around us. Many people want the best of both worlds, but they wonder how many native plants they need to have to make a positive difference and how many non-natives they can enjoy without degrading the landscape. The answer depends on your goals. If your primary goal is to make a special collection of Japanese conifers, you had better use non-native conifers from Japan. If your goal is to restore your local food web to conserve biodiversity, you will need to use the indigenous plants that contribute the most energy to that food web. If you want to have collections of exotic plants *and* to landscape sustainably at the same time, you will need to compromise your expectations for both goals.

Our problems are not coming from horticulturists who want to express themselves with non-native ornamentals. There aren't that many serious gardeners, and they do not impact enough land to make a big difference. Rather, our problems come from the millions of typical homeowners and corporate land managers who have

no particular aspirations for their landscapes other than to fit in with the neighbors. These are the people who determine the biotic richness of thousands of square miles of suburbia, yet they don't even know that there is an alternative to exotic ornamentals. And they are encouraged in their ignorance by nurseries that limit their selections and by gardening publications that discuss no alternatives.

In the past we have embraced a landscaping paradigm that was based only on aesthetics because we did not see our yards as parts of natural systems. In fact, we found satisfaction in creating unnatural landscapes and were reluctant to share our spaces with nature. After all, who needed to share? Nature was healthy elsewhere—or so we thought. Today nature is very unhealthy. But we can nurture her back to health within our managed ecosystems—within our yards—if we use the plants that are her lifeblood. It won't be easy, because it will require a shift in attitude: a new consciousness about the consequences of

landscaping with non-native plants. Still, I am optimistic that we can and will do this. Humans are adept at using new information to modify previous perceptions and have made many impressive reversals in the past as the consequences of our choices became clear (Reed 2010). The SUVs that looked so good to us when gas was cheap have lost their appeal. We banned DDT when we learned that it was no longer killing our pests but *was* killing our birds (Carson 1962). In the same way, we can learn to value our native plant heritage by recognizing how poorly non-native ornamentals compare with native species in one of the most important ecological functions performed by plants, that of supporting food webs. Today we value a plant only for what it looks like in peak bloom, fall color, or mature habit. I am hopeful that tomorrow we will also see it, and hold it in reverence, for the complex web of life it supports: the luna moth, the blue-tailed skink, the painted bunting . . . the diversity of life that enriches us daily.

farmscraper, and for raising the necessary water, soil, fertilizer, animal foods, and machinery to the height of your high-rise fields. Does producing food in this manner actually consume less energy and resources than would be required to raise the same harvest on conventional farms and ship it to population centers? If such calculations are not your forte, then seek out an unbiased authority who can help you to an informed conclusion. That's what we've done. For each chapter of this book, we've selected different authors, individuals with extensive, firsthand experience in the aspect of gardening they describe, experts who have made an in-depth study of their craft. Such detailed, factual knowledge must be the foundation of true sustainability. Without it, this new campaign will be nothing more than greenwashing by another name.

### How this book can help

Creating a truly sustainable garden isn't difficult, but it does require a gentler, more holistic approach. To enable nature to take over such tasks as irrigation and fertilization requires an understanding of the systems involved, and the recognition that they all are interconnected. Ensuring that the plants get the minerals they need for healthy growth, for example, is no longer just a matter of broadcasting fertilizers. Instead, fertility becomes a reflection of a healthy soil with a robust flora and fauna of beneficial microorganisms, which in turns

reflects a more sensitive approach to moisture management and pest control. Which means that the plants must be selected to suit the site and climate. All these things must be managed in a coordinated manner, if they are to work together successfully. That's why this book's relevance begins well before the opening of a nursery catalog or the turning of the first spadeful of soil.

- In Chapter 1, David Deardorff and Kathryn Wadsworth train their knowledge of plant pathology and love of gardening on pests and diseases and how best to cope with them. Like any good physicians, they focus on prevention—their nine-point program provides a sustainable foundation for horticultural health no matter what sort of garden you are contemplating.
- Chapter 2 introduces the new Sustainable Sites Initiative (SITES). Developed at the instigation of the U.S. Green Building Council, these guidelines are intended to do for landscape design what the LEED system has done for green building design and construction. Designers and gardeners will find that SITES provides both a blueprint for planning and a sort of tangible vocabulary in which they can express themselves sustainably.
- The biggest consumer of resources and energy in the average garden is the lawn. That's why in Chapter 3

nurseryman and designer John Greenlee presents alternatives, seducing former mower-addicts, as he has for more than twenty years, with his visions of sustainable meadow gardens. And if you'd still like a bit of clipped turf, as a play space for children perhaps, or a firebreak, prairie-plants guru Neil Diboll contributes a succinct epilogue on “no mow” lawns for ecological—and economical—landscapes.

- In Chapter 4, your guide is Rick Darke, a leading authority on the restoration of native species to their rightful place in the garden and a horticultural polymath who served for more than a decade as Curator of Plants at Longwood Gardens. His expertise is integrating and successfully balancing natives with non-invasive exotic species, and on the design of regionally adapted plantings.
- In Chapter 5, Eric Toensmeier examines how edible and useful plants can be assembled into functioning ecosystems, and how growing food sustainably can transform your garden, your cuisine—and maybe even your community. Broadening the scope of your garden to include the diversity of unconventional fruits and greens Toensmeier touts will reduce the environmental costs of your harvests while also enriching mealtimes with countless flavors you won't find in the corner market.
- Sustainability doesn't just involve the healing of the global environment; it is a way to address the continuing, challenging fallout of our history of abusive exploitation and development. In Chapter 6, David Wolfe of Cornell University shares his insights and offers ways for us to negotiate the inevitable stresses of gardening in an era of climatic upheaval.
- Water is both an essential resource and, potentially, a gardener's most potent tool. I've been studying the issues associated with water use by gardeners for twenty years, and in Chapter 7, I present a guide to reducing water consumption in the garden—and at the same time outline how you can turn your garden into a means for cleansing storm runoff, making it a boost for rather than a drain on the local water supply.
- One of the many benefits of sustainable gardening is that it can take your planting to a new level—literally. In Chapter 8, Ed Snodgrass and Linda McIntyre, leaders in the design and planting of green roofs, outline the potential this new sort of gardening has for reducing water pollution while also furnishing visual pleasure and serving as habitat for wildlife.
- Collaborating with nature in the sustainable garden means inviting the wild back in. Doug Tallamy, professor of entomology and wildlife ecology at

the University of Delaware, tells how to manage this re-opening of the borders in Chapter 9, and why doing so will benefit you, your neighbors, and other living creatures equally.

- Gardening sustainably means cultivating the soil as well as plantings. Elaine Ingham, a former professor at Oregon State University, has continued to pursue her research into the ecology of soil life. Chapter 10 tells how different ways of managing the garden affect the many players in the soil food web, and how growers of every kind can use this knowledge to promote plant growth and reduce reliance on inorganic chemical fertilizers and pesticides.
- And finally, Toby Hemenway, a gardener and thinker who has played a central role in translating permaculture principles to fit North American ecosystems, ties it all together in Chapter 11, through the concept of whole system design. For a sustainable gardener, this is the essential process of connecting the dots, of making every element of the landscape work in unison so that each reinforces and extends each other.

There isn't a single solution to any aspect of sustainability, and every one of the authors included in this book encourages experimentation. We view our advice as a beginning rather than an end point, for a

diversity of responses is going to be crucial to achieving success in this area.

### The payoff

Defenders of the status quo frequently complain that the economic and cultural reforms recommended by environmentalists are immediate in their costs, while the benefits are remote. This shouldn't dissuade us from making such investments in the future, of course. Still, it does make especially welcome the fact that the changes this book proposes are not only inexpensive but also almost instantaneous in their rewards.

Experience has shown many times that it's in response to a challenge that the best, most exciting gardens emerge. Certainly, the landscape we've created through our current lavish consumption of resources is disappointingly bland. Garden equipment powered with fossil fuels, cheap synthetic fertilizers and pesticides, and federal and state water projects that supply irrigation almost for free might seem to have made anything possible, horticulturally speaking. What they've achieved, though, is to make us lazy. They made it easy to impose the same, cookie-cutter model of landscape in every community across the United States, so that our gardens have, over the last couple of generations, lost much of their regional flavor.

The exceptions to this dreary rule have arisen most commonly in response to adversity. It was the droughts of the 1980s

that caused gardeners in the western states to experiment with more imaginative, locally adapted garden styles. In Arizona and New Mexico, gardens inspired by the local desert began to emerge. Californians began experimenting with drought-tolerant plants from their own state and from other climatically similar regions. It was in large part the concern over invasive weeds from abroad that drove the rediscovery of native plants over the last couple of decades; now we see prairie restorations and gardens in the Midwest, woodland gardens in the East and Northwest.

This isn't a new phenomenon. It was hunger, a need for a new and more reliable food source, that prompted Neolithic people to create the first gardens, and it is hunger that has enriched our plots since: we have gone back to the wild repeatedly for new crops and new sources of food. The need to protect the garden against animal and human intruders led to the architectural framing of gardens; the desire to create flat growing spaces in hilly terrain led to the terraced landscape masterpieces of the Italian Renaissance; and the scarcity of arable land in Japan encouraged the development of bonsai and other techniques that distilled broad experiences into small spaces. This relationship between need and ingenuity continues today: our newfound concern for sustainability has already created an explosion of rain gardens and green roofs. This is only a beginning. The challenges we confront are sure to pro-

duce endless innovation, and it will be our privilege to enjoy the results.

### Sustainable leadership

It's a testimony to our democracy, as imperfect as it may be, that in matters of environmental policy Americans have been accustomed to relying on leadership from the top down. We look to elected officials and to state and federal agencies for answers to environmental challenges. Certainly, the laws and regulations they issue will play an essential role. But by itself, these official measures cannot achieve the sort of door-to-door conversion that must occur; politicians and civil servants cannot impose a transformation of personal attitudes. For that, we need bottom-up leadership: we need personal, one-on-one persuasion. We need people willing to set an example in every community across the United States. In short, we need grass-roots activism on a massive scale. We need gardeners.

Grass roots are something gardeners know all about, and not just in the botanical sense. There's a long history in the United States of gardeners organizing for community action. The local garden clubs that began to appear in the late nineteenth century were social meeting places, but virtually all included in their mission statements the preservation of native trees and wildflowers. Despite their white-glove image, these organizations, with current membership in the hundreds of thousands, fund research at the cutting edge of