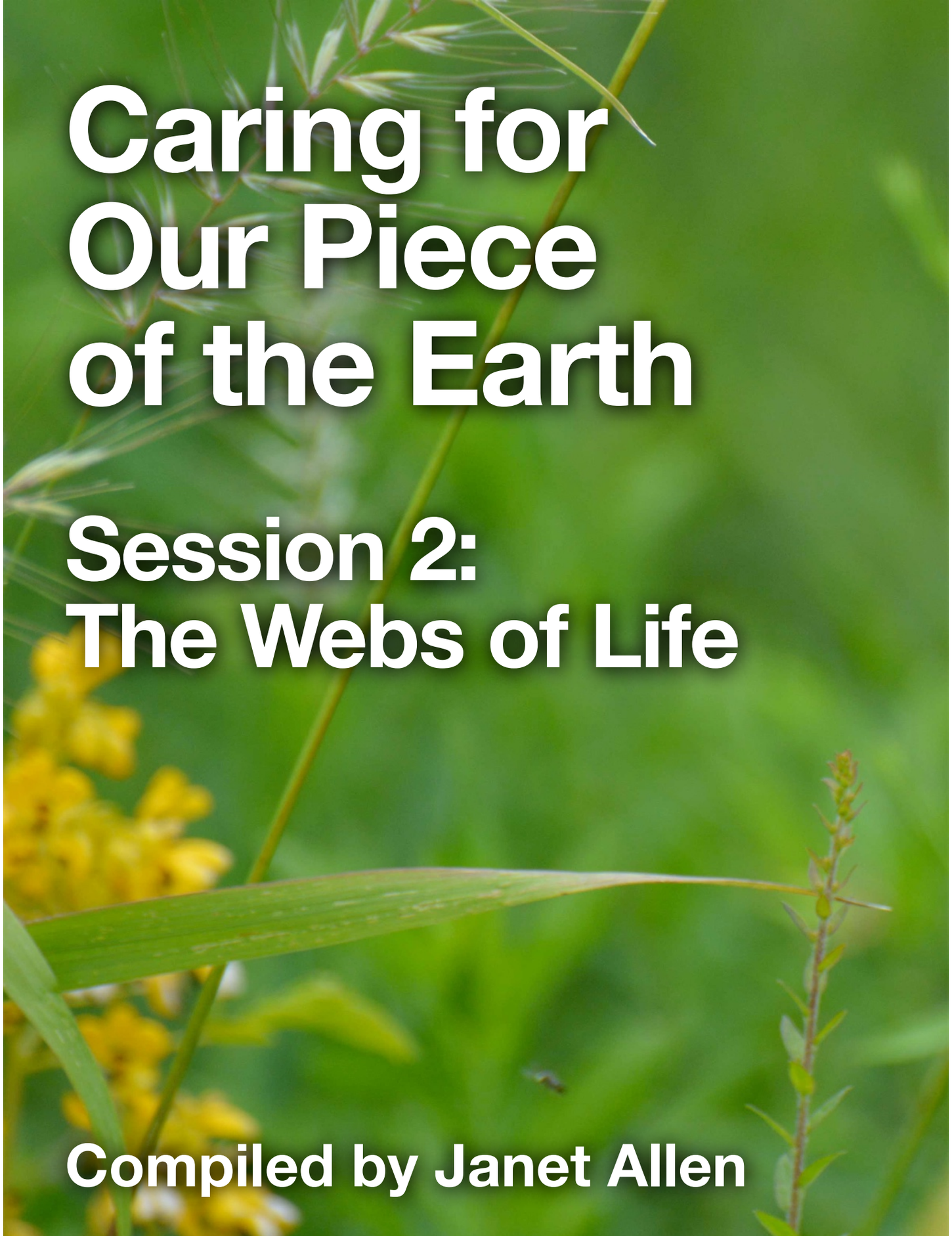

Caring for
Our Piece
of the Earth
Session 2:
The Webs of Life
Compiled by Janet Allen

Caring for Our Piece of the Earth

Session 2:
The Webs of Life

janetallen3@verizon.net
www.ourhabitatgarden.org

Updated 10/2/19

Caring for Our Piece of the Earth

The Webs of Life

To me the choice is clear. The costs of increasing the percentage and biomass of natives in our suburban landscapes are small, and the benefits are immense.

Increasing the percentage of natives in suburbia is a grassroots solution to the extinction crisis …

Our success is up to each one of us individually. We can each make a measurable difference almost immediately by planting a native nearby.

~ Doug Tallamy
Bringing Nature Home, pp. 286-287

Section 1

About this session

In this session we'll learn about the role of plants in the food web. We'll also discuss the impacts on the food web of replacing native plants with non-native plants, and the even greater impact of introducing non-native invasive plants.

Next, we'll learn about the hidden soil food web that supports healthy plants.

Finally, we'll learn some ways we can care for these food webs to support healthy ecosystems in our yards and beyond.

REMINDER: You don't have to read or view everything, but please read the material flagged with . Material titled in **BLACK** is recommended; material titled in **GREY** is optional.

Opening

If your group chooses to have this role, the Opener starts the session with an opening, *not more than two or three minutes,* about their relationship to the natural world.

Circle question

What are your favorite plants in your yard? Do you know if they're native or not?

Reminder to the facilitator: The circle question should move quickly. Elicit an answer from each participant without questions or comments from others.

There are many beautiful native plants, such as this cardinal lobelia (Lobelia cardinalis). The hummingbirds like it, too!

Pre-meeting activity: A walk through your neighborhood

You've probably taken many walks through your neighborhood, perhaps chatting with neighbors, noticing various home improvement projects, noting who has a cool new car.

But this time, take special note of the landscaping.

Here are some things you could observe:

- What is the average ratio of lawn vs. plants in the typical neighborhood landscape?
- Which plants are most commonly planted in landscapes?
- Do you know if the plants you see are native or non-native? Are there any plants considered to be invasive species?
- Are they planted in groups or as individual specimens?
- Are the landscapes three-dimensional, including (depending on your region) tall trees, shorter trees, shrubs, and herbaceous plants? If not, which layers tend to be missing?
- What is the usual treatment of the ground layer? Mulch, fallen leaves, stones, bare ground, plants?

We'll discuss your findings when we meet.

Discussion questions

1. **ACTIVITY:** What did you notice on your "walk through your neighborhood"?
2. Did one or two ideas from this session's articles or videos especially resonate with you? Briefly share why.
3. Many definitions of "native" include the criteria that they were here before the Europeans arrived. The Darke/Tallamy definition instead emphasizes relationships. What do you think about this distinction, especially in an era of climate change?
4. Consider the differences between homeowners' usual use of the term "invasive" and an ecological definition.
5. Have you had (or heard) any of the misconceptions mentioned in the *"Misconceptions I've heard"* article?
6. Would you find it appealing to live in the Austin home landscape featured in the *"Natives for Sustainability"* video?
7. What does your community do with the ground layer of their landscapes? Do people "leave leaves" or is there a culture of "clean-up overkill"?
8. Have you thought about the difference between "dirt" and "soil" before?

Putting it into practice

Here are some suggestions for putting into practice what you're learning in the coming days, weeks, months, and years.

- Find a list of plants native to your ecoregion. (Some are in Further Resources at the end of this section.) *Remember, a plant native in one region isn't necessarily native in another region even if it's on the same continent — despite the generic "native" label many commercial nurseries use!* Use plant lists from a reputable source compiled specifically for your own region.
- Find a list of plants that are not only non-native but also invasive in your ecoregion. (Some are in Further Resources at the end of this section.)
- Inventory the plants you currently have in your yard. Which are native to your region? Non-native? Invasive? "Nativars"?
- Create a "wish list" of natives you'd like to add to your yard and see where you might be able to purchase them.
- Explore the soils in your yard. Are there differences in the soils in different parts of your yard, perhaps related to different present or past landscaping practices?
- Think about ways you can help create and maintain a healthy soil food web in your yard.

In this forest, leaves remain to decay, feeding the soil

We can do the same at home, leaving fall leaves and other garden debris to enrich the soil and provide habitat for many creatures

Section 2

Plant terms

In the past, plants were often simply described as “pretty,” “carefree,” or “not bothered by pests.” After all, that’s what appealed to homeowners!

Now plants are increasingly characterized by terms such as “native,” “non-native,” “invasive,” “cultivar,” or even “just a weed.”

These terms often mean different things to different people and have varied implications for the plant choices we make.

Let’s start with definitions of some commonly-used terms.

Is joe-pye weed (Eupatorium maculatum) just a “weed”?

Optional: Quick Quiz Just for Fun

ANSWERS AT THE END OF SESSION 2

Row 1: Daisy	Daylily	Chicory	Lilac
Row 2: Dandelion	Cardinal lobelia	Queen Anne’s lace	Forsythia
Row 3: Daffodil	Peony	Tulip	Petunia

What is “native”?

There is no one agreed-upon definition of what is “native,” but the following definition is a good one:

“A plant or animal that has evolved in a given place over a period of time sufficient to develop complex and essential relationships with the physical environment and other organisms in a given ecological community.”

~ RICK DARKE AND DOUG TALLAMY
THE LIVING LANDSCAPE, P. 93

Oak trees, such as this red oak, have many relationships with other organisms.

What is a non-native plant?

“A plant introduced with human help (intentionally or accidentally) to a new place or new type of habitat where it was not previously found. Note: Not all non-native plants are invasive.”

~ USDA

The familiar hosta is actually a non-native plant from Asia.

What is a naturalized plant?

“A non-native plant that does not need human help to reproduce and maintain itself over time in an area where it is not native. Notes: Even though their offspring reproduce and spread naturally (without human help), naturalized plants do not, over time, become native members of the local plant community.”

~ USDA

Though many people think of daisies as the quintessential wildflower, they were imported from Eurasia long ago and are naturalized in many locations.

What is an invasive plant?

“A plant that is both non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting plant communities or ecosystems.”

~ USDA

NOTE: Although some native plant species may spread aggressively, only non-native plants are technically “invasive.”

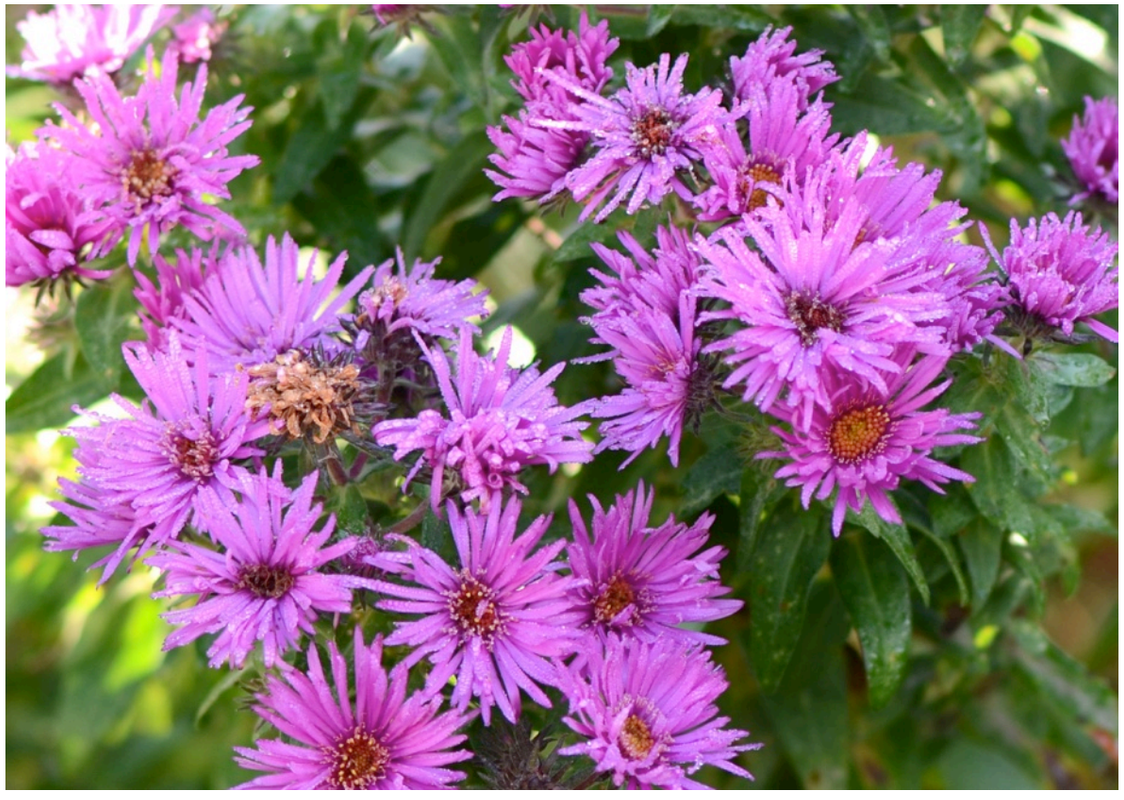
Though widely sold and planted, burning bush is a non-native that invades natural areas. How? By birds eating the berries, then excreting their seeds (along with built-in “fertilizer”) when they happen to fly over natural areas!

What is a cultivar? A nativar?

“A cultivar is a clone or seed strain selected for a particular trait or traits. It's written capitalized, unitalicized, and in single quotes, i.e., Trillium grandiflorum 'Rosalie'*.”*

~ WILLIAM CULLINA, WILDFLOWERS, P.6

A new term has popped up in the last few years: “**nativar**.” This term indicates that it's a cultivar or hybrid of a native plant.



Though attractive to humans, few insects appeared at this cultivar of a native aster, especially when compared to the species.

What is a “weed”?

A weed is a plant (native or non-native) that is not valued in the place where it is growing.

~ COMMON USAGE

“*Any plant that poses a major threat to agriculture and/or natural ecosystems within the United States.”*

~ USDA

“Weed” in a name doesn’t make it a “weed”!

The term “weed” reflects people’s goals for their land, but has no ecological meaning!

Milk“weed” is essential food for monarch caterpillars

Joe-pye “weed” is a handsome nectar-rich native that also provides seeds for birds

Misconceptions I've heard by Janet Allen

"So you want me to plant weeds?"

People sometimes object to the recommendation to plant native plants because they assume that native plants are the weeds they see in untended urban areas; i.e. plants not intentionally planted.

Ironically, most plants found in these areas are non-native plants, often brought by early settlers and since naturalized. They're very familiar to people, and since they've been here so long they assume they're what we mean by "native" plants.

Purple loosestrife, chicory, Queen Anne's lace, and other non-native plants

"I know vinca is native – I see it growing all over out in the country."

Some non-native plants were frequently planted near old homesteads long ago, such as this vinca shown carpeting land at a nature center. The houses are long gone, but the plants remain … and spread. Just because something is growing out in the wild doesn't mean it's native.

This nature center is noted for its beautiful spring ephemerals such as trillium, bloodroot, and the like. But non-natives such as this vinca, garlic mustard, and others have taken over many areas.

“Burning bush must be fine. I bought it at the garden center.”

Many people assume plants sold at garden centers are obviously suitable for home landscapes. On the contrary, many plants sold in garden centers are non-native invasive plants, such as these burning bushes.

Efforts to ban commonly-sold invasive (but profitable) plants have often been thwarted by the horticultural industry.

Burning bush is used extensively because it’s cheap — in all senses of the word!

Just a few more of the many invasive plants *still being sold*:

English ivy

Various cultivars of Japanese barberry are used in commercial and in home landscapes

Native or not?

Why are native plants so important?
by Doug Tallamy / University of Delaware

Please watch this 2-minute video (at bottom of the following webpage)**:**
http://audubonva.org/audubon-at-home-1

A true story with a moral

Seeing truckloads of plants arriving to create a landscape around a new house, the supervising landscaper was asked, “Are these native plants?”

“Yes,” he replied. (Pause.) “Well, not ‘technically native,’” he amended.

The plants being unloaded? Camellias — undoubtedly beautiful, but “technically native” only to Asia!

The moral:
Do your own research to find **truly** native plants!

Diane’s prairie
by Tony Collings

This short video is about the beauty of native plants and their importance for the health of the planet. It focuses on one member of the native plant movement who gardens with plants that support insects and birds.

A prairie is appropriate in some ecoregions, but perhaps not in yours. Burns are common in some areas, but not others. But this film isn’t just about how to create a prairie, but rather is an example of taking action to create appropriate natural landscapes using plants native to an area – an example of dedication, stewardship, and of “caring for our piece of the earth.”

A beautifully filmed, inspiring video! **Highly recommended!**

Please view this 6-minute video:
https://www.youtube.com/watch?v=BAGQ7sppeL4

A sign you can display after certifying your yard

Natives for sustainability

Please view Episode 116 of the PBS series *Growing a Greener World*.

This video features the Lady Bird Johnson Wildflower Center and also a family that created a Certified Wildlife Habitat.

Please view the first 18 minutes of this video:

http://www.growingagreenerworld.com/episode116/

Native, or Not So Much? by Janet Marinelli / NWF

Native plants transformed into flashy "nativars" may look pretty, but are they good for wildlife?

Please read:

https://www.nwf.org/Magazines/National-Wildlife/2016/JuneJuly/Gardening/Cultivars

Flower Power: A Q&A with Annie White by Nancy Lawson / The Humane Gardener

Native plants transformed into flashy "nativars" may look pretty, but are they good for wildlife?

Please read:

http://www.humanegardener.com/flower-power-a-qa-with-annie-white/

Nativars: Where do they fit in? ~ Wild Ones

An excellent description of the issues concerning nativars. [This is the official Wild Ones position statement on the issue.]

(Not currently available) OPTIONAL: Download the PDF at www.wildones.org/wp-content/uploads/2011/12/Nativars-Statement.pdf

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From nursery to nature: Are native cultivars as valuable to pollinators as native species? by Annie S. White

OPTIONAL: ongoing research on nativars:

https://pollinatorgardens.org/2013/02/08/my-research/

I was fooled!
by Janet Allen

When I started my habitat garden in the late 1990s, native plants were difficult to find in my area. Wanting to plant shrubs that produced berries for birds, I was thrilled to discover that a local nursery had a native shrub known to be favored by birds: serviceberry (*Amelanchier canadensis*).

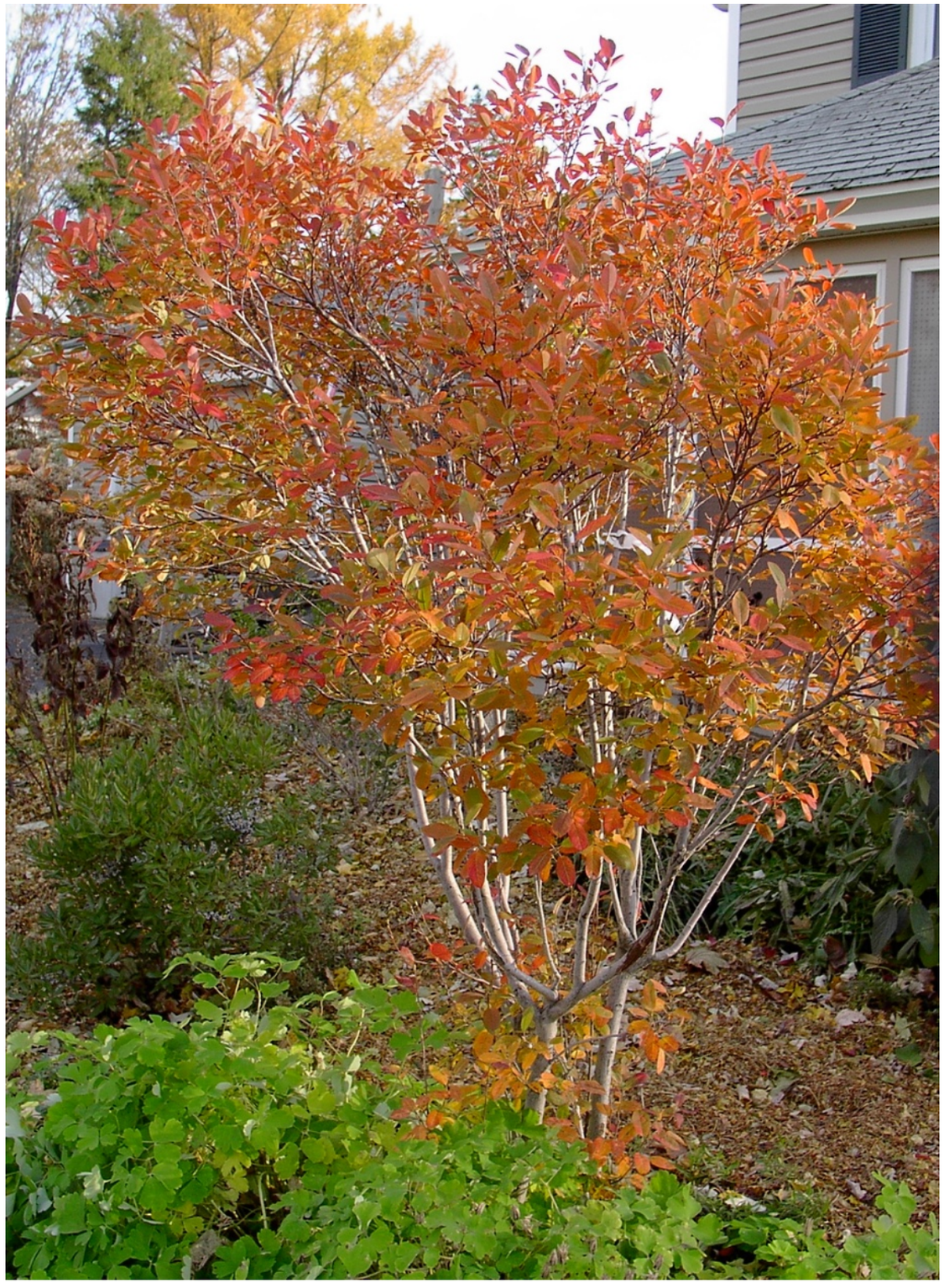
It grew well, and I eagerly waited for berries so I could watch birds enjoying the feast. I waited and waited. Finally, berries appeared, but very few.

Meanwhile, I had planted a second *A. canadensis*. This one soon produced the promised masses of berries the birds indeed devoured.

Why did one serviceberry produce berries and not the other? The first one was the patented cultivar 'Glenn Form'; the second was the much more affordable plain species.

After a few years, we cut down that expensive cultivar. Sure, it was ornamental, but our land could be better used by a plant that supported life.

Note: My experience isn't unique. As the Missouri Botanical Garden notes, in this cultivar *"... less than 10% of the flowers produce mature fruit."* http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=293359



The 'Glenn Form' cultivar of the native Amelanchier canadensis

Ecological implications of “native” by Doug Tallamy

A gingko tree in fall

“There is another reason we should be cautious about the ecological ramifications of the label ‘native.’ Most people talk about native plants within the context of their geographic origin rather than their ecological function. …

For example, Ginkgo biloba, the oldest living tree species on earth, used to have a global distribution…. Gingko disappeared from North America seven million years ago, yet because it once lived in what is now Virginia, some claim that it is a tree native to Virginia. …

It is likely that North American ginkgoes once supported a large and complex food web, including many insect herbivores that specialized on its leaves. Once ginkgo disappeared, however, what do you think happened to those insect specialists?...

An ecosystem is the combination of an interacting community of living organisms and their physical environment, functioning as an ecological unit in a given place. The operative word in this definition is ‘interacting.’ ...

There are so many specialized relationships in ecosystems that we can easily say ecological specialization is the rule rather than the exception. Most organisms depend on relationships with particular species or particular kinds of species for their existence; any old species will not do. The species that evolved within an ecosystem are what created that ecosystem over time and they cannot be interchanged willy-nilly without destroying the relationships that drive functions in that particular ecosystem.

We have also learned that, in the absence of human tinkering, the more interacting species there are in an ecosystem, the more stable and productive is that ecosystem. ...

Traditional residential landscapes built from turf grass and Asian ornamentals are novel ecosystems, as are our county, state, and national parks that are overrun with Bradford pear, kudzu, Oriental bittersweet, privet, multiflora rose, bush honeysuckle, buckthorn, Japanese honeysuckle, ailanthus [tree of heaven], Japanese knotweed, Norway maple, and burning bush. These ecosystems have lost many of the relationships sustained by indigenous plants.”

THE LIVING LANDSCAPE, PP. 105-108

Section 4

Invasive plants

Invasive plants have not only altered our home landscapes but also our natural areas. They can disrupt ecosystems, reduce biodiversity, and destroy habitat.

Three points:

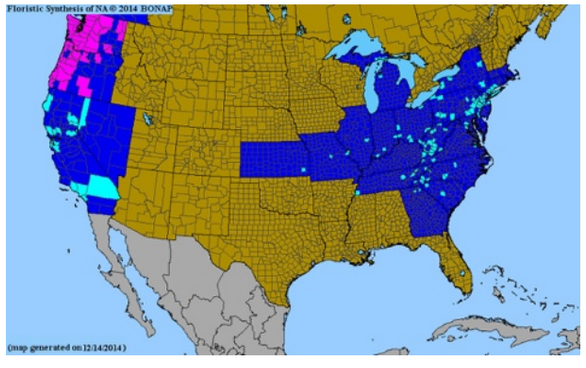
First, some overly exuberant native plants can feel invasive in your home landscape if they're taking up more than their fair share of space and invading ever more space. But as annoying as this can be, this is primarily a landscaping problem, not an ecological one. Native plants are **not** officially termed "invasive."

Second, not every non-native plant is invasive. But these non-invasive plants usually don't have relationships with native plants and animals, so the problem is that they take space that native plants might more profitably use to provide habitat.

Third, plants that become invasive in one region may not become invasive in another. Sometimes, though, there's a "lag phase" before a non-native seemingly non-invasive plant leaps out of our gardens and invades the world beyond — and by then it's too late to easily eradicate it.

Caution: Not all extension service advice should be followed!

Although most extension services provide valuable information most of the time, sometimes they lean toward conventional gardening rather than thinking about healthy ecosystems beyond our yards. Buddleia, often called butterfly bush, for example, is recommended by the NC State Extension (https://plants.ces.ncsu.edu/plants/all/buddleia-davidii/) even though it is widely recognized as an invasive plant even in North Carolina (https://www.inaturalist.org/guide_taxa/355854), escaping from our yards into the world beyond.



BONAP.org showing extent of buddleia invasion

“My burning bush isn’t going anywhere!” by Janet Allen

When I note in my presentations that burning bush *(Euonymus alatus)* is a problem since it invades natural areas, some people are indignant. “My burning bush stays put. And I don’t see seedlings in my yard.”

I’ve learned that people are very attached to this plant! It’s inexpensive to buy, easy to grow, and has bright red leaves in the fall — if it’s growing in a sunny location.

It’s understandable that people don’t think it’s invading forests. First, it doesn’t “burn” if it’s growing in shade so it’s hard to notice.

Burning bush berries

Second, they’re correct about their particular plant. It isn’t walking out of their yard and into the woods. But as you will see in the following Japanese barberry video, seeds from the burning bush berries can be dispersed by birds.

Burning bush growing in shade doesn’t “burn” very brightly

Though not immediately obvious, this shady forested area was infested with burning bush, “disguised” as a plain green shrub

With such beautiful alternatives as this native blueberry in its glorious fall color, why do we need the invasive burning bush?

Going rogue: Story of Japanese barberry ~ Univ. of Minnesota Extension

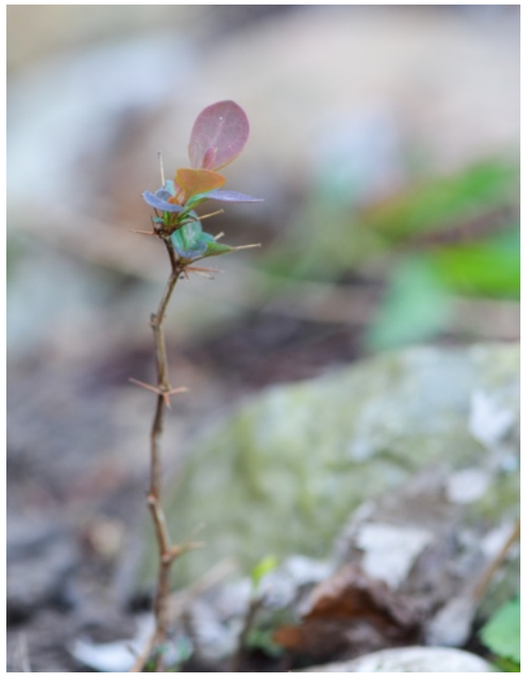
An excellent video explaining how barberry can spread, problems it causes, and how to manage it.

Please watch this 3-minute video:

https://www.youtube.com/watch?v=ZA7r2kMO2Z0

Yes, as this sign at the famous Longwood Gardens says, "Japanese barberry attracts birds" ... BUT is that a sufficiently good reason for growing it? Ultimately, it results in less habitat for birds as it invades natural areas.

Japanese barberry has invaded this wooded area



This barberry seedling was found growing in a home garden years after the original plant was removed.

Japanese barberry and burning bush are just two examples of the problems caused by invasive plants that escape from cultivation. There are *many more* invasive plants, many of which are still being sold, promoted, and planted.

And managing these invasives is expensive. One estimate* for Indiana alone is $86 million a year.

* Indiana Natural Resources Council

Sorry, birders
by Sara Stein

"Sorry, birders: I must now hit this nerve. The fact that a plant feeds birds does not vindicate its use.

It is true that without the northward spread of multiflora roses, we Yankees would not enjoy the song of mockingbirds on moonlit nights. But if those rose hips enable one bird to make it through our northern winters, the meadows that might otherwise flourish where multifloras have invaded would support many more bird species on the myriad insects they provide in spring and summer, the variety of the grains and flower seeds they offer in the winter, and the rodent diet they serve up throughout the year.

One slaps the label "weed" on a species, not because it is without virtue, but because whatever virtues that plant may have cannot outweigh the countless virtues of the entire habitat it displaces …

…

In California, at a conservation forum attended largely by people who have come to be called "tree huggers," a sweet-faced young woman reproached me for my prejudice toward aliens. "After all," she said, "all plants grow from the same earth."

No, they do not. They grow in different portions of the earth, in differing conditions and as members of distinct communities within which, biologically speaking, they know their place. Move them from that place, release them from their competitors, free them from their predators, give them license to behave without the external disciplines that have controlled their behavior in their homeland, and they may grow up barbarians."

~ PLANTING NOAH'S GARDEN, PP. 172-173, 175

Originally promoted as living fences and to benefit birds, multiflora rose was planted extensively - 20 million plants in North Carolina alone! It is now recognized as a noxious weed.

More examples of just a few common invasive plants many of which are *still being sold*

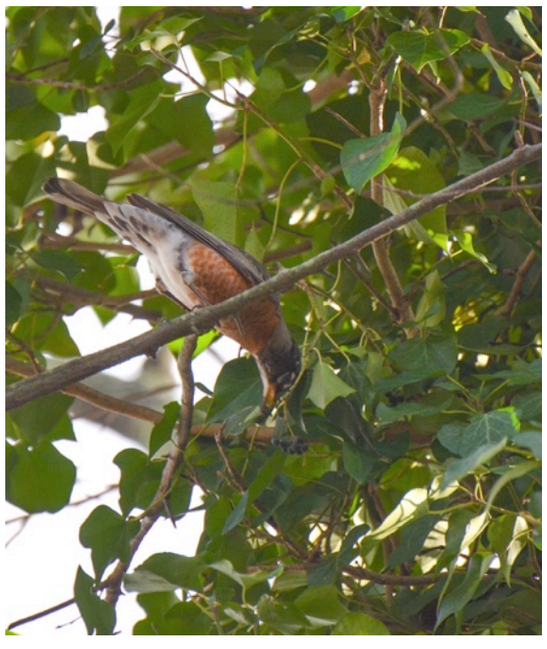
And as Will Rogers said,

"If you find yourself in a hole, stop digging."

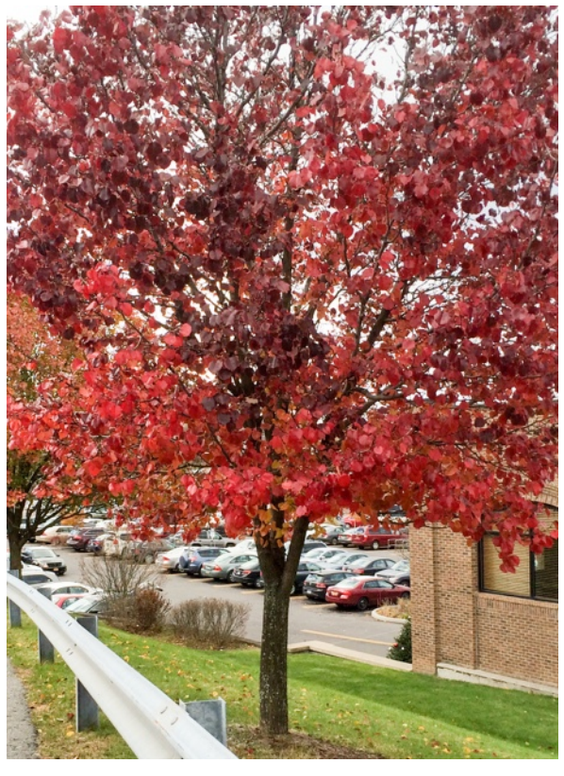
Dame's rocket (Hesperis matronalis), not to be confused with the similar-looking but native phlox (which has 5 petals, not 4.)

Privets such as Chinese privet (Ligustrum sinense) are one of the top invasive plants in the Southeast.

Various varieties of bamboo



English ivy (Hedera helix) - about to be spread by a bird eating its berries

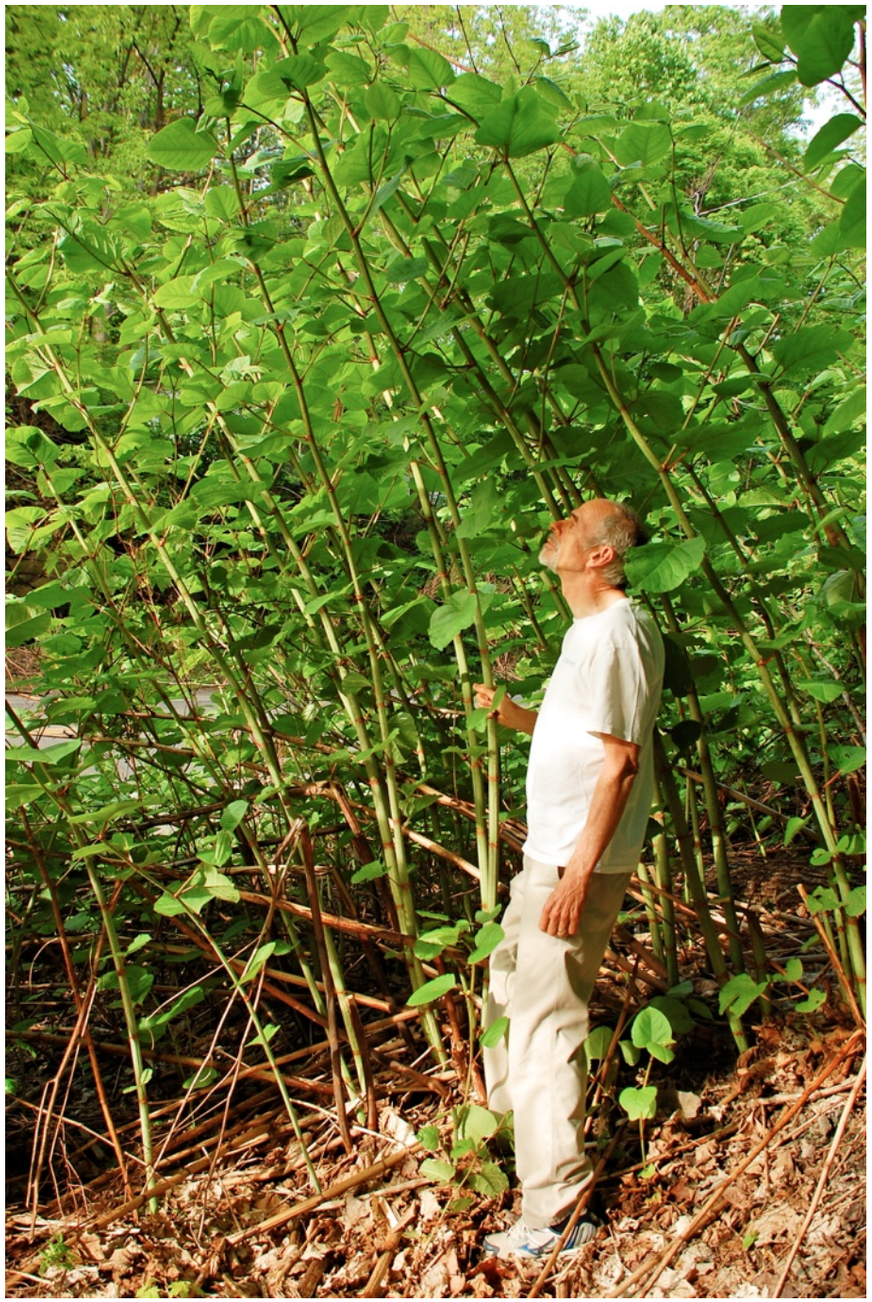


Bradford aka callery pear (Pyrus calleryana)

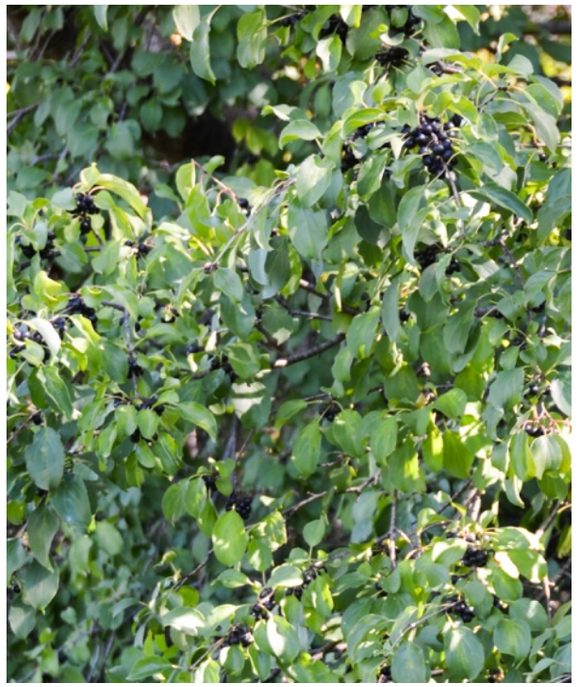
Norway maple (Acer platanoides), in this case the cultivar ' Crimson King.' (Yes, this is a Norway maple!)

And some that aren't (generally) sold

Here's just a small sample of plants invading and degrading natural areas in various parts of the country.



Japanese knotweed (Polygonum cuspidatum)



European buckthorn (Rhamnus cathartica)

Black swallowwort (Cynanchum louiseae)

Purple loosestrife (Lythrum salicaria)

Swallow-wort, a milkweed relative, is a particular threat to monarch butterflies, but also to biodiversity in general. Learn more about pale and black swallow-wort at http://news.cornell.edu/stories/2014/04/invasive-vines-swallow-new-yorks-natural-areas

Garlic mustard (Alliaria petiolata)

Can't they eventually be considered "native" if they're here long enough?

Don't plants and ecosystems evolve and change? Why wouldn't plants originally not part of an ecosystem eventually be considered "native"?

One thing to remember is the time scale in which evolution takes place. A few hundred years seems like a long time to humans, but is not long in evolutionary terms.

Common reed (Phragmites australis) forms dense thickets, displacing native wetlands plants, altering hydrology, and blocking sunlight to the aquatic community.

As Tallamy notes in *Bringing Nature Home*, in its homeland the non-native phragmites supports 170 insects, but even after being in North America more than 300 years, it still supports only 5 insects. It just takes up space — and lots of it.

On a global basis ... the two great destroyers of biodiversity are first, habitat destruction and second, invasion by exotic species.

- E. O. Wilson

Section 5

Zones vs. Ecoregions

Plants exist in both a particular ecoregion and in a particular hardiness zone.

Hardiness zones indicate where plants can survive in terms of the minimum winter temperature. For example, both New York and Montana include hardiness zone 4, so a plant native to New York's zone 4 could survive in Montana's zone 4.

The ecoregion map (on the next page) shows natural communities of plants. That plant from New York might be able to survive in Montana, but does it belong there?

The continents of Asia and Europe have many plant hardiness zones in common with the US, which is why plants from Europe and Asia can grow here — in other words, they **survive** the winter temperatures in that zone.

BUT do they belong here? In other words, do they have **relationships** with the other plants and animals in the region?

When you're looking for native plants that support life, think ecoregion, not hardiness zone.

What ecoregion are you in?

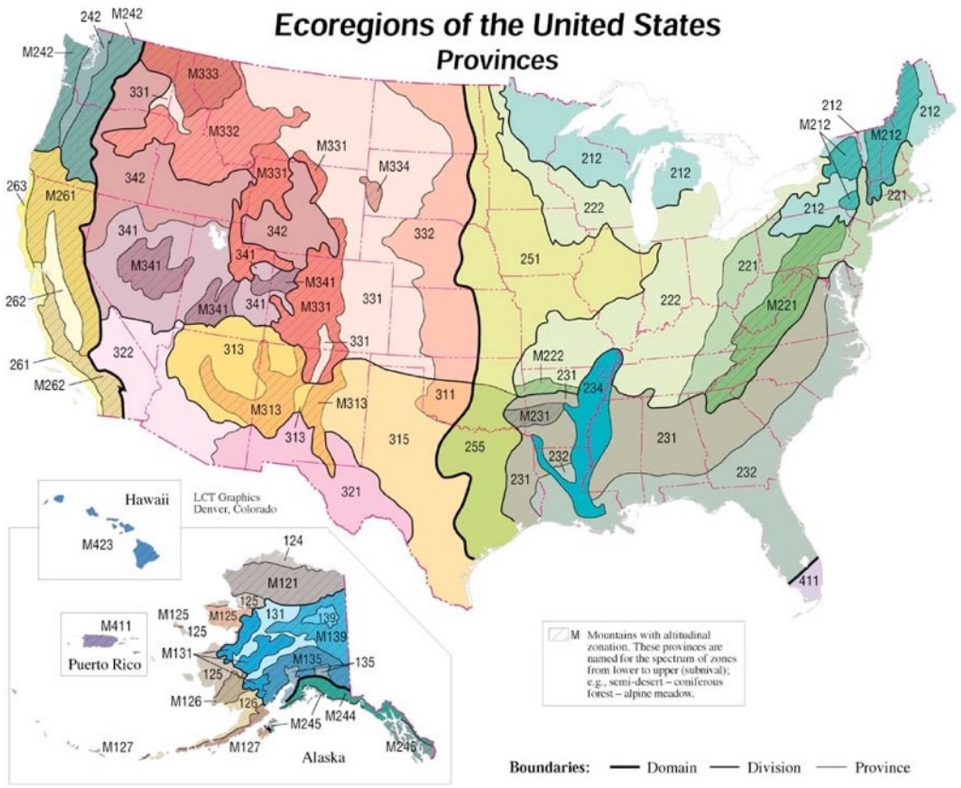
Except for general principles which apply most everywhere, for many choices it's important to know your own ecoregion

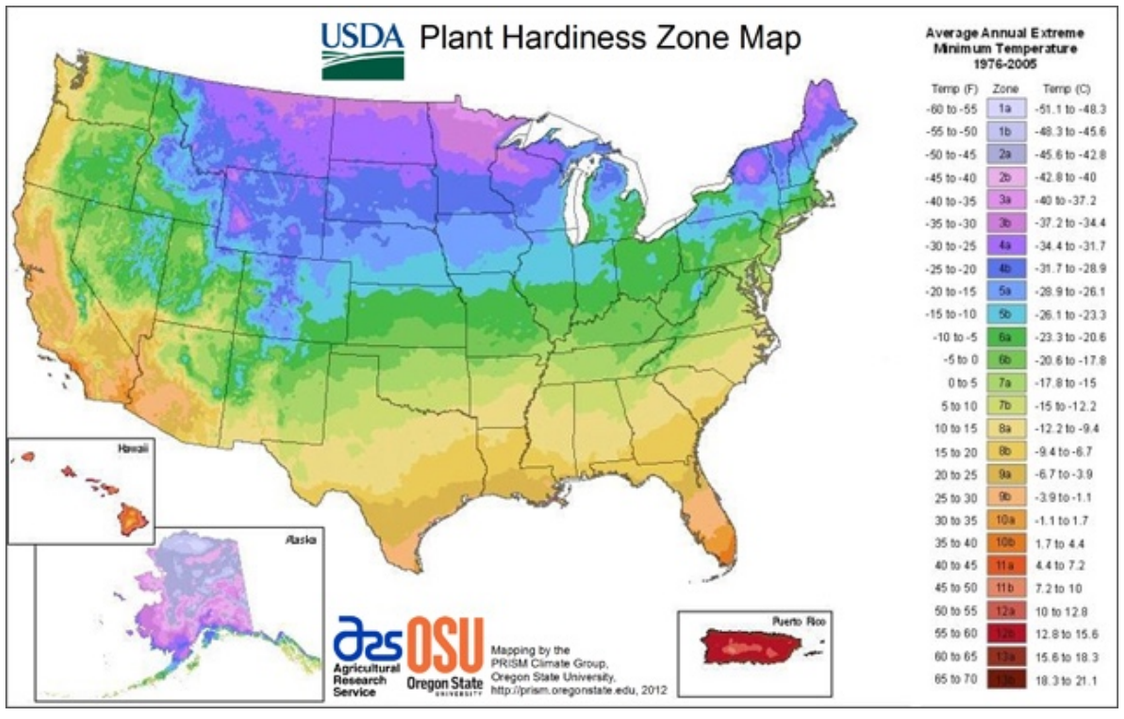
Find your own ecoregion on The Habitat Network at:
http://content.yardmap.org/learn/eco-regions-us/

Why hardiness zones, native ranges and ecoregions
by Mariette Nowak / Wild Ones Journal

This article includes the same ecoregion map as shown on the next page, **but with the names of the ecoregions included**.

(Not currently available) OPTIONAL:
https://www.wildones.org/wp-content/uploads/2012/02/Ecoregion-Brochure.pdf



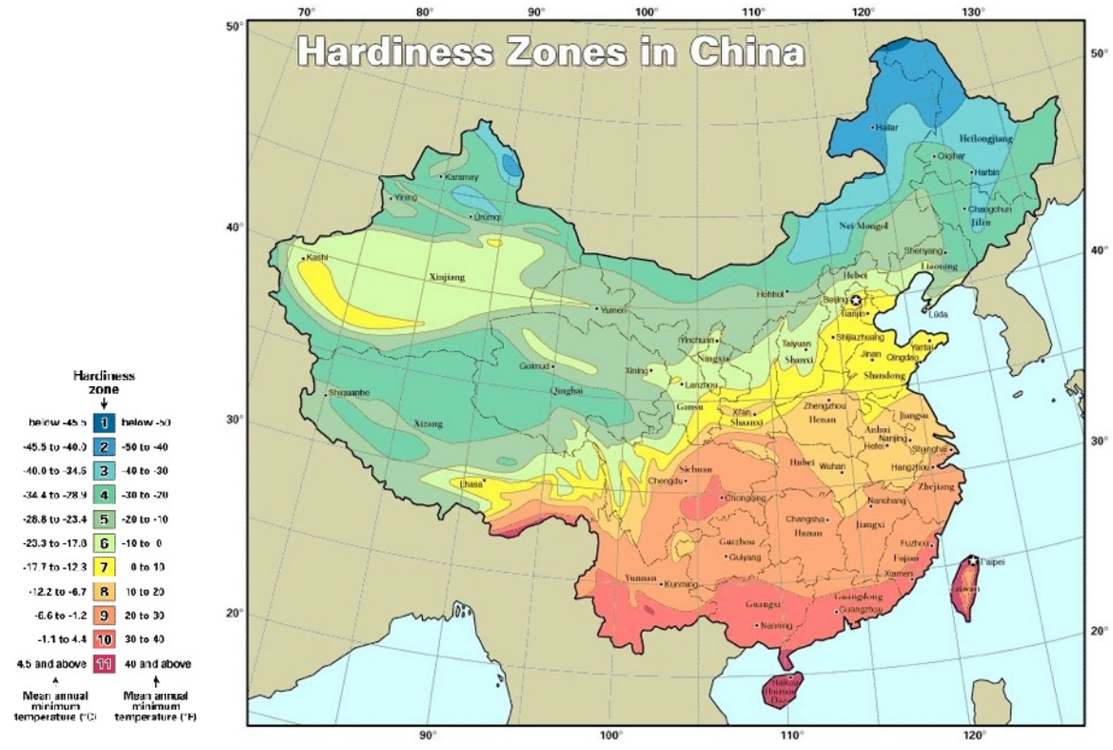


Why have so many ornamental plants been introduced from China?

Because they are able to grow here!

The plant hardiness zones of China and the U.S. are very similar, meaning that plants that can survive the winter in a particular zone in China can survive the winter in that same zone in the U.S. For example, a plant from Zone 4 in China can survive the cold winters of Zone 4 in the U.S.

BUT that doesn't mean they have *relationships* with other plants and animals. The *ecoregions* are NOT the same.



Plant hardiness zones in China -
Map by Mark P. Widrlechner, USDA-ARS North Central Regional Plant Introduction Station, Ames, Iowa.

Local ecotype guidelines ~ Wild Ones

"Local ecotype" is a plant from local or regional sources with similar conditions as the site where plants are being planted.

For example, swamp milkweed (*Asclepias incarnata*) is native to both New York and North Carolina. They may look the same to gardeners, but the ecotype for this species will be genetically distinct in each location.

(Not currently available) OPTIONAL:
https://www.wildones.org/wp-content/uploads/2014/05/Local-Ecotype-Guidelines.pdf

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Citrus greening: What can we learn? by Susan Reed

This article details one example of a non-native pest that is affecting our citrus industry. It's an example of the importance of buying locally-grown native plants.

OPTIONAL:
http://susanreedla.com/blog/archives/native-plants-and-gardens/128-citrus-greening-what-can-we-learn.html

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What have we lost or are we in danger of losing?

We've discussed the impact of non-native invasive *plants* on ecosystems, but that is not the only threat.

Many exotic pests and diseases have entered our continent by means of plants being brought from other continents for ornamental horticulture. (Others have arrived in shipping containers etc.)

Some of these pests and diseases have (so far) been confined to one area of the continent; others have spread far beyond the initial infestation.

A native arrowwood viburnum, killed by repeated attacks of the viburnum leaf beetle, an exotic pest

Here are just a few of the many past and future threats to healthy ecosystems

Chestnut blight fungus from Asia in the late 1800s — considered the most consequential loss of all time for both people and wildlife

Dutch elm disease, probably from the Himalayas by way of the Dutch East Indies

Emerald ash borer from Northern China and Korea

Dogwood anthracnose, possibly introduced by means of Kousa dogwood but origin is uncertain

Hemlock wooly adelgid, native to Asia

Gypsy moth, native to Europe and Asia

Earthworms (in areas where glaciers had existed), some brought from Europe; now a new Asian invader

Beetles:

- *Viburnum leaf beetles* from Europe and Asia,
- *Great mountain pine beetles*, likely to be the largest insect outbreak on the planet in recorded history
- *Japanese beetle* from northern Japan

Affecting oaks:

- *Oak wilt*, possibly introduced from Central or South America
- *Sudden oak death*, probably from Asia

Other exotic pests and diseases affect our food crops. Here are just two examples:

Brown marmorated stink bug from Asia

Basil downy mildew, perhaps from Uganda

Think about:

- Which of these have affected your ecoregion? Which are expected to reach your ecoregion in the future?
- How many losses can we sustain and still have functioning ecosystems and food crops for future generations?

The non-native oleander aphid was likely introduced with the non-native ornamental oleander plants.

What to plant in your area

This section includes general lists that cover the continent as well as resources that are region-specific.

This is not a complete list. If you have other resources from credible sources for native plants or invasive plants for your region, send them along and I'll include it in a future edition of this study guide. (Email janetallen3@verizon.net.)

Native plant lists for all ecoregions

These websites and books include all native plants in North America and you can search these lists to find the ones native to your ecoregion. (Regional lists are in the next section.)

On the web

Biota of North America Program

This lists plants for each county as to whether they're native, non-native, or extirpated (see their color key).

http://bonap.org

Native Plants Finder

~ US Forest Service, Nat'l Wildlife Fed'n, Univ. of Delaware

Just enter your zip code to get a list of plants native to your area. Based on Doug Tallamy's work; ranked by the number of butterfly and moth caterpillars that use them as host plants.

http://www.nwf.org/NativePlantFinder/Plants

Lady Bird Johnson Wildflower Center

You can search by state and by cultural conditions. But note that any given state is likely to have more than one ecoregion.

Individual plants:

http://www.wildflower.org/plants/

List for your state:

https://www.wildflower.org/collections/

Audubon Native Plants for Birds

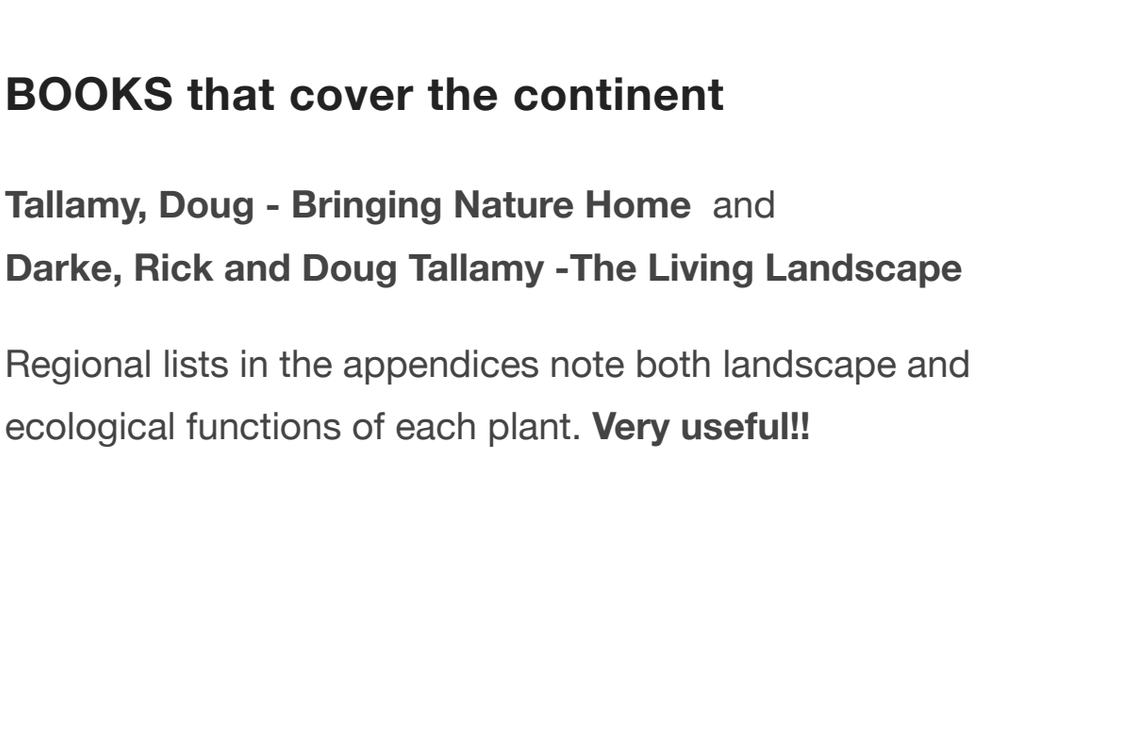
You can enter your zip code to find native plants for your area.

http://www.audubon.org/plantsforbirds

BOOKS that cover the continent

Tallamy, Doug - Bringing Nature Home and
Darke, Rick and Doug Tallamy -The Living Landscape

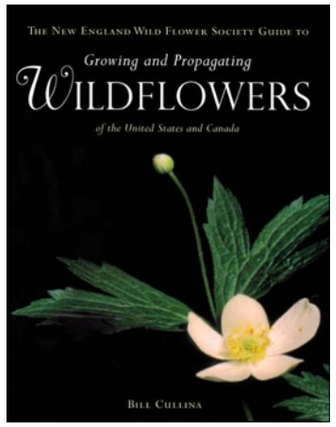
Regional lists in the appendices note both landscape and ecological functions of each plant. **Very useful!!**



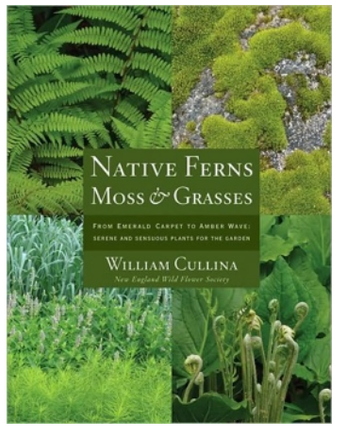
The Living Landscape book has excellent information in the appendices

Cullina, William

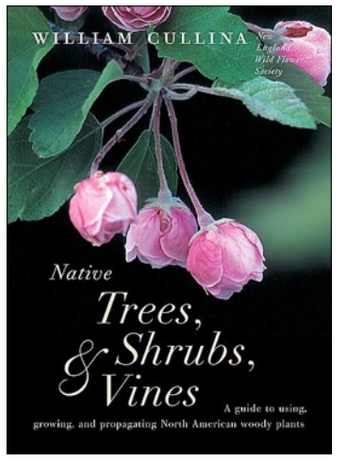
These three books by William Cullina are out of print but are available as used copies. They have wonderful descriptions of the plants, cultural requirements, and wildlife benefits.



Growing and Propagating Wildflowers of the United States and Canada



Native Ferns, Moss, & Grasses



Native Trees, Shrubs & Vines

State and regional native plant resources

Most states and regions have native plant societies or other native plant organizations. Sometimes they simply list all plants — native or non-native — that are **present** in a region, not necessarily **recommended**. In these cases, ***make sure you filter for "native"*** rather than assume that all plants listed are suitable.

CAUTION: Many state extension services have excellent materials, but some still focus on conventional landscaping and sometimes recommend non-native or even invasive plants.

NOTE: The following resources refer to general regions of the country, not technically ecoregions.

Biological diversity
is the key to
the maintenance
of the world
as we know it.

~ E. O. Wilson,
Biodiversity

The Northeast, Mid-Atlantic, New England

New York Flora Association
Lists all plants present in NYS. *To find native plants be sure to select "Yes" for the "Native" filter.*
http://www.newyork.plantatlas.usf.edu/Default.aspx

GoBotany ~ Native Plant Trust (formerly New England Wildflower Society)
Discover thousands of New England plants, with a Plant ID guide.
https://gobotany.nativeplanttrust.org/

Connecticut Botanical Society
Links to plants are in the left hand menu:
https://www.ct-botanical-society.org/

BOOKS for the Northeast, Mid-Atlantic, New England

Leopold, Don
Native Plants of the Northeast
Includes plants east of the Mississippi, especially Northeast.

Summers, Carolyn
Designing Gardens with Flora of the American East

The Southeast

Going Native: Urban Landscaping for Wildlife with Native Plants
~ NC State

Why go native, how to go native, and how to create your own native landscape. Excellent!
https://www.ncsu.edu/goingnative/index.html

North Carolina Audubon

They have a list of **700 Bird-Friendly Native Plants** at:
http://nc.audubon.org/700

And a lot of good information about **Bird-friendly Communities** at:
http://nc.audubon.org/conservation/conservation/bird-friendly-communities

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Carolina Nature
by Will Cook
Good photos of Southeast native plants.
http://www.carolinanature.com/plants/

BOOKS for the Southeast

Mellichamp, Larry et. al.
Native Plants of the Southeast: A Comprehensive Guide to the Best 460 Species for the Garden

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The Midwest and Plains

BOOKS for the Midwest and Plains

Branhagen, Alan
Native Plants of the Midwest: A Comprehensive Guide to the Best 500 Species for the Garden

Wasowski, Sally
Gardening with Prairie Plants

About trees

The Hidden Life of Trees: What They Feel, How They Communicate—Discoveries from a Secret World

by Peter Wohlleben

From Amazon review:

Are trees social beings? In this international bestseller, forester and author Peter Wohlleben convincingly makes the case that, yes, the forest is a social network. He draws on groundbreaking scientific discoveries to describe how trees are like human families: tree parents live together with their children, communicate with them, support them as they grow, share nutrients with those who are sick or struggling, and even warn each other of impending dangers. Wohlleben also shares his deep love of woods and forests, explaining the amazing processes of life, death, and regeneration he has observed in his woodland. After learning about the complex life of trees, a walk in the woods will never be the same again.

Includes a *Note From a Forest Scientist*, by Dr.Suzanne Simard (whose TED talk was an optional resource earlier in this chapter).

Something to think about:

Some people — even those who praise the book in general — have disagreed with the author's anthropomorphism since he often ascribes human emotions and traits to trees.

But consider:

Is it possible humans elevate ourselves too much, separating ourselves from other animals and living beings? Are we too unaware of our instinctual responses or behaviors determined to some extent more by our gut microbiome than our intellect? Do we discount other beings' ability to have thoughts and feelings?

Section 7

What NOT to plant

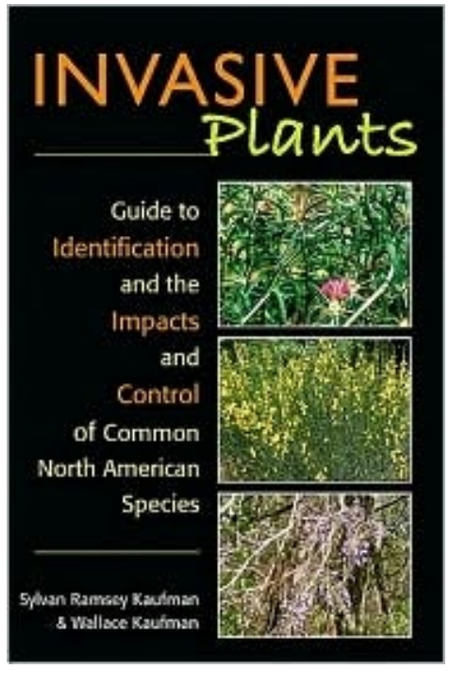
Many organizations and government agencies have compiled lists of plants that are invading various ecoregions.

And remember, as we pointed out earlier, only non-native plants are technically “invasive” despite the common practice of calling plants invasive that merely are aggressive (as annoying as they can sometimes be). “Invasive” plants negatively affect native plant communities.

National information

Invasive Plants by Sylvan Ramsey Kaufman and Wallace Kaufman

A guidebook for identifying invasive plants and their impacts as well as how to control them.



Invasive.org: Center for Invasive Species and Ecosystem Health

List species listed on an invasive species list or noxious weed law in North America.

http://www.invasive.org/species/weeds.cfm

Invasive Plant Atlas of the United States

A collaborative project between the National Park Service, the Univ. of Georgia Center for Invasive Species and Ecosystem Health, the Invasive Plant Atlas of New England and the Lady Bird Johnson Wildflower Center. It assist with identification, early detection, prevention, and management of invasive plants.

The focus is on non-native invasive plant species impacting natural areas, excluding agricultural and other heavily developed and managed lands. It features species information, images, distribution maps, and early detection reporting procedures.

https://www.invasiveplantatlas.org/

Mistaken ID? Invasive Plants and their Native Look-alikes: This booklet makes an important point: Make sure you don't eradicate a native plant that you mistake for an invasive look-alike!

A **FREE** PDF file that can be viewed and downloaded at:
http://www.nybg.org/files/scientists/rnaczi/Mistaken_Identity_Final.pdf

The Northeast, Mid-Atlantic, New England

PRISM: Partnership for Regional Invasive Species Management:
https://www.dec.ny.gov/animals/47433.html

For example, PRISM for the Finger Lakes Region is at http://fingerlakesinvasives.org/ and terrestrial species only at

http://fingerlakesinvasives.org/species_environments/terrestrial/

Plant invaders of the Mid-Atlantic Natural Areas ~ National Park Service
The mid-Atlantic region includes the District of Columbia and the states of Delaware, Maryland, New Jersey, Pennsylvania, Virginia and West Virginia.
https://www.invasive.org/eastern/Midatlantic/

Invasive Plant Atlas of New England

https://www.eddmaps.org/ipane/

The Southeast and Plains

Southeast Invasive Plants Council
https://www.se-eppc.org/weeds.cfm

and click on the links for each state on the right to find state-specific information. For example, here is the list from the **North Carolina Invasive Plants Council**:
http://nc-ipc.weebly.com/

North Carolina Native Plants Society
Invasive Exotic Species List

An excellent resource; listing invasive plants according to severity of ecological threat. Note that some (or even many!) of the plants listed as threats *are still being sold!*
http://www.ncwildflower.org/plant_galleries/invasives_list

What monsters are lurking in your yard?
Learn how to ID and rid your yard of invasive plants
by North Carolina Audubon
An excellent description of the dangers of some prominent North Carolina invasives *AND how to get rid of them.*
http://nc.audubon.org/news/what-monsters-are-lurking-your-yard

Going Native: Invasive Exotic Plants of the Southeast
~ NC State University

This table contains a list of selected invasive, exotic species that are causing particular problems for native plants or wildlife in the Southeast. Click on each link in the list to get more information about the plant: identifying it, how to control it, and native alternatives.

https://ncsu.edu/goingnative/howto/mapping/invexse/index.html

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A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community.

It is wrong when it tends otherwise.

~ Aldo Leopold,
Sand County Almanac

Chapter 2

The Soil and Ground Layer

While it is relatively easy to recognize the perennial grasses and seed-eating sparrows as characteristic of meadows, the ecosystems exist in their fullest sense underground.

What we see aboveground is only the outer margin of an ecosystem that explodes in intricacy and life below."

~ Amy Seidl,
Early Spring: An Ecologist and Her Children Wake to a Warming World

The ground layer
by Rick Darke and Doug Tallamy

“Except where it is clothed with plants, the ground layer and its intricate living processes are often overlooked in gardening circles, yet the events that occur here are among the most important to life in the entire ecosystem. The forest floor is where accumulated organic material is decomposed and made available once again for plant nutrition by a myriad of fungi and bacteria, earthworms, insects and other arthropods, and mammals.

It’s unfortunate that the term most often used for the accumulation of organic matter on the ground is litter, because this material is anything but trash. …

Ground layer litter, in the form of leaves, twigs, bits of bark and dead wood, seeds and seed pods and capsules, plays critical roles in conserving moisture, replenishing nutrients, and creating niches — microhabitats — needed by various species of animals and plants especially in their earliest stages of regeneration. Duff is an alternative term referring to dead plant material that has accumulated on the ground.”

~ THE LIVING LANDSCAPE, P. 47

The soil food web

The secret life of soil
by Peg Herring / Oregon State University Extension Service

This short article briefly describes the main kinds of organisms found in soil that *“work together in a system that is truly the foundation of life.*"

Please read:

http://extension.oregonstate.edu/gardening/secret-life-soil-0

Soil that is alive … is well
by Joe Lamp’l

This article discusses how microbes and other life in the soil keep it healthy and productive.

Please read:

http://www.growingagreenerworld.com/soil-that-is-alive-is-well/

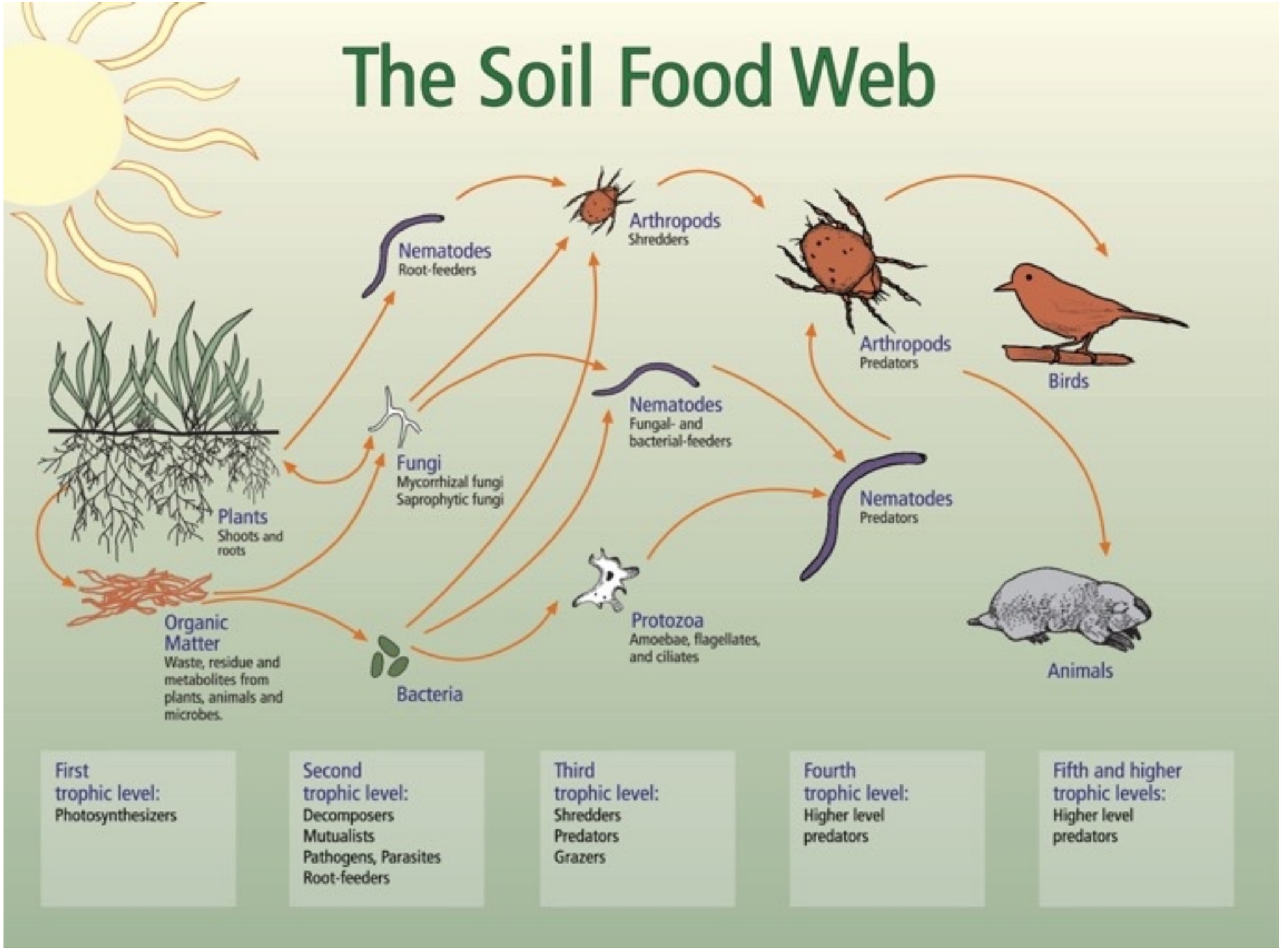
Soils are living
~ Soil Science Society of America

This video shows some of the many creatures that both depend on a healthy soil food web and also are essential to maintaining healthy soil and biodiversity.

Please watch this 3-minute “Soils are Living!” video at :

https://www.soils.org/iys/monthly-videos - in the **July** section.

A single teaspoon of soil can hold up to one billion bacteria, several yards of fungal filaments, several thousand protozoa, and scores of nematodes



From: USDA Natural Resources Conservation Service

Section 2

The world's soil is precious

Is climate change putting world's microbiomes at risk?
by Jim Robbins / Yale Environment 360

"Researchers are only beginning to understand the complexities of the microbes in the earth's soil and the role they play in fostering healthy ecosystems. Now, climate change is threatening to disrupt these microbes and the key functions they provide."

http://e360.yale.edu/features/is_climate_change_putting_world_microbiomes_at_risk

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Why soil could make climate change worse than scientists thought
by Justin Worland / TIME Magazine

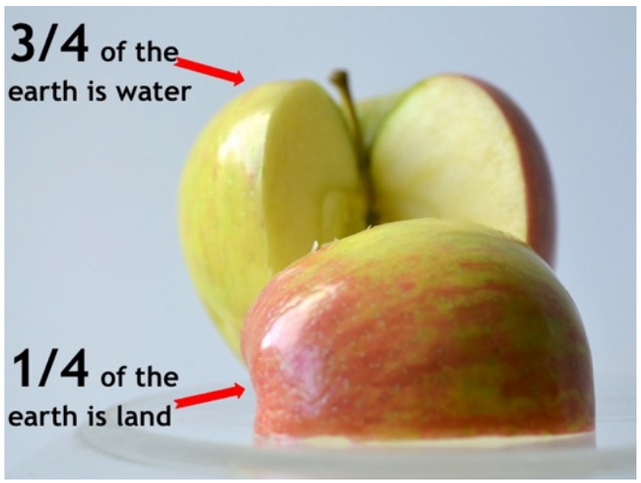
"The new study suggests a significant new feedback mechanism that could create unexpected challenges for fighting climate change."

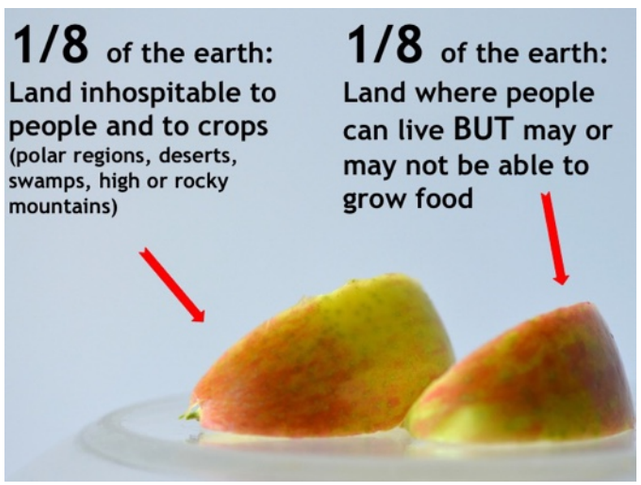
OPTIONAL:

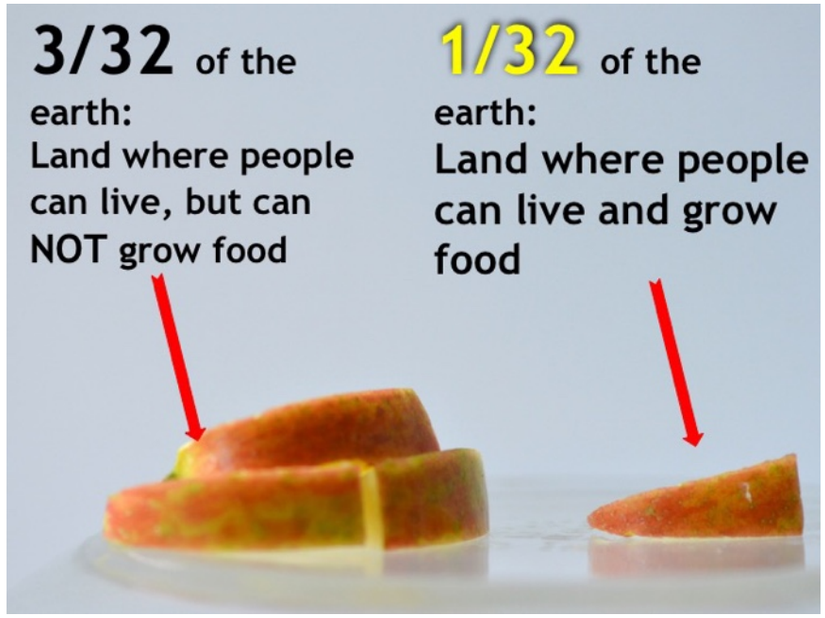
http://time.com/4697227/soil-climate-change-carbon-sink/

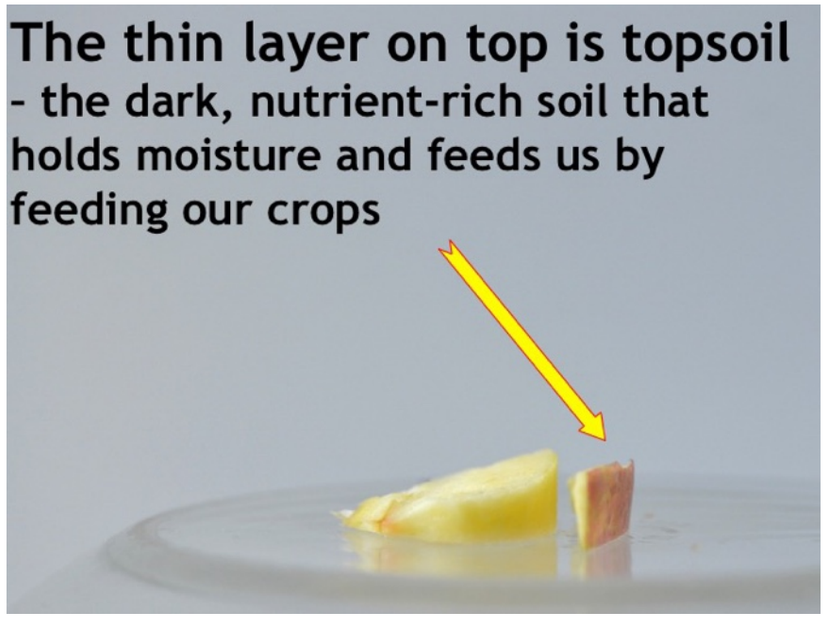
We depend on healthy soil and healthy soil depends on its microbiome

Protect and preserve our soil.
There's not much of it!









We're losing topsoil faster than it can be replaced. And in a human time scale, topsoil is a non-renewable resource. *It can take **hundreds of years** to form **an inch** of topsoil.*

Preserve and protect topsoil on your piece of the earth!

Section 3

Cleaning up?

Leaf “litter”
by Becca Rodomsky-Bish / Habitat Network

This article highlights some of the ways leaves are secretly at work in your gardens and parks.

Please read:

http://content.yardmap.org/learn/leaf-litter/

Clean-up overkill
by Susan Reed

A dreaded fall chore — raking leaves — is followed by the spring chore of raking debris accumulated over the winter. Should we reconsider these practices?

Please read:

http://susanreedla.com/blog/archives/what-not-to-do/103-avoid-clean-up-overkill.html

An all-too-common site in fall and spring!

Logs
by Jacob Johnston / Habitat Network

What good is a fallen tree? This article highlights some of the important roles fallen trees have.

Please read:

http://content.yardmap.org/learn/logs/

Creating a nature-friendly garden or backyard: Benefits of slugs & snails in the garden
by Marlene A. Condon / Frogs are Green

Limiting fall cleanup has many benefits. Some may surprise you!

Please read:

http://frogsaregreen.org/tag/benefits-of-slugs-and-snails-in-garden/

It's obvious that something has been excavating this habitat log. But also note this log's inherent beauty. Why not include it in our landscape?

Snail egg masses ready to "hatch." Have you left any dead material for them to eat ... or only your plants?

Robbing their life savings by Sara Stein

"But I realize now that to help one's garden overmuch is to hinder it.

I must have been living in another world when I wrote, only a few years ago and with considerable satisfaction, of the view from my window of our gardens 'bare to their bones, neat and clean, nicely edged, weed-free.'

Now I see that there is teeming life down there that, neatly and cleanly, I was starving. Why was I not replacing in their beds the limp bodies of weeds I had uprooted? What was I doing cutting flowers to the ground, raking them away, bagging grass clippings, blowing autumn leaves from underneath the hedge?

I was robbing the life savings from my garden beds, exposing them to the elements to leach their lifeblood away..."

~ NOAH'S GARDEN, PP. 134-135

Limp bodies of weeds becoming soil

***JUNE 8** - Excess plants were pulled and their "limp bodies" laid on the soil.*

***JUNE 9** - By the next day they were already less noticeable.*

***JUNE 11** - Already on their way to becoming part of the soil.*

No such thing as too many leaves!
by Janet Allen

Started as a full barrel the previous fall, by January, the pile had shrunk.

Digging into the pile

After sitting for a year, the pile had become leaf humus.

The beautiful result: leaf humus, ready to feed the soil!

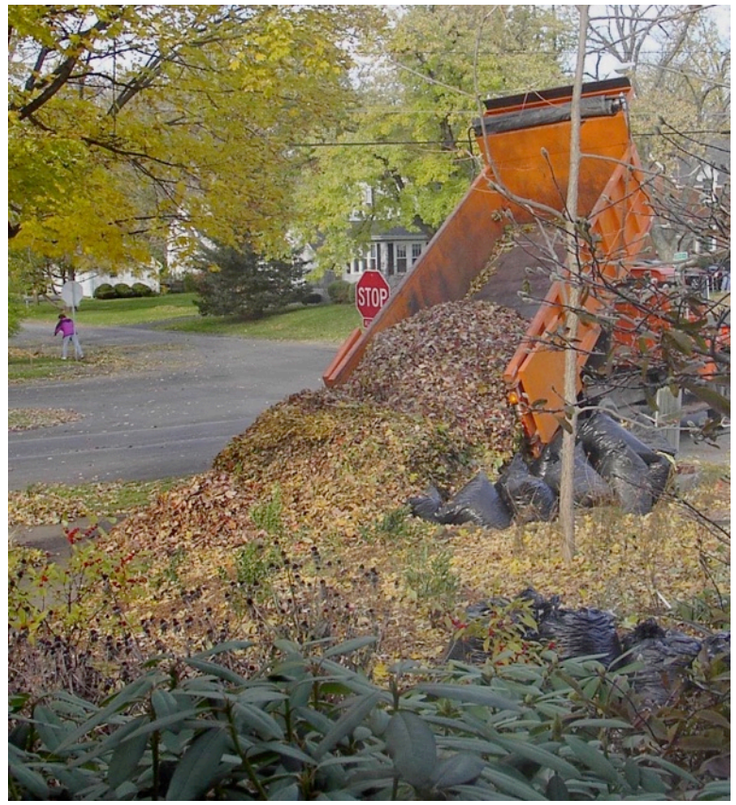
With almost no effort, we produced a beautiful soil amendment.

Creating the leaf barrels was easy. We just circled some fencing and connected the edges.

Then we waited for the leaves to decompose. No turning needed!

This organic matter feeds the life in the soil, and healthy soil produces healthy plants.

We use some of this leaf humus in our woodland areas and some in our vegetable garden.



We asked the passing town truck to dump its leaves

We created more and larger “barrels” for more neighborhood leaves!

Love ‘Em and Leave ‘Em ~ Westchester County

A win-win! Towns don’t have to cart away leaves, and lawns don’t need chemical fertilizers.

Please read:

http://www.leleny.org/p/homeowners.html

OPTIONAL videos on mulch-mowing:

https://www.youtube.com/watch?v=67Ne_nFFOxc

and

https://www.youtube.com/watch?v=xX7BhcFqxwE

BEFORE (on left) and AFTER (on right) mulch mowing

Section 4

Learning more about soil

Optional resources to further explore soil

Books

Teaming with Microbes

by Jeff Lowenfels and Wayne Lewis

From the Amazon review:

[This book] proves soil is anything but an inert substance. Healthy soil is teeming with life — not just earthworms and insects, but a staggering multitude of bacteria, fungi, and other microorganisms. When we use chemical fertilizers, we injure the microbial life that sustains healthy plants, and thus become increasingly dependent on an arsenal of artificial substances, many of them toxic to humans as well as other forms of life. But there is an alternative to this vicious circle: to garden in a way that strengthens, rather than destroys, the soil food web — the complex world of soil-dwelling organisms whose interactions create a nurturing environment for plants.

Interview with the author Jeff Lowenfels

~ Growing a Greener World

No time to read the book? Here's a 34-min. podcast featuring the author:
http://www.growingagreenerworld.com/029-ggw-the-soil-food-web-teaming-with-microbes-an-interview-with-co-author-jeff-lowenfels/

Healthy soil is important for growing healthy food

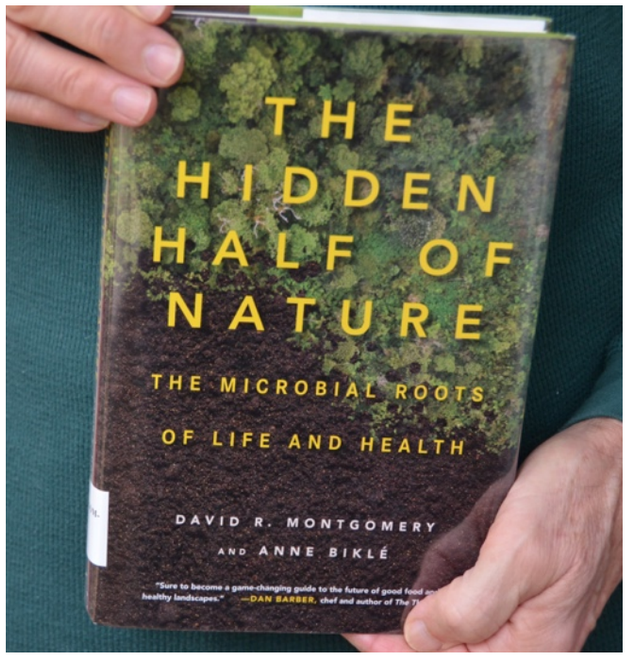
The Hidden Half of Nature:

The Microbial Roots of Life and Health

by David Montgomery and Anne Biklé

From Amazon.com review:

Prepare to set aside what you think you know about yourself and microbes. Good health—for people and for plants—depends on Earth's smallest creatures. The Hidden Half of Nature tells the story of our tangled relationship with microbes and their potential to revolutionize agriculture and medicine, from garden to gut.



Explores the amazing connections between our gut microbiome and the soil.

Montgomery is also the author of *Dirt: The Erosion of Civilizations* and of the book *Growing A Revolution: Bringing Our Soil Back to Life.*

Websites and articles to learn more

Soil food web

by Elaine Ingham

http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/soils/health/biology/?cid=nrcs142p2_053868

Mycorrhizae and plants

by Maryanne Whitman / Wild Ones Journal

(Not currently available) Download the PDF at:
http://www.wildones.org/download/mysteries/mysterymycorrhizaeandplants.pdf

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USDA – Soil food web

http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/

The UN International Year of Soils - 2015

http://www.fao.org/soils-2015/en/

Healthy soil microbes, healthy people
by Mike Amaranthus and Bruce Allyn / The Atlantic

The microbial community in the ground is as important as the one in our guts.

http://www.theatlantic.com/health/archive/2013/06/healthy-soil-microbes-healthy-people/276710/

Invasion of non-native earthworms
~ Great Lakes Worm Watch

Most people grow up learning that earthworms are good for gardens. *But regions that had once been covered by glaciers have non-native European worms; there are no native worms there. And they're not good for forests.*

This is an issue for *only the northern tier of states*. Check the website's map to see if it's an issue for your area.
http://greatlakeswormwatch.org/forest/soil.html

And now Asian earthworms have invaded, with even greater potential for harm.
Learn more and report them:
http://www.greatlakeswormwatch.org/identification/european_asian.html

Microbiomes at the roots: A new look at forest ecology by Richard Conniff / Yale Environment 360

With advances in genetic sequencing technology, scientists are now able to readily identify the microbes living in and around the roots of trees with implications for everything from tropical forest restoration to climate change planning.

http://e360.yale.edu/feature/microbiomes_at_the_roots_a_new_look_at_forest_ecology/2699

Soils help to combat and adapt to climate change
~ Food and Agriculture Organization / U.N.

A nice description of the carbon cycle and soil.
A PDF file is available at:
http://www.fao.org/3/a-i4737e.pdf

Movies and videos about soil:

Yes, there are movies about soil! Both of these are excellent and can be streamed. (If you're viewing these as a group activity, please choose the appropriate license.)

Dirt! The Movie

http://www.dirtthemovie.org/

For personal use, you can stream the movie for $2.99 at https://gumroad.com/benpro#

Symphony of the Soil

Beautifully filmed documentary that was featured in the U.N. Year of Soils

http://www.symphonyofthesoil.com/

Some short segments "Grace Notes" are free on the website at http://www.symphonyofthesoil.com/watch/grace-notes/

Information on viewing options: http://www.symphonyofthesoil.com/the-films/symphony-of-the-soil/

How trees talk to each other

by Suzanne Simard / TED talk video

18-minute video: http://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other

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Dust Bowl by Ken Burns

A PBS interactive website: http://www.pbs.org/kenburns/dustbowl/interactive/

The Dust Bowl of the 1930s was a environmental and human disaster caused by poor stewardship of the soil.

Row 1: Daisy	Daylily	Chicory	Lilac
Row 2: Dandelion	Cardinal lobelia	Queen Anne’s lace	Forsythia
Row 3: Daffodil	Peony	Tulip	Petunia

Answer to Quiz:

Only the cardinal lobelia (*Lobelia cardinalis*) is native to most of the U.S. except for the Northwest. A few species of **peony** (though not the one pictured) are native to western U.S.

The other familiar plants are from other parts of the world.

Ox-eye daisy (*Leucanthemum vulgare*): Europe and Asia

Daylily (*Hemerocallis fulva*): Asia

Chicory (*Cichorium intybus*): Europe

Lilac (*Syringa vulgaris*): Balkan Peninsula

Dandelion (*Taraxacum officinale*): Eurasian

Queen Anne’s lace (*Daucus carota*): Europe and Asia

Forsythia (*Forsythia* - various species): Asia and Europe

Daffodil (*Narcissus pseudonarcissus*): Europe and North Africa

Peony (*Paeonia* - various species): Asia and Europe; Western U.S.

Tulip (*Tulipa*): Eurasian and North Africa

Petunia (*Petunia* - various species): South America