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Arizona Landscape Palms and their Management

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Introduction

Palm trees offer versatility and dramatic impact unparalleled among other desert adapted plants for low and mid elevation landscapes in Arizona. They broaden the plant palette for designers, contributing dramatic foliage, flower and fruit structures, bold shapes, diverse textures, and sizes. Palms are treasured for creating a feeling of relaxed luxury and infusing the landscape with exotic and tropical flavor. Although usually associated with iconic California landscapes, many palm species work well in Arizona when selected and managed judiciously to ensure long-term health and landscape sustainability. Palms suitable for Arizona climates need to tolerate freezing temperatures, high heat, and low humidity. This publication covers 18 palm species that can be successfully cultivated in Arizona given appropriate growing conditions. We describe how palms differ in form and growth from other trees as a result of their unique biology, considerations for using them effectively in the landscape, and cultural practices for planting, transplanting, maintaining, and controlling their pests and diseases. This content provides a basis for understanding suitability of various palm species for Arizona climate and microclimates, and the long-term commitment required to ensure performance, longevity and aesthetic contribution to a landscape.

Landscape Use

Palms can be planted in groves, clusters or, placed singly as accent specimens. Planted adjacent to swimming pools, patios, or smaller landscapes, palm trees instantly create a tropical appeal. The strong, vertical form of tall species balance the scale of large buildings and in mass plantings define boundaries of large spaces by lining parkways and drives. Depending on the species, tall palms can be wispy and graceful or massive and bold. Grouping different palm species of various heights, color, and texture can provide a focal point and add interest to a landscape setting. Palms can serve as a screen, provide shade, habitat, and create an understory to enhance landscape diversity (Davison and Begeman, 2000).

Care should be exercised in selecting palms that are not only well-adapted to the prevailing climate and microclimate but are also of appropriate size to be successful in the chosen site for many years. Several of the palm species listed below for landscape use in Arizona grow up to 60 feet tall with a canopy spread of 20-30 feet at maturity. Species differ in their maintenance requirements and pruning costs, especially if fruiting stalks need to be removed annually to prevent fruit drop, will become more expensive as plants grow taller.

Ecology and Climate Adaptation

With about 2,500 palm species in about 200 genera available worldwide, palms are among the best known, most extensively cultivated and economically important plant families as a source of food, fiber and oils, and landscape ornamentation (Hodel, 2012). Most palm trees are native to wet tropical regions, with few occurring in harsher climates, and even less occurring in subtropical, desert, and temperate climates. Arizona's landscape palms should be chosen from this latter group as freezing temperatures in winter, high temperatures in summer, and low humidity limit the number of species for Arizona (Davison and Begeman, 2000). Most species tolerant to the Arizona climate grow well below 4,000 feet elevation, and only a few can flourish at higher elevations. Only one palm species, the California fan palm (*Washingtonia filifera*), is native to the oases and canyons of western Arizona in the Kofa Mountains, in southeastern California, and near Prescott, Arizona (Miller, 1983). Native and cultivated palm species have a wide distribution in North America. In Arizona, there are many palm species that may be grown from Kingman to Yuma along the Colorado River and up to 4,000 feet elevation in many parts of southern Arizona. The California fan, Mexican

fan, Mediterranean fan, windmill, Canary Island date and Mexican blue palms can be grown in areas of USDA zone 8a, where minimum temperatures can range from 10 to 15 °F (-12.2 to -9.4 °C). However, these plants may benefit from a warmer microclimate and younger palms are still at risk of severe freeze damage.

Palms with marginal hardiness may be grown successfully in microclimates where they are protected from extreme low and high temperatures, strong wind and arid conditions. Although palms become more cold-hardy with age, avoid frost pockets, where cold air collects during the nighttime. When properly selected and placed in the site, palm trees will return benefits to the environment, such as shade, atmospheric carbon sequestration, air filtration, storm water mitigation, and soil erosion. Palms provide the same ecosystem services per unit of leaf area as most other trees, however, because palms have smaller canopies, more plants are required to achieve equivalent per-tree benefits. Understanding the unique aspects of palm tree biology aids proper selection, installation and management.

Palm Morphology and Anatomy

Palm trees are fibrous trunked, often referred to as woody monocots in the botanical family *Arecaceae*. They differ in their development and growth from woody eudicots and conifers. Most species are characterized by a single straight trunk without side branches although there are some species with multiple trunks originating at the base.

Palm stems or trunks are composed of pseudobark, cortex, and a central cylinder. The pseudobark covering of palm trunks, unlike the bark of eudicot or conifer trees, consists of sclerified or hardened cells. The remainder of the cortex forms a narrow band of mostly parenchyma cells, around the trunk diameter, that lignify with age and give strength to the stem. The central cylinder consists of vascular bundles containing both xylem and phloem to transport water, minerals, and carbohydrates. These vascular bundles, enclosed by a rigid, fibrous sheath that also contributes structural support to the stem, are dispersed throughout the central cylinder, with the majority near the cortex.

Unlike eudicots and conifers, palms do not have a secondary cambium in the stem. As such palms do not produce annual growth rings. Further, because they lack secondary cambium, wounds do not close, but remain visible throughout the life of the palm. The surface of palm trunks can vary from smooth, slightly rough to very rough and some species show the leaf scars where leaves have been pruned off. During their juvenile development, palms grow to their final stem diameter and produce a full canopy of leaves, then start to grow in height without further horizontal stem expansion. This development means that palms must produce enough leaf area and adequate vascular system early in their lives to support later vertical growth and all future development. Additionally, unlike eudicots and conifers which have hundreds of terminal growing points, palms have a single apical meristem. If the apical meristem is damaged from lightning or other mechanical injury resulting in death of the growing point, the entire plant will die as there is no other meristem to resume growth. Leaves, inflorescences, and flower structures all emerge from the apical meristem.

Palm leaves, called fronds, are very large in size and evergreen. Palms can be distinguished by their leaf shape, as fan palms have palmate leaves, while feather palm have pinnate leaves. Palmate leaves are characterized by the leaf segments originating at the top of the petiole and joined almost to the tip. In feather palms the segments are individual leaflets that are not joined and originate from the rachis, which is the extension of the petiole. Leaves consist of a blade, petiole and base. The leaf blade is the expanded leaf surface, which is either pleated or flat, depending on the species. Petioles support the massive leaves, but they are also flexible to allow leaves to bend in the wind. Petioles may be toothed, or armed, along the margins.

New fronds emerge in the center of the apical meristem and are surrounded by the older leaves, with the crown forming a spherical shape. Palms require an optimal number of leaves to support growth and maintenance of the mature tree. Prior to vertical stem growth occurring, the leaf crown attains maximum size and the leaf number and the transport capacity through the vascular system becomes fixed. Leaves present beyond this number senesce and are shed or persist as a dried leaf skirt.

Palm flowers individually are inconspicuous. However, as aggregated into a flower head or inflorescence, they can be showy and more massive than the leaves, ranging in length from two to twenty feet. Flowers develop into fleshy fruits, such as drupes or berries.

Palm roots are typical for monocots, being fibrous, they are composed of many slender primary roots. These adventitious roots arise from the base of the trunk in the root initiation zone. The root initiation zone is associated with a flared base of the trunk as part of this zone can be above ground, allowing roots to be visible at the base of the trunk. Palm roots emerge with their final diameter and will not grow large and woody like eudicots and conifers. These root features allow for transplanting of large palm trees where the shallow, fibrous root system can be successfully dug up and moved. This development pattern also prevents the root–pavement conflicts caused by many eudicot and conifer trees as they expand in trunk diameter.

The majority of the root system of palms is located in the top foot of the soil and near the base of the trunk. However,

palm roots extend horizontally, in large specimens considerable distance from the trunk. When palm roots are cut, most species initiate new roots behind the cut, producing smaller size secondary and tertiary roots. A few species initiate new roots only from the root initiation zone but not close to a cut.

Planting and Transplanting

Palms are usually transplanted into the landscape from container grown, field-grown, transplanted, or large boxed specimens. The nature of the root system allows for even very large specimens to be transplanted readily to a new site, providing the instant gratification of a mature landscape. The best time to transplant palms in the Southwestern United States is from May to July when soil temperatures above 65°F (18.3°C) stimulate new root regeneration and growth leading to fast establishment. Transplanting palms during the cool season delays root growth and can stress the plants, resulting in poor establishment. Planting hole preparation, setting the plant at the correct depth, proper backfill, and irrigation, fertilization, and mulching following transplanting are all important factors for successful establishment.

Planting Container Grown Palms

Smaller palms grown in containers are planted by digging the planting hole as deep as the root ball and about twice as wide. However, on large specimens, the hole need only be about six inches wider on all sides. Palms thrive in well-drained soil so the drainage in the area where palms will be placed needs to be tested before planting. It is critical that the palm is planted with the interface between the roots and trunk at or slightly below the soil line, but the trunk should never be buried in the soil. Planting too deep often results in death of the palm due to lack of oxygen for energy production, or root diseases. Disturbing the outside of the root ball is usually not necessary since the fibrous palm roots do not encircle the root ball and new roots will start growing from the root initiation zone after transplanting (Hodel, 2013).

Soil dug from the planting hole should be used as backfill, no amendments should be added. The use of unamended builder's or concrete sand as the sole backfill material might help provide support and stability to large and tall specimens. Backfill should be gently tamped around the root ball and immediately watered to settle. Creating a temporary irrigation berm just past the perimeter of the planting hole ensures that the entire root ball and the backfill will be saturated upon irrigation. The irrigation interval will vary depending on the weather and characteristics of the palm. Manually and visually check the original root ball, backfill, and surrounding site soil and irrigate to the depth of the original root ball as needed to keep the soil moist but not saturated. Expand the irrigation away from the trunk over time to accommodate new root growth into the surrounding soil.

To reduce nutrient deficiency, fertilize palms with a palm specialty fertilizer placed on top of the soil following transplanting of palms from containers (Broschat, 2009). Cover the soil with organic mulch, keeping the mulch away from the trunk base.

Transplanting Field Grown Palms

Large palms unlike other large trees can be successfully transplanted due to their single trunk, lack of branches, and fibrous, relatively shallow root system. Transplanting large palms requires heavy equipment and should be done by professionals with suitable expertise. When installing field-grown and transplanted trees, additional care should be taken. Large landscape palms must be handled gently in all phases of the transplanting operation. The primary focus of transplanting activities should be to protect the terminal bud from rough handling or bumping during excavation, transit, and planting. If the terminal bud is damaged, death of the tree will occur shortly thereafter. For this reason, the terminal bud is often protected by binding to a splint during the transplanting process. Attention should be given to protecting the trunk by bracing and wrapping it during excavation, transit, and planting, so as to minimize mechanical stress on the trunk and reduce opportunity for wounding (Hodel, 2013).

Juvenile palms should have reached their mature diameter if they are scheduled for transplanting or should be dug with a larger root ball. Plants should be well watered before digging them from their current location. In preparation for transplanting, palm fronds are bundled and tied together to protect both the apical meristem and the fronds during transport. In moderate climates, fronds should be untied immediately after transplanting. Removing green fronds from the base of the canopy during transplanting is not recommended in moderate to warm climates with higher relative humidity. However, in extremely hot, arid conditions, green fronds can be removed prior to transplanting to reduce water loss through transpiration. Nonetheless, the number of fronds to be removed should be minimized as it takes years for the canopy to produce new fronds. Further, in hot dry climates, palms benefit from keeping the fronds tied for some time after transplanting (Pittenger et al., 2005).

The size of the root ball to be dug depends on the species and the plant size. Root balls should be a minimum of 12 inches in diameter and depth. Standard industry practice is up to 18 inches in radius from the trunk for palm trees up to 65 feet. Since most palm species initiate new roots from

cut roots, they establish quickly after being transplanted. A smaller root ball, that is one to two feet wider than the trunk, and one to three feet deep will usually be sufficient. Large plants benefit from a deeper and wider root ball which better anchors the plant, especially taller ones, in the new location. While palms regenerate roots readily under optimal conditions, healthy roots are needed for this to occur. In general, a larger root ball will reduce incidence of stress and enhance the resilience of the newly planted tree when adverse conditions develop. Covering the root ball during transport with burlap will preserve its integrity and protect it from drying out. While some eudicot trees are root pruned in the field before transplanting to stimulate new root growth, this practice is not beneficial for palms (Pittenger et al., 2005).

The region where roots meet the trunk should be planted at grade or one inch below the soil surface, but not deeper. Burying the trunk of palms leads to plant death for any size palm. Backfill should consist of well-draining soil from the original planting hole or sand, especially if the soil is not well drained. Plants require irrigation of the original root ball, the backfill, and the surrounding soil after transplanting. Establishing a berm as described above will keep this area well irrigated during establishment and is key to maintain healthy palms. Field grown or transplanted palms should be fertilized within a few months after transplanting to prevent nutrient deficiencies and support establishment. The addition of root hormones or mycorrhizae to the root ball has not been shown to stimulate new root growth or benefit the plant. Mulching the root zone around the trunk supports root establishment and conserves water (Hodel, 2013).

Large palms planted in areas with strong winds may require bracing for one season to allow the new root system to develop and anchor the plant. Wood, or guy wires attached to a wooden brace, strapped around the trunk can be used as supports. Supports should not be nailed directly to the trunk as these wounds will remain for the life of the tree.

Cultural Practices for Established Palms

Irrigation – It is generally accepted that deep watering is crucial and that no palm, even an arid desert native, is really drought tolerant, since these grow in oases. Sufficient, deep irrigation promotes a healthy tree, adequate growth rate, disease tolerance, and pest resistance. Wetting the soil at least 4-6 feet beyond the trunk and at least 2 feet deep maintains a healthy plant. How often to irrigate depends on the soil texture, weather, and when the top of the soil profile dries out. Palm species differ in their water requirements. Some species including California and Mexican fan palms required no additional water if they are grown in a coastal Mediterranean climate (Pittenger et al., 2009), however, in the arid climates of Arizona some irrigation during the summer months benefits these plants. Windmill palm and queen palm require supplemental irrigation year-round even in a coastal climate.

Overwatering can result in vertical trunk splitting in landscape palms, creating an entry point for disease. Consistent water from adjacent sprinklers striking the pseudobark can result in trunk erosion and staining. In this case, the pseudobark, cortex and central cylinder erode giving the trunk a shaggy appearance and leaving the trunk vulnerable to infection. Mineral deposition on the trunk only affects the appearance of the tree, but is not known to impact tree health. Constant moisture on the base of the trunk may lead to the formation of aerial root proliferations. Large masses of adventitious roots emerge up to ten feet from the trunk base. These growths primarily affect tree aesthetics and do not impact structural integrity or tree health.

Fertilization – Regular fertilization to prevent nutrient deficiencies is important to palm health and appearance. Once leaves show a nutrient deficiency they cannot recover and will display this damage until they have been replaced with new foliage (Broschat, 2009). Fertilization should begin immediately after transplanting for transplanted container palms and several months after transplanting for larger specimens from the field or landscape. Since nitrogen is the nutrient needed in greatest quantities, it is the most likely to be deficient in Arizona landscape palms. Like nitrogen (N), potassium (K) and magnesium (Mg) are also macronutrients needed in greatest quantities to prevent deficiencies. Phosphorous (P) is not needed in large amounts. Of the micronutrients, manganese (Mn) is needed at 1-2%, while only trace amounts of iron, zinc and copper are needed for healthy palms. For best effect, N, K, Mg, and B should be in a form that releases slowly while other micronutrients (Mn, iron, zinc, and copper) should be in sulfate or chelated form (Broschat, 2021). An example of a palm fertilizer specially developed for palm maintenance is $8N\text{-}2P_2O_5\text{-}12K_2O{+}4Mg$ with micronutrients. The correct ratios of the different macronutrients are important to meet plant needs; if they are not in the correct ratio, the plant can suffer as a result of nutrient competition for uptake. For example, application of excessively high N fertilizer can kill a palm due to the resulting deficiency in potassium.

Nutrient deficiencies become apparent as fronds change color from green to light yellow, develop necrotic spots, or show dieback of leaflets and parts of the frond (Broschat, 2009). Symptoms vary by species and may start on the oldest or youngest fronds. When grown in sandy soils, queen palms and date palms are especially sensitive to potassium

deficiency. Nutrient deficiencies can often be corrected with the application of the nutrient that is low in supply, however, it can take several years for this to correct deficiencies and fronds that have developed symptoms of discoloration or dieback will often not be able to recover. Those fronds will be removed when they eventually turn brown, but should not be cut off as long as they have some green tissue.

Initial symptoms of nitrogen appear as light green foliage coloration which eventually develops into yellowing of older fronds and ultimately spreading chlorosis through the entire canopy if the deficiency persists. Palms are high potassium users and may show deficiency symptoms on older leaves with yellow speckles appearing first on the tip of the frond and later progressing throughout the leaf blade and midrib. Overwatering or application of high nitrogen fertilizers can promote potassium deficiency. Fronds affected by magnesium deficiency turn yellow while the midrib remains green. Magnesium deficiency affects older leaves first and manifests as a yellowing, chlorotic tissue on the tip of the leaflets or blade moving towards the base which remains green. If the deficiency worsens, the entire frond including the midrib can turn yellow.

In Arizona, palms should be fertilized twice per year when the soil is warm and roots are active. For established trees, apply a palm-specialty fertilizer in spring and mid-summer. Controlled release granular fertilizers provide a steady supply of nutrients, and minimize leaching and runoff. Apply the product according to package directions. Spread the product under the canopy but away from the trunk. Water thoroughly, to a depth of 12 inches, to release nutrients into the soil.

Pruning – Palm tree pruning requirements vary by species. Generally, as new foliage is produced from the terminal bud, lower fronds senesce and turn brown. These dead, lower fronds may persist or they may fall off. When they persist, they form a thatch called a "shag" or "skirt" that may be retained for trunk protection or historic character, or which may be pruned to reduce the hazard of falling debris or to enhance the tree's appearance. In all cases, rules governing pruning include: (1) defining a clear reason for each cut, (2) pruning at the correct time, and (3) following correct practices like those described in the ANSI standards for pruning available through the International Society of Arboriculture.

Reasons to prune include removing unwanted, dead or diseased leaves, living and dead inflorescences and infructescences (fruiting stalks), or unwanted trunks of multi-trunk species. Green, living leaves should only be removed in preparation for transplanting in very hot, arid climates so as to reduce surface area and resulting water loss. Removal of green leaves is strongly discouraged as this limits photosynthesis, reduces energy production and storage, ultimately weakening the plant.

Routine annual pruning is often scheduled in summer after flower stalks have emerged to allow both fronds and flower or fruit stalks to be removed at the same time. For fronds that were damaged by freezing temperatures, they should be removed after the risk of cold injury has passed.

Pruning practices include removing fronds by cutting the petiole or leaf base as close to the trunk as possible. Ideally, only leaf bases or petioles that easily fall or pull away from the trunk should be removed. Peeling or skinning trunks to remove petiole remnants and leaf bases is typically unnecessary and may wound the pseudobark, cortex, and even the central cylinder and transmit disease. Avoid pruning any living leaves attached above the horizontal plane (prune leaves no higher than nine and three o'clock). Palms that are consistently over-pruned develop weakness and often break in the wind. Removal of leaves displaying deficiency symptoms of mobile nutrients, including potassium and magnesium, should be avoided, to allow these nutrients to be transported to other areas of the plant.

How much to prune? Because palms have large leaves, their photosynthetic surface area is effectively concentrated, such that, a single extra cut can significantly reduce the tree's capacity to support healthy growth and repair. When considering how much to prune, a good rule of thumb is to restrict pruning to no more than twenty-five percent of the living canopy in a season, and avoid pruning more than once per season.

During pruning or other palm maintenance, no nails or spikes should be used to climb the tree. Wounds are permanent as the tree has no cambium to grow over it and may leave the tree open to infection from diseases.

Pests and Diseases

Integrated pest management is the preferred strategy for dealing with palm disease and insects. Prevention should be a priority in palm management as it is often the best, and sometimes the only means to treat a diseased tree. Healthy, adapted palms are less likely to attract insect pests and are better able to resist infection. Disease and insect infestations are rarely observed on properly selected and well managed palm trees. Some of the common pests (Elliott et al., 2010; Hodel, 2012) and diseases (Olsen, 1999; Hodel, 2012) affecting Arizona landscape palms are described here.

- **Texas Root Rot** –
  - Causal Agent: *Phymatotrichum omnivorum*, a fungal pathogen.
  - Host range: All palms (and other monocots) are resistant to Texas root rot, but may act as carriers.
  - Symptoms: Palms will not show symptoms of the disease.
  - Transmission: Transplanted palms can carry the disease and infect other adjacent plants. They should be tested to determine if the disease is present prior to transplanting to prevent disease spread.

- **Diamond Scale** –
  - Causal agent: *Sphaerodothus neowashingtonia*, a fungal pathogen.
  - Host range: *Washingtonia filifera*, hybrids of *W. robusta* with *W. filifera*.
  - Transmission and Disease Mechanism: Wind and water-borne spores from the pathogen infect all parts of the plant. Cool, humid nights in early summer encourage infection with symptoms appearing later in the dry, warm summer or fall months. This disease is rare in Arizona.
  - Symptoms and Diagnostic Indicators: Dark, water soaked spots in the foliage, which later turn into larger, black diamond shaped fruiting bodies aligned along the long axis of the host foliage. Heavily infected tissues are covered by a sooty dust.
  - Treatments: Avoid use of *W. filifera* where the disease occurs. Otherwise, attempt prevention through improved cultural practices including adequate irrigation, fertilization, and cultivation of healthy soils.
- **Thielaviopsis Rot** –
  - Causal agent: *Thielaviopsis paradoxa*, a fungal pathogen.
  - Host range: Many palm species are susceptible. In Arizona, the disease has been identified on *Phoenix dactylifera* and *Syagrus romanzoffiana*.
  - Transmission and Disease Mechanism: Spores are mechanically transmitted on pruning saws and on climbing spikes. Incidence of disease increases with pruning of green tissue, poor irrigation, and high soil salinity.
  - Symptoms and Diagnostic Indicators: Crown and/or bud rot, trunk rot and root rot. In Arizona, the most common infections are in the main trunk and in fronds. Old leaves die back and trunk may appear discolored, or bent revealing rot and weakness that progresses from the outer pseudobark to the central cylinder. While some trees that have failed due to sudden crown drop have this pathogen present, it is not confirmed as a causal agent for this notorious disease. Other diagnostic indicators of Thielaviopsis rot include discoloration of leaf petioles or trunk, and microscopic identification or culture of the spores.
  - Treatments: There is no control for Thielaviopsis rot. Prevention is the best means to control the disease by use of clean tools between trees and selection of clean trees when purchasing or transplanting.
- **Fusarium Wilt** –
  - Causal agent: *Fusarium oxysporum f.* sp. *canariensis.*
  - Host: *Phoenix canariensis*
  - Fusarium wilt of queen and Mexican fan palm has been identified in Arizona in 2016.
  - Transmission and Disease Mechanism: Direct infection occurs almost exclusively through contaminated pruning tools but infection may also be transmitted indirectly by drift of spore-containing sawdust and movement of contaminated soil and water to adjacent plants.
  - Symptoms and Diagnostic Indicators: Lower leaves turn yellow, then brown often with leaflets on one side of the leaf axis becoming brown first. Rapid death of the crown, dead leaves persist. Vascular discoloration and streaking will also appear.
  - Treatments: This disease is fatal and there is no treatment for diseased trees. Excellent cultural practices will effectively prevent the disease or facilitate disease management. Especially important are the use of quality well-composted, disease free mulch, proper irrigation, good drainage and use of manual pruning saws which need to be disinfested between trees.
- **Ganoderma Root Rot** –
  - Causal agent: *Ganoderma zonatum* affects landscape palms commonly planted in the Southwest.
  - Host range: *Phoenix* spp., *Washingtonia* spp. in Arizona, and sixty-five other palms in Florida.
  - Transmission and Disease Mechanism: Reddish-brown spores are released from mature conks, germinate in the soil and infest the roots.
  - Symptoms and Diagnostic Indicators: Wilting leaves, reduced growth resulting from vascular deterioration, and evidence of rotting primarily at the base of the trunk. (For this reason, this disease is sometimes called butt rot). Initially, the trunk base will show dark colored, swollen and distorted areas but will later produce a small, flattened, white fungal conk which matures into a brownish half-moon shaped mature structure.
  - Treatments: No specific factors are known to predispose palms to ganoderma root rot. Regular monitoring for conks and swift removal of the tree limits disease spread. Burning the lower portion of the diseased trunk is recommended.
- **False Smut** –
  - Causal agent: *Graphiola phoenicis*.
  - Host range: *P. canariensis, P. dactylifera* mostly, but also known to affect an additional thirty other palm species.
  - Transmission and Disease Mechanism: Water and wind-borne spores affect leaves that are wet for prolonged periods.

- Symptoms and Diagnostic Indicators: Nuisance disease that results in death of individual leaves over several years. Symptoms initially resemble potassium deficiency with yellow spots appearing on leaflets early on and black, cup-shaped fruiting bodies appearing on leaves later.
- Treatments: Prevention with proper irrigation (i.e. morning irrigation, avoiding wet leaves) and sanitation. Timely application of thiophanate methyl fungicides and copper compounds will suppress disease development.

- **Phytophthora Bud and Collar Rot** –
  - Causal agent: *Phytophthora* sp., a water-mold
  - Host range: *Washingtonia filifera*, and *W. robusta* primarily, but with *Syagrus romanzoffiana*, and *Butia capitata* affected to a lesser degree.
  - Transmission and Disease Mechanism: Splashing water, movement of infected plants, and frequently wet foliage favor development of the disease.
  - Symptoms and Diagnostic Indicators: Reduced growth and vigor precede loss of leaf color, chlorosis and death. Leaf death first affects young leaves along with rotting of the apical bud.
  - Treatments: Prevention by excluding diseased plants as well as proper sanitation and appropriate irrigation management reduce incidence. Fungicides are useful in preventing the disease in small plants, but are mostly ineffective for mature landscape specimens.

- **Pink Rot** –
  - Causal agent: *Nalanthamala vermoeseni (Gliocladium vermoeseni)*
  - Host range: *Phoenix* spp. *Howea forsteriana, Syagrus romanzoffiana, Trachycarpus fortunei, Washingtonia filifera* and *W. robusta.*
  - Transmission and Disease Mechanism: An opportunistic, secondary infection that afflicts stressed, wounded, diseased, or older palms.
  - Symptoms and Diagnostic Indicators: Leaf and rachis spots and rots with pinkish masses of spores often visible in the cross section of the leaf bases.
  - Treatments: Minimize wounding and plant stress from abiotic (water, temperature, salinity, wounding etc.) and other biotic factors by selecting adapted plants, and through excellent cultural and sanitation practices.

- **Giant Palm Borer** -
  - Causal agent: *Dinapate wrightii*, a beetle.
  - Host range: *Washingtonia filifera* and *Phoenix dactylifera.*
  - Transmission and Disease Mechanism: Trees in the wild carry the beetle, which can attack adjacent cultivated landscape trees or be directly moved into the landscape on wild-transplanted trees. Larvae hatch from nests at the base of petioles before burrowing into soft tissues of the leaf bases and eventually, throughout the whole trunk.
  - Symptoms and Diagnostic Indicators: A labyrinth of tunnels is created throughout the trunk by the chewing larvae. Some reports of audible chewing sounds and snapping trunk fibers in heavily infested trees.
  - Treatments: No reliable detection system is reported. Appropriate cultural care of trees may reduce attacks. Birds, like the common flicker and ladder-backed Gila woodpeckers are natural predators.

- **Fan Palm Caterpillar** –
  - Causal agent: *Litoprosopus coachella*, a one-inch-long, pink-green-colored caterpillar larvae.
  - Host range: *Washingtonia filifera* and *W. robusta.*
  - Transmission and Disease Mechanism: Larvae consume flowers and move to the leaf bases to pupate.
  - Symptoms and Diagnostic Indicators: Serious injury is unlikely, but damage inflicted by this pest may predispose trees to infection by other pests or pathogens.
  - Treatments: Early removal of inflorescences reduces populations.

- **Root Knot Nematode** -
  - Causal agent: *Meloidogyne* spp. (Olsen, 2011)
  - Host range: Most landscape plants including trees, shrubs, vegetables and bedding plants can serve as a host for the nematode. Palms affected by nematodes include *Washingtonia filifera*, *W. robusta*, *Chamaerops humilis*, and *Trachycarpus fortunei.*
  - Transmission and Disease Mechanism: Nematodes invade small feeder roots and limit uptake of nutrients and water. Their activity increases in warm, moist, sandy soils.
  - Symptoms and Diagnostic Indicators: Newly emerged fronds appear bunchy and small and severe infections can be fatal for the tree. Infected roots will display very small nodules.
  - Treatments: Impossible to eradicate once soils are infected. Soil can be solarized before replanting the infested site with vigorous, resistant plants with healthy root systems.

Palms for Arizona

- Scientific Name: ***Bismarckia nobilis***

  - Common Name: Bismarck palm
  - Palm Type: Fan
  - Description: Nearly rounded, grayish green to silvery-blue-green leaves are 8′-10′ across. The 5′ long petiole is covered with cinnamon colored scales.
  - Landscape Use: Striking color and form make this plant an ideal specimen plant.
  - Foliage: Evergreen
  - Climate Zone: USDA 9-11 / Sunset 13-17, and 19-24
  - Height: 6′-60′ (usually 30′ in cultivation)
  - Light Exposure: Full sun
  - Spread: 20′-25′
  - Water Use: Moderate
  - Growth Rate: Fast
  - Trunk Width: Solitary trunk of 2′ diameter
  - Cultural Requirements: This species is highly tolerant of intense heat, where it will grow more slowly than in humid and moderate climates. Good moisture supply with good drainage is best. Cold hardy down to 22ºF, but will recover if the bud is protected.
  - Problems: This tree is appropriate for protected regions of USDA Zone 9 and Sunset Zone 13, where they may experience cold injury, but will recover in one season.

- Scientific Name: ***Brahea armata***

  - Common Name: Mexican blue palm
  - Palm Type: Fan
  - Description: Waxy, silvery-blue leaves arch gracefully from the erect columnar trunk of this striking palm. Faintly fragrant, creamy white flowers are arrayed on flower stalks 18 feet or more in length. Some consider it better appearing in youth because mature specimens develop a stockier trunk and the foliage has a less pronounced blue color.
  - Landscape Use: This beautiful tree offers much versatility as a landscape palm or as a container subject. The attractive blue foliage makes a nice contrast with desert vegetation.
  - Foliage: Evergreen
  - Climate Zone: USDA 8-11 / Sunset H1, and 10-24
  - Height: 25′-30′
  - Light Exposure: Part shade, full or reflected sun
  - Spread: 6′-10′
  - Water Use: Low to medium
  - Growth Rate: Slow
  - Trunk Width: 2′
  - Cultural Requirements: Mexican blue palm tolerates extremes of heat, cold, wind and a wide range of growing conditions. Regular, widely spaced irrigation is best.
  - Problems: None reported.

- Scientific Name: ***Brahea brandegeei***

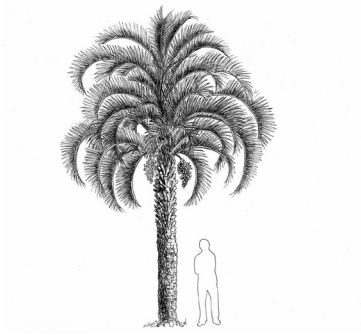
  - Common Name: San Jose Hesper palm
  - Palm Type: Fan
  - Description: Tallest of the Brahea genus. Appearance is similar to *Washingtonia robusta* with persistent, 3′ long green fronds with light gray undersides, and attractive, patterned trunk.
  - Landscape Use: Tall, slender palm to accent height in diverse landscapes.
  - Foliage: Evergreen
  - Climate Zone: USDA 9a-11, Sunset 13-24
  - Height: 40′-60′ (potentially up to 125′)
  - Light Exposure: Full sun
  - Spread: 7′
  - Water Use: Low
  - Growth Rate: Moderate to fast.
  - Trunk Width: 12″ and solitary.
  - Cultural Requirements: Thrives in hot locations with little humidity. Is highly tolerant of drought, and will tolerate freezing temperatures.

- Problems: Leaf damage below 25°F, and very limited availability in trade.

- Scientific Name: ***Brahea edulis***

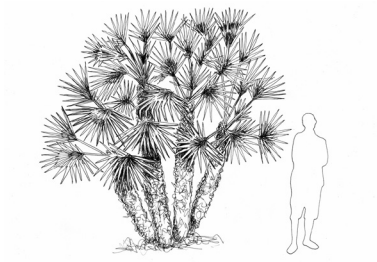
  - Common Name: Guadalupe fan palm
  - Palm Type: Fan
  - Description: A robust, handsome palm similar to Mexican blue palm but with less conspicuous flowers. Large, medium green leaves hold their color well through the winter and shed cleanly. Flowers appear on 4-5 foot long stalks and are followed by heavy clusters of small, black barely edible fruit.
  - Landscape Use: This fan palm is excellent as a specimen, in groups, or as a container plant when young. It is more effective for smaller scale use than Washingtonias.
  - Foliage: Evergreen
  - Climate Zone: USDA 9-11, Sunset 12-17, 19-24
  - Height: 20′-30′
  - Light Exposure: Part shade, full or reflected sun
  - Spread: 8′-10′
  - Water Use: Low to medium
  - Growth Rate: Slow to moderate
  - Trunk Width: 1.5′
  - Cultural Requirements: This species adapts to a wide variety of soil and cultural conditions. Deep, infrequent irrigation is best.
  - Problems: None recorded in Arizona.

- Scientific Name: ***Butia capitata***



  - Common Name: Pindo palm
  - Palm Type: Feather
  - Description: Gray-green, strongly recurved fronds create a graceful, cascading crown. The stocky trunk becomes patterned with the stubs of old leaf bases with age. Females bear large clusters of edible (pineapple flavored) fruits.
  - Landscape Use: Ideal as a low, bushy specimen in the garden. It is attractive when interplanted among tall, slender palms for contrast. It is also suitable for large containers or tubs.
  - Foliage: Evergreen
  - Climate Zone: USDA 7-10/ Sunset H1, and 8-24
  - Height: 10′ – 20′
  - Light Exposure: Part shade, full or reflected sun.
  - Spread: 5′ – 15′
  - Water Use: Medium to high.
  - Growth Rate: Slow.
  - Trunk Width: 1′ – 2′
  - Cultural Requirements: Old fronds need to be cut evenly to avoid a ragged appearance. Deep, infrequent irrigation is best.
  - Problems: Iron chlorosis can occur in alkaline, or poorly drained soils. Susceptible to bud rot and root-knot nematodes.

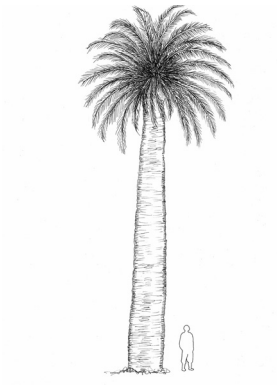
- Scientific Name: ***Chamaerops humilis***



  - Common Name: Mediterranean fan palm
  - Palm Type: Fan
  - Description: This slow grower is one of the most cold-hardy of all palms. The distinctive fan-shaped fronds are composed of stiff, blue-green to gray-green segments. These eventually form a compact head at the end of each curved stem. In Arizona, the bushy, multi-trunked type is the most commonly used form of this highly variable species.
  - Landscape Use: The suckering habit eventually results in pleasing stem groupings and enhanced landscape interest. This small palm makes a striking accent plant against architectural features. It is one of the best species for containers as well as for massing at the base of taller growing palms.
  - Foliage: Evergreen
  - Climate Zone: USDA 8-14/Sunset H1, H2, and 4-24
  - Height: 5′-15′
  - Light Exposure: Part shade to full sun
  - Spread: 5′-20′
  - Water Use: Low, medium or high
  - Growth Rate: Slow

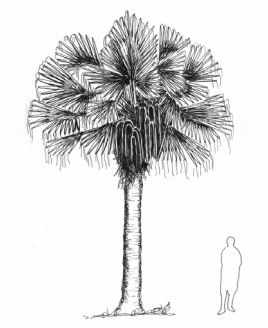
- Trunk Width: Clumping
- Cultural Requirements: Mediterranean fan palm survives much neglect but grows best in rich soil with ample water. Some pruning may be necessary to limit the number of stems and to remove old fronds.
- Problems: None recorded in Arizona

- Scientific Name: ***Jubaea chilensis***



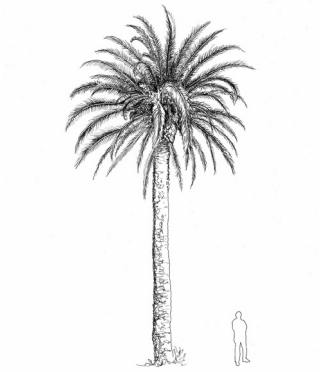
- Common Name: Chilean wine palm
- Palm Type: Feather
- Description: The Chilean wine palm develops a massive, columnar trunk which is one of the thickest of all palms. This self-pruning species forms a handsome patterned surface on the gray trunk. The dense feather-duster crown is made up of stiff, bristling leaves.
- Landscape Use: The massive character of Chilean wine palm merits its use as a specimen in parks and large garden areas.
- Foliage: Evergreen
- Climate Zone: USDA 9-10a, Sunset 12-24
- Height: 50′-80′
- Light Exposure: Full sun
- Spread: 20′-30′
- Water Use: Medium to high
- Growth Rate: Extremely slow
- Trunk Width: 3′-4′
- Cultural Requirements: Regular watering and fertilization is best.
- Problems: Not commonly available in Arizona.

- Scientific Name: ***Livistona chinensis***



- Common Name: Chinese fountain palm
- Palm Type: Fan
- Description: Chinese fountain palm develops a rounded fountain-like crown of graceful leaves atop a slender trunk. The shiny, bright green foliage forms a distinctive fringe of drooping leaf tips on mature plants. The large 3- to 5-foot fans are self-cleaning, leaving an attractive, leaf-scarred trunk.
- Landscape Use: A striking landscape specimen for warm winter areas. Tolerance of low light conditions makes it an excellent plant for indoor use when young. It is not commonly available in Arizona.
- Foliage: Evergreen
- Climate Zone: USDA 9-12/Sunset H1, H2, 9, 13-17, and 19-24
- Height: 15′-25′
- Light Exposure: Part shade
- Spread: 10′-15′
- Water Use: Medium to high
- Growth Rate: Slow to moderate
- Trunk Width: 1′-1.5′
- Cultural Requirements: Afternoon shade is important in hot desert climates
- Problems: Frost damage is likely in cold microclimates

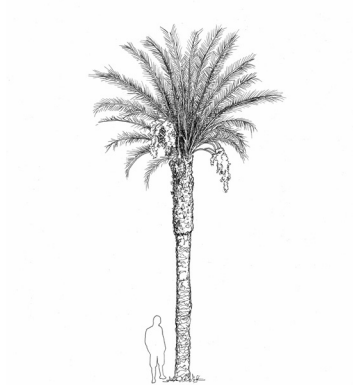
- Scientific Name: ***Phoenix canariensis***



- Common Name: Canary Island date palm
- Palm Type: Feather
- Description: Canary Island date palm is a large, wide-spreading feather palm of majestic proportions. The glistening, dark green leaves are long and arching, giving the crown a distinct fountain-like outline and form. The trunk of young trees is typically covered with persistent leaf bases giving a pineapple-like appearance. Female trees produce clusters of orange-yellow fruit in the fall.
- Landscape Use: Most effectively used along avenues, in parks, and large commercial and residential landscapes. Young trees make attractive and undemanding container subjects.
- Foliage: Evergreen
- Climate Zone: USDA 8-13/Sunset H1, H2, 8, 9, and 12-24
- Height: 40′-50′
- Light Exposure: Part shade, full or reflected sun
- Spread: 20′-40′
- Water Use: Medium to high
- Growth Rate: Slow

- Trunk Width: 2′-3′
- Cultural Requirements: Deep, regular irrigation and fertilization encourages faster growth. Periodic pruning and grooming are necessary for best appearance.
- Problems: Fruit is messy and attractive to birds. Pruning maintenance can be costly. Dry rot is sometimes an unsightly problem on frond stubs and trunk. This palm recovers slowly from frost damage. Susceptible to root knot nematodes, bud rot, and palm borers. May develop magnesium deficiency.

- Scientific Name: ***Phoenix dactylifera***

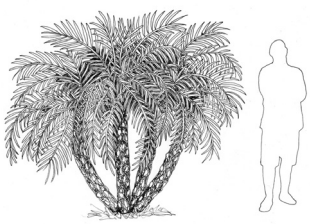


- Common Name: True date palm
- Palm Type: Feather
- Description: A rough textured slender trunk and feathery, wide-spreading canopy characterize the date palm. The gray-green head of leaves is ascending in the center and down-curving towards the outside, giving a stiff formal appearance. Offshoots may appear at ground level or infrequently on the trunk. Trees are male or female, and both sexes must be planted to ensure fruit production. In some areas, pollen can be obtained commercially to fertilize a single female tree.
- Landscape Use: In urban landscapes this palm makes a dramatic specimen tree. It is also planted in rows along roadways and drives. The date palm blends well with desert growth to give a feeling of a desert oasis. Its slender trunk makes this species more graceful for some landscape uses than Canary Island date palm.
- Foliage: Evergreen
- Climate Zone: USDA 8-12/Sunset H1, H2, 8, 9, and 11-24
- Height: 50′-60′
- Light Exposure: Part shade to full sun
- Spread: 25′- 35′
- Water Use: Low, medium or high
- Growth Rate: Slow
- Trunk Width: 1′-2′
- Cultural Requirements: To develop a single trunk or maintain a neat appearance, offshoots need to be removed or limited to a few in number. Transplanting is best in late spring. Regular irrigation and fertilizer encourages best growth.
- Problems: Old fronds and fruit drop require considerable cleanup. Too messy for pool/patio use. Susceptible to bud rot, palm borer, and nematodes. Pruning may be costly when the palm is tall.

- Scientific Name: ***Phoenix reclinata***

- Common Name: Senegal Date Palm
- Palm Type: Feather
- Description: Tall and slender, this species develops a dense head of graceful, feathery fronds. The bright green leaves are much smaller than those of the Canary Island or date palm. Suckers from the base can be encouraged to form a tree with several trunks. These tend to lean away from one another as they mature. Hybrids of this species and Canary Island date palm are hardier and more massive in scale.
- Landscape Use: This is a very striking specimen palm adapted for use in warm, sheltered microclimates in low elevation desert locations. The slender leaning habit of the clump form lends great charm and a distinctly tropical appearance to the landscape.
- Foliage: Evergreen
- Climate Zone: USDA 9-13/ Sunset H2, 9, 13-17, and 21-24
- Height: 20′-30′
- Light Exposure: Part shade to full sun
- Spread: 8′-12′
- Water Use: Medium to high
- Growth Rate: Moderate
- Trunk Width: clumping
- Cultural Requirements: Plants respond well to regular watering and application of nitrogen fertilizers. Not commonly available in Arizona.
- Problems: For use in protected, nearly frost-free, microclimate areas only. Severe frost damage may be expected when temperatures fall below the mid-20s F.

- Scientific Name: ***Phoenix roebelenii***



- Common Name: Pygmy date palm
- Palm Type: Feather
- Description: This dwarf, slow-growing palm develops a dense, graceful crown on a single, straight to curving trunk. The arching finely cut, dark green leaves create a delicate, refined appearance.

- Landscape Use: The Pygmy date palm is valued as a highly decorative, small-scale palm for protected locations. It is ideally suited for container culture.
- Foliage: Evergreen
- Climate Zone: USDA 9-14/ Sunset H1, H2, 13, 16, 17, and 22-24
- Height: 6′-8′
- Light Exposure: Part shade to full sun
- Spread: 3′-5′
- Water Use: Medium to high
- Growth Rate: Slow
- Trunk width: 4″-6″
- Cultural Requirements: Regular watering and application of nitrogen fertilizer promotes vigorous, lush growth.
- Problems: Spines present on the leaf petiole are a minor nuisance. Frost damage is likely in cold microclimates. Susceptible to micronutrient deficiencies.

- Scientific Name: ***Rhapis excelsa***

- Common Name: Broadleaf lady palm
- Palm Type: Fan
- Description: A cultivated tree, native to southern China with multiple bamboo-like trunks. Dark green, glossy foliage has wide segments (thus, the name Broadleaf lady palm.)
- Landscape Use: Well suited to low-light, and low-humidity environments. Suitable for indoor use.
- Foliage: Evergreen
- Climate Zone: USDA 10-15/ Sunset H1, H2, 12-17, and 19-24
- Height: 12′
- Light Exposure: Shade or bright, indirect light.
- Spread: Clumping habit
- Water Use: Moderate
- Growth Rate: Slow (indoors) to moderate (outdoors)
- Trunk Width: Multi-stemmed trunk up to 1″ in diameter.
- Cultural Requirements: Low light, low humidity. Propagates readily from underground rhizomes. Requires evenly moist, but well drained soil.
- Problems: Poorly suited to cold temperatures outside of USDA Zones 10-15, with poor drought tolerance. Best suited to low light conditions as leaves may burn in full sun. Somewhat susceptible to scale insects and root rot with poorly drained soils or unsuitable environments.

- Scientific Name: ***Sabal uresana***

- Common Name: Sonoran palmetto
- Palm Type: Fan
- Description: This picturesque fan palm is native to the canyons and tablelands of Sonora, Mexico. Young plants are particularly attractive forming a cluster of large bluish-green fans with deeply divided segments. With maturity, the blue color of the fans becomes less prominent and a fairly stout trunk develops, especially if covered with persistent leaf bases.
- Landscape Use: The Sonoran palmetto is excellent as a specimen, along avenues or in parks.
- Foliage: Evergreen
- Climate Zone: USDA 7-10
- Height: 30′-40′
- Light Exposure: Full sun
- Spread: 15′-25′
- Water Use: Low to medium
- Growth Rate: Slow
- Trunk Width: 2′-3′
- Cultural Requirements: Once established, this palm is very cold hardy. Well drained soil is necessary for best growth.
- Problems: Not commonly available in Arizona.

- Scientific Name: ***Syagrus romanzoffiana***

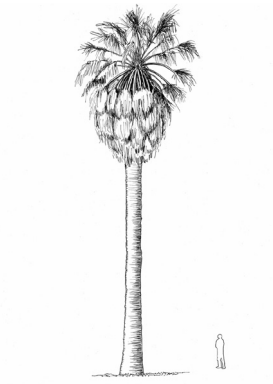
- Common Name: Queen palm
- Palm Type: Feather
- Description: A tall, graceful palm with a luxurious head of arching 10-15-foot fronds. Prominent rings develop on the smooth gray, upright trunk. The bright-green, feathery leaves form long, papery filaments with exposure to wind and temperature extremes.
- Landscape Use: The Queen palm creates a lush, tropical effect for pools, home gardens or courtyards of large buildings. It makes a showy appearance both

as a single specimen or clumped in groups.
- Foliage: Evergreen
- Climate Zone: USDA 9-15/Sunset H1, H2, 12-17, and 19-23
- Height: 30′ - 40′
- Light Exposure: Part shade to full sun.
- Spread: 15′ – 30′
- Water Use: Medium to high.
- Growth Rate: Moderate to fast.
- Trunk Width: 1′-1.5′
- Cultural Requirements: This palm responds well to nitrogen fertilizer, extra iron, and ample water. Plant in protected areas to reduce wind and cold damage.
- Problems: Cold sensitivity limits use to below 2500′ elevation. Fronds may develop iron chlorosis and manganese deficiency. Susceptible to spider mites, root knot nematode, and bud rot. High winds may also damage long fronds.

- Scientific Name: ***Trachycarpus fortunei***

- Common Name: Windmill palm
- Palm Type: Fan
- Description: Windmill palm is small, slow-growing and tolerant of both heat and cold. Fan-shaped leaves are displayed in a windmill-like fashion in a compact, regular head. The slender, upright trunk tapers inversely from top to bottom. Stubs of old fronds protrude from a shaggy covering of hairy, black fibers.
- Landscape Use: This semi-dwarf compact species is effective for tropical plantings, atriums and containers. It makes artistic pairs for an entryway, along a narrow walk or drive.
- Foliage: Evergreen
- Climate Zone: USDA 7-10/Sunset H1, 4-24
- Height: 30′-40′
- Light Exposure: Part shade to full sun
- Spread: 6′-8′
- Water Use: Medium to high
- Growth Rate: Slow
- Trunk Width: 4″-6″
- Cultural Requirements: Responds well to regular irrigation and fertilizer. Appearance is best when grown in the shelter of taller trees or on the east side of structures where the tree is shaded from afternoon sun. Occasional pruning is necessary for a neat appearance.
- Problems: Fronds may become tattered in high winds and tip-burn with reflected sun and heat.

- Scientific Name: ***Washingtonia filifera***



- Common Name: California fan palm
- Palm Type: Fan
- Description: A powerful, stately palm whose heavy trunk supports a crown of large, fan-shaped leaves. Foliage stands erect and spreading on spiny petioles when young. With maturity, leaves droop to the smooth trunk forming a handsome thatch. This species hybridizes easily with *W. robusta*, so that a large variation in appearance is possible, even from commercial sources.
- Landscape Use: The massive character of this palm tends to dominate small landscapes and small structures. The best use is as a street or park tree or a specimen in large-scale landscapes.
- Foliage: Evergreen
- Climate Zone: USDA 8-14/Sunset H1, H2, 8-24
- Height: 40′-60′
- Light Exposure: Part shade to full sun
- Spread: 15′-20′
- Water Use: Low to Medium
- Growth Rate: Moderate to fast
- Trunk Width: 2′-3′
- Cultural Requirements: Some drought tolerance is shown but prefers regular, infrequent, deep irrigation. Good soil drainage is important. Periodic grooming to improve appearance and intermittent removal of volunteer seedlings. Fertilize annually in spring or summer.
- Problems: Thatch may harbor pests and be a fire hazard. Yearly trimming can be costly. Susceptible to bud rot and root knot nematodes.

- Scientific Name: ***Washingtonia robusta***

- Common Name: Mexican fan palm
- Palm Type: Fan
- Description: This tall, graceful fast-growing palm is well adapted to Arizona's heat and low humidity. Bright green, fan-shaped leaves form a luxuriant and more compact head than California fan palm. The trunk flares at the base but tapers into a slender column above. The dry leaf thatch might not be as uniform or attractive as that of the California fan palm. It can be removed or allowed to hang naturally, and often breaks loose. This species hybridizes easily with *W. filifera*, so that a large variation in appearance is possible, even from commercial sources.
- Landscape Use: Planted as a street or park tree, lawn specimen and in groups for a tropical effect. Its height, form and ease of transplanting make it a popular landscape specimen to lend vertical scale to large spaces.
- Foliage: Evergreen
- Climate Zone: USDA 8-11/Sunset H1, H2, 8-24
- Height: 40'-100'
- Light Exposure: Part shade to full sun
- Spread: 10'-15'
- Water Use: Low, medium or high
- Growth Rate: Fast
- Trunk Width: 1'-1.5'
- Cultural Requirements: Tolerance is shown to poor conditions but best growth occurs with good soil and regular irrigation. Occasional grooming is needed. Fertilize annually.
- Problems: Although often injured by winter cold, near the limits of its range this palm regrows a new head of leaves by mid-spring. Somewhat more disease-resistant than other palms. Palm flower caterpillars are an occasional litter problem beneath the tree or in nearby structures. Avoid planting near power lines.

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Resources

University of Florida IFAS Palm Care website: https://edis.ifas.ufl.edu/entity/topic/palm_care

University of California Hodel Western Arborist Palm Series. https://ucanr.edu/sites/HodelPalmsTrees/Hodel_Western_Arborist_Palm_Series/

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