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November 11, 2016

Dear Friends,

Here is the 181st issue of our weekly gardening newsletter for Houston, the Gulf Coast and beyond. We really appreciate all of our readers hanging in there with us, sharing stories and inspiring us in so many ways.

Thanks so much!

This newsletter is a project of The Lazy Gardener, Brenda Beust Smith, John Ferguson and Mark Bowen (John and Mark are with Nature's Way Resources). We also have a great supporting cast of contributing writers and technical specialists who will chime in and tweak away regularly. We would love to keep receiving your input on this newsletter . . . comments . . . suggestions . . . questions. . . E mail your thoughts to: lazygardenerandfriends@gmail.com. Thanks so much for your interest.

Please or sign yourself up to receive this newsletter by clicking the "Join Our Mailing List" link just below. We will never sell or share our mailing list to protect the privacy of our subscribers.

Enjoy!

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THE MAGIC OF BONSAI . . . AND MORE OF THIS FALL'S NON-STOP BLOOMERS!

*"Bonsai art is the display of a landscape -- without the landscape."
-- Nobu Kajiware*

By BRENDA BEUST SMITH

As our gardening spaces shrink, smaller plants are becoming more in vogue. Perhaps none more so -- on a far broader horizon -- than bonsai (pronounced "BONE-sigh"), which translates "tree in a pot."

For patios, townhouse gardens, balconies and/or regular landscape niches, bonsai can artistically provide eye focus in too-subdued spaces, adding illusions of greater depth -- "*landscapes within a landscape*" -- than actually exist. And yes, most bonsai can (and should!) stay outdoors year-round.

Although bonsai can look extremely complex, it isn't that difficult to get started -- and can be a lot of fun.

I can't honestly say this is "lazy" gardening. But be forewarned -- bonsai can easily become addictive! Just don't expect celebrity in reaching the level of, say, national bonsai winners Hoe and Soon Chuah of the Houston Bonsai Society. For this we're talking decades of intense study and dedication.

Fortunately the [Houston Bonsai Society](http://myemail.constantcontact.com/Lazy-Gardener---Friends-Houston-Garden-Newsletter-.html?oid=1112503958110&aid=xoQmhtKISzQ) is a great source of information and hands-on help.

One good place to get your feet wet, and/or to see sophisticated, award-winning bonsai, is Houston Bonsai Society's Annual Tree Exhibition (Sat., Nov. 12, 9-4 at Mercer Botanic Garden, 22306 Aldine-Westfield).

Look again at the left hand picture at the top of this column and then at the photos below. Two special treats at Saturday's Tree Exhibition at Mercer will be these two bonsai, both seen in left hand photo.

Hoe Chuah's ficus bonsai, on far left, won the 2016 National First Place Tropical Tree Award. The 2016 National First Place Kusamono Bonsai Award was won by Hoe's wife, Soon Chuah, for her collection of incredibly tiny potted plants on the right side in that photo.

Tradition dictates Kusamono bonsai be presented as a companion piece. For this competition, Soon's Kusamono was companion to Hoe's ficus, creating in that top picture the "display of a landscape -- without the landscape." Below: closer looks at Hoe's 18-inch high ficus tree, left, and Soon's 7-inch bonsai, right.



Bonsai as an art form originated in China around 2,000 years ago. Buddhist monks introduced it to Japan in the 12th Century AD, and WWII soldiers are credited with bringing bonsai to the States.

First, the [Houston Bonsai Society website](http://www.houstonbonsai.org) dispels some common misconceptions about this art form:

- Bonsai is not a specific plant. Simplifying a very complex, ancient technique, bonsai is a method of artistically miniaturizing normally large plants, usually trees. It can be created from any small leaf woody perennial, including herbs such as rosemary
- Bonsai isn't always tiny. Some bonsai can be as tall as four feet.
- Probably the greatest misconception: bonsai should be kept indoors. Most bonsai are outdoor plants that require winter cold and will not survive extended stays indoors. If you must keep a bonsai indoors, select a tropical such as ficus, which does not require winter cold.

Serious bonsai practitioners usually easily spot beginners' efforts. Giveaways are most often triggered by:

- Forgetting bonsai are three-dimensional, with back branches for depth.
- Lack of a strong root system and/or good taper to the trunk.
- Fertilizing and/or watering too much or too little.
- Styling trees like a hedge with a flat top to the apex, or very pointed and triangular trees.
- Wiring that is crossing or not securely anchored.
- Lack of pruning so that the interior of the tree cannot be seen.
- Attempting to manipulate a tree into a style poorly chosen for that species.
- Repotting or root pruning at the wrong time of the year.
- Pruning off too much rather than too little.

During Saturday's Houston Bonsai Society's Day of Bonsai Annual Tree Exhibition, world-renowned tropical bonsai artist/author Pedro Morales will conduct free workshops at noon and 1pm. Bonsai exhibits will include a wide variety of styles and forms such as these pictured below:



What plants can you use for bonsai? Try azaleas, bald cypress, boxwoods, cedar, cotoneaster, crepe myrtle, elm, ficus, firethorn, holly, juniper, Japanese maples, oaks, pines, quince, serrissa, dwarf yaupon,

Chinese/Japanese yew, weeping willows, wisteria. Bonsai from blooming trees or shrubs will flower if treated correctly.

Sat., Nov. 12: Day of Bonsai Annual Tree Exhibition, 9am-4pm, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Houston Bonsai Society event. houstonbonsaisociety.com.

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MORE DETERMINED FALL BLOOMERS In the Oct. 28 *LG&F Newsletter*, we reviewed great fall flowering plants still in full bloom and showing no sign of slowing down. Here's a follow-up I just photographed.

Mel Basham's yard has long been a favorite "photo op," as newspapers call them. Mel's artist's eye, combined with a love of natives and *au natural* approach is definitely enhanced by dedicated gardening.

Here it is November and not only is her eclectic landscape a mass of color, but Mel (above right) is growing the tallest cosmos (left & center) and the most gorgeous morning glory vine (right) I've ever seen.

This former Aldine ISD art teacher now lives at Lake Livingston where it's already been colder at nights than it has here in the Greater Houston area. If these are still gorgeous up there, they can be here too!

NOTE: Our Lazy Gardener & Friends Houston Garden Newsletter archives are "under reconstruction." If you didn't see the Oct. 28 issue, or need another issue, email me at lazygardener@sbcglobal.net. I'll send you a pdf version.

* * *

TIP O' THE TROWEL TO TEXAS PARKS & WILDLIFE! In honor of both veterans and active military, day-use entrance fees for ALL visitors will be waived at all Texas State Parks on Nov. 13, the first Sunday after Veterans Day. To find a Texas State Park near you: TexasStateParks.org.

**Brenda's column in the free, emailed LAZY GARDENER & FRIENDS HOUSTON GARDEN NEWSLETTER is based on her 45+ years as the Houston Chronicle's Lazy Gardener. To sign up: [CLICK HERE](#)*

LG&F GARDEN CALENDAR EVENTS submitted in our EXACT format will be copied & added to calendar right away. Any necessary re-typing/reformatting may take couple of weeks. See calendar for format. Always check the LG&F Newsletter Calendar to make sure your submitted event is listed! If not, let me know!*

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WEEKLY GARDENING EVENTS & ANNOUNCEMENTS CALENDAR

PLEASE READ BEFORE SUBMITTING AN EVENT TO THIS CALENDAR.

Events **NOT** submitted in the **EXACT** written format below may take two weeks or longer to be reformatted/retyped. After that point, if your event does not appear, please email us. Sorry, no children's programs. - Submit to: lazygardener@sbcglobal.net

IF WE INSPIRE YOU TO ATTEND ANY OF THESE EVENTS, PLEASE TELL SPONSORS YOU HEARD ABOUT IT IN THE LAZY GARDENER & FRIENDS HOUSTON GARDEN NEWSLETTER

FRI., NOV. 11: FLOWER SHOW - JUDGING DEMYSTIFIED by SUZANNE MILSTEAD & NELL SHIMEK, 10am, & TRAFFIC FLOW, 1pm, White Oak Convention Center, 7603 Antoine. Free. Houston Federation of Garden Clubs event. houstonfederationgardenclubs.org

SAT., NOV 12: PECKERWOOD GARDEN OPEN DAY, 10am-2pm tours, 20559 FM 359 Road, Hempstead. \$10. Garden Conservancy event. peckerwoodgarden.org 979-826-3232; info@peckerwoodgarden.org

SAT., NOV. 12: HERBS THAT LIKE TO CHILL by HENRY FLOWERS, 10am, Enchanted Forest, 10611 FM1750 & 2pm, Enchanted Gardens, 6420 FM359, both Richmond. myenchanted.com

MON., NOV. 14: DOCENT TRAINING-REFRESH YOUR SKILLS, 9am-noon, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

WED., NOV. 16: SUCCULENTS OF THE RICHTERSVELDT PARK, SOUTH AFRICA by WALLACE WARD, 7:30pm, Metropolitan Multi-Services Center, 1475 West Gray. Free. hcsstex.org/

THURS., NOV. 17: ANNUAL BRING PLANT/SEED TO SWAP & POTLUCK DISH DINNER, 6:30-9pm: Houston Arboretum and Nature Center, 4501 Woodway Dr. Free. Native Plant Society of Texas - Houston Chapter. npsot.org/wp/houston

SAT., NOV. 19: ANNUAL ENCHANTED OPEN HOUSE & EVENING, 2-8pm, Enchanted Gardens, 6420 FM359, Richmond. Free. myenchanted.com

MON., NOV. 21: STORYTIME IN THE GARDEN, 10:30 am- 11:30 am, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160

MON., NOV. 21: OPEN GARDEN DAY & PLANT SALE, 8:30-11am, Genoa Friendship Garden, 1202 Genoa Red Bluff Rd. Free. Harris County Master Gardeners at Precinct 2 event. hcmga.tamu.edu

SAT., NOV 26: PECKERWOOD GARDEN OPEN DAY, 10am-2pm tours, 20559 FM 359 Road, Hempstead. \$10. Garden Conservancy event. peckerwoodgarden.org , 979-826-3232; info@peckerwoodgarden.org

SAT., NOV. 26: ANNUAL ENCHANTED OPEN HOUSE & EVENING, 2-8pm, Enchanted Forest, 10611 FM 2759, Richmond. Free. myenchanted.com

TUE., NOV 29: TOOL CARE by TIM JAHNKE and HENRY HARRISON, III, 6:30-8:30 pm. AgriLife Extension, Carbide Park, 4102 Main, La Marque. Galveston County Master Gardener event. Free, but pre-register: galvcountrymgs@gmail.com, 281-534-3413,

SAT. DEC. 3: THE ARBOR GATE CHRISTMAS OPEN HOUSE, 2-6pm, 15635 FM 2920, Tomball. 281-351-8851. Free; register: arborgate.com

SAT., DEC. 3: GROWING CITRUS IN HOUSTON & S.E. TEXAS, 9:30-11:30am, Houston Museum of Natural Science. \$45. Urban Harvest event. 713-880-5540; urbanharvest.org

SAT., DEC 3: HOLIDAY OPEN HOUSE, 10am-4pm, Buchanan's Native Plants, 611 E 11th. Free. 713-861-5702; buchanansplants.com/events

SAT., DEC. 3: FRUIT TREES by SCOTT SNODGRASS, 10am, Enchanted Forest, 10611 FM1750; 2pm, Enchanted Gardens, 6420 FM359, both Richmond. Free. myenchanted.com

SAT., DEC 3: GROWING TOMATOES FROM SEEDS by IRA GERVAIS, 9-11:30 am, & SOIL HEALTH & EVALUATION by JIM GILLIAM, 1-2:30 pm, AgriLife Extension, Carbide Park, 4102 Main, La Marque. Galveston County Master Gardener events. Free, but pre-register: galvcountymgs@gmail.com; 281-534-3413; aggie-horticulture.tamu.edu/galveston

WED., DEC. 7: SMALL TREES RECOMMENDED FOR SMALL YARDS by SANDRA DEVALL, 9:30am, C.L. United Methodist Church at 16335 El Camino Real. Gardeners By The Bay event. Free. 281-474-5051

FRI., DEC. 9: HOLLY-JUJAH by JIM JOHNSON, 10am, White Oak Convention Center, 7603 Antoine. \$25 advance sale only. Houston Federation of Garden Clubs eve nt. houstonfederationgardenclubs.org

SAT., DEC. 10: WINTER AT MERCER BOTANIC GARDEN, 9am-noon, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

SAT., DEC. 10: CITRUS FEST & Q&A BY DR. BOB RANDALL, 8:30AM-NOON, URBAN HARVEST FARMER'S MARKET, 3000 RICHMOND AVE @ EASTSIDE. URBAN HARVEST EVENT. 713-880-5540, URBANHARVEST.ORG.

MON., DEC 12: CITRUS SEMINAR & TASTING by MONTE NESBITT, TX A&M Extension Specialist, 6-8 pm, AgriLife Extension, Carbide Park, 4102 Main, La Marque. Galveston County Master Gardener event. Free, but pre-register: galvcountymgs@gmail.com, 281-534-3413, www.aggie-horticulture.tamu.edu/galveston

WED. DEC. 14: CHRISTMAS CRAFTS USING NATURAL MATERIALS, noon-2pm, Mercer Botanic Gardens , 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

SAT., DEC 17: PECKERWOOD GARDEN OPEN DAY, 10am-2pm tours, 20559 FM 359 Road, Hempstead. \$10. Garden Conservancy event. peckerwoodgarden.org , 979-826-3232; info@peckerwoodgarden.org

SAT., DEC. 17: CHRISTMAS BIRD COUNT, 8am, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: albbarr@comcast.net.

MON., DEC. 19: STORYTIME IN THE GARDEN, 10:30 am- 11:30 am, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

MON., DEC. 19: WALLER COUNTY MASTER GARDENER TRAINING REGISTRATION DEADLINE. 9am-4pm Saturday classes starting Jan. 14. \$160. Waller County Extension Office. txmg.org/wallermg; wallermgardener2013@gmail.com; 979-826-7651

WED., JAN. 11: EXPLORING THE PRIMEVAL FLORA OF NEW CALEDONIA, noon-2pm, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

FRI., JAN. 13: PENNY WISE / POUND FOOLISH: WHEN & WHY TO HIRE A LANDSCAPE PROFESSIONAL by RITA HODGE, 10am, White Oak Convention Center, 7603 Antoine. Free. Houston Federation of Garden Clubs event. houstonfederationgardenclubs.org

MON., JAN. 16: STORYTIME IN THE GARDEN, 10:30-11:30 am, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

MON., JAN 23-FEB. 27: TEXAS GULF COAST GARDENER TIER III: THE ART OF LANDSCAPE DESIGN, 9am-3pm with an hour lunch break, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. \$250. Register: 713-274-4160.

WED., FEB. 8: MICROGREENS, noon - 2pm, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

FRI., FEB.10: FLORAL DESIGN INSPIRED BY ART by HOUSTON DESIGNING WOMEN, 10am, White Oak Convention Center, 7603 Antoine. Free. Houston Federation of Garden Clubs event. houstonfederationgardenclubs.org

SAT., FEB 18, 2017: GALVESTON COUNTY MASTER GARDENERS SPRING 2017 PLANT SALE, 9 am-1 pm with pre-sale seminar 8-8:50 am, Jack Brooks Park Rodeo Arena, 10 Jack Brooks Rd and Hwy 6, Hitchcock, TX 77563 (Galveston County Fairgrounds)

MON., FEB. 20: STORYTIME IN THE GARDEN, 10:30-11:30 am, Mercer Botanic Garden, 22306 Aldine-Westfield, Humble. Free. Register: 713-274-4160.

SAT., APR. 22: EARTH DAY PARTY FOR THE PLANET, Armand Bayou Nature Center, 8500 Bay Area Blvd., Pasadena. abnc.org

If we inspire you to attend any of these events, please let them know you heard about it in . . .
THE LAZY GARDENER & FRIENDS NEWSLETTER!

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T H E LAZY GARDENER & FRIENDS HOUSTON GARDEN NEWSLETTER

JOHN'S CORNER

MINERALS - The Elements and What They Do

Part 2 (In its entirety this time)



Today we continue with our study of all the minerals, what they do, with a look at elements number 4, 5, and 6 on the Periodic table. See the October 21, 2016 Newsletter for a list of references and introduction.

4) Beryllium (Be) - Beryllium is the first or lightest of the elements known as the "alkaline earths" which include calcium, magnesium, strontium, etc. It is found in many minerals but most often found in the mineral beryl (beryllium aluminum silicate) which is a source of this element. It is a metal used in nuclear reactors, aerospace, and electronics. If we add a few atoms of chromium to the crystal structure of this mineral we get the gemstones we call emeralds. Change a few other atoms and we get the gemstone aquamarine. We find beryllium in igneous rocks at 2-8 ppm, shale at 3 ppm, and only 0.1 for sandstone or limestone. It accumulates in coal and can often reach 330 ppm with some levels as high as 2,000 ppm in some deposits. Beryllium is found in fresh water at 0.001 ppm and seawater at 0.0000006 ppm. For land plants, it is less than 0.1 ppm and even less in land animals. If the human body has plenty of selenium then we rid ourselves of excess beryllium as too much would disrupt the calcium-magnesium relationships or cause berylliosis in our lungs. If beryllium is in a salt form like beryllium chloride (BeCl_2) or beryllium sulfate (BeSO_4), it is very soluble in water and toxic to plants.

Notice that beryllium is in the same column on the periodic table as calcium (Ca) and magnesium (Mg), which means it has similar chemical properties. Since it is chemically similar to magnesium and calcium, plants easily absorb beryllium. If there is too much in our soils, it will substitute for magnesium (Mg) and cause antagonistic interactions with several metabolic processes. It can also substitute for magnesium in human enzymes and cause them to malfunction. If levels in the soil reach 2-16 ppm it can prevent seed germination, inhibit the uptake of calcium (Ca), magnesium (Mg), and to some degree phosphorous (P) along with degrading some proteins and enzymes. In high amounts, it is toxic to many life forms. However, in very small amounts beryllium has been found to stimulate the growth of certain microbes and plant species.

5) Boron (B) - Boron is an element that is known as a "metalloid" as it has properties of both metals and non-metals. Boron is found in igneous rocks at 30 ppm, 96 ppm in clays and 145 ppm in limestone, in seawater at 4,500 ppm and in fresh water 2-150 ppm. Boron is an anion, which means it has a negative electrical charge when ionized.

Boron is often found in nature as boric oxide (B_2O_3). It is also found in feldspars and micas, which are common minerals in clay soils or as the insoluble mineral tourmaline, a semi-precious gemstone. In tourmaline, the boron is chemically locked up and not in an available form until actions by microbes breaks the molecule apart and release the boron.

Boron is used in pesticides, cosmetics, and fertilizers. Combine boron with nitrogen and we get cubic nitride crystals that are almost as hard as diamonds and more heat resistant, hence, they are commonly used for abrasives in many industries. When boron is combined with iron and neodymium, it forms one of the strongest magnets known. Boron is found in household products from Silly Putty to Borax cleaning agents. As a result, boron is a major source of pollution in streams as it comes from the sewage sludge where all these chemicals are dumped and accumulate. Soil contamination with excess boron is now a worldwide problem.

Many forms of boron minerals or ions are readily absorbable by plants. Boron is an essential element for microbial and plant growth, however all the functions and relations are not fully understood. Mycorrhizal plants have a greater need for boron than non-mycorrhizal plants.

A shortage of boron in the soil is associated with increased insect and fungal damage, and stunting in some plant species while other species seem unaffected. Boron deficiency is often associated with the death of the terminal bud, light green coloring, splintering, or cracking of tubers. An adequate amount of available boron in the soil is a strong disease fighter since it helps the plants immune system become resistance to disease. It is associated with the prevention of many plant problems; cracked stems in celery, internal cork in apples, black heart in beets and turnips, yellowing of alfalfa leaves, etc. Other signs of boron deficiency are; tips of growing plant turns inward and dies, buds becomes light green, roots are brown in center, flowers do not form, leaves are small crinkled deformed with irregular areas of discoloration. Boron deficiency is most likely to occur on sandy soils, soils low in organic matter and in areas of high rainfall or frequent watering.

This element is involved with carbohydrate transportation, it is required for certain physiological processes such as enzyme and co-enzyme systems, it influences plant growth in many ways but not fully understood. It also helps plants use nitrogen efficiently. Studies have found that it is associated with the translocation of sugars in plants hence closely related to quality and taste of foods. Boron regulates flowering and fruiting, cell division, salt absorption, hormone movement and pollen germination, carbohydrate metabolism, water use, nitrogen assimilation and other aspects of plant growth.

Boron interacts in the uptake of other nutrients by plants as it influences membrane permeability and cell colloids. This element is associated with energy transformation reactions, carbohydrate transport, blossom retention, and critical for root elongation.

If there is low levels of zinc (Zn) in the soil, some plants absorb boron to toxic levels, especially in the roots. Boron has an antagonistic relation of silicate ions for absorption sites of boron. Too much calcium (lime) will induce boron deficiency in acid soils. Too much phosphorus (P) ions will decrease boron mobility in the soil and absorption. Uptake and distribution of phosphorous in plants is dependent on the boron concentration in the soil as too much boron prevents the roots from absorbing phosphorous. However, adequate boron assists plants with potassium (K) uptake.

Boron is used as structural element in the cell walls of plants as it strengthens them, but elevated levels of boron hurt citrus plants like oranges and lemons. Using grey-water that has cleaning agents with boron in them can lead to a buildup of this element in the soil.

Olives will not set fruit if boron levels are too low, and plants grown in soils with insufficient levels are more susceptible to insects and disease. Some believe that boron may function as a natural insecticide since boric acid is toxic to many insects. Some plants like hyacinths require boron to produce their fragrance which contains a boron compound.

However, excess boron in the soil restricts growth, causes sickly green color often mistaken for nitrogen deficiency, associated with root deterioration and poor yields. One of the problems with using artificial fertilizers is that there is a very narrow range of boron in the soil that decides whether it is toxic or beneficial. Water-soluble artificial fertilizers just dump the boron into the soil even if it is not needed causing toxicity problems.

Watering with the effluent from septic systems can also be a source of excess boron in the soils as with grey-water mentioned above.

In humans, boron has an important role in mineral and hormone metabolism, cell membrane function, and enzymes function. Boron affects osteoporosis, heart trouble, diabetes, and senility. Its effects are more marked when vitamin D3 and magnesium (Mg) are deficient. It protects men against deadly prostate cancer (it selectively kills prostate cancer cells while leaving healthy cells unharmed) as it lowers PSA (Prostate Specific Antigen), elevated PSA has been found to be causative factor in prostate cancer progression. Boron has been found to fight inflammation and decrease joint swelling as it inhibits lipoxygenase (LOX) an enzyme that triggers the inflammatory cascade to increase inflammatory leukotrienes. Boron is essential to promoting strong healthy bones. Most conventionally grown foods do not provide enough boron. Life Extension, November 2015 pp. 33-38.

Boron regulates the absorption of calcium, and it is used in making estrogen. A lack of boron leads to increased menopause symptoms in women and a lack of testosterone in men.

Apples, plums, grapes, avocados, most vegetables, nuts, and legumes are our major food sources of boron (if it is in the soil in sufficient quantities for plants to absorb).

6) Carbon (C) - "Carbon stands supreme as having the chemical properties on which all life depends", John Emsley. Carbon is found in many forms from pencil lead to the gemstones we call diamonds. Carbon is the main component of coal and hydrocarbons that our society depends on for energy. It is also a major component of natural gas in the form of methane (CH₄). Carbon can be found in igneous rocks at 200 ppm, shale's at 15,300 ppm, sandstones at 13,800 ppm, and limestone's at 113,500 ppm. In marine plants, carbon increases to 345,000 ppm and in land plants to 454,000 ppm.

When carbon is combined with oxygen (O₂), it forms carbon dioxide (CO₂) which is directly linked to global warming. When carbon dioxide freezes, it becomes dry ice and if dissolved in rainwater it forms carbonic acid with a pH of 5.7

Carbon is the element most used by plants as between 45-56% of a plants compounds are structured with carbon. Carbon is the basic building block for all organic materials and the key to life, as we know it.

Carbon is frequently referred to as the energy of the soil. For example, when we burn wood in our fireplace energy is released in the form of heat and light. The carbon in the wood is combined chemically with oxygen (O₂) in the air releasing energy. Alternatively, when carbon in gasoline is combined chemically with oxygen (O₂) in the air releasing energy that powers our cars. Hence, the carbon in organic matter in the soil provides the energy to grow soil life from microbes to earthworms, release nutrients from rocks and minerals, create soil structure, etc.

If we look at the major components of most terrestrial plants, they can be broken down into glucose, cellulose, lignin, and some proteins. The amount of these compounds varies between species, for example a tree will have more lignin than a annual flower. Additionally, all plants have water (H₂O) in their cells, roots and stems that are not part of the plant. If the water is removed and we look at what is left they are primarily molecules made of carbon chains. A few examples are:

Glucose $C_6H_{12}O_6$ - has six carbon atoms as its base units
Cellulose $(C_6H_{10}O_5)_n$ - has six carbon atoms as its base units
Lignin $(C_{32}H_{34}O_{11})_n$ - has 32 carbon atoms as its base units
Proteins are composed of amino acids that all have carbon as their base unit.

We can look at the vascular tissue, the cambium layers, and the bark of the plant all of which are composed of molecules based on chains of carbon atoms.

Typically, for trees we see the following breakdown: 50% Carbon, 42% Oxygen, 6% Hydrogen, 1% Nitrogen, and 1% other.

When we look at all the atoms that compose a plant or tree, carbon is the most common element. As mentioned, carbon in decaying organic matter is the energy source for microbes and other soil life, carbon is the base unit for humus that is so critical for good soil health. Plants can get carbon from the air via photosynthesis or be absorbed via their roots. Note that the character of the nitrogen source governs carbon availability and carbon becomes deficient if too much nitrogen is available.

Researchers have found that healthy, fertile soils with low insect, disease and weed pressure have 30 carbon atoms for every nitrogen atom what is known as a thirty to one ratio (30:1). This ratio is common in natures from microbes, to earthworms, to birds and mammals including mankind.

Good sources of carbon for gardeners are compost, native mulches, leonardite, humates, and coal.

MINERALS - The Elements and What They Do

Part 3

See the October 21, 2016 Newsletter for list of references.

7) Nitrogen (N) - Every gardener knows that nitrogen is essential for plants to grow and be healthy. Every living thing needs nitrogen, and it is a key component of tens of thousands of molecules, some of which are highly reactive (think explosives).

Nitrogen can be found in igneous rocks at 20 ppm, in healthy fresh water at 0.23 ppm, seawater at 0.5 ppm, 1,000 ppm in humus, marine plants at 15,000 ppm, land plants at 30,000 ppm, land animals at 100,000 ppm. Human blood has 34,000 ppm (3.4%) while bone can have 43,000 ppm (4.3%) and similarly for other animals. This is why blood meal and bone meal work so well as an organic fertilizer. However, our major supply of nitrogen is the atmosphere, which is 78% nitrogen or four million billion tons! The problem or issue is that the nitrogen in the air is in the form of a nitrogen atom very strongly chemically bonded to a second nitrogen atom (N_2), which is extremely inert and essentially useless to plants, animals and almost all life in this form.

On our earth, nitrogen occurs in many forms that are useable by plants and animals that one will recognize:

Nitrogen oxide (NO) - helps to help relax blood vessels and help prevent heart attacks, the nitric oxide producing enzyme (NO-synthase) is abundant in the brain

Nitrite (NO_2^-) - is easily converted into nitrosamines, which are known carcinogens

Nitrate (NO_3^-) - which we recognize as a plant nutrient

Notice how adding additional oxygen atoms (O) change the properties of the nitrogen molecule or ion above.

When N combines with carbon and hydrogen it can form hydrogen cyanide (HCN) which is highly toxic. If two atoms of nitrogen are combined with oxygen (N_2O) we get laughing gas which is used as a propellant in items like whipped cream.

When nitrogen is in the form of ammonium nitrate (NH_3NO_3) a common artificial fertilizer, it is highly explosive (remember the Oklahoma City Bombings or the explosions at the fertilizer plant outside of Waco a couple years ago). It is also a component in gunpowder, trinitrotoluene (TNT) and nitroglycerine.

Nitrogen boils at -320.8°F (-196°C), hence it is often used as a cryogenic cooling liquid; dermatologists often use liquid nitrogen to freeze cancerous spots or growths on our skin.

All life requires nitrogen (N) as it functions as a structural atom in proteins, amino acids, nucleic acids like RNA and DNA and a wide variety of organic molecules. When in a more reactive form such as ammonia (NH_3) it is caustic and hazardous, however when diluted with water it becomes a common cleaning agent. If we add an extra hydrogen atom (H) it becomes a fertilizer component (NH_4^+) we know as ammonium.

In gardening, plants use a lot of nitrogen often reaching 3% of plants total compounds. Nitrogen accounts for 16-18% of a plants amino acids and proteins and it is required for leaf growth.

We have seen that nitrogen is an extremely important atom in everything we do and in the world around us. So how do we get nitrogen in the air (N_2) which is inert and essentially useless, into a form that plants, animals, and humans can use?

Most of the nitrogen that we can use starts with bacteria in the soil and algae in the oceans that have the ability to break apart the extremely tough chemical triple bond found in the inert N_2 molecule. These microbes are the primary "fixers" of nitrogen that convert nitrogen from the air into a form that plants and animals can use. All gardeners know that plants we call "legumes" are specialists in attracting bacteria with the enzymes called nitrogenase that are required to fix nitrogen. Many species of blue-green algae also contain this enzyme and can fix nitrogen. However, for algae in the soil to fix nitrogen they require the element molybdenum (Mo) be present which is used as a catalyst. The other common but lesser source of useable nitrogen occurs during thunderstorms where lightning breaks the triple bond of the nitrogen molecule in the air and allows

the nitrogen to be absorbed into rainwater. This is why many plants look more vigorous after a summer rain shower as the leaves absorb the nitrogen.

NOTE: As we continue through each of the elements, we will see that many processes in soil, plants, microbes, animals, and humans require or are dependent upon the presence of other elements as seen in the example above. The out-of-date assumption that plants only need 16 elements is why we have so many problems in horticulture and agriculture to health problems in animals and humans.

Nitrogen is the most mis-used of all the fertilizer elements. Research at Oregon State University in 1996, by Dr. Elaine Ingham a soil microbial ecologist, completed studies on over 6,000 soil samples from around the world. She has found that in ALL cases, all nitrogen (N) inputs to the soil feed the microbes first. This means that microbes must process ALL nitrogen inputs (synthetic or organic) *before* plants can use it. The useable nitrogen is in the "manure" produced by the microbes or given directly to the plant by the microbes in healthy soils!

Starting in 1998, research showed that excess nitrogen creates weak succulent growth that: attracts insects and pathogens, pollutes groundwater, causes fruits to crack, creates bitter pits, causes tip burn of leafy vegetables, increases tomatoes blossom end rot, browning of cauliflower curds, new growth dieback, and drooping flowers on roses.

Water-soluble nitrogen from synthetic fertilizers pushes tissue growth; however, other essential nutrients cannot be absorbed from the soil profile fast enough to keep up even though they may be available in the soil. This process leads to an out-of balance condition that weakens plants creating susceptibility to insects and disease.

Even as far back as 1999 we started learning that the form of nitrogen provided to plants was important to their health. There was a paper published in the Journal of Environmental Horticulture where they found that Azalea Lace Bugs were attracted to Azaleas fed with artificial fertilizers.

Other researchers have found that the chemical form of nitrogen supplied to plants affects protein synthesis. Nitrogen supplied from synthetic sources (artificial fertilizers) results in lower protein content than the same amount of nitrogen from natural sources. Additional studies have found that nitrogen supplied from synthetic sources results in much higher rates of disease and attracts pest insects. It was also been found that excessive availability of nitrogen derived from synthetic fertilizers can delay maturity of many plant species. For gardeners yellowing leaves may be a sign of nitrogen deficiency. A couple studies have found that Texas soils require less nitrogen than soils anywhere else in the United States. Excess nitrogen creates a chemical imbalance that hurts plant growth. The leaves become dark green, excessive weak succulent growth with weakens plant fibers along with reduced sugar content which attracts insects and leads to delayed crop maturity.

Nitrogen as nitrate (NO_3^-) from artificial fertilizers is very water-soluble, this means it leaches very easily from the soil polluting our ground water, streams and even the air we breathe. This nitrogen loss leads to algae blooms in our streams, the algae bloom then consumes the available oxygen. Without oxygen, minnows, crayfish, and other aquatic life die which allows a mosquito's entire larva to develop since they are not being eaten anymore. Now we have an increase in our mosquito

problems and the diseases they carry. Bacteria have 5 carbon atoms to every nitrogen atom in their bodies (C:N), what is called a 5:1 ratio. A lack of dissolved nitrogen in the water limits the growth of pathogenic bacteria in nature. Now with the extra nitrogen pollution from artificial fertilizers these pathogenic bacteria can grow to extremely high levels.

In addition, elevated levels of nitrogen as NO_3^- constitute health hazards to both humans and animals. It takes almost 300 carbon dioxide molecules to cause the same amount of global warming as one molecule of nitrogen oxide. Soil microbiologists have found that most of the plant species we call weeds have to have their nitrogen in the nitrate form (NO_3^-), while most of our perennial plants from flowers to trees require their nitrogen in the ammonium form (NH_4^+).

The most useful forms of nitrogen are found in organic matter where the nitrogen is released through microbial activity. Recently it was discovered that trees can also get nitrogen from fungi that take it directly from nitrogen rich rock minerals.

Sources: compost, organic fertilizers, rain, air, microbes, blood and bone meal, animal tissue such as feathers or meat.

8) Oxygen (O) - An often overlooked but extremely important element when dealing with soils and plants. It is the third most abundant element in the universe and makes up 20% of the atmosphere, more than a million billion tons. It is the most abundant element on earth accounting for half of the weight of the earth's crust and 86% of the weight of the water in our oceans.

Oxygen is found in igneous rocks at 464,000 ppm, shale at 483,000 ppm, sandstone at 492,000 ppm, limestone at 497,000 ppm, fresh water at 889,000 ppm and seawater at 857,000 ppm, soils at 490,000 ppm, and land plants at 410,000 ppm.

Oxygen has the ability to oxidize (rapid as in a fire or slow and gentle in our bodies). It is often called the "fuel of life" as the reaction of oxygen and carbon releases energy whether it is in our fireplace, our bodies, or in microbes in the soil. It is a byproduct of photosynthesis that is performed by plants that we cannot live without.

In the atmosphere, oxygen binds with itself to form a molecule in air (O_2). It is one of the major building blocks of all organic compounds (carbohydrates, proteins, fats, and nucleic acids (DNA and RNA)). Oxygen becomes a major building block of soils when combined with silicon (SiO_2). Half of the known elements that are found in nature combine with oxygen to form minerals we call oxides. The crust of the earth is composed of silicon-oxygen minerals.

A few of these are familiar to gardeners as rust or iron oxide (Fe_2O_3), carbonates (CO_3^{2-}), silicates (SiO_4^{4-}), phosphates (PO_4^{3-}), or potassium nitrate (salt peter) (KNO_3). Other forms of oxygen we all know are hydrogen peroxide (H_2O_2) or ozone (O_3).

The human body is 60% water (H_2O) and oxygen is 61% of our total body mass. Oxygen is so important that 43-45% of all the compounds in a plant contain oxygen. A healthy soil is 25% air of which oxygen is the critical ingredient required by microbes and plants. Adding oxygen to soils often

creates an immediate growth response, a lack of oxygen creates conditions in which diseases, and pests thrive. A lack of oxygen also encourages weed seeds to germinate. Most pathogenic organisms whether human or plants are anaerobic and do not like oxygen. Oxygen is critical for all beneficial biological processes in the soil. This is why aeration by microbes and earthworms is so important. We do not want to kill them by using toxic chemicals.

It is interesting that the enzyme nitrogenase requires a low oxygen environment to work; the plant keeps its oxygen levels low at the root nodule by binding oxygen to a specialized protein called leghemoglobin. It is a delicate balancing act, as plants have to keep oxygen levels low enough for the enzyme to work but high enough to keep the bacteria alive.

Note: Oxygen does not function well in our soils or our bodies if there is a deficiency of selenium.

Sources: compost, water (H₂O), air (O₂), hydrogen peroxide

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<http://natureswayresources.com/>

ADOPTABLE DOG OF THE MONTH

DIESEL

Diesel was abandoned by his owners when they moved, and he ended up at Montgomery County Animal Shelter.

Diesel is a American Blue Pittbull Mix and is thought to be about 10 years old.

He knows basic commands- is housebroken and crate trained- loves everyone he meets... Loves bones, treats and squeaky toys- even likes a nice jog. He has a good amount of life to live and would love to have somewhere to spend it. If he has siblings- they have to be female.

Diesel loves to play and socialize and is so much fun to have around.

He is fixed and has all of his shots.

If interested in adopting Diesel, please reply to this newsletter and type "Diesel" in the subject line. Diesel is not at the shelter currently. He is in foster care.



ABOUT US

BRENDA BEUST SMITH

WE KNOW HER BEST AS THE LAZY GARDENER . . .

. . . but Brenda Beust Smith is also:

- * a national award-winning writer & editor
- * a nationally-published writer & photographer
- * a national horticultural speaker
- * a former Houston Chronicle reporter

When the Chronicle discontinued Brenda 's 45-year-old "Lazy Gardener" print column a couple of years ago, it ranked as the longest-running, continuously-published local newspaper column in the Greater Houston area.

Brenda 's gradual sideways step from Chronicle reporter into gardening writing led first to an 18-year series of when-to-do-what Lazy Gardener Calendars, then to her *Lazy Gardener's Guide* book and now to her *Lazy Gardener's Guide* on CD (which retails for \$20. However, \$5 of every sale is returned to the sponsoring group at her speaking engagements).

A Harris County Master Gardener, Brenda has served on the boards of many Greater Houston area horticulture organizations and has hosted local radio and TV shows, most notably a 10+-year Lazy Gardener run on HoustonPBS (Ch. 8) and her call-in "EcoGardening" show on KPFT-FM.

Brenda recently ended her decades-long stint as Production Manager of the Garden Club of America's **BULLETIN** magazine. Although still an active horticulture lecturer and broad-based freelance writer, Brenda's main focus now is **THE LAZY GARDENER & FRIENDS HOUSTON GARDEN NEWSLETTER** with John Ferguson and Mark Bowen of Nature's Way Resources.

A native of New Orleans and graduate of St. Agnes Academy and the University of Houston, Brenda lives in Aldine and is married to the now retired Aldine High School Coach Bill Smith. They have one son, Blake.

Regarding this newsletter, Brenda is the lead writer, originator of it and the daily inspiration for it. We so appreciate the way she has made gardening such a fun way to celebrate life together for such a long time.

JOHN FERGUSON

John is a native Houstonian and has over 27 years of business experience. He owns Nature's Way Resources, a composting company that specializes in high quality compost, mulch, and soil mixes. He holds a MS degree in Physics and Geology and is a licensed Soil Scientist in Texas.

John has won many awards in horticulture and environmental issues. He represents the composting industry on the Houston-Galveston Area Council for solid waste. His personal garden has been featured in several horticultural books and "Better Homes and Gardens" magazine. His business has been recognized in the Wall Street Journal for the quality and value of their products. He is a member of the Physics Honor Society and many other professional societies. John is the co-author of the book *Organic Management for the Professional*.

For this newsletter, John contributes articles regularly and is responsible for publishing it.

MARK BOWEN

Mark is a native Houstonian, a horticulturist, certified permaculturist and organic specialist with a background in garden design, land restoration and organic project management. He is currently the general manager of Nature's Way Resources. Mark is also the co-author of the book *Habitat Gardening for Houston*

and Southeast Texas, the author of the book *Naturalistic Landscaping for the Gulf Coast*, co-author of the *Bayou Planting Guide* and contributing landscape designer for the book *Landscaping Homes: Texas*.

With respect to this newsletter, Mark serves as a co-editor and periodic article contributor.

PABLO HERNANDEZ

Pablo Hernandez is the special projects coordinator for Nature's Way Resources. His realm of responsibilities include: serving as a webmaster, IT support, technical problem solving/troubleshooting, metrics management, quality control, and he is a certified compost facility operator.

Pablo helps this newsletter happen from a technical support standpoint.



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