

Chances are, you have never thought of your garden - indeed, of all of the space on your land - as a wildlife preserve that represents the last chance we have for sustaining plants and animals that were once common throughout the United States. That is exactly the role our suburban landscapes are now playing, and will play even more critically in the near future. If this is news to you, it's not your fault.

We were taught from childhood that gardens are for beauty; they are a chance to express our artistic talents, to have fun with, and relax in. And, whether we like it or not, the way we landscape our properties is taken by our neighbors as a statement of our wealth and social status.

No one has taught us that we have forced the plants and animals that evolved in North America (our nation's biodiversity) to depend more and more on human-dominated landscapes for their continued existence. We have always thought that biodiversity was happy somewhere out there - "in nature" - in our local woodlot, or perhaps our national parks, or best of all "in the rain forest." We have heard nothing about the rate at which species are disappearing from our neighborhoods, towns, counties, and states.

We have never been taught how vital biodiversity is for our own well-being.

We Have Taken It All

The population of the United States, now nearing three hundred and six million people, has doubled since most of us were kids, and continues to grow by eight thousand forty-six people per day. This, coupled with our love affair with the car, and our quest to own ever-larger homes, has fueled urbanized development that continues to sprawl over two million additional acres per year (the size of Yellowstone National Park). We have connected all of our developments with four million miles of roads, and their combined paved surface could occupy roughly the area of Pennsylvania.

Somewhere along the way we decided to convert most of our leisure and decorative places, both at work and at home, into huge expanses of lawn. So far we have planted some forty million acres in lawn. Each weekend we mow to a one-inch height an area the size of Missouri or Oklahoma, and congratulate ourselves on a job well done.

To make things worse, the little woodlots and "open spaces" that we have not paved over or manicured are far from pristine. Nearly all are second-growth that has been thoroughly invaded by alien plants like autumn olive, multiflora rose, Oriental bittersweet, and Japanese honeysuckle. So far, over thirty-four hundred species of alien plants have invaded nearly two hundred million acres of the United States.

To nature lovers these are horrifying statistics. I stress them so that we can clearly understand the challenge before us. We have turned fifty-four percent of the lower forty-eight states into cities and suburbs, and forty-one percent more into various forms of agriculture. That's right: We humans have taken ninety-five percent of nature and made it unnatural. Most of the five percent we have left pristine is either too high or too dry to support much of anything.

So what does it matter? Are there consequences to turning so much land into the park-like settings humans enjoy? Absolutely. Both for biodiversity and for us. Our fellow creatures need food and shelter to survive and reproduce, and in too many places we have eliminated both. State natural heritage folks estimate that as many as thirty-three thousand species of plants and animals in this country are "imperiled." Many of those that haven't suffered local extinction are now too rare to perform their ecosystem role effectively. These can be considered functionally extinct.

The song birds that brighten spring mornings have been in decline since the nineteen sixties, having lost forty percent of their numbers. Birds that breed in meadows are in even more trouble. Once-common species such as

the northern bobwhite, eastern meadowlark, field sparrow, and grasshopper sparrow have declined eighty-two, seventy-two, sixty-eight, and sixty-five percent, in total numbers, and are completely absent from many areas that used to support healthy populations. Evening grosbeaks have declined ninety percent in fifteen years because we are leveling their boreal forest breeding grounds to make junk mail. For most of us, hearing such numbers triggers a passing sadness, but few people feel personally threatened by the loss of biodiversity.

Why We Need Biodiversity

Here is why every one of us should feel threatened. Here is why it matters. Losses to biodiversity are a clear sign that our own life-support systems are failing. The ecosystems that support us - that determine the carrying capacity of our Earth and our local spaces - are run by biodiversity. It is biodiversity that generates oxygen and clean water, creates topsoil out of rock, buffers extreme weather events like droughts and floods, pollinates our crops, and recycles the mountains of garbage we create every day.

Now, with human-induced climate change threatening the planet, it is biodiversity that could suck that carbon out of the air and sequester it in living plants if given half a chance. It is plants that turn sunlight into all of the food that supports life on Earth, yet we continue to reduce complex forests into lawns the world over.

Humans cannot live as the only species on this planet because it is *other species* that create the ecosystem services essential to our survival. Every time we force a species to extinction we promote our own demise. Biodiversity is not optional.

Parks Are Not Enough

I am often asked why the habitats we have preserved within our park system are not enough to save most species from extinction. Research has shown that the area required to sustain biodiversity is pretty much the same as the area required to generate it in the first place. Put another way: Species are lost in the same proportion with

which a habitat is reduced in size. The consequence of this simple relationship is profound. Since we have taken ninety-five percent of the United States from nature, we can expect to lose ninety-five percent of the species that once lived here, along with the services they have provided us.

The good news is that extinction takes a while, so if we start sharing our landscapes with other living things, we should be able to save much of the biodiversity that still exists.

Start Locally: Redesigning Suburbia

Scientific facts, deduced from thousands of studies about how energy moves through food webs, outline for us what it will take to give our local animals what they need to survive and reproduce on our properties: Native plants, and lots of them.

Here is the general reasoning:

- Plants are the source of all energy that supports life. In other words, all animals get their energy directly from plants, or by eating something that has already eaten a plant.
- Some animals don't eat plants directly. They must rely on other animals, which do eat plants, to transmit the energy.
- The group of animals most responsible for passing energy from plants to the animals that don't eat plants directly, is insects. This is what makes insects such vital components of healthy ecosystems. So many animals depend on insects for food (e.g., spiders, reptiles, amphibians, rodents, bats, and ninety-six percent of all terrestrial birds), that removing insects from an ecosystem spells its doom.

If you think back on our suburban landscaping history, getting rid of insects is exactly what we have tried to do. For over a century we have favored ornamental landscape plants from China and Europe over those that evolved right here. Among the reasons for favoring the imported plants has been the observation that they "are not subject to insect infestation."

Research now tells us that not all plants are created equal. Every plant species protects its leaves with a species-specific mixture of chemicals. With few exceptions, only insect species that have shared a long evolutionary history with a particular plant lineage have developed the physiological adaptations required to digest the chemicals in their host's leaves. Insects have specialized over time to eat only the plants carrying particular chemicals. When we present insects from Pennsylvania with plants that evolved on another continent, chances are those insects will be unable to digest them.

We used to think this was good. Avoid insect infestation by planting suggested species, and/or spray and kill all insects that do show up on our plants.

Now we know that an insect that cannot, for whatever reason, eat part of a leaf, cannot fulfill its role in the food web.

We have planted Kousa dogwood (*Cornus kousa*), a species from China that supports no insect herbivores, instead of our native flowering dogwood (*Cornus florida*) that supports one hundred and seventeen species of moths and butterflies alone. On hundreds of thousands of acres we have planted goldenraintree (*Koeleruteria paniculata*) from China, a tree that supports one caterpillar species, instead of a variety of our beautiful oaks, and we have lost the chance to grow five hundred and thirty-four species of caterpillars, all of them nutritious bird food. My own research has shown that native ornamentals support twenty-nine times more biodiversity than do alien ornamentals. Further, it's unnerving to learn that eighty-two percent of the woody invasives in our country are escapees of the horticultural industry.

Your Garden Has a Function

In the past we have not designed gardens that play a critical ecological role in the landscape, but we must do so in the future. The importance of our doing this cannot be overstated. We need to quickly replace unnecessary lawn with densely planted woodlots in

the East and West, and natural prairies in the Midwest; whatever can serve as habitat for our local biodiversity.

Homeowners can do this by planting the borders of their properties with plants native to their region: In the East, native trees such as white oaks (*Quercus alba*), black willows (*Salix nigra*), red maples (*Acer rubrum*), green ashes (*Fraxinus pennsylvanica*), black walnuts (*Juglans nigra*), river birches (*Betula nigra*) and shagbark hickories (*Carya ovata*), under-planted with woodies like serviceberry (*Amelanchier canadensis*), arrowwood (*Viburnum dentatum*), hazelnut (*Corylus americanus*), and blueberries (*Vaccinium spp*). Our studies have shown that even modest increases in the native plant cover on suburban properties significantly increases the number and species of breeding birds, including birds of conservation concern.

We have also recently demonstrated that homeowners needn't worry that native insects will defoliate their gardens. A diversity of native plants will support a diversity of native insects that, in turn, support a healthy community of natural enemies that keeps them in check. One bluebird pair brings up to three hundred caterpillars back their nest every day. You will be hard-pressed to find any caterpillars in your yard if you create habitat for breeding birds. In a recent study, homeowners who planted natives exclusively found that only three percent of the leaves on their properties were damaged by insects.

As gardeners and stewards of our land, we have never been so empowered to help save biodiversity from extinction, and the need to do so has never been so great. All we need to do is plant native plants.

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