COLLEGE OF AGRICULTURE & LIFE SCIENCES
Cooperative Extension

Backyards & Beyond

RURAL LIVING IN ARIZONA

WINTER 2016

VOLUME 10, NUMBER 1

FEATURED PLANT

Susan Pater, Extension Agent, University of Arizona Cooperative Extension, Cochise County

Common Name: Brittlebush
Scientific Name: *Encelia farinosa*

Photo credits: Larger photo (gords_picks)
Inset photo (jonlin)

Brittlebush is a member of the sunflower family and can be found growing on rocky or gravelly slopes and washes within the Sonoran Desert and portions of the Mohave Desert. Its name comes from the brittleness of the stems. It is a compact, dome-shaped, 3 to 4 foot high shrub with yellow flowers on long leafless stalks protruding above the leafy portion of the plant. The leaves are alternate, light greenish-gray to almost white, wooly, and oval to triangle-shaped. The leaves have serrated edges and are 1 to 4 inches long. The leaves are densely covered with short, crooked hairs. These hairs help insulate the plant against heat and cold, help capture moisture and reduce the amount of water lost. The white color reflects sunlight helping to keep the plant cool in the desert environment.

Blooming in early spring the flowers are in branched clusters with 2 inch wide individual flower heads with a dark yellow to purplish mound of disk-corollas from which radiate 1 inch yellow rays with a lobed, squared off tip. With its gray green leaves and bright yellow flower heads, it is one of the most striking shrubs in the desert mountains and hills. During periods of severe drought and after heavy frosts the leaves will drop off leaving the brownish gray stems to store water until the rain comes. The brittle wood secretes a clear resin that was used by Native Americans as glue and also as a chewing gum. The sap is fragrant and the early Spanish missionaries burned it as an incense in churches, thus the name "Incienso."

Brittlebush does well in backyard landscapes when placed away from irrigation. Be careful not to overwater. The flowers attract butterflies. To encourage repeat flowering you can cut it back some after bloom. It can be easily transplanted and grows well from seed. It has spread dramatically in areas not natural to its distribution in large part due to hydroseeding along highways to help stabilize disturbed areas. Kangaroo rats will eat the seed when not much else is available. Mule deer and desert bighorn sheep browse on it.

FEATURED BIRD

Dan L. Fischer - Author of Early Southwest Ornithologists, 1528-1900. Univ. of Arizona Press.

Common Name: Western Screech-Owl
Scientific Name: *Megascops kennicottii*

DAN L. FISCHER

In early spring, after remaining in concealment within a tree cavity or dense thicket throughout the day, the Western Screech-Owl emerges at dusk to begin nocturnal activities. Usually it begins with a series of loud clear whistled vocalizations, giving the direction of its approximate location. One strikingly distinctive song consists of a sequence of accelerating notes in a cadence resembling an accelerating rhythmic "bouncing ball." Several owl species in this region, often difficult to observe at night, sing respective songs that are important aids in their identification. With this knowledge and when pursuit is hampered it is often unnecessary to observe the bird visually to identify or note its presence. With a wing span of 21" and length of 8.5", this is the larger of seven small owls that occur in southeastern Arizona. Along with two others, it has ear tuffs that are prominent when raised. Six larger owls also occur totaling thirteen for the region, therefore this area has the greatest assortment of owl species in the United States.

In Arizona the range of the Western Screech-Owl extends from the lower deserts of saguaro to riparian areas and into the pine–oak woodlands. They are the most common and widespread of the smaller owls. Their diet consists of prey items including various small to large arthropods, mice, small snakes, and occasionally small birds. Like all owls, they swallow most items whole and regurgitate the indigestible fragments such as insect skeletonal parts, bones, fur and feathers in the form of pellets.

Two to four white eggs are generally laid in a natural or old woodpecker cavity in early March. Incubation is at least three weeks and the young fledge in another three to four weeks. They are fed by both parents for about an additional six weeks as they learn to hunt.

The discovery of the Western Screech-Owl was made in Sitka by a group of naturalists, including Robert Kennicott (1835-1866), all employed by the Western Union Telegraph Company attempting to implement and plan for an overland telegraph link from "Russian America" to Siberia. During Kennicott's short life he became such an energetic and exhaustive specimen collector that he suffered two heart attacks, the second proved to be fatal while at Fort Nulato on a bank of the lower Yukon River. One year after his death Alaska was purchased from Russia by the United States and became known as "Seward's folly or icebox."

During his life Kennicott contributed hundreds of various scientific specimens to the US National Museum and the Academy of Natural Sciences of Chicago, where he was one of the founders. After receiving a specimen of this owl, Daniel Giraud Elliot (1835-1915), also a founder of the latter institution where he was Curator of Zoology, named the Western Screech-Owl in tribute to Kennicott for his many contributions to science in 1867.


STEVE COLLENDER

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Backyards & Beyond

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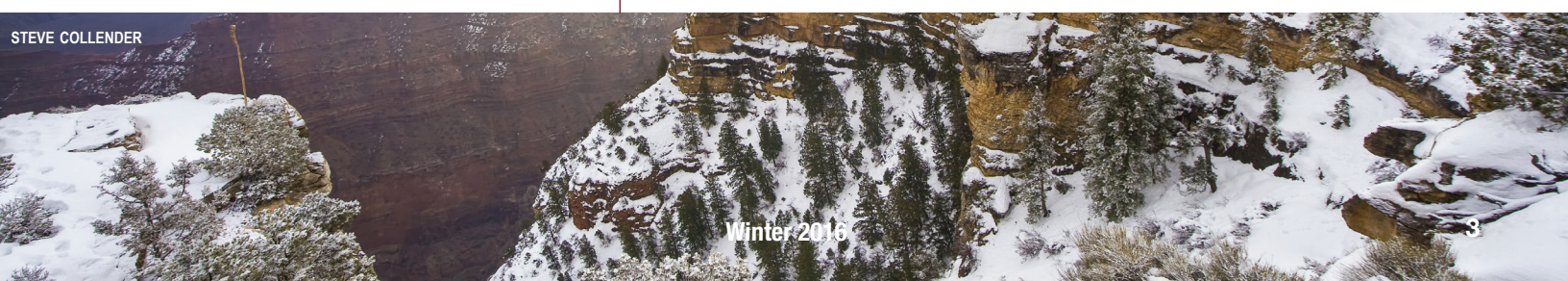

STEVE COLLENDER

PRUNING
DECIDUOUS SHADE TREES

Elizabeth Davison: Former Lecturer, Department of Plant Sciences; Tom DeGomez: Former Regional Specialist and Area Agent

Trees in the wild are never pruned, yet they often have long healthy lives. In a natural setting, their branches develop a balance and form typical of the species. It is when trees grown in un-natural settings (nurseries) are brought into an urban situation that correct pruning becomes so important. Pruning is both a skill and an art.

The pruning principles discussed in this publication have proven to provide the best possible out comes including tree longevity and safety. Although trees may live for years following improper pruning their life span and safety may be severely reduced. We encourage proper pruning so that the trees we care for may bring us pleasure for many years.

Many reasons for pruning are born out of planting the wrong tree in a specific location. Choosing "The Right Tree for the Right Place" can greatly reduce future problems with unwanted limbs.

Why prune a tree?

There are only a few valid reasons to prune a tree in the urban landscape:

- Promote tree's health
- Reduce hazards to people
- Train a young tree
- Increase or decrease flowers/fruit

Identify the purpose for pruning your deciduous shade tree. Resist pruning because the tree is growing rapidly, or because the neighbors are working on their trees. Understand that pruning always causes a wound and always results in some response in the tree:

- Loss of foliage and ability to create food from sunlight
- Potential entry points for decay organisms
- An increase in sprouting
- Reduced or increased vigor
- Susceptibility to insect problems

Decide whether the desired benefit will override the negative effect on the tree.

When to prune a deciduous tree

In general, pruning has a greater benefit if it is performed while the tree is young. Wounds are smaller and recovery is more rapid. This document will discuss pruning young trees and older trees separately.

Deciduous trees are those that lose their leaves and go through a dormant period in response to cold (and sometimes drought). The best time of year to prune is during this **dormancy — when all of the foliage has dropped.** Generally this occurs from mid-December to the latter part of January.

All pruning should be done before buds show evidence of swelling. Why?

- Less likelihood of tearing bark
- Less likelihood of dripping sap
- More time for recovery before bud break
- Easier to see branch structure
- Less likelihood of stimulating unwanted growth

Equipment needed for pruning

Limbs of various sizes will be removed during pruning. Matching the limb size to the hand tool will improve efficiency. Buy the best tool you can afford. In general, you get what you pay for.

For limbs over one inch (2.5 cm) in diameter, use a **pruning saw**. There are several available styles. High quality forged stainless steel is strongest. Those with blades on both sides of the teeth will cut efficiently on both forward and backward strokes. Models with blades that narrow at the end will allow easy access to tight spots.

Pruning loppers are convenient for limbs that are about the size of a finger. Blades that cut like scissors ("bypass" type) will make cleaner cuts. Models are available that have gears for efficient movement, hollow handles for reduced weight, and high quality steel blades.

Hand **pruning shears** are best for branches less than 1/2 inch (1.25 cm). Left handed-versions are available. Those with bypass blades,

and handles that fit the hand will cut efficiently with less effort. Hand pruners are the first choice when pruning because they do the least amount of damage to the tree. Use them when trees are young to direct growth for proper canopy development reducing the need for saws and loppers when trees are older.

There is always the possibility of spreading a disease from one plant to another. When pruning several plants, it is wise to disinfest your tools between plants. Dip or coat the blades with a 10% bleach solution or with alcohol. After using pruning tools, thoroughly wash, dry, and coat the blades with a film of light oil to prevent rusting. If kept sharp and clean, good tools will provide years of service.

Proper technique

Rapid sealing off of pruning wounds depends upon where the pruning cut is made. Most trees produce a corky ridge at the juncture or crotch of a branch; this is called the **Branch Bark Ridge.** At the base of a limb is a ring of growth; this is called the **Branch Collar**. The pruning cut should be made just outside a line connecting these two points. This technique is called Natural Target Pruning, and it minimizes problems in recovery. See Figure 1.

If a tree does not produce the characteristic branch collar or ring of bark, make the cut so that the angles between the verticle line of the tree and the bark ridge are the same as the angle where the cut should be made. See Figure 2.

Large heavy limbs over 2" in diameter should be cut in a 3-step process as shown in Figure 3. Sharper tools make cleaner cuts.

Do not apply pruning paint; wounds have been found to recover more rapidly in the open air.

Pruning/training young trees

(FIRST 3 YEARS ON THE SITE)

Proper pruning when the tree is young will result in a mature tree that is structurally stronger, lives longer, requires less pruning, and is less costly to maintain.

A. Pruning Your Tree At Planting Time:

There is no need to prune a newly-planted tree unless branches have been damaged or if major defects in form are present in branches greater than 1 inch in diameter. Major defects include: multiple central leaders, branches with included bark, rubbing branches and water sprouts and suckers. It has been found that removing tips and buds of young trees slows root growth. If trees are left unpruned, expanding buds and new leaves help root expansion and tree establishment. Damaged branches can be removed at their point of origin, or they can be cut back to a lateral branch that will provide foliage and help establishment the first season.

B. Young Tree Health And Structure:

A word of caution: different tree species grow at different rates. Your tree may not seem to be adding any height or spread for the first year or so. Check the irrigation design and frequency, keep the soil mulched, and avoid compacting the root zone. Resist the urge to prune a young tree simply to "force" new growth. Such growth is weakly attached, rarely looks good, and will require additional maintenance later in the tree's life. Conversely, overwatering and overfeeding a young tree may result in fast growth that appears to need pruning each year. Cutting back on irrigation after the first summer, particularly if the species is adapted to

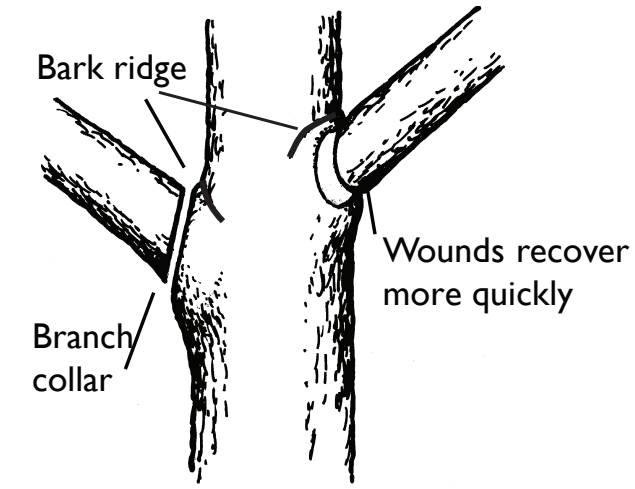


Figure 1. Natural Target Pruning.

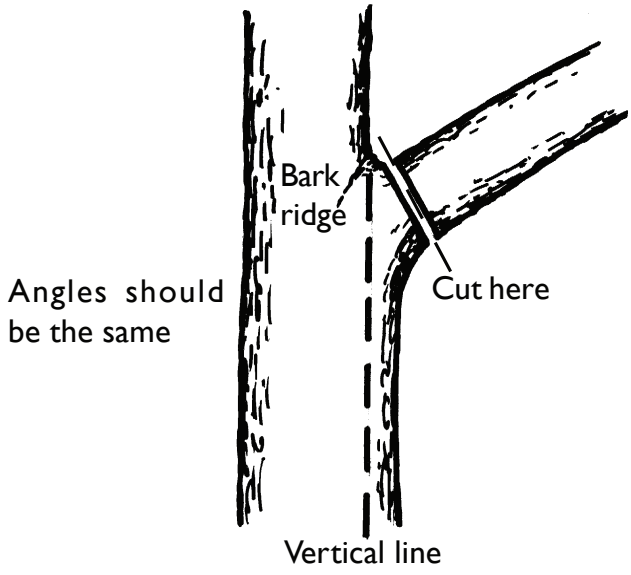


Figure 2. Angle to cut if the Branch Collar is not evident.

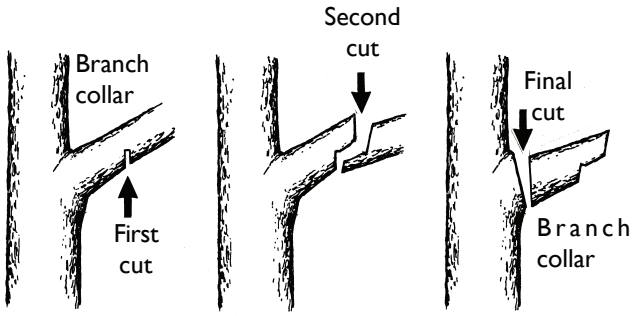


Figure 3. Three cuts are necessary to remove large limbs. This procedure prevents bark from stripping down the trunk.

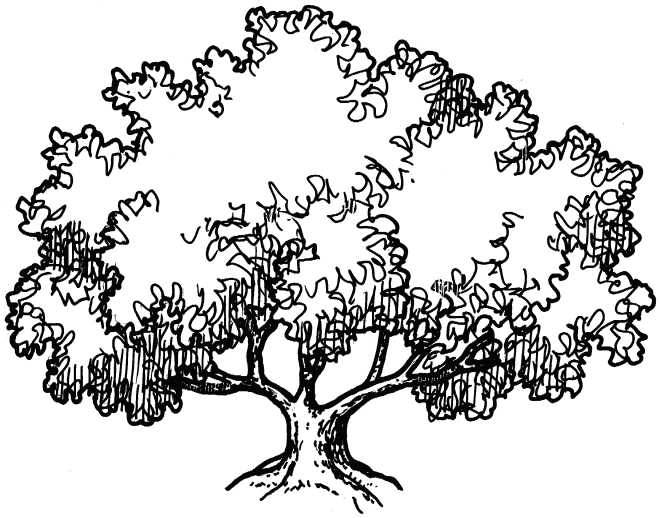


Figure 4. Wide-spreading tree.

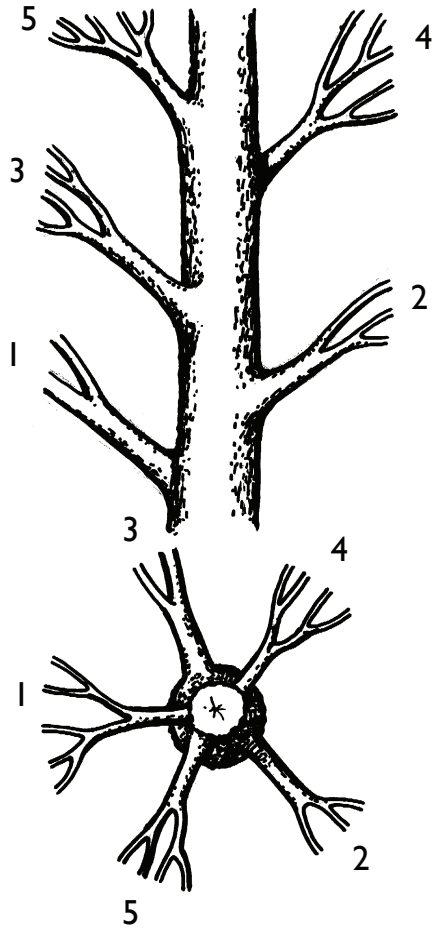


Figure 5. Scaffold branches require proper vertical and radial spacing on the trunk.

your climate, can slow growth and maintain a more balanced tree that requires less maintenance.

Know the **species' natural form.** Many deciduous trees, including most desert trees, have a rounded spreading shape with no single central leader. See Figure 4. The lateral branches grow as fast or faster than the main trunk. Do not try to force a rounded species into a tall narrow shape (or a tall species into a rounded shape!)

Rounded spreading deciduous tree species may naturally form **multiple trunks**. These can be very attractive and provide much needed shade. To develop a multi-trunk tree in a species that naturally has low branching, allow the secondary trunks to arise close to the ground with wide branch angles. If several trunks all arise from the soil, choose 3 or 4 of the largest, removing the smaller ones.

Early in the tree's life, decide between closely spaced **scaffold branches** (large branches that form the main structure). Try to visualize how the tree will look as it thickens in years to come. Know the natural form of the species. Remember — branches do not slowly rise with time! As a tree grows, branches retain their position on the trunk, though they increase in diameter and become more crowded. Spacing scaffold branches radially and vertically allows growth to be channeled where it will be more effective. See Figure 5. No more than 1/4 of the canopy should be removed at any one time. Depending on the tree's growth rate and branching structure, this training may take several years.

During the tree's first 3–4 dormant seasons, keep an eye on the water sprouts (vigorous upright shoots from a branch), suckers (vigorous upright shoots from below the soil level), and rubbing branches. See Figure 6. These should be pruned at their points of origin. Again, cut cleanly just outside the branch collar.

Should **small branches covering the lower trunk** be removed? Not completely. Cutting off lower trunk branches does not "force" growth of the top, and may result in more sprouting from the cut area. It has been found that small branches along the lower trunk provide hormones and food for trunk expansion and stability. Leaving them intact, or only trimming back slightly will help the trunk develop taper and strength during early years. See Figure 7.

Note of caution: The longer temporary branches are left on, the larger the wound when cut.

Most tree species form secondary branches at regular intervals along the trunk and scaffold branches. Removing branch ends or tips usually causes a proliferation of buds to break open down the stem, resulting in a "bushier" form that will need more attention in future years. If one branch is longer than the others, prune it back to a side branch that's headed in the right direction. Do not shear the tips of tree branches.

Likewise, "topping" or severely heading back large branches causes large wounds and severe stress to the tree. This practice results in a proliferation of sprouts that all originate from the same area, are weakly attached, and will need extensive care in future years. Topping is extremely detrimental to any tree species.

Some trees that are planted in pedestrian areas may more easily survive in the sites if their lower scaffold branches are at least 8 ft above the ground. See Figure 8. This is called raising the crown, and is best done gradually; i.e., prune one scaffold branch each year over several dormant seasons, rather than removing them all at once. The lowest permanent branches should have wide angles and be less than half the width of the trunk at the point of attachment. Clean cuts just outside the branch collar will allow more rapid recovery. See Figure 1.

Pruning older trees

(LONGER THAN 3 YEARS ON THE SITE)

A. Form and Health of the Tree:

Trees growing in native habitat develop natural forms even though they were never pruned. There may be some defects: large limbs may be rubbing against each other, limbs may be crossing over to the opposite side or there may be sprouts arising on the main trunk or near ground level. Even with defects present, these trees have stabilized branch structures and they normally withstand strong winds. Their graceful forms are more attractive than severely pruned trees in home yards.

If your older tree has never been pruned, this doesn't mean it needs to be. Walk around the tree and carefully observe limb placement. Look for obvious defects on larger size limbs: narrow angles that have included bark (a buildup of bark within the angle), branches originating too close together, or rubbing or crossing branches.

Branch angles are important. Narrow angles are more prone to splitting because included bark cells do not join together. Angles that are closer than 60° will cause problems later on. (See Figure 9.) Remove the smaller or least desirable branch by cutting outside the Branch Collar.

Large scaffold branches should be evenly spaced throughout the tree. If two branches originate from points less than about 12" (30 cm) from each other, they will only put stress on the trunk as they increase in girth. Decide if two or more branches are originating from the same point on the trunk. Choose the one with the narrowest crotch angle, or the most internal one and remove it. If there are several troublesome branches, take the one that will leave the smallest void if removed.

If two limbs are paralleling each other too closely, the least desirable one should be cut at its point of origin. Try to visualize the appearance of the tree if one or the other is removed. Which one is best placed? Which one will leave the smallest void if removed? Which one will leave the smallest wound? If the branch is larger than about an inch, use the 3–step method as shown in Figure 3.

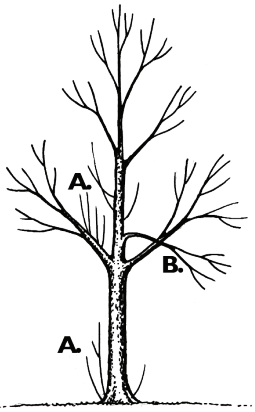
The same procedure should be used if two large limbs are rubbing against each other. Study the placement of each and then remove the least desirable one.

After removing these undesirable limbs, **STOP and re-evaluate**. If you are tempted to severely prune, remember this: trees with natural forms are beautiful and healthy. By removing only those limbs that threaten sound structure, you will have a tree that surpasses those in nature. Severe pruning destroys the natural form and causes trees to develop shapes that are completely different than nature intended. More importantly, from a health standpoint, removing more than 1/4 the total amount of the live wood at any one time causes significant stress and reduced photosynthetic ability as the tree recovers.

Remove only limbs that cause problems and allow the tree to develop a natural growth habit. Few pruning cuts will be made; sunlight will filter through the foliage, reducing leaf drop, the bark will not burn from sudden exposure to sun, and wind will pass through the tree without threatening breakage.

B. Reduction of Height and Width:

Reduction of height or width may be necessary, but it is also possible that the tree has been planted in the wrong site. If the natural form of the species includes a wide spreading canopy, it was the wrong choice for a narrow walkway or close to a building. The landscape might be improved by removing the tree and replacing it with one that has a more narrow upright form. Likewise, if the species typically makes a tall narrow canopy,



A. Water sprouts and suckers
These sprouts can occur at the base or inside the crown. They are rapidly growing, weakly attached, and upright. Usually they use more energy than they return to the tree.

B. Rubbing branches
Branches that rub result in wounds, decay and notches. Remove one of the offending branches.

Figure 6. Water sprouts, suckers, and rubbing branches..

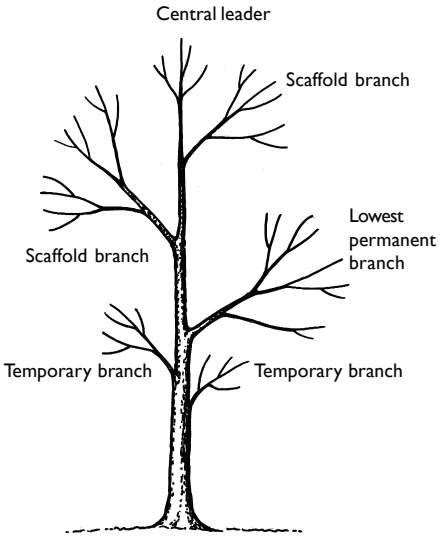


Figure 7. Temporary branches.

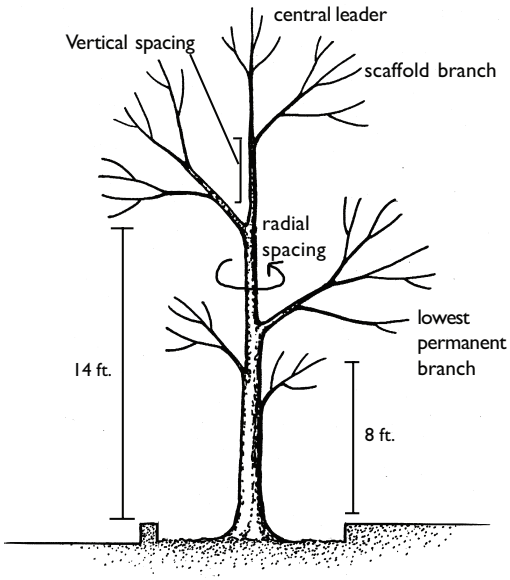


Figure 8. Pedestrian space below crown.

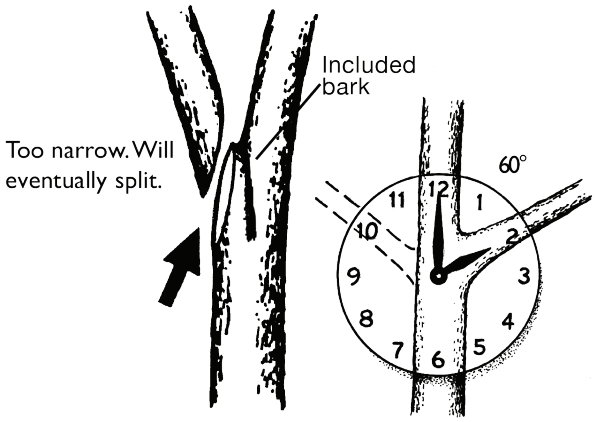


Figure 9. Narrow branch angles. Narrow branch angles are often accompanied with included bark.

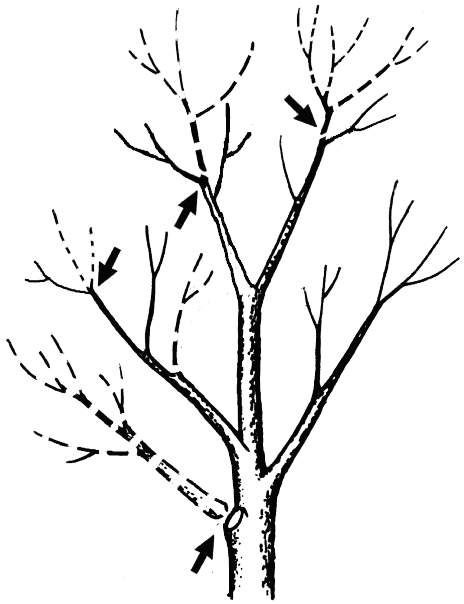


Figure 10. Cutting back to a lateral branch.

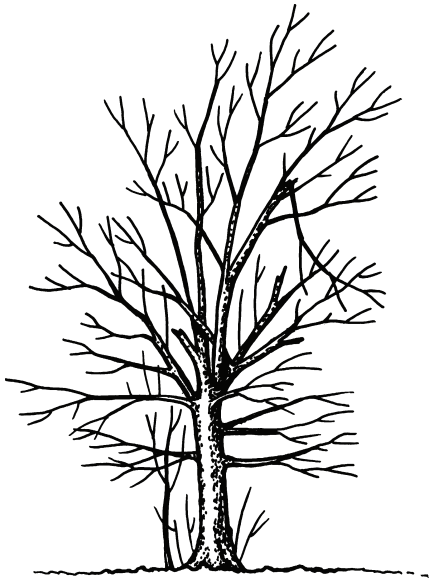


Figure 11. Tree that has been neglected.

it is the wrong tree for under power lines or roof overhangs.

As a one time effort, however, a limb or the central leader can be removed to reduce the height or redirect growth from interfering with a building. See Figure 10. Be aware that, depending on the species, the tree may respond to the cut by putting forth more growth than what was originally there. This is particularly true in attempts to reduce the height. A professional tree care expert should be consulted for help with reduction in height. See Arizona Cooperative Extension Publication # AZ1003: *How to Hire a Tree Expert*.

Before removing lateral branches to **reduce a tree's width**, remember your goal is to prevent regrowth from the wound. Always attempt to cut back to a side branch, or to the point of origin. See Figure 10. Either of these choices will discourage development of numerous new limbs that are weakly attached. Cut back to a branch that is at least 1/3 the diameter of the part that's removed. Heavy branches should be cut in 3 steps as shown in Figure 3.

Trees often suffer limb breakage during severe wind storms. Removal of heavy, large limbs should be left to professionals. Cut limbs do not always fall in the intended places and serious damage to home or body is always a hazard. Smaller broken limbs resting on the ground can be removed with little danger. Can a fractured limb be lifted and wrapped and heal itself? NO. Trees do not heal the way bones do.

C. Pruning to Increase Flowering or Fruiting:

Older trees of low vigor can be induced to produce more flowers. When problem branches are thinned out, the branches remaining have more available light and nutrients. Typically, flowers on wood produced after the pruning will be larger or more numerous. Species that flower early in the spring on last season's wood should be pruned after the bloom season. Species that flower later in the season, on wood formed the current year, should be pruned during the dormant season.≠≠

Pruning or ruining?

There is an old saying among professional arborists in connection with tree pruning, "If in doubt, don't prune." Nature has a unique way of allowing trees to develop natural forms that balance shoot growth with root zone health. When this natural form is destroyed, trees will react accordingly — by producing rank, weakly-attached growth, elongation of existing shoots, reduced vigor, increased susceptibility to insect or disease problems, or consumption of stored carbohydrates.

There is always a reaction. If even one limb is removed from a tree, there should be a reason for doing so. Anyone who prunes for the sake of pruning "because everyone else is" will undoubtedly cause problems that will be difficult to correct in later years.

On the other hand, careful selective pruning for any of the valid reasons listed will produce a healthy, beautiful tree that will enhance your landscape and improve the quality of life in your neighborhood for years to come.

Note: Although the same basic principles discused herein apply to fruit trees; pruning management for fruit trees can vary considerably from shade trees. Consult with your local county Extension office for information on pruning fruit trees.

FOOD PRODUCT DATING AND STORAGE TIMES

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Check the Date

Nutritious food is an important part of our individual health and wellness. One way to ensure your food is nutritious is to check the date on packages. The date is a guideline to help consumers use food when it is at its peak quality or before spoilage begins. Proper storage conditions and times are also essential in keeping healthy food safe to consume.

State's Choice

With the exception of infant formula, Federal regulations do not require product dating, so individual states decide whether to use them.[1]

If a company does use "open dating" on a food product, the date must show a month, day, and year for shelf-stable and frozen products, as well as an explanatory phrase to indicate the meaning of the date such as "use by" "sell by" or "best by."

Food Product Date Types

"Open dating" refers to an actual calendar date instead of a coded date created by the manufacturer.[1] Open Dating is found mainly on packages of perishable foods such as meat, poultry, eggs, and dairy products. The date helps store employees know when to pull these foods off the shelf. It can also benefit consumers by letting them know when a product is at its best quality. However, this date is not necessarily an indicator of food safety.

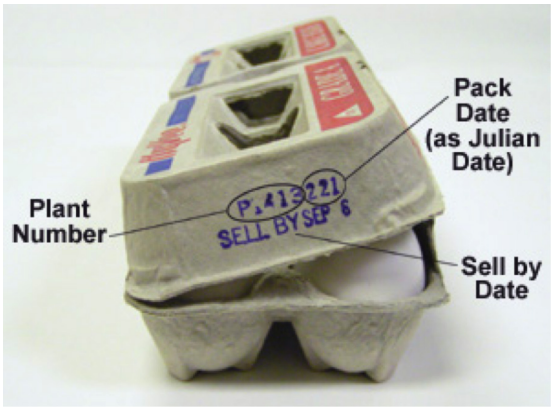
Types of Dates:

- **Sell By** – indicates how long the product should be displayed for sale. Consumers should purchase products before the sell by date.
- **Best If Used By** – indicates the date of the product's optimal flavor and quality. It is not a purchase or safety date.
- **Use By** – indicates the last date of the product's peak quality. It also helps consumers decide when food is no longer safe to eat. This date is determined by the food product manufacturer.

Product dates do not always denote that the food is unsafe.[1] Even if the date on the food product expires during home storage, perishable foods should be safe, nutritious, and of good quality if they are properly stored.

Dates on Egg Cartons

If a "sell by" date such as "SELL BY Nov 5" is printed on an egg carton, be sure the date has not passed when you purchase the eggs. That date is the last day the store may sell the eggs as "fresh." Once eggs are purchased, they can be stored at home, refrigerated, for 3 to 5 weeks. The "sell by" date will most likely expire, but the eggs are completely safe to eat.[1]



The example in the egg carton pictured above shows a Julian date. A Julian date is the number of days past January 1st that the eggs were packed and is for your information.

Dating of Infant Formula and Baby Foods

Federal regulation requires a "use by" date on baby formula for quality as well as nutrient retention.[1] The "use by" date is selected on the basis of product analysis and other tests during the formula's shelf life. The date also is based on the conditions for handling, storage, use and preparation, which are printed on the product label. Consumers should not buy or use infant formula after its "use by" date.

Canned Goods Codes

In order to facilitate the tracking of canned food in interstate commerce, manufacturers give each can a packing code.[1] These codes appear as a series of letters and/or numbers that refer to the date or time of manufacture. They are not meant for consumers to interpret as "use by" dates. Cans typically have a "best-if-used by" date that indicates the product's peak quality.

The USDA states that canned foods are safe indefinitely as long as they are stored in a place that is free from extreme temperatures—freezing and heat above 90°F. The USDA further states that if the can looks normal and is free of dents, rust, and swelling, it should be safe to consume. In general, high-acid canned foods such as tomatoes, grapefruit, pineapple, and other fruits, will maintain their best quality for 12-18 months. Low-acid canned foods such as meat, poultry, fish and most vegetables, will maintain their best quality for 2-5 years.

Storage Times

Because product dates are not a guide for safe use of a product, the following tips can ensure that canned food remains top quality:

- Purchase canned food before the expiration date.
- Store perishable food properly and promptly after purchase.
- The USDA states that once the product is frozen, foods can be kept frozen at 0°F degrees continuously and are safe indefinitely, although quality declines.[1]
- Consumers should always follow handling recommendations on the product.
- If a product has a "use by" date, follow that recommendation.
- If a product has a "sell by" date or no date, cook and/or freeze the product by the times on the following charts.

Processed Product	Unopened, After Purchase	After Opening
Cooked poultry	3 to 4 days	3 to 4 days
Cooked sausage	3 to 4 days	3 to 4 days
Sausage, hard/dry, shelf-stable	6 weeks/ pantry	3 weeks
Corned beef, uncooked, in pouch with pickling juices	5 to 7 days	5 to 7 days
Vacuum-packed dinners, commercial brand with USDA seal	2 weeks	3 to 4 days
Bacon	2 weeks	7 days
Hot dogs	2 weeks*	7 days
Lunch meats	2 weeks*	7 days
Ham, fully cooked	7 days	3 days-slices 7 days-whole
Ham, canned, labeled "keep refrigerated"	9 months	3 to 4 days
Ham, canned, shelf-stable	2 years/ pantry	3 to 5 days
Canned meat and poultry, shelf-stable	2 to 5 years/ pantry	3 to 4 days

*No longer than one week after a "sell by" date.

Refrigerator Home Storage of Fresh or Uncooked Items Held at 40°F or Below[1]	
Product	**Storage Times After Purchase**
Poultry	1 to 2 days
Beef, veal, pork, lamb	3 to 5 days
Ground meat or poultry	1 to 2 days
Cured ham, cook before eating	5 to 7 days
Sausage, uncooked	1 to 2 days
Eggs, raw in shell	3 to 5 weeks

Reference

1. U.S. Department of Agriculture. (2013). http://www.fsis.usda.gov Website. Food Product Dating. http://www.fsis.usda.gov/wps/wcm/connect/19013cb7-8a4d-474c-8bd7-bda76b9defb3/Food_Product_Dating.pdf?MOD=AJPERES. Accessed November 3, 2014.
2. U.S. Food and Drug Administration. (2014) http://fda.gov Website. To Your Health! http://www.fda.gov/Food/FoodborneIllnessContaminants/PeopleAtRisk/ucm182679.htm#storchart. Accessed November 7, 2014.

ARIZONA
CLIMATE ZONES
AND THEIR APPLICATION TO GROWING PLANTS

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Fig. 1. Physiographic Provinces of Arizona. Photo credit: Arizona Department of Water Resources.

Plants grow best in climates to which they are most adapted. Knowing the climate zone of a location is one of the factors to successfully cultivate plants outdoors. While soil, water, and light are critical, low or high temperatures can limit plant growth in a certain location. Arizona is a large state spanning 335 miles east to west and 390 miles north to south with diverse climate zones. The climate is influenced by elevation which determines the high and low temperatures, and by rainfall which varies across the state. Rainfall ranges from 3 inches annually in Yuma, the southwestern corner of Arizona, to more than 30 inches in the mountain areas. Arizona's climate is classified as arid or semi-arid because evapotranspiration, the combined loss of water from soil and plants in a location, is greater than the amount of rainfall the area receives.

How should climate zones be used by landscapers and gardeners?

Climate zones are useful to understand the temperature limitations of a location and select appropriate plants for long-term successful plant performance. Microclimates and unseasonal low temperatures, such as an early freeze in fall before plants have hardened off or a late freeze in spring after plant growth or flowering has started, can cause damage although the minimum annual temperatures have not been exceeded. For plants to thrive continually in a location, other factors such as soil quality, water and fertilizer availability, light, wind, and exposure to extreme conditions will affect plant growth and health.

Arizona climate zones

Arizona's climate is in part affected by three physiographic landforms, the Colorado Plateau, the Transition Zone, and the Basin and Range (Fig. 1). The Colorado Plateau rises to elevations of 5,000 to 8,000 feet and occupies the northern part of the state, except for a narrow strip along the northwest border. At its southern edge, the Colorado Plateau ends with the Mogollon Rim, a steep slope with drops of 2,000 to 3,000 feet. The adjacent Transition Zone, also known as the Central Highlands, is characterized by rugged mountains, and leads into the Basin and Range which occupies most of

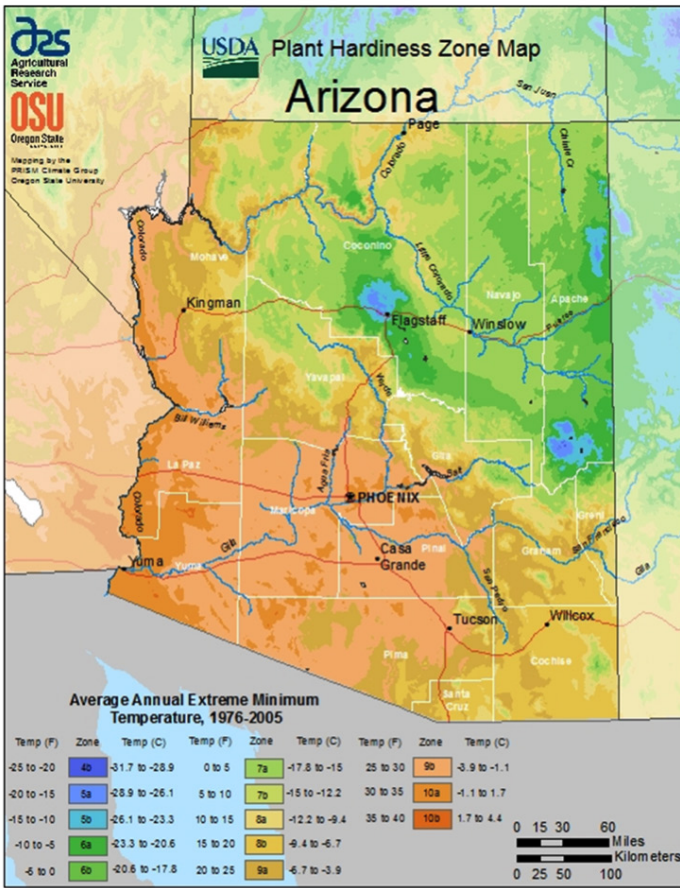

Fig. 2. USDA Plant Hardiness Zone Map for Arizona assigns zones based on the average annual minimum temperatures and ranges from zone 4b to 10b..

the lower elevation in the southern part of the state and an area along the Colorado River and to the north. Lowland desert with some mountain ranges dominate the Basin and Range with year-round warm climate at the lower elevations. The diverse geography within each landform, such as canyons, creates microclimates that can change drastically over a short distance.

Climate zones refer to the long-term temperature and rainfall patterns that shape the natural vegetation in a geographic location. Landscapers, agronomists, and gardeners know how to select appropriate soils or how to change the soil conditions so they are favorable to the plants they cultivate. Irrigation is generally available to supplement rainfall. However, minimum and maximum temperatures outdoors cannot be changed and determine which plants can be cultivated successfully in a certain location. Three climate zone maps using different criteria are available for Arizona residents to choose suitable plant material for individual zones. The United States Department of Agriculture (USDA) Hardiness Zone Map (Fig. 2) classifies zones by minimum temperature. The American Horticulture Society (AHS) Heat Zone map uses the number of days above a threshold temperature, and the Sunset climate zones are defined by a combination of climate factors. Table 1 lists the three types of zones for the major cities in Arizona. Table 2 lists common landscape plants and their classification for the three climate zone maps.

The USDA Hardiness Zone Map (2012) is based on the average annual minimum winter temperature in a geographic location and is based on temperature records collected from 1976 to 2005. Zones range from 1 to 13 with 10-degree Fahrenheit increments. Further refinement is provided by dividing each zone into "a" and "b" subzones based on 5 degree increments. Zone 1 starts at -60°F and zone 13 applies to subtropical and tropical locations where minimum temperatures drop only to 50°F to 60°F. USDA Hardiness zones in Arizona range from 4b to 10b (Fig. 2). Coldest locations in zone 4b, where temperatures drop to -20°F to -25°F, include the San Francisco Peaks, the White Mountains, and Mount Graham. Residents of Flagstaff, Arizona live in zone 6a, where temperatures dip to -10 to -5°F and plant material needs to be hardy to these temperatures to survive. The warmest locations are located in the southwestern and southcentral part of the state, zone 10, mainly along the Colorado River and the Phoenix metropolitan area with minimum temperatures between 30°F to 40°F.

The USDA Hardiness zone map can be accessed at http://planthardiness.ars.usda.gov/PHZMWeb/. The quickest way to find the USDA hardiness zone of an area is the zip code finder. The interactive map of the website allows viewing a terrain, road, or satellite map of an area with optional layering of the maps. Pointing plus clicking to any location shows the zone, average minimum temperature, temperature range of the zone, and latitude and longitude. The interactive map was constructed using grid cells with a size of half a mile. This detailed information is especially valuable where rapid elevation changes occur over short distances and result in changes in climate zones.

The USDA Hardiness Zone map delivers great accuracy for Arizona regarding the minimum temperatures we can expect based on recent 30 year averages. This is useful in selecting well-adapted plant material for

a location. Selection of marginally hardy plant material grown outdoors needs to be carefully matched to the expected minimum temperatures. Microclimates are affected by their immediate surroundings and are often warmer in urban areas where heat is absorbed, stored, or reflected, and colder in areas where strong temperature inversions occur, especially along rivers and washes.

Plant species are assigned USDA hardiness zones based on trials of growing plants in different regions. Long-term survival in the coldest zone a given species was evaluated in earns the species the rating for that zone. These trials are carried out by botanical gardens, nurseries, and different organizations involved in plant research. There is no single source where the USDA hardiness zones of plants are published. This information can be found in horticulture books, nursery catalogs, and many websites providing plant descriptions. It is common to find slightly different USDA hardiness zones for one species when different entities tested the plant. New species and cultivars entering the market are generally tested in several locations to inform consumers about the minimum temperatures these plants can tolerate.

When it comes to hardiness, cold is only one extreme plants experience during the year. USDA zones 9a and 9b common in southern Arizona also occur along the Oregon Coast and on the tip of the Olympic Peninsula in Washington. However, we know not to choose plants that thrive in those coastal regions because plants in southern Arizona are exposed to large daily fluctuations in temperature, low humidity, and extremely high summer temperatures which can be more stressful than low winter temperatures. For nurseries, landscapers, and gardeners in the Southwest, the Sunset climate zones are the most comprehensive source to use for choosing plant material that is well adapted to the vagaries of desert climate.

The Sunset climate zones consider all aspects of climate such as latitude, high and low temperatures, elevation, ocean or continental air influence, and humidity. Plant growth is also affected by the length of the growing season, first and last frost date, and the annual pattern and amount of rainfall which is incorporated into the Sunset climate zones. Maps of the climate zones are found at:

http://www.sunset.com/garden/climate-zones.

The warmest locations in Arizona are assigned Sunset climate zone 13, the low or subtropical desert areas. This covers elevations up to 1,100 feet and includes the Phoenix area to Yuma, and land along the Colorado River. Average summer temperatures reach 107°F, but up to 15 nights of freezing temperatures, mostly in December and January, limit the plant palette. Tender subtropical plants can survive the freezes if they grow in protected locations, depending on the plant species, lowest temperature, and duration of freezing. Zone 12, the intermediate desert has on average 5 more freezing nights than zone 13, but with lower temperatures and over a longer period of time. Summer temperatures are about 5°F cooler than in zone 13. When growing deciduous fruit trees that require winter chilling (a minimum number of hours of temperatures between 45°F and 32°F) in

Table 1. Cities in Arizona and their classification according to the USDA Hardiness Zones, the Sunset Climate Zones, and the AHS Heat Zones.

City	USDA Hardiness Zone	Minimum Temperature (°F)	Sunset climate zone	Sunset zone description	AHS Heat Zone	No. days above 86°F
Flagstaff	6a	-10 to -5	2B	Warmer summer intermountain climate	2	1 - 7
Show Low	7a	0 to 5	2B	Warmer summer intermountain climate	4	15 - 30
Prescott	7b	5 to 10	3A	Mild mountain and intermountain climates	6	46 - 60
Tuba City	7b	5 to 10	3B	Mildest mountain and intermountain climates	8	91 - 120
Willcox	8a	10 to 15	10	Arizona - New Mexico high desert	9	121 - 150
Bisbee	8a	10 to 15	10	Arizona - New Mexico high desert	6	46 - 60
Sedona, Sierra Vista, Camp Verde, Page, and Kingman	8b	15 to 20	10	Arizona - New Mexico high desert	8	91 - 120
Safford	8b	15 to 20	12	Arizona's intermediate desert	9	121 - 150
Globe	9a	20 to 25	10	Arizona - New Mexico high desert	7	61 - 90
Casa Grande	9a	20 to 25	12	Arizona's intermediate desert	11	181 - 210
Tucson	9b	25 to 30	12	Arizona's intermediate desert	10	151 - 180
Phoenix Metro	9b	25 to 30	13	Low or subtropical desert	10	151 - 180
Ajo	10a	30 to 35	12	Arizona's intermediate desert	11	181 - 210
Bullhead City, Lake Havasu City, and Yuma	10a	30 to 35	13	Low or subtropical desert	11	181 - 210

Table 2. Commonly used landscape plant materials used in Arizona and their classification according to US Department of Agriculture Hardiness Zone, Sunset Climate Zone, and American Horticulture Society Heat Zone.

Latin Name	Common Name	USDA Hardiness Zone[1]	Sunset Climate Zone[2]	AHS Heat Zonee[3]
Trees				
Acacia farnesiana	Sweet acacia	9 - 11	8, 9, 12 - 24	12 - 1
Acacia stenophylla	Shoestring acacia	9 - 11	8, 9, 12 - 24	12 - 1
Acer x freemanii	Freeman maple	3 - 9	2A, 3A, 1 - 9, 14 - 17	10 - 3
Catalpa bignonioides	Southern catalpa	5 - 9	3 - 10, 14 - 24	-
Celtis reticulata	Western hackberry	5 - 13	2 - 24, best in 2, 3, 7 -13, 18 - 21	-
Cercis occidentalis	Western redbud	7 - 9	2 - 24	12 - 9
Chilopsis linearis	Desert Willow	7 - 11	3B, 7 - 14, 18 - 23	11 - 7
X Chitalpa tashkentensis	Chitalpa	6 - 11	3 - 24	-
Cupressus arizonica	Arizona cypress	7 - 9	7 - 24	9 -3
Dalbergia sissoo	Indian rosewood, Sissoo	9, 10 - 11	13, 19, 21 - 24	-
Ebenopsis ebano	Texas ebony	8 - 11	12, 13	-
Ficus carica	Fig, edible	8 - 11	4 - 9, 11 - 24	12 - 1
Fraxinus pennsylvanica	Green ash	3 - 9	1 - 6	8 - 2
Fraxinus velutina	Arizona ash	7 - 11	3B - 24	8 - 2
Juglans major	Arizona walnut	4 - 9	10 - 13	-
Juniperus deppeana	Alligator juniper	7 - 9	1 - 3, 10 - 12	9 - 1
Malus sp.	Flowering crabapple	4 - 8	1 - 11, 14 - 21	8 - 2
Parkinsonia florida	Blue palo verde	8 - 11	8 - 14, 18 - 20	-
Phoenix dactylifera	Date palm	9 - 11	8, 9, 11 - 24	-
Pinus eldarica	Afghan pine	6 - 11	6 - 9, 11 - 24	-
Pinus ponderosa	Ponderosa pine	3 - 7	1 - 10, 14 - 21	-
Platanus wrightii	Arizona sycamore	7 - 11	10 - 12	-
Prosopis glandulosa	Honey mesquite	10 - 11	10 -13, 18 - 24	-
Prosopis velutina	Velvet mesquite	9 - 11	10 -13, 18 - 24	-
Quercus arizonica	Arizona white oak	3 - 9	-	-
Quercus buckleyi	Texas red oak	6 - 11	3B, 6 - 12, 18 - 22	-
Quercus virginiana	Southern live oak	7 - 10	4 - 24	-
Robinia neomexicana	New Mexico locust	6 - 9	2, 3, 7 - 11, 14, 18 - 24	-
Washingtonia filifera	California fan palm	9 - 11	8, 9, 10, 11 - 24	-
Washingtonia robusta	Mexican fan palm	9 - 11	8, 9, 10, 11 - 24	-
Shrubs and Accent Plants				
Agave americana	Century plant	9 - 11	10, 12 - 24	12 - 5
Agave parryi	Parry's agave	9 - 11	2B, 3, 6 - 24	12 - 5
Atriplex canescens	Four-wing saltbush	6 - 10	1 - 3, 7 - 24	12 - 5
Caesalpinia gilliesii	Bird of paradise	9 - 11	8 - 16, 18 - 24	-
Caesalpinia pulcherrima	Red bird of paradise	9 - 11	12 - 16, 18 - 23	-
Calliandra californica	Baja fairy duster	9 - 11	12 - 16, 18 - 23	-
Cornus stolonifera	Red-osier dogwood	3 - 8	1 - 9, 14 - 21	9 - 1
Carnegia gigantea	Saguaro	9	12, 13, 18 - 21	-
Dasylirion wheeleri	Desert spoon, Sotol	8 - 10	10 - 24	-

Latin Name	Common Name	USDA Hardiness Zone[1]	Sunset Climate Zone[2]	AHS Heat Zonee[3]
Ferocactus spp.	Barrel cactus	9 -11	8 - 24	-
Forsythia x intermedia	Forsythia	4 - 8	2B - 11, 14 - 16, 18, 19	8 - 4
Fouquieria splendens	Ocotillo	8 - 10	10 - 13, 18 - 20	-
Juniperus spp.	Juniper shrubs	2 - 9	1 - 24	9 -1
Hesperaloe parviflora	Red yucca	8 - 10	2B, 3, 7 - 16, 18 - 24	-
Larrea tridentata	Creosote	8 - 10	7 - 14, 18 -21	-
Leucophyllum spp and varieties	Texas ranger	8 - 11	7 - 24	-
Ligustrum vulgare	Privet	7 - 10	2 - 24	9 - 1
Nerium oleander	Oleander	8 - 10	8 - 16, 18 - 24	12 - 1
Opuntia spp.	Prickly pear	3 - 11	12 - 24	-
Punica granatum	Pomegranate	8 - 10	5 - 24	12 - 5
Rhus ovata	Sugar bush	7 - 11	9 - 12, 14 - 24	9 -5
Vauquelinia californica	Arizona rosewood	8 - 10	10 - 13	-
Vitex agnus-castus	Chaste tree	7 - 11	4 - 24	10 -1
Yucca baccata	Banana yucca	5 - 11	1 -3, 7, 9 - 14, 18 - 24	9 - 1

[1] The following references were used for USDA plant hardiness and were accessed on 3/2/2015:
http://hort.ifas.ufl.edu/woody/selection.shtml
http://selectree.calpoly.edu/
http://oregonstate.edu/dept/ldplants/
https://ag.purdue.edu/pages/default.aspx
http://plants.usda.gov/java/
http://extension.usu.edu/
http://aggie-horticulture.tamu.edu/ornamentals/nativeshrubs/
http://www.missouribotanicalgarden.org/
http://redwood.mortonarb.org/

[2] Only Sunset climate zones from the continental US are listed, Alaska and Hawaii zones are not included.

[3] AHS heat zones are given only for the genus.

zone 12 or 13, select varieties having a low chilling requirement (less than 300 hours) to ensure a good crop every year. Subtropical plants in zone 12 need to be tolerant of cold temperatures. Cool season vegetables are grown most successfully in both zones from September to late spring.

Sunset climate zone 10, the high desert areas of Arizona and New Mexico, applies to locations 3,300 to 5,000 feet in elevation. In this zone 75 to 100 nights of freezing temperatures occur and extreme lows of -10°F have been recorded. The growing season is approximately 7 months from early April until early November. Zone 3A, the mild areas of mountain and intermountain climates, is found around Prescott and east of Flagstaff to New Mexico. The growing season extends from May to mid- October and average winter minimum temperatures range from 15°F to 25°F. Zone 3B, the mildest areas of the intermountain climates is represented with a small area in Southeast Arizona and around Tuba City in the northern part of the state. This zone is similar to zone 3A with slightly warmer winters, warmer summers, and a growing season about one month longer.

Zone 2B, the warmer-summer intermountain climate, is prominent in the area of the Colorado Plateau and some mountains in Southeast Arizona. The warm growing season lasts from May to September and average minimum temperatures in winter are from 12°F to 22°F. The coldest zones in Arizona are 2A and 1A and are found at the highest elevations in the state. Long, snowy winters and brief growing seasons restrict the plant palette to hardy evergreens, some deciduous woody plants, and herbaceous perennials.

The Sunset Publishing Company is the sole reference authority assigning specific climate zones to a plant. Their designations are based on the input of many experts and are regularly updated and expanded with additional plants. In addition to the climate zones, individual plant descriptions have information about light and irrigation requirements.

The Plant Heat Zone Map was developed in 1997 by the American Horticultural Society (AHS) using daily high temperatures recorded by the National Weather Service from 1974 to 1995. The 12 zones of the heat zone map are classified based on the number of heat days with temperatures above 86°F (30°C), which assumes (sometimes incorrectly) that plants begin to experience serious heat stress or cell damage above this temperature. Zone 1 has less than one heat day and zone 12 has more than 210 heat days. The map can be accessed at:

http://www.ahs.org/gardening-resources/gardening-maps/heat-zone-map.

In Arizona, heat zones span from zone 4, with more than 15 to 30 heat days at the high elevations in the north, to zone 11 with more than 180 to 210 heat days. Most of the area of the Colorado Plateau and the Transition zone are classified as zones 4 to 8 with more than 14 to 120 heat days. Heat zones are relevant for plants that suffer from heat stress above the threshold temperature. However, many plants native or adapted to the Arizona low elevation climate are desert plants that thrive when temperatures are well above 86°F on a daily basis.

Heat zone classifications of plants are found in the Heat Zone Gardening reference book (see References: Cathey, 1998) and are based on the adaptability of plants to summer heat and optimum performance. This means that plants can grow acceptable in warmer or cooler heat zones, but not necessarily with top performance. Heat zones are assigned only to the genus, not individual species, although most descriptions use species or cultivar examples in their description. Heat zone classification of plants has not been updated or expanded since the publication of the original reference book in 1998 and does not cover many plants relevant for Arizona landscapes.

SEASON FOR HEALTH

A Guide For Using Herbs and Spices For Your Home Cooking

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Herbs and spices create flavorful meals and popular chefs. They have also played a significant role in culture, society, and economics throughout history. Europeans greatly valued spices and sent explorers to navigate routes for the spice trade. Additionally, spices have long been used in culinary preparation for their ability to keep food from spoiling and herbal medicines are famous for their natural healing powers, having played key roles in many ceremonies throughout numerous cultures. Both herbs and spices are celebrated for their taste, smell and color, and many cultures have recognized their healing powers, as well.

As science is now proving, the benefits of cooking with herbs and spices go beyond adding taste, flavor and color to foods. Recent studies have presented information about the healthy properties of some herbs and spices, and we are learning more about how these spices can help us. For example, recent studies show that garlic has medicinal properties similar to some drugs prescribed by a doctor.[1] Eating about one clove of garlic per day has been shown to lower cholesterol, blood pressure, and possibly have cancer-fighting properties.[1,2] Additionally, spices like turmeric have been noted for their healing properties and great taste. A recent study investigated how turmeric works, and demonstrated the benefits of turmeric for treatment of rheumatoid arthritis.[3] Another similar study on turmeric reported the anti-breast cancer effects of the powerful yellow spice.[4]

This article introduces common herbs and spices that can be found in grocery stores or gardens, explains their health benefits used in cooking and provides tips on how to incorporate them into a balanced diet

SPICES AND HERBS

What makes an ingredient an herb and not a spice? In any grocery store you can find both herbs and spices. In general, herbs tend to be more leafy and plant-like (Figure 1) and spices are more likely dried and ground (roots, buds, seeds, berries or fruits of plants and trees), and are commonly found in grocery stores as powders in small jars. However, there is no clear definition between herbs and spices. According to the American Spice Trade Association, spices are defined as any plant vegetable substance in the whole, broken, or ground form for seasoning purposes.[5] This broadens the definition of spices to include herbs, dehydrated vegetables (examples, garlic and onion), spice blends and spice seeds. Besides these definitions, some plants yield both an herb and a spice. For example, dill weed (an herb) and dill seed (a spice) come from the same plant, but the American Spice Trade Association defines both as spices.[5]

HERBS

More than just leafy greens, these plants are perhaps the longest-used flavoring ingredients. Again, herbs tend to be fresh-looking, small plants (or roots) (Figures 1). However, ground and dried versions of herbs are also commonly sold, and are sometimes more potent than their leafy green (or whole root) counterparts. (Figure 2) Fresh herbs are available at most grocery stores in the produce section, and are usually sold by the small bundle. When purchasing herbs, choose plants without any

wilted or brown leaves or stems. Store fresh herbs in a cup or a vase with water (Figure 1) or wrapped in a damp paper towel in the refrigerator. To keep unused fresh herbs longer, they can be packed and frozen in plastic bags for later use. Another way to preserve these tasty ingredients is to briefly sauté fresh herbs in extra virgin olive oil, and then freeze the herbs and oil in an ice cube tray. The blocks of extra virgin olive oil can then be used for a quick method to start a healthy and flavorful meal, simply by unthawing a block in a saucepan over low heat. Growing container herbs at home is also an easy way to have fresh herbs year-round, anytime you want to use them.[6]

With different flavor profiles and appetizing aromas, herbs are a delicious component of cooking, but the benefits extend beyond taste. Research is beginning to demonstrate just how great the protective health benefits may be. Herbs, along with many fruits, vegetables, and edible plants, contain antioxidants, and have anti-inflammatory properties.[1,2,4,7,8]

Antioxidants are substances found in foods which inhibit ("anti") oxidation in the body's cells. Oxidation is a chemical reaction that produces free radicals. Free radicals cause destruction of our body's cells and antioxidants stop them. Recent studies have shown antioxidants reduce the risk of heart disease and cancer. Antioxidants can be found in vegetables, fruits, plants, herbs, and spices.

The following is a list of commonly used herbs.

Basil

Sweet, warm, and aromatic. Although sweet basil (or Italian basil) is more common, Thai basil also has a distinct flavor. Thai basil has a purple stem, instead of green like sweet or Italian basil, and is closer to the flavor and aroma of mint than other basils. Use with meats, seafood, and vegetables. Sweet basil complements the flavor of tomatoes very well. Basil has a strong and delicious flavor, especially in sauces like pesto. This is one of the easiest herbs to grow in a home garden.[9]

Cilantro

Fresh and earthy. Cilantro refers to the leaves of the coriander plant. Use with traditional Mexican-style dishes, meats, salads, and sauces. Cilantro adds a great brightness of fresh flavor to foods.

Chives

Delicate onion flavor (not as potent as yellow or red onion). Use chives fresh to maintain color and flavor. Chives are commonly added to baked potatoes, soups, and egg dishes.

Dill

Sweet and aromatic. Use with seafood, egg dishes, soups, potato salad, or vegetables. Add to vinegar and oil to make an herb salad dressing.

Mint

Sweet and aromatic. Use with salads, sauces, and stir-fry dishes. Mint is also commonly used in baking. Adding a few mint leaves and fruits like lemon, pineapple, orange or berries to water (also called infusing flavors) is a fun way to create a healthy, refreshing drink.

Oregano

Savory and earthy. Use with meats and vegetables. Oregano is a basic ingredient in Italian and Mexican cooking. It complements the flavor of tomatoes in pizza and soups.

Parsley

Savory, aromatic, and subtle. High in vitamin K. Not only is parsley a garnish for any dish, it goes wonderfully with grilled meats and vegetables, and in salads.

Rosemary

Strong and fragrant. Use with meats and hearty vegetables. Place a few leaves on top of roasts or baked chicken and potatoes.

Sage

Strong and aromatic, tastes best cooked. Sage pairs well with roasted poultry, stews, and casseroles. As a possible health benefit, sage may improve mood and cognitive functions.[10]

Thyme

Fragrant and fresh tasting. Thyme complements other herbs, such as rosemary and oregano. Use with chicken, meat, seafood and hearty vegetable stews/soups. It is a key herb used to make Cajun gumbo.

Prices of herbs from various stores range from less than $1.00 to upwards of $3.00 per bundle, and can usually be used for 2-3 servings of recipes. The average price for fresh herbs is $1.50 (about $0.75-$0.50 per recipe). This makes them an affordable part of any recipe. The prices of all herbs listed here were collected at local grocery stores (high-end stores, megastores, and supermarkets) twice during spring/summer and fall/winter near the University campus area. All price data was compiled and averaged.

SPICES

Spices come in incredibly diverse varieties, flavors, and colors—almost as distinct as the array of tasteful dishes they can be used to flavor. Not only do these powerful spices pack a punch on the taste buds, but also possibly for your health and wellness. Just like herbs, many spices contain antioxidants.[1,2,8] Additionally, the American Institute for Cancer Research referenced turmeric, black pepper, and garlic for their possible cancer-fighting benefits.[7]

Figure 1. Common leafy herbs (left to right: Italian parsley, rosemary, basil, thyme, oregano)

What is Italian Seasoning?

Over the years, Italian seasoning has gained popularity in grocery stores and recipes, alike. This blend of spices usually includes dried basil, parsley, rosemary, oregano, thyme, and marjoram. Italian seasoning is a great way to flavor vegetables and meats, while providing a healthy alternative to salt.

Figure 2. Fresh and Dried Basil (Left) and Dill (Right)

The following is a list of commonly used spices.

Black pepper

Pungent, strong and aromatic. Black pepper, or peppercorn, is the dried berry of the Piper nigrum vine.[5] Use with any dish as a flavoring agent.

Bay leaves (dried)

Savory and earthy. Use with meats, vegetables, soups, and stews.

Cayenne pepper

Spicy, aromatic, and colorful. Adds spicy, hot taste and bright red color. Try blending cayenne pepper and paprika to make a milder taste.

Chili powder/Chili peppers

Savory, strong, and pungent. A common ingredient in chili and in Mexican cuisines. Use with chicken and meats.

Cinnamon

Sweet and aromatic. Cinnamon comes from the bark of the Cinnamomum spp. plant and cinnamon is available as dried tubular sticks or ground powder.[5] Use with baked goods and fruits. Cinnamon complements the flavor of apple in apple pie. A stick of cinnamon can be placed in coffee, tea, or warm apple cider.

Cumin

Strong and aromatic. Ground cumin comes from the seeds of the Cuminum cyminum plant.[5] It is an important ingredient for traditional Mexican and Indian dish flavoring. Use with meats, stews, and vegetables.

Paprika

Savory, earthy, and colorful. High in vitamin A. Use with meats and other dishes for a red coloring. Paprika can be used to flavor rice or season vegetables and salads. It can also liven up soups with a bright, red color.

Turmeric

Aromatic, warm, and bitter taste. Curcumin, chemical compound with antioxidant properties in turmeric.[3,4] Research is ongoing.[8] Turmeric is a staple ingredient in curry powder. Use in curried dishes. Add turmeric to egg salad to give an extra yellow color. Turmeric complements lentil recipes. Mix rice with raisins, cashews and season with turmeric and cumin.

Jars and containers of spices are sold in most grocery stores, and usually range from $1.00-$7.00. On average, spices cost about $0.14 per serving (one teaspoon) making spices another affordable way to flavor foods. The prices of a jar or bottle of spices listed here were collected at local grocery stores (high end stores, megastores, and supermarkets) twice during spring/summer and fall/winter near the University campus area. All price data was compiled and averaged.

VEGETABLES USED AS SPICES OR HERBS

Some vegetables are strong and pungent, making them great ingredients to flavor foods. In addition to herbs and spices, vegetables offer incredibly healthy flavor options for cooking. Garlic and onion are two popular ingredients used in almost every culture and style of cooking. Using vegetables for taste reaps the same benefits of herbs and spices (less salt and fats), but with the added benefits of the nutrients in vegetables. The USDA recommends eating 2-3 cups of vegetables a day for a healthy and balanced diet.[11]

The following is a list of common vegetables used as spices or herbs.

Celery

Strong, aromatic, and fresh. Celery is a great ingredient for flavoring soups. Instead of adding a lot of salt to stews or soups, add celery to enhance the flavor.

Garlic

Strong and aromatic. The garlic commonly sold in grocery stores is the bulb of the Allium sativum plant. Use with a wide variety of dishes. Since garlic has such a versatile flavor, it is a great ingredient to use for almost any dish. The strong, appetizing flavor of garlic also means less salt, oils, butter, and fat are needed to make meals taste great.

Onion

Strong, sweet, and savory. Use with almost any dish. Similar to garlic, onions commonly sold in grocery stores are the bulbs of the Allium cepa plant. There are several common varieties of onions sold in stores including yellow, sweet, and red onion. Yellow onion has a very versatile flavor, and can be used for any style of cooking. Onions are also very affordable, and are usually sold for under $1. Use caution when cutting onions, as the vegetable releases strong and pungent fumes, which may cause watery eyes and blurred vision.

Complete references available at

https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1686-2015.pdf

RECIPES

HOW TO USE SPICES & HERBS

When cooking with fresh or dry herbs, use the following general rule for conversion: 1 part dried herb is equal to 3 parts fresh herbs. For example, if a recipe calls for 1 tablespoon of fresh basil, use only 1 teaspoon of dried, since 3 teaspoons is equal 1 tablespoon. The reason for this conversion is that dried herbs are generally more concentrated than fresh herbs, thus, you'll need less -- typically three times the amount of fresh herbs as dry. Adjust the amount of herbs, as you like.

When doubling a recipe, do not double spices and herbs. Increase amounts by 1½ times, and add more or less, as you like.

Below are recipes and ideas for how to bring more herbs and spices into your daily diet. Try herbs and spices in salads, soups, and sauces or on chicken, meats, and seafood. Use them in your favorite home-cooked meals.

USE COMBINATIONS OF THESE HERB AND SPICE FLAVOR PROFILES TO LIVEN UP YOUR NEXT MEAL!

WITH CHICKEN

Mediterranean	Southwestern	Spiced citrus
Basil	Black pepper	Black pepper
Black pepper	Cayenne pepper	Cilantro
Garlic	Chili powder	Garlic
Oregano	Cilantro	Ginger
Parsley	Cumin	Oregano
Rosemary	Garlic	Parsley
Thyme	Paprika	Rosemary
		Thyme
Use with: olive, tomato, eggplant, squash, or peppers	Use with: red pepper flakes, onion, corn, tomato, chilies, avocado, or peppers	Use with: lemon, lemon zest, squash, carrot, asparagus, mushroom, and artichoke

Fresh Mediterranean Chopped Herbs and Greens Salad

Prep time: 10 minutes

Makes 3-4 servings

Ingredients:
4 cups fresh arugula greens, chopped
½ cup fresh parsley leaves, chopped
½ cup fresh basil leaves, chopped
½ cup fresh dill leaves, chopped
¼ cup fresh red onion, chopped
2 medium tomatoes, chopped

For the Dressing:
3 tablespoons extra virgin olive oil
2 tablespoons red wine vinegar
1 tablespoon Italian seasoning (or any combination of dried basil, parsley, rosemary, oregano, thyme, and marjoram)
1 teaspoon salt
1 teaspoon black pepper

Directions:
1. Chop all ingredients (arugula greens, parsley, basil, dill, red onion, tomatoes) and add to a large mixing bowl. Mix greens and vegetables together.
2. In a smaller bowl, combine extra virgin olive oil, red wine vinegar, Italian seasoning, salt and black pepper. Mix well.
3. Pour dressing over greens and vegetables and mix well to coat.
4. Serve immediately and enjoy.

Optional:
Add grilled/baked chicken, olives, Parmesan cheese and different vegetables for a more filling dish.

Per serving:
121 calories, Carbohydrates: 5g, Fat: 11g, Protein: 2g

Total cost:
$10.90, about $2.73 per serving

With Red Meat

Barbeque	Savory	Asian-inspired
Black pepper	Basil	Black pepper
Cayenne pepper	Black pepper	Cilantro
Chili powder	Garlic	Garlic
Cumin	Oregano	Ginger
Garlic	Parsley	Onion powder
Mustard powder	Rosemary	
Onion powder	Sage	
Paprika	Thyme	
Use with: Onion, corn, zucchini, squash, eggplant, mushroom, tomato, sweet potato, or peppers	Use with: Onion, mushroom, broccoli, tomato, carrot, peas, green beans, or sweet potato	Use with: Sesame (seed, oil), soy sauce, vinegar, lemon, red pepper flakes, scallion, onion, mushroom, snap peas, carrot, peppers, or cabbage

Hearty Beef and Vegetable Stew

(Adapted from What's Cooking? USDA Mixing Bowl[11])

Prep time: 1 hour

Makes 6-8 servings

Ingredients:

1/4 pound beef round roast, thawed and chopped
1 tablespoon vegetable oil
4 cups water
2 cups winter squash, chopped (or 2 cups cabbage, finely chopped)
½ cup onions, chopped
½ cup carrots, peeled and chopped
½ cup parsnips, peeled and chopped (optional)
1 celery stalk, chopped
3 cloves garlic, finely chopped (or 1 teaspoon garlic powder)
1 teaspoon dried oregano
3 bay leaves, dried and whole
1 tablespoon parsley, chopped (optional)
¼ cup macaroni, dry
1 large tomato, chopped (or 1 can, about 15 ounces, low-sodium diced tomatoes)
½ cup green pepper, finely chopped
Salt, to taste
Black pepper, to taste

Directions:

1. In a large pot, brown beef in oil over medium to high heat for 8 to 10 minutes. Drain fat.
2. Add water, squash, onion, carrot, parsnips, celery, garlic, oregano, bay leaves and parsley. Mix well.
3. Bring pot to a boil. Lower heat and cook for 20 minutes.
4. Add macaroni, tomatoes, green pepper, salt and pepper.
5. Keep cooking over low heat for 20 minutes, until vegetables are soft and meat is tender. Serve hot.

Per serving:
115 calories; Carbohydrate: 15g, Fat: 4g, Protein: 6g

Total cost:
$10.90, about $2.73 per serving

With Fish

Asian-inspired	Cajun	Savory Herbs
Black pepper	Basil	Basil
Cilantro	Black pepper	Black pepper
Garlic	Cayenne pepper	Garlic
Ginger	Chili powder	Marjoram
Onion powder	Cumin	Oregano
	Fennel	Parsley
Use with: Sesame (seed, oil), soy sauce, teriyaki, vinegar, lemon, red pepper flakes, scallion, onion, mushroom, snap peas, carrot, peppers, and cabbage	Garlic	Rosemary
	Mustard powder	Sage
	Onion powder	Thyme
	Oregano	
	Paprika	
	Sage	
	Thyme	
Use with: Onion, corn, zucchini, squash, eggplant, mushroom, tomato, sweet potato, or peppers	Use with: Lemon, red pepper flakes, tomato, peppers, okra, mushroom, onion, zucchini, squash, green beans, and corn	Use with: Onion, lemon, mushroom, broccoli, carrot, peas, green beans, sweet potato, tomato, and asparagus

Steamed Salmon and Veggies[12]

Prep time: 40-45 minutes

Makes 4 servings

Ingredients:

1 lb. salmon fillet
4 fresh garlic, minced
1 fresh zucchini, sliced
1 onion, chopped
⅛ head cabbage, chopped
2 carrots, sliced
½ lb. mushroom, sliced
1 colored bell pepper, cut into short, thin strips
½ lemon, cut into 4, make lemon wedges
Dill, thyme, or any kind of herb as desired
4 Tbsp. extra virgin olive oil
⅛ Tbsp. salt and ⅛ Tbsp. pepper

Directions:

1. Heat a pan and pour 2 Tbsp. olive oil over low heat.
2. Sauté garlic over low heat for about 1 minute (if garlic is turning brown, it is too long).
3. Spread cabbage, carrots, bell peppers, and mushrooms on the pan.
4. Salt and pepper the salmon, and place on top of these vegetables.
5. Add onion and zucchini on top of the salmon.
6. Put on a lid* and cook with low heat until fish is cooked (about 30 minutes).
7. Dress with dill, thyme or any herb, as you like.
8. Pour 2 Tbsp. olive oil.
9. Serve with lemon.

*if you do not have a lid, use aluminum foil to cover the vegetables and salmon.

Per serving: 360 calories, carbohydrate: 15g, Protein: 26g, Fat: 22g

Total cost: $12-18, about $4.50 per serving

RESISTANCE TRAINING
HEALTH BENEFITS AND RECOMMENDATIONS

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Resistance training, also known as strength training/exercise, has been growing in popularity in recent years. Resistance training is a form of physical activity that has been traditionally perceived as a component of training programs limited to athletic individuals and competitive weightlifters seeking to improve performance. However, this conception is no longer true. Extensive research reveals that not only is resistance training an effective method for improving muscular strength, endurance, and power, but it is also effective for improving the health status of most individuals – not only competitive athletes [1]. Also, it is a vital part of a balanced physical activity routine that includes aerobic and flexibility activities [2]. This article provides information about the health benefits and recommendations for the enhancement of strength, muscular fitness, and improvement of one's ability to perform tasks and reducing the risk of injury using resistance training.

What is Resistance Training?

Resistance training is any physical activity that causes the muscles to work against an additional force or weight (this concept is called resistance). There are essentially two different types of resistance training exercises:

1. Isotonic exercise – these exercises involve any movement of your muscle groups (legs, arms, stomach, back, etc.) against some type of resistance (examples: lifting barbells, dumbbells, exercise using resistance bands, or body weight exercises including pushups and sit-ups).
2. Isometric exercise – these exercises do not involve movement of the joint itself, but instead the muscle group is held still in place against the resistance (examples: plank holds, wall sits, holding grocery bags, etc.)

Both forms of resistance training can be used to firm and strengthen muscle. As the muscle strengthens, the amount of resistance can also increase, encouraging further muscle building and strength. Any muscle group can benefit from resistance training.

Health Benefits of Resistance Training

Resistance training can be effective in the development of muscular strength, muscular endurance, and muscular mass, in a broad range of people, including women and older adults. As older adults age, they lose muscle mass and quality (less strength for the same muscle mass), a condition known as sarcopenia. Resistance training can help slow down the loss of muscle mass by continually rebuilding muscles. Resistance training also enhances muscle strength, which protects joints and improves stability and balance, reducing the risk of falls.

Resistance training can be a great tool to help older people prevent fractures that occur due to falls. Regular resistance training will increase muscle and bone strength, as well as bone density, leading to strong bones and more protection against fall fractures. Resistance training programs designed for older adults, such as *Stay Strong Stay Healthy (University of Missouri, Extension)* also support a better quality of life by promoting independence and contributing to the maintenance of functional abilities [3].

Research demonstrates that resistance training may decrease the risk of heart disease by lowering body fat, decreasing blood pressure, and improving cholesterol level [1]. The American Heart Association recommends resistance training as a component of a comprehensive exercise program (not a replacement for aerobic exercise in a program) designed to help meet the health and fitness goals for people with and without heart disease [4].

Resistance Training Guidelines

Current exercise guidelines recommend the inclusion of resistance training for healthy persons of all ages. *Physical Activity Guidelines for Americans* recommends all adults participate in moderate or high intensity resistance training two or more days a week. Children and adolescents are recommended to resistance train at least three days a week [2]. In 2011, the American College of Sports Medicine (ACSM) published research-based guidelines for resistance training using machine-based exercises and free weights (examples: dumbbells and barbells) [5]. The guidelines are summarized here and in Table 1.

Frequency:

For general health and fitness programs, the ACSM recommends doing a resistance training program 2-3 non-consecutive days per week that works on each major muscle group.

Table 1. Recommendations for Resistance Exercise Guidelines

Frequency (days/week)	Intensity	Repetitions	Type	Comments
2 to 3 days/week for each major muscle group	**For strength improvement:** For older or sedentary individuals, begin at a very light to light intensity; For novice-to- intermediate individuals, a moderate to hard intensity; For experienced individuals, hard to very hard intensity. **For endurance improvement:** A low level of resistance.	**For strength improvement:** For most adults, including middle age and older adults starting resistance training, 8-12 repetitions for 2-4 sets; For more frail adults, 10 to 15 repetitions for 1 set. For bone strengthening, 6-8 repetitions for 1-3 sets. **For endurance improvement:** For most adults, 15-20 repetitions for 1-2 sets.	Variety of exercise equipment (free weights, resistance machines, resistance bands, resistance tubes or body weight) can be used through the full range of motion of the joint, using proper breathing and lifting techniques.	**For strength improvement:** Rest up to 3 minutes to focus more on strength. The extra recovery time allows the muscle to work harder on the next set. **For endurance improvement:** Rest less than one minute between sets. For beginning resistance training, limit to a single set performed 2 days per week.

*Set – a set consists of several repetitions performed one after another with no break between them
References: [4], [5], [6]

Intensity:

There are three recommended levels of intensity for strength improvement: 1) experienced individuals can work at a resistance load at hard to very difficult, 2) novice-to-intermediate individuals should exercise at a moderate to hard intensity, and 3) older or frail individuals initiating a resistance training program may begin a resistance load at a very light to light intensity. It is important that those in the early stages of resistance training perform the exercises at a light to moderate intensity level. This will allow time for the muscles to adapt and for learning good techniques and form, thereby improving balance and reducing muscle soreness and risk of injury.

Repetitions:

For most adults, the selected resistance/weight (intensity) should permit the completion of 8-12 repetitions for one to three sets*. For older and frail individuals, a greater number of repetitions (10-15) per set with very light intensity are recommended [4]. (*Set – a set consists of several repetitions performed one after another with no break between them.)

Resistance training programs are effective for improving bone health. For bone strengthening, two to three sets of resistance training exercises with the maximum amount of weight that can be lifted for six to eight repetitions is recommended [6, 7].

The ACSM recommends that resistance training should follow the principle of progressive overload [5]. This means that the weights being lifted are heavy enough to create muscular fatigue. When the amount of weight being used becomes easier, the weight can be increased. As individuals progress, the weight can continue to be increased (overload) to facilitate improvement in muscular strength and endurance.

Resistance Training Equipment

Many types of resistance training equipment can be used effectively to improve muscular fitness. Among these are free weights, resistance machines, and resistance bands. Even your own body weight can be used for resistance training. Each method of resistance training has advantages and disadvantages. Choosing one or a combination of these can help you reach your fitness goals.

Free weights:

Examples of free weights are barbells and dumbbells.

Advantages:

- Free weights can be used for many different exercises.
- Free weights allow you to train anywhere (at home or at a gym): the added convenience may increase the likelihood of performing resistance training exercises more regularly.
- You have freedom to move based on your unique anatomy, unlike the more confined movement of machines. It allows your body to move how it is naturally built to move.
- Free weights require more coordination and balance to use than machines: this helps strengthen the supporting muscles in addition to the main muscles being trained.
- If you have limited time to exercise or don't have access to a gym, free weights are a good choice.

Disadvantages:

- There is a risk of injury from dropping or improperly using barbells or dumbbells.
- Resistance training using free weights requires skills and knowledge to learn proper technique. It is a good idea to have a certified fitness trainer help you get started to prevent injury.

Resistance machines:

Many stationary resistance machines in gyms use selectable stacks of weights to change resistance.

Advantages:

- Resistance machines focus on one muscle group at a time, allowing a specific range of motion.
- Resistance machines don't require as much coordination and balance as free weights. They assist with control of movement, reducing the risk of injury.
- Resistance machines are relatively safe; as long as they are properly adjusted for the correct intensity of your training level without dramatic increases in weight/resistance or number of repetitions, and they are used at a moderate to slow controlled speed.

Disadvantages

- Cost – you must have a gym membership or access to a place with resistance machines.
- Each machine is typically limited to working just one muscle group, so several machines are needed to cover all of the muscle groups.
- When increasing weight, you must add a whole or half plate which may be too much for some individuals.
- If your body does not anatomically match the movement of the resistance machine due to height or body shape, you are more likely to injure a joint with repetitive use over time.

Resistance bands or tubes:

Resistance bands or tubes consist of elastic bands or tubes that can substitute for free weights or machines to help you build muscular strength, fitness, and bone density. They come with various levels of resistance from extra light to extra heavy.

Advantages:

- Resistance bands or tubes offer an inexpensive and portable way to get a full-body strength-training workout at home, in the office, or outdoors.
- Resistance bands or tubes can be used for many different exercises and are more versatile than free –weights [8].
- They are relatively safe and cost-effective.

Disadvantages:

- Over time, resistance bands or tubes may lose some of their elasticity.
- Resistance bands may contain latex. If you are sensitive or allergic to latex, check the package label to find out if the bands contain latex.

Body Weight (plank holds, push-ups, squats, stomach curls, wall sit, etc.):

You can use your own body weight for resistance training.

Advantages:

- You can do most exercises that strengthen your body using its own weight anywhere and anytime.
- You don't need any equipment - only a small amount of space.
- It is suitable for almost anyone with minimal risk of injury.
- Many of these exercises can be found in books, videos, apps, and websites [9].

Disadvantages:

- Resistance is always equal to own body weight.

Safety – Important Precautions

Prior to beginning any exercise program, including the resistance training described in this article, you should check with your medical doctor first to make sure it is safe to start. Resistance training is not suitable for everyone. To reduce the risk of injury, it is important to learn proper techniques. Before you begin any type of resistance training exercise program, get advice from a certified fitness expert that has experience working with people in your age group. You should stop participating in any physical activity, including resistance training, that causes abnormal pain or discomfort, and immediately obtain medical consultation.

Overtraining

You may be excited to start the challenge of resistance training, but you should avoid a dramatic increase in exercise volume (frequency, intensity, and repetitions) to reduce the risk of overtraining. The ACSM recommends that a 2-3% increase in intensity is appropriate when the individual can comfortably perform the current workload for one to two sets for two consecutive training sessions.

Remember to start slowly, use proper form, avoid weights that are too heavy for your strength level, and follow the principle of progressive overload: use weights/resistance heavy enough to create muscular fatigue, and then when that gets easy, increase the weight/resistance slowly. Lift at that new weight until the same number of repetitions can be achieved. When you first add new weight/resistance, you will lift with fewer repetitions because it is heavier and harder, but as you gain muscle strength, you can perform more repetitions. The principle of progressive overload prevents injury while creating better outcomes for your training.


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DAWN KEY

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