Have you done anything lately for your friends, the soil microbes?

My guess is that most people do not even give a thought about these friends who do so much for our gardens and landscapes. In reality, the microscopic flora and fauna of our desert soils are critical to the healthy balance of our garden and landscape soils. In a well-balanced soil, they will be more numerous than grazing sheep in an Arizona winter alfalfa field. Like those who care for the sheep, a good gardener will want to take care of this flock of tiny, silent partners.

Microorganisms are small, usually one-celled fungi or bacteria that live in the soil. Some break down decomposing organic matter into valuable and healthy soil components, while others provide other, equally important benefits. Except for those that cause plant diseases, the plant pathogens, the vast majority of soil microbes are known to be beneficial and play a vitally important function in keeping soil-based systems in good health.

There are many types of beneficial microorganisms of course, but those of major interest to gardeners are those that decompose dead plant material down into its basic parts, the *Rhizobium* bacteria that feed legume plants with nitrogen they pull out of the air, and the mycorrhizal fungi.

Microorganisms are part of an intricate system of tiny creatures which recycle vital plant nutrients and maintain the basic soil structure. Without them, the best soils could end up with the productive power and tilth of an asphalt parking lot. With their assistance, even poor soils, with patience and good management, can be reclaimed.

There are three major types of microorganisms. The first group are the bacteria. The bacteria come in many shapes and sizes, but most live and function as single cells. Like most microorganisms, bacteria are tiny; about one million of them can fit on a pinhead-sized platform. What they lack in size, they make up for in activity. They can devour food quickly and reproduce at a dizzying pace.

*Rhizobium* is slightly different. It is not a decomposer. This bacteria forms a mutually beneficial relationship with the roots of legume plants, like beans and peas. The plant gives it a place to live and reproduce and it extracts nitrogen from the air, turns it into forms that the plant can use, and shares it with its host. Ever wonder why it is not necessary to fertilize mesquite, Palo Verde, *Cassia*, sweet acacia, and ironwood? They are all desert legumes.
The *Actinomycetes* are a specific type of fungi that play a key role in the soil. *Actinomycetes* are slightly larger than bacteria and tend to have many cells. In fact, their branch-like arms give them the appearance of tiny trees under the microscope. The internal heat that makes a good compost pile work is usually due to the efforts of the actinomycetes. They have an amazing ability to survive and function at extremely high soil temperatures. They can also break down some very tough organic residues, such as the shells of insects.

Another group consists of a complex mixture of various types of fungi. Real work horses, they will do more work, on less food, than about any other soil organism. They are great survivors and can tolerate dry soil conditions. They decompose resistant materials and bind soil particles together with their rope-like filaments. When organic matter is added to desert soils, the fungi will be the workhorses in breaking the material down into its beneficial component parts.

Most of the members of three groups of microbes make up a major part of the food chain group called primary decomposers. They are responsible for sixty to eighty percent of all chemical reactions in the soil. Along with larger animals, like earthworms, they break down plant and animal residues into forms that can be reused by plants. If it weren’t for the microbes, compost and other organic soil amendments like dead leaves and leftover plant residues would end up as no more than sterile, lifeless trash.

Microorganisms improve a soil’s ability to absorb water and exchange air with the atmosphere, both key functions. As bacteria work in the soil, some of the products that they secrete act as a cement to hold soil particles, called aggregates, together. This process helps keep the spaces between the individual soil particles, the pore spaces, open for easy entrance of water and air. Other tasks that microbes perform include buffering soil pH, helping make nutrients more available for uptake by the plant and lowering salt concentrations.

Life in the soil is complex and ongoing. Secondary decomposers, such as nematodes, mites, and small insects feed on the primary decomposers and these, in turn, are food for even larger animals. Eventually, the later generations of the tiniest microorganisms will consume the remains of these larger soil inhabitants, and the cycle of life begins again. These cycles play an important role in the various systems that allow life and civilization to exist.

In addition to the decomposing microorganisms are those that provide other services to plants, and there are few plants that do not enter into associations with the mycorrhizal fungi. The relationships can be complex, but in general, the fungi tap into the roots of the plants and provide a generally beneficial relationship. The plant supplies a ready stream of food materials, sugars moved down into the roots from the leaves. The mycorrhizal fungi pick up extra supplies of water and minerals which they share with the plants. This extra boost to the plant sometimes means the difference between success and failure, life and death.

To some extent, the beneficial activities of all the soil microorganisms can be managed by one who carefully and thoughtfully provides the necessary raw materials. In our area, it is critical to apply extra supplies of organic materials and make sure that the environment has sufficient water to meet the needs not only of the plants, but also for the microorganisms. It is important to remember that water is just as important for the microbes as it is for plants. A moist, but not saturated, soil environment is ideal. Good water management in garden and landscapes and in compost piles is essential.

Hidden in the soil are microscopic friends that help keep our gardens and landscapes healthy and looking good. There are several garden tasks, easily done, that can help keep our soils balanced and the microorganisms working hard for us.
Many trees and shrubs in Pinal County are showing signs of decline. The reasons for this are many but proper care instead of neglect will go a long ways in helping these valuable landscape plants stay healthy throughout their lives.

Two of the very first keys for developing healthy and thriving trees and shrubs are the selection and planting of good stock. Both are essential. Then, once the tree or shrub is in the ground it needs good care including proper irrigation, timely fertilization, and correct pruning. Violations of any of these principles could result in dead or dying trees.

Selection of good, quality plants is absolutely critical to the long term health and development of trees and shrubs. A plant that has inherent weaknesses or health problems at planting really has a low chance of survival to maturity. Improper planting techniques can add additional problems that may tip the balance against even otherwise healthy plants.

Two major weaknesses that are not easy to see are girdling and kinked roots. Girdling roots are roots that loop around the root ball and encircle the trunk of the tree. Girdling roots can actually become embedded in the trunk proper as the tree grows causing the trunk to become weakened and constricted. Just as a snake envelopes and squeezes the life from its prey, girdling roots can slowly but surely squeeze the life from growing plants.

Kinked roots are roots that make quick turns in one direction or another. Sometimes these roots will double back on themselves and then grow in a direction that is at a wide angle from the original direction of growth. Just like a kinked water hose, kinked roots have difficulty in moving fluids from one part of the plant to another. This often results in stunted, weak plants that can quickly die, especially in the early years of growth.

Girdling and kinked roots usually occur when a plant outgrows its pot. When the roots grow to the edge of the container, because they cannot grow through the barrier, they either turn to begin the long circle around the edge of the pot, or they double back in the direction from whence they came. Plants left too long in a container that is too small for the root system will often have girdled and kinked roots. Because a strong, wide and deep root system is critical for physical support of the tree, these problems must either be avoided or corrected at the time of planting.

Sometimes kinked or girdling roots are visible on the soil surface in the containers but more often than not, these problems will not be immediately apparent. Most nurseries will not be too excited if you pull the pots off the root ball and start checking for girdling right there onsite, but reputable nurseries should be willing to at least discuss the issues with you and help you to find good plants. Don’t be afraid to ask the nursery people for help and guidance.

Before planting and after the container has been removed, check the exposed roots near the edge of the root ball for signs of sudden changes of root direction. Sometimes it can be helpful to spray the root ball with water to remove a small quantity of soil. The water is much less likely to damage the tender feeder roots than a hard tool like a shovel or a hand trowel. Removing a small amount of soil will provide a better view of conditions just under the soil surface.

If you find girdling roots, consider taking the plant back to its source. If this is not possible, you can try to reclaim the plant by cutting the root off cleanly just before the point in which it makes its radical turn. A sharp clean cut is very important because a shredded or mashed root is much more likely to die back after pruning. It will also be less likely to send out new roots to replace those which were cut off. Hand shears are an ideal tool but occasionally larger loppers or a saw may be needed.

Proper planting is also critical to long term plant health. When planting, ensure that the hole is wider than it is deep and that the hole is no deeper than the depth of the soil in the container. It is no longer considered essential to dig a deep hole for drainage because the settling of soil after planting will often drag the tree deeper into the soil. This exposes tender trunk tissue that should be well in the air to soil borne plant disease microbes.

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Be careful of placing too much torque, which means twisting and jerking, on the root ball because the feeder roots contain tiny root hairs that do the business of taking up water and nutrients. Torque can rip and tear these important structures and lead to transplant shock.

Backfill the planting hole with the same soil that came from the planting soil and add mulch, not to the soil returned to the soil, but to the surface of the soil to cool the soil surface and cut down on water loss through evaporation.

After planting, and for the first few weeks, it is important to keep the soil around the plant roots moist. Depending upon how much sand is in the soil, and the temperature, it may be necessary to irrigate every day until the plant becomes acclimatized to its new location. Sandy soils need more frequent irrigation than those planted in silt or clay soils. Once the tree or shrub is mature, it should be watered from the trunk out to the drip line and deep enough to moisten all of the roots, generally this is about three feet deep for trees and two feet for shrubs. I am convinced that many trees and shrubs are irrigated to a depth much less than what they really need. This results in devastating consequences, especially during the hot weather of summer.

Most non-leguminous plants require regular fertilization. We normally recommend that fruit trees like citrus, apricot, and peach be fertilized at least three times a year: once in February, once in late May or early June; and once in August. Because every fertilizer is different, our Extension recommendations are given in pounds of actual nitrogen, the nutrient that is most often missing from our soils. A full sized tree, no matter whether it is a fruit tree or otherwise, will need about one pound of actual nitrogen per tree per year.

To calculate a nitrogen dose from this recommendation, divide 100 per cent by the percentage of nitrogen, the first of three numbers on the fertilizer container. Then multiply the answer, 5, by the pounds of nutrient recommended, 1. Thus for ammonium sulfate, a common garden fertilizer, we would divide 100 by 21, the number on the bag, and then multiply it times the pounds of nitrogen recommended, 1. This calculates out to five pounds of ammonium sulfate per tree per year.

Note: don’t be putting it all on at one time and call it good. That much would burn the roots. Split it up into thirds and put one-third on in February, another third on in May, and the last one on in August. Legume plants like mesquite, Palo Verde, Cassia, and sweet acacia do not need nitrogen fertilizers because the Rhizobium bacteria in the soil help them pull nitrogen from the air. That is a story for another time.

Many trees decline and die, I believe, because of improper pruning. Taking too much wood at one time and reducing the total number of leaves on the tree is tough on any plant, but especially on trees and shrubs. The plant stores energy from photosynthesis in the wood of the tree, that is, the branches and roots. When we remove more than thirty percent of the wood at any one time, we also cut away much of the plant’s stored energy. That is not good. Likewise, by reducing the total leaf canopy, we reduce a plant’s ability to make new energy. Heavy pruning can shorten the life of a tree by forcing the plant to use more energy than it can produce. That is not good either. When we prune trees and shrubs appropriately, they have a much better chance of living a long, productive life.

Armed with knowledge and a little experience, it is possible to properly select and care for our landscape trees and shrubs. It is this proper care than will ensure a long and successful life in our landscapes.

Trade names used in this publication are for identification only and do not imply endorsement of products named or criticism of similar products not mentioned.
There are many different types of butterflies of course and each of them provide color and diversity to our gardens and landscapes. It is the monarch, perhaps, that is best known. In their color and size, they easily capture our attention and respect as they flit from bush to bush and tree to tree. The drought has played havoc with native habitat in wild settings by reducing the number and diversity of plants upon which the monarch depends. By creating butterfly habitat on our property, we provide a place for them to rest and to find critical nourishment.

It is not hard to understand why people are drawn to the color and delicate lines of butterflies. For centuries, artists have studied the detail of their form so that they could better capture their inherent beauty. For those who study the science of life, the butterfly and its relatives represents an intricacy of growth and development that is absolutely amazing. For most of us, however, there is something calming to just sit back, cozy in our patio chair, and watch these colorful visitors move through our yards.

For many of us, the sighting of a butterfly may be short and sweet. We spot one as it flits into our yard, watch it as it moves through, and then sigh as it disappears out sight. We ask ourselves, “Why doesn’t it hang around a little longer?” In the case of the monarch, it may simply be that it has to keep moving because it is on its annual migration down to central Mexico or to the coast of California, depending upon the way the wind is blowing. If an insect is in migration mode, there may be little to stop it in its journey, but all butterflies will hang around for a time, even migrating insects, when there is something in the yard to attract their attention and make them want to stop.

If we think like a butterfly, we could ask ourselves this question: Would I like to stop, rest, and spend a little time where there are plants that provide food and shelter, or in a bare yard devoid of plants? When we think that through, we can see why the creation of an attractive landscape with lots of flowers and places to rest can entice these interesting insects to hang around our yards.

In order for butterflies to exist from generation to generation, several things need to happen. A butterfly is an insect with a complex life cycle. There isn’t just a butterfly. There also has to be an egg, a larva or caterpillar, a chrysalis or cocoon and then the adult butterfly. If one of the earlier stages fails, there can be no butterfly.

The first stage is the egg. It is placed in a likely spot by the adult female butterfly. That is one of the things that she searches for in her flitting about. The egg hatches into a larva whose primary job is to eat. The caterpillar must eat enough food and store enough energy to carry it through to adulthood. If there is not enough food available, the caterpillar dies and, again, there can be no butterfly. At the end of the larval stage, the insect forms a chrysalis, sometimes called a cocoon. It is during this “resting stage” that it transforms into an adult butterfly. Emerging from the chrysalis, the adult butterfly mates and lays eggs so that the cycle can be repeated. The adult needs lots of energy to do its job so it visits flowers regularly to tank up on the high energy nectar found in the flowers.

If we understand and supply the needs of each particular stage of growth, it is fairly easy to attract butterflies into our yards. Adult butterflies need lots of energy, so we need to first plant bushes with lots of colorful, nectar-laden flowers. The larvae are heavy eaters so they need food plants that will give them the proper nutrition. When we identify and plant these type of plants, chances are we will have an instant butterfly garden.

Since there are many types of butterflies in Arizona, each with their own tastes and needs, it really can get quite complicated to be all things to all butterflies, especially at first. The best idea, then, is to start slow and build your garden over time. Select a particular butterfly, such as the monarch, research its needs, and then place in the yard the particular plants that are most inviting to that particular insect. In the case of the monarch, it tends to like sunflower and milkweed. The giant swallowtail is attracted to citrus. As you learn, add plants for other butterflies and watch your garden become home for these interesting insects. There are many good resources available. Simply search the Internet for “desert butterfly gardens” or “butterfly gardens Arizona” on your browser.
As you assemble your landscape plan, remember to choose plants that are well adapted to our Sonoran Desert conditions. Plants at home in the desert flourish under our growing conditions and require little work after they are planted. Annuals such as marigold, verbena, and zinnia or perennials like lantana, rosemary, salvia, and daisy are good, easy-to-grow selections.

You obviously will want to see the butterflies when they visit your yard, so make sure that you place the plants to your best viewing advantage. Plant the tallest plants, like trees and large shrubs, at the back of your field of view and shorter plants towards the front. If you reverse this and put the tallest plants in front, you will have to get out of your comfy chair and walk past the trees to see the butterflies that are attracted to the shorter plants. Put the taller plants behind and the shorter plants up front and you get to see it all from your chair. Trees and bushy shrubs also serve as a windbreak to encourage the butterflies to remain active even on windy days.

It is important to group your plants also by water demand. Do not put a high water demand plant like Buddleia butterfly bush on the same drip system as a low water demand plant like Lysiloma.

Not only do you waste water, but too much water or too little water can be devastating to plant health. If we are going to make every drop of water count, I suggest that we ought to plan our landscapes around low to moderate use plants.

Make sure that you allow plenty of sunshine in your butterfly garden. Most of the plants attractive to butterflies require full sun for good growth and development. Too much shade can impair their health and limit their ability to attract butterflies. Plenty of sunshine also provides good light for viewing butterflies and for taking pictures to share with others.

While the monarch is a well known butterfly, there are many, many others. The more common families include the swallowtails, the whites and sulphurs, the blues and airstreaks, the snouts, the brushfoots and the skippers. Your reference, if it has good pictures, will help you identify the various families and individual butterflies within the families. It will also tell you which plants are most attractive to these insects.

By incorporating plants attractive to butterflies into our landscapes, we can enjoy the presence of these interesting insects year after year. We can also provide excellent habitat that helps those that migrate, like the monarch, in their annual journeys.
The return of warmer weather triggers the emergence of desert critters from their winter hibernation. Snakes, ground squirrels, and lizards are all examples of animals native to the desert that take a long nap during the cool weather. Into this group we must also place the various species of scorpion.

After emerging from their winter resting period, scorpions are ready to find a meal to recharge their energy. It is common for them to move fairly quickly as they wander around searching for prey, mainly small ground-dwelling insects that they find. In their search, sometimes they wander indoors.

Our encounter with a scorpion this past weekend was fairly routine, easy to solve, but hardly unexpected. I knew that the warm temperatures had surely woken the scorpions and got them moving. Sooner or later I was sure that we would see one in the house. In our case, my wife saw it first.

Because of its painful sting, the scorpion is often considered to be one of the villains of the desert. Indeed, the bark scorpion does have a painful sting and, in the very young and very old, can possibly cause life threatening symptoms. However, people are stung each year by scorpions, including the bark scorpion, and come through the event with nothing more than a little discomfort. Because they hunt and eat insects, we classify them as friends and as long as they stay outdoors, they are fine. It is when they come indoors that problems arise.

Scorpions generally prefer to be outside rather than indoors, but they may enter houses for a number of reasons. It is common to notice more movement of scorpions when their feeding grounds have been disturbed by some major changes outside, such as construction or removal of trees. They can squeeze under doors or through cracks easily and it is not uncommon to find them where you least expect them.

There are many species of scorpions in the low desert areas of Southern Arizona ranging in size from 2 to 4 inches in length. The largest, and often deemed the scariest, is the giant hairy scorpion. However, the venom of this scorpion is relatively mild. One of the smallest of the scorpions is the striped-tail or ground scorpion. Although the sting of these and most other scorpions is painful, kind of like a bee sting, it is generally not life threatening. The bark scorpion sting, however, is painful enough that most people stung by this scorpion would say that it gets your attention quickly.

Symptoms of a bark scorpion sting are an initial burning sensation, which patients have described as feeling like the injured limb has been thrust into a fire. Later numbness and tingling follow, which is reported to feel like the limb has “fallen asleep”. Again, the elderly and children are particularly susceptible and should be observed carefully. If you believe that you have been stung by a bark scorpion or by any other poisonous insect or spider, you should call the Arizona Poison and Drug Information Center right away at 1-800-222-1222. Operators will assist you in seeking appropriate treatment, if necessary.

Most of the time fortunately, these encounters are outside when rocks are turned over, lumber piles moved or leaf litter disturbed. Occasionally these encounters take place inside the home where quite understandable feelings of concern often lead to worry. My advice is to just relax, usher the intruder out the door and then take a deep breath. Where there is one, there is not necessarily another.

Scorpions are eight-legged relatives of spiders and are found throughout the low desert areas of Arizona. They have their own unique shape with a long tail behind and a set of arms, called Pedi palps tipped with pinchers in front. The tail is equipped with a stinger that can inject poison into prey. Because of their appearance and their ability to inflict pain, they often seem strange, foreign, and threatening to many who are unfamiliar with their habits. To those who understand them, they are simply part of desert life. While close encounters can be unnerving, there is no reason to panic or become unnecessarily afraid of them. In fact, many life-long desert dwellers have never been stung.
So, you say, how do I avoid them? If I see one in the house, what do I do? There are a number of things that anyone can do to lessen the chance of a painful sting or encountering a scorpion indoors.

Because scorpions are most active after dark, it is a good idea to always wear shoes when walking outside, and don’t touch anything you cannot clearly see. During scorpion season, the hot months of the year, I like to wear house slippers when I get up in the middle of the night because you never know if they might be doing their thing where I want to step.

During the day, scorpions seek protective shelter under loose objects like wood piles, rocks or the bark of trees. Indoors, always look inside shoes before putting them on in the morning and carefully shake out clothing or towels that you feel might have been in a location where there may have been access to scorpions. When working outdoors, use gloves to move an item that may be sheltering a scorpion. Indoors, they like to hide in dark areas, such as under boxes, piles of clothing next to the washing machine, or anywhere there is a place to hide from those who would do them damage.

To reduce the total population around your house and to minimize the possibility of a scorpion wandering indoors, consider removing outdoor sites where scorpions hide such as rock or wood piles, loose boards, debris and old tires. Again, be to wear heavy work gloves when doing these chores. Tighten door and window seals to keep insects and scorpions outside. Check for other openings, such as vents or holes, and cover or close them. Have palm trees pruned and peeled regularly to 10 to 15 feet above the ground.

A black light is a useful tool in finding scorpions indoors or out because the animals glow in the dark when the light shines on them. The scorpions can then be dispatched, or captured and released later in a safe location. Crack and crevice indoor insecticide sprays are generally not extremely effective against these animals. The residual insecticide may keep them moving so that they are easier to spot and remove, but the insecticides are relatively slow acting as far as these larger animals are concerned.

In our case last weekend, before I could respond to my wife’s visitor announcement she had quickly solved the problem by removing the animal from the house. While it is important to have a healthy respect for the scorpion, there is little reason to fear. By understanding the behavior of the animal and taking a few precautions, most people will live out their lives without ever being stung.

If you have questions about this newsletter, have any plant related problems, or wish to have a publication sent to you, please call (520) 836-5221 x204 or (520) 374-6263 and leave a message. If you have a plant problem and are able to email a picture, please send a picture with any information you can provide about the plant, and your contact information to our diagnostic team at macmastergardener@gmail.com and a Master Gardener will contact you.

This newsletter is available to view on our website at: http://extension.arizona.edu/pinal

Richard D.Gibson
Extension Agent, Agriculture

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