ARIZONA COOPERATIVE EXTENSION
THE UNIVERSITY OF ARIZONA • COLLEGE OF AGRICULTURE AND LIFE SCIENCES

Backyards & Beyond

Winter 2009 RURAL LIVING IN ARIZONA Volume 3, Number 1

Featured Plant

Common Name: Mesquite

Scientific Name: *Prosopis* spp.

Ashley Sheperd

Steve Archer, Ph.D., Professor; Steve Woods, Graduate Student; and Larry Howery, Ph.D., Rangeland Management Extension Specialist; all with the School of Natural Resources, University of Arizona, Tucson

Mesquite is a nitrogen-fixing tree or shrub of the genus *Prosopis* (bean or legume family, Fabaceae). In the United States there are three main species: velvet mesquite (*P. velutina*, in Arizona), honey mesquite (*P. glandulosa* var. *glandulosa*, in New Mexico and Texas) and western honey mesquite (*P. glandulosa* var. *torreyana*, in California). Mesquite also occurs in South America, Africa, the Middle East, India and Australia.

On sandy or shallow soils, mesquite is a low-growing, multi-stemmed shrub. On deeper, loamier soils it can be a large shrub. In riparian zones, arroyos or where there is permanent water within 15 feet of the soil surface, or where annual rainfall is >20 inches, mesquites may be tree-like in size and architecture. One mesquite in Real County, Texas stands 52 feet tall with a trunk circumference of 152 inches.

Widespread across the Southwestern USA from central Texas to California and from Oklahoma into Mexico, mesquite has had a significant influence on human kind. Mesquite plants were important to Native Americans as a source of food, shelter, fuel, weapons, medicine, and farming tools. Early settlers trying to eek out an existence on challenging lands both praised and cursed mesquite. It gave shelter and shade. Its dense, sturdy wood is highly resistant to decay and insect attack, and thus valuable for fencing and construction. Mesquite pods, rich in nutrients and carbohydrates, were an invaluable source of food for livestock, especially in drought years. Early travelers across the Southwest referred to the mesquite bean as "manna from heaven" and used it as a coffee substitute and source of flour. But, its aggressive invasion of beloved grasslands in modern times made it a serious rangeland pest.

Why has mesquite been such an aggressive invader of grasslands? There appear to be many reasons. The pods are widely consumed by animals, including cattle, sheep and horses. Its seeds, like those of most leguminous (bean) plants, have a rock-hard coat. Thus, many of the seeds in pods consumed by large mammals escape mastication and pass through the digestive tract unharmed. They are then transported away from adult plants that may harbor insects that feed on mesquite seeds (for example, bruchid beetles). For germination to occur, the seed coat must be scratched or cracked so water can enter. This is often facilitated by passage through animals. Seed ingested by livestock are deposited in a moist, nutrient rich medium (dung) in areas where grasses have been grazed and fine fuel loads needed to carry fire have been reduced. Mesquite seedlings develop a taproot that can extend below the rooting zone of grasses within a month or two. This gives them access to deeper stores of soil moisture and makes them relatively immune from competition. Their roots can also harbor nitrogen-fixing microorganisms, potentially a great advantage. Furthermore, mesquite seedlings have the capacity to regenerate from dormant buds at a very early age. Even when a young plant is top-killed by drought, fire or a rabbit, it persists and quickly sprouts back. Finally, mesquite leaves are not particularly palatable so plants experience little browsing pressure. The mesquite plant has a lot going for it.

With the introduction of livestock into North America and the virtual elimination of fire from grasslands, mesquite has had many more opportunities for dispersal and establishment than prior to Anglo-European settlement. It has clearly taken advantage of them!

Featured Bird

Common Name: Say's Phoebe

Scientific Name: *Sayornis saya*

Dan L. Fischer

Dan L. Fischer – Author of *Early Southwest Ornithologists*, 1528-1900. University of Arizona Press

Of the several flycatchers that occur in Arizona, few reside here throughout the year. The exception is the Say's Phoebe, a small handsome brownish bird with contrasting shades of gray on its back, a pale rusty belly and black tail. While perched, it frequently flicks and spreads it tail. Found only in the west, it ranges in summer from Mexico north as far as central Alaska. It is a bird generally occurring in open country of grasslands, badlands, and barren foothills up to 6500 feet, and occasionally higher, where it forages on flying insects from perches of generally low vegetation. Not being restricted to riparian areas, it is widely distributed throughout the state.

Before the developments of human expansion into the west Say's Phoebes confined their nesting sites to natural rock ledges, caves and potholes. Being readily adaptable, they quickly began using a variety of manmade structures of old buildings where they construct their small nests in covered situations under suitable eaves, rafters, ledges and, on occasion, old mailboxes. Even old mine shafts and adits are sometimes utilized. The birds generally pair in February and the first of 4-5 white eggs are usually laid in early March. Following incubation of 12 days or more, the young fledge shortly after two weeks. When conditions are favorable the female may start a second nest by laying another clutch nearby before the young of the first have fledged, leaving the feeding duties to the male. It is not unusual for a pair to triple-brood within a single nesting season. Appearing rather inconspicious, these birds are very territorial and never appear numerous to the casual observer.

It was in 1819-1820 on the first military expedition west that included a naturalist when this bird was originally discovered. Major Stephen H. Long (1784-1864), a topographic engineer, included in his company for the trip Thomas Say (1787-1843), one of the founders of the Academy of Natural Sciences in Philadelphia, and his young assistant, artist-naturalist Titian R. Peale (1799-1885). The expedition into the southern Rocky Mountains, however, was nearly a disaster for Say as he suffered from ill health, was robbed of his possessions and field notes, not only by Pawnee, but again by deserting soldiers. Despite these obstacles, the expedition was considered rich in bird discoveries for Say described nine new birds species, which incidently, occur in Arizona.

Returning to Philadelphia, Say became acquainted with the nephew of Napoleon, Prince Charles Lucien Jules Laurent Bonaparte (1803-1857), who was a visiting ornithologist to America in 1823. While inspecting the birds from the expedition Bonaparte discovered two additional birds, one a brownish flycatcher collected by Peale, which he named in honor of his new friend Say, "a naturalist, of whom America may justly be proud...." Originally named *Muscicapa saya*, Bonaparte, a quarter of a century later, changed the generic name to *Sayornis* which is also shared with the Black and Eastern Phoebes.

Backyards & Beyond

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Dieter Hawlan

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Grasslands or Shrubland?

Tipping the Balance

Figure 1. Top: Desert grasslands on the Santa Rita Experimental Range in southeastern Arizona in 1904. Woody plants such as mesquite were present, but largely confined to arroyos. Bottom: The same landscape photographed in 1997. Mesquite shrublands currently dominate uplands. (Photo station 333 from SRER digital archives: http://ag.arizona.edu/SRER/).

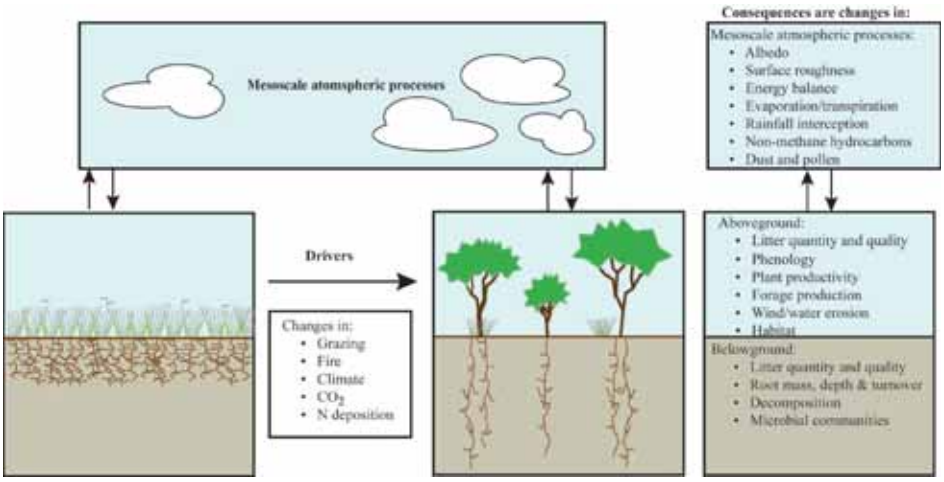

Figure 2. Drivers of woody plant encroachment (see Text Box 1) and the potential consequences of ecosystem function and land surface-atmosphere interactions.

Introduction

Grasslands and savannas (grasslands with scattered shrubs or trees) constitute about 50% of the Earth's land surface. Characterized by low and highly variable rainfall, these ecosystems account for about one-third of plant production on land, contain about one-third of the world's human population and support the majority of the world's livestock production. Their extensive airsheds and watersheds provide habitat for game and non-game wildlife and a myriad of ecosystem goods and services important to rapidly growing settlements and cities that may be geographically distant. Grasslands and savannas thus have considerable, multi-dimensional conservation value.

A striking change in grasslands worldwide in recent decades has been the proliferation of trees and shrubs (Figure 1). In Arizona, the abundance of native woody plants such as mesquite (see Featured Plant, this issue), creosote bush [(see Featured Plant in *B&B* vol. 2 (2008)], juniper [see Featured Plant in *B&B* vol. 2, Issue 3 (2008)], oaks and ponderosa pine have increased within their historic geographic ranges. Non-native woody plants such as salt cedar and Russian olive have also spread. Increased woody plant abundance represents a fundamental alteration of habitat and the food webs linking plants, herbivores, carnivores and decomposer organisms.

Why has woody plant abundance increased on rangelands?

Causes of woody plant encroachment are actively debated. Traditional explanations center around intensified livestock grazing, changes in climate and fire regimes, and declines (natural and human-induced) in the abundance of browsing animals (Figure 2). Increases in nitrogen deposition and atmospheric carbon dioxide concentration since the Industrial Revolution may also have played a role.

All of these have likely interacted to varying degrees in various locations. Hence, it is difficult to rank their importance (Text Box 1). As you travel across Arizona and New Mexico, you may notice that woody plant encroachment has occurred on one side of a fence or road but not

Steve Archer, Ph.D., Professor; Steve Woods, Graduate Student; and Larry Howery, Ph.D., Range Management Extension Specialist; all with the School of Natural Resources, University of Arizona, Tucson

the other. These nearby areas often have similar soils and topography and have experienced similar climate, carbon dioxide enrichment and nitrogen deposition. Marked contrasts in vegetation over such a short distance suggest that explanations are likely to be local factors. For instance, differences in livestock grazing, brush management, and fire history.

What's the big deal?

When woody plants replace grasses, fundamental changes occur in ecosystem function – how plants process water, energy and nutrients (Figure 2). These changes often reduce forage production and alter grass composition. Shrub proliferation can also affect livestock safety and health, as woody plants provide cover for predators and habitat for insect and arthropod pests. Gathering and moving livestock can also be more difficult with increased woody plant height and density. Increases in shrub cover might reduce stream flow and groundwater recharge, though broad generalizations regarding shrub effects on water yield should be viewed with caution. It also represents fundamental changes in habitat for grassland-adapted birds, reptiles, rodents and large mammals. Increases in shrub abundance also affects soil bacteria and fungi critical in the decomposition process. Though not well understood, shrub proliferation has the potential to influence local weather and atmospheric chemistry (greenhouse gas concentrations and ozone production) by altering albedo (the reflection of incoming sunlight), cloud formation (via changes in evaporation/transpiration, soil temperature and dust production), carbon sequestration and plant/soil emissions of carbon dioxide, nitrous oxide, methane and non-methane hydrocarbons.

The Way Forward?

Conservation of existing grasslands and savannas will require progressive management that ensures that grass production is maintained and that prescribed fire can be used regularly. In areas where woody plants have already taken over, grassland restoration may require the implementation of integrated brush management systems strategically employing chemical and mechanical treatments in conjunction with prescribed fire.

Suggested Readings

Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes, pp.13-68. In "Ecological implications of livestock herbivory in the West" (M. Vavra, W. Laycock, R. Pieper, eds.). Society for Range Management, Denver, CO.

McClaran, M. P. 2003. A century of vegetation change on the Santa Rita Experimental Range, pp. 16-33. In "Santa Rita Experimental Range: 100 years (1903 to 2003) of accomplishments and contributions." Proc. RMRS-P-30, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, UT, Tucson, AZ. See also: http://ag.arizona.edu/SRER/proceedings.html.

Van Auken, O. W. 2000. Shrub invasions of North American semiarid grasslands. Annual Review of Ecology & Systematics 31:197-215.

CAUSES OF WOODY PLANT ENCROACHMENT

Causes for the increased abundance of woody plants in drylands are actively debated. There is no single-factor explanation for this widespread phenomenon. Most likely, it reflects drivers that vary locally or regionally, or from the interaction of more than one driver. Changes in a given driver may be necessary to tip the balance between woody and herbaceous vegetation, but may not be sufficient unless co-occurring with changes in other drivers. Potential causes for increases in wood plant (WP) abundance in rangelands include changes in:

CLIMATE – Changes in the amount and seasonality of precipitation (PPT) can affect the balance between grasses and WPs. Increases in total PPT can enhance WP size and density; decreases in PPT can promote shifts from mesophytic grasses to xerophytic shrubs. Shifts from summer to winter PPT regimes can favor woody plants. PPT effects at local scales are strongly mediated by soil texture and depth: WPs are favored on relatively deep, well-drained soils; and grasses on shallow, clayey/loamy soils.

GRAZING – Utilization of grasses by herbivores reduces their leaf and root biomass making them more susceptible to other environmental stresses. Repeated heavy grazing by large numbers and high concentrations of livestock without adequate rest and plant recovery, and utilization of grass seeds by granivores (rodents, ants) can cause shifts in herbaceous species composition to assemblages less effective at competitively excluding woody plant seedlings. Herbivores and granivores may also be effective agents of WP seed dispersal in certain cases. Changes in soil properties and microclimate accompanying over-grazing may create conditions more favorable for WP establishment and less favorable for grass establishment.

BROWSING – Preferential utilization of WPs by browsing animals (e.g., goats) may keep shrubs and trees from establishing or from reaching large sizes or high densities. WPs kept low in stature by browsers will be more susceptible to fire. Reductions in the abundance of browsers may remove a major constraint to WP dominance on sites that are otherwise climatically and edaphically suitable. Widespread eradication of prairie dogs in the early 1900s may have created opportunities for woody plant encroachment in areas where these colonial rodents occurred.

FIRE REGIMES – Grasslands and savannas are typically characterized by high fine fuel loads and hence frequent fire that would either prevent woody plants from establishing or prevent fire-tolerant WPs from gaining dominance. Past heavy grazing reduced fine fuel abundance, and likely reduced the frequency and intensity of fires that historically kept WPs suppressed.

INCREASES IN ATMOSPHERIC CO_2 – There is some evidence that increases in atmospheric CO_2 concentrations since the industrial revolution may have favored WPs that have the C_3 photosynthetic pathway over grasses with the C_4 photosynthetic pathway. However, WPs have numerous other adaptations that allow them to compensate for and overcome disadvantages that may be related to their photosynthetic pathway. Furthermore, the differential response of photosynthetic pathways to CO_2 fertilization cannot explain increases in WP abundance in temperate regions where both grasses and shrubs possess the C_3 photosynthetic pathway.

NITROGEN DEPOSITION – A correlation between levels of N deposition and the extent of forest expansion into grasslands has been shown for the northern Great Plains of North America.

Jonathan Reilly

Go Dutch!

Stephanie Shank, Extension Agent, 4-H Youth Development, University of Arizona Cooperative Extension, Yavapai County

Cooking in a Dutch oven is regarded as an art and somewhat a mystery to many people. However, almost anything that a person can cook in a regular kitchen oven can also be cooked outdoors in a Dutch oven.

A traditional Dutch oven is a cast iron cooking pot with a tight fitting lid. The sturdiness of cast iron and the versatility of the Dutch oven made it a popular cooking vessel in the old West. Dutch ovens with a rimmed lid and tiny legs on the bottom were perfect for cooking outdoors with coals. Pioneers, ranchers and chuckwagon cooks had their favorite recipes and could keep their families and ranch hands happy at the dinner table and around the campfire.

Even in modern days the Dutch oven is useful and fun for cooking meals. During the time of year when it's not hot enough to turn on the air conditioner and not cool enough for the heater, the Dutch oven can allow for a hot meal to be cooked outside and not heat up the kitchen or house. Additionally, it can be a fun way to experience a little bit of the old West.

Some basic equipment is needed for Dutch oven cooking. First and foremost is the basic 12" Dutch oven. Dutch ovens can be purchased at outdoor equipment stores, hardware stores, through online merchants, or even at second hand shops. Although the traditional Dutch oven is cast iron, some companies now offer a cast aluminum Dutch oven. Cast aluminum is lighter weight and is an option to consider if the Dutch oven might be taken on a camping trip or a horse packing trip. For cooking outdoors, it is important that the Dutch oven has a close-fitting lid with a flanged or rimmed lid. The flange or rim keeps the coals from falling off. The Dutch oven should have legs on the bottom which will allow space for charcoal underneath the pot. The Dutch oven also has a bail handle so that the pot can be lifted and moved easily. The Dutch oven and lid should be examined to ensure that neither is cracked.

Another choice recently available to the Dutch oven shopper is a "pre-seasoned" Dutch oven. Traditional Dutch ovens are cast iron and must be seasoned. This seasoning process will protect the Dutch oven from rust and will provide an almost stick-proof coating. To season a traditional Dutch oven, whether it is brand new or an old treasure found in an attic or second hand shop, the pot and lid must be washed very well. Scrub off any factory applied coating on a new pot, or rust or rancid grease from an old pot. Allow the pot to dry thoroughly and then apply a thin coat of vegetable oil on all surfaces. It is not advisable to use butter or lard in this process as these can become rancid. Fat from other animal sources can have moisture in it and cause your pot to rust. After applying the oil, the Dutch oven and lid should be placed in a 350° oven for 60 minutes. After 60 minutes, the oven should be turned off and the Dutch oven should be allowed to cool down. Do not attempt to hurry the cooling process by immersing or rinsing the Dutch oven with water as the water may crack a hot Dutch oven. This seasoning process can also be done in an outside barbeque grill, provided there is enough space inside the closed grill to accommodate the Dutch oven and the lid. A Dutch oven that is purchased "pre-seasoned" from the factory does not have to be seasoned at home.

Other essential equipment for safety and convenience are a lid lifter to remove the lid during and after cooking; a lid rest, which provides a place to set the lid while preparing, checking cooking

progress or serving food from a Dutch oven; long handled tongs used for moving and arranging hot coals; a leather barbeque mitt or heavy potholder, for protection from a hot Dutch oven.

Safety considerations also include selecting a safe place to cook in a Dutch oven. The source of heat used when cooking with a Dutch oven are coals from a campfire or charcoal briquettes. Since Dutch oven cooking uses hot coals, it is important that fire safety be practiced. The area where the hot coals are placed should not be on or adjacent to anything flammable. Keep this location away from the house or other structures and areas with dry vegetation that might fuel a wildfire. Remember that hot coals may leave a scorch mark on concrete. National forests have various regulations for collecting firewood, which may make it hard to find or illegal to use. Different kinds of firewood burn longer or are reputed to burn hotter, giving variable results. Charcoal briquettes are a fairly standard unit and are easy to use and readily available. Using a charcoal briquette chimney to start charcoal briquettes helps to contain coals and flames when starting a fire. An old charcoal barbeque grill, galvanized oil-changing pan (cleaned), or cinderblocks strategically arranged will provide a safe cooking spot and will also offer some wind protection.

Usually charcoal briquettes will yield about one hour of heat. Allow 20-30 minutes from the time of starting the briquettes until they will be hot and ready to use. If a recipe requires more cooking time, it will be necessary to start another batch of briquettes before the first batch has burned away. The basic rule of thumb for determining the temperature of a Dutch oven and how many briquettes to use is the "four up, four down rule." That is, for a 325° 12" Dutch oven, use 16 coals on top (12+4=16) and 8 coals on the bottom (12-4=8). For every additional 25° desired, add an additional briquette both on top and underneath the oven. For example, 350° would require 17 on top and 9 on the bottom. In written recipes, the combination of coals to use is sometimes noted as a ratio; for example 17/9.

In the past, some people have preferred not to wash cast iron cookware, but because of food safety considerations the Dutch oven should be cleaned by washing with slightly soapy water. Excessive dishwashing detergent should not be used, nor should the Dutch oven be soaked for an extended period of time because the detergent will remove the seasoning and the soaking will cause the pot to rust. In both cases, the Dutch oven will need to be re-seasoned. When done washing and rinsing, the Dutch oven can be thoroughly dried by hand drying or placing back over any leftover coals. After the Dutch oven has dried, a thin coat of vegetable oil should be applied to the inside, and the Dutch oven then put back over the warm coals for a few minutes. Excess residual oil should be removed with a paper towel. Lining a Dutch oven with aluminum foil can make cleanup much easier, especially with sticky or sugary foods. Store the Dutch oven in a safe, dry location where it would not be subject to many temperature fluctuations. Dutch ovens are very heavy; dropping a Dutch oven can cause it to break. The storage location should be convenient and facilitate ease of handling. A few paper towels should be nestled between the Dutch oven and the lid to keep them ajar and to absorb any moisture so that the Dutch oven doesn't rust.

Dutch oven recipes can be found by consulting Dutch oven cookbooks available from a bookstore or online, Dutch oven internet websites or family cookbooks. Here is a website with recipes and videos produced through Washington State University.

http://kwsumedia.org/Programs/DutchOven/DutchOven.aspx

Once you get started cooking in a Dutch oven, it is fun to adapt recipes from your own kitchen to outdoors in a Dutch oven. Here is a recipe to get you started. The beauty of this recipe is its simplicity. Give it a try. Good luck and go Dutch!

Dutch Oven Dump Cake

½ cup butter, divided
1 20-ounce can prepared fruit pie filling such as apple, apricot, blueberry, cherry, peach, etc.
1 two-layer cake mix
1 12-ounce can ginger ale or lemon-lime soda

Line a 12" Dutch oven with aluminum foil. Place ¼ cup of butter in the bottom of the Dutch oven and place the Dutch oven over a bed of 8 hot prepared charcoal briquettes. When the butter has melted, pour the can of fruit pie filling on top of the melted butter. Sprinkle the cake mix evenly over the fruit pie filling. Cut the remaining ¼ cup of butter into small bits and distribute evenly over the dry cake mix. Gently pour soda evenly over cake mix. Do not stir. Put lid on Dutch oven and add 16 hot prepared charcoal briquettes on top. Bake for 30-45 minutes. When the top is lightly brown and it smells good, it is done!

ARIZONA'S STATE TRUST LAND

Providing for economic growth and sustainable natural resources

Willie Sommers, Range Resource Area Manager, Arizona State Land Department

Background

Many of our rural residents are fortunate to live in close proximity to wide open spaces that provide a myriad of opportunities for sport and recreation. Arizona is a state with a considerable percentage of land owned by the federal government and managed as public land (Figure 1). While you may be familiar with the National Forest system, what do you know about Arizona's State Trust lands? Did you know that roughly 9.2 million acres in Arizona are held in trust primarily for the benefit of our public education system? Did you also know that State Trust land is not public land?

An Act of Congress, that established the Arizona Territory in 1863, endowed the new Territory with two sections of lands withdrawn from the federal domain and dedicated to specific purposes. Sections 16 and 36 of each township were dedicated by this Act for the benefit of the Common Schools. Later, through the 1910 State Enabling Act, Sections 2 and 32 of each township were also dedicated and held in trust. In 1915 the State Land Code established the Land Department and the system by which State Trust lands are managed today. The Land Department manages Trust land to maximize revenues for 14 beneficiaries including our public schools. The largest beneficiaries are the Common Schools (K-12), receiving approximately 87% of Trust land revenue. Some other beneficiaries include the Legislative, Executive & Judicial Buildings, the University of Arizona, and the School for the Deaf & Blind located in Tucson.

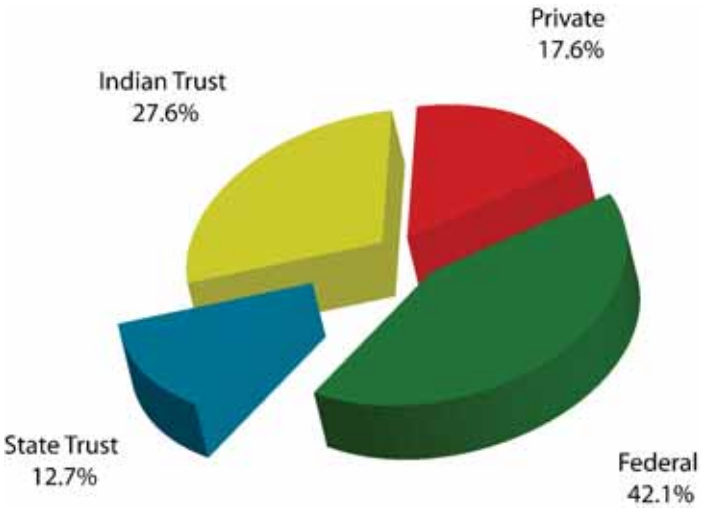

Figure 1. Land ownership in the State of Arizona.

Arizona State Land Department's Mission

To manage State Trust lands and resources to enhance value and optimize economic return for the Trust beneficiaries, consistent with sound stewardship, conservation, and business management principles supporting socioeconomic goals for citizens here today and generations to come.To manage and provide support for resource conservation programs for the well-being of the public and the State's natural environment.

Sales, Leases and Revenue

In order to generate revenue, State Trust land is either leased for its highest and best use or sold to the highest bidder at public auction, which is mandated by law. There are two categories of leases issued by the Land Department – surface and subsurface leases. The subsurface leases include minerals and oil and gas leases, whereas surface leases are issued for agriculture, grazing, rights of ways (roads and utilities), and commercial purposes. A large majority (about 8.4 million acres) of Trust land is leased for livestock grazing often as part of a ranching operation with associated private and federal land (Figure 2). State grazing leases are issued for a term of 10 years or less, and some have been held by ranching families for multiple generations.

The Land Department typically sells a relatively small amount of Trust land each year. For example, in fiscal year 2007 the Land Department held 16 auctions and sold 4,262 acres, including a 26 acre parcel in northeast Phoenix which sold for $28.5 million. Fiscal year 2007 was a historic revenue year for the Land Department – receipts totaled $332 million. This was due in part to some very competitive sales auctions, a Land

Figure 2. Private and State Trust land managed together as part of a cattle ranch in southern Yavapai County.

Commissioner with considerable real estate knowledge and experience, and the hard work of the Land Department's employees.

Revenue generated by the Land Department is deposited based on its source to either the Permanent Fund or is distributed to beneficiaries as Expendable revenue. The Permanent Fund receives revenue from natural product sales, royalties from mineral materials, and sales of Trust land. The State Treasurer manages the Permanent Fund. Expendable revenue includes rent from leases, interest on sales contracts, and the State Treasurer's formula distribution from the Permanent Fund. These dollars are transferred directly to the beneficiaries for use in their operations.

Hunting and Recreation

While Trust land comprises a substantial portion of the open space where Arizona's residents can enjoy the outdoors, no one may enter State Trust land without a permit. Authority for granting permits has been given by the Legislature to the Land Department in all instances except those concerning hunting, fishing, and access for archaeological purposes. Hunting and fishing permits are administered by the Game and Fish Department, and the scope of their use is limited to hunting and fishing purposes exclusively. Likewise, permits for entry on State Trust land for archaeological purposes are issued by the Arizona State Museum. Any other use of State Trust lands must be permitted by the Land Department.

A recreation permit is required to camp, hike, or travel on State Trust land that is open to recreational uses. Some State Trust lands have been closed by Land Commissioner Order due to environmental concerns or hazardous conditions. Other activities authorized with a recreation permit include horseback riding, picnicking, bicycling, photography, sightseeing and bird watching. Camping is allowed under a recreation permit but is limited not to exceed 14 days. Target shooting is not allowed on State Trust land. In rural areas, most Trust land is available for recreation and these areas are typically leased for livestock grazing. It is important for recreationists not to interfere with other permitted users of State Trust land. Those seeking outdoor recreation are encouraged to consult maps to learn the land ownership pattern where they plan to visit.

Conclusion

Each agency that manages land has its own rules and regulations to enforce. The Land Department is no different, and since 1915 it has managed land under the mandates of the federal Enabling Act and the Arizona Constitution. As Arizona continues to experience growth and development, the Land Department will continue to have an important role in providing land for permitted users. It is the hope of this author that you are now more informed about Trust land and its relationship to public education and natural resources.

For more information on the Land Department and its management of Trust land, please visit **http://www.land.state.az.us.**

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Homer M. Hansen

RAVENS

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The Common Raven (*Corvus corax*) is the largest of all songbirds and thought by many to also be the smartest of all the birds. It has one of the broadest geographic ranges of all birds spanning across western North America, most of Canada, Europe, and many other parts of the world. Ravens occupy most major climate regions from the arctic to low deserts.

Ravens are similar to Crows in appearance, but are larger with longer, narrower wings, a wedge-shaped tail, and weigh about two times that of the Crow. Males and females have glossy black plumage that cast purplish and greenish reflections. The feathers of the raven's throat and breast are long and loose, like fringe. On average, male ravens are slightly larger than females.

The Chihuahuan Raven (*Corvus cryptoleucus*) is found in southeastern Arizona and southeastern Colorado and western Kansas, eastern New Mexico, west Texas, and northern Mexico. In Arizona, the Common Raven's range overlaps with the Chihuahuan Raven and it requires a trained eye to differentiate between the two species. The Chihuahuan Raven is slightly smaller than the Common raven, has a shorter bill with longer nasal bristles, and a slightly different voice. The bases of neck and body feathers of the Chihuahuan Raven are white, not gray like those of other American Crows and Common Ravens.

Common ravens have a wide range of vocalizations. Their most common call is a deep baritone "brronk" but they have been observed imitating various sounds from barking dogs to ringing bells to squeaky hinges. In flight, ravens make a "swish-swish" sound and often soar on flat wings similar to hawks. The raven is also an acrobatic flier making rolls and somersaults in the air and even flying upside down. Canyon rims and mountain tops are excellent places to observe ravens in flight.

Raven nests are two to four feet in diameter constructed of twigs and branches lined with grass, moss, fur, and other soft materials. Following courtship, they remain paired for the year and possibly for life. Females lay eggs from mid-February to late May, depending on the latitude. The female incubates three to seven eggs for about three weeks. The male brings food to the nest for her. Both parents feed the young. After five or six weeks, the nestlings fledge. Fledglings may remain with their parents for several months.

Mated raven pairs more-or-less remain in their localized nesting area year-round. Conversely, lower status juveniles form wandering unmated groups. Juvenile ravens are also very curious while older ravens become more cautious over time. Zoologist Dr. Bernd Heinrich, observed ravens for four years in Maine and subsequently authored the book *Ravens In Winter*. One observation was that a juvenile raven would "recruit" others to a food source because, by sharing with others it gains "friends," from which it may gain a mate in the future due to its foraging abilities. Other sources contend that ravens do this to simply overwhelm the local territory owners by force of numbers to gain access to the food.

Ravens are opportunistic omnivores eating meat, reptiles, eggs, grain, and carrion. They also feed on garbage and waste near human settlements. Common Ravens are usually found solitarily or in pairs while the Chihuahuan Raven is very social. However, when they find especially good food sources, such as carcasses of large mammals or abundant grain, they may form large communal roosts. Some roosts in the West have numbered over 2,000 birds and lasted for months.

Ravens are also known to follow predators to scavenge on leftovers and to patrol roadways for carrion. Some information sources say ravens were historically associated with bison and wolves on the grasslands of the Great Plains, but their range diminished with reductions in bison and wolf populations and cultivation of the prairies. Being intelligent and adaptable creatures, they modified their feeding habits to match the altered environment.

Ravens also have a dubious reputation among farmers and wildlife managers. Farmers often blame ravens and crows for uprooting seedlings and other crop damage. Wildlife managers have documented ravens killing young of game and non-game species. In Prescott, Arizona, Common Ravens were observed by Arizona Game and Fish Department tormenting pronghorn fawns. Coyotes and domestic dogs were also harassing the fawns in this herd. It should be noted that this behavior is not normal for ravens and this is in an area where commercial and residential development have severely degraded pronghorn habitat.

American Crows are much more likely to cause human/wildlife conflicts because they can form large migratory flocks. These conflicts can be crop damage as described above in addition to health risks associated with their roosting areas. Both ravens and crows are protected by the Migratory Bird Treaty Act making it a federal crime to kill them or have them as pets without going through a permitting process. The only bird species that can be injured or harassed in Arizona without a permit are Rock Doves (feral pigeons), English Sparrows, and European Starlings.

Finally, ravens are a common subject in folklore. They are often portrayed as tricksters, harbingers of the afterlife, and messengers of the gods. Among Native Americans of the Pacific Northwest, ravens are credited with creating humans, providing salmon for food, supplying water during drought, and bringing fire to humankind. In Edgar Allen Poe's classic poem, *The Raven* visits a lonely soul and invokes haunting emotions of lost love, evil, and suffering as the raven calmly sits and speaks the word "nevermore." Whatever your perspective, I hope readers will appreciate the many unique qualities of ravens.

Charles Gerba

Gray Water: Too Precious to Waste

Water Reuse Options for Arizona

Channah Rock, Ph.D., Water Quality Specialist, Soil, Water and Environmental Science Department, University of Arizona

A nexus of factors are currently pressuring Arizona's water resources; these factors include a growing population, ongoing drought and recognition of the importance of riparian areas. Accordingly, water managers are considering all available sources of water supplies including water reuse. These increasing demands on limited water resources have made water reuse for municipal and residential irrigation an attractive option for extending water supplies in the semiarid southwest.

One viable option for extending the potable (drinking) water supply in the southwest is the use of gray water for irrigation. In Arizona, gray water is defined as wastewater (collected separately from your sewage flow) which originates from a clothes washer, bathtub, shower or sink, but not from a kitchen sink, dishwasher or toilet. In Pima County alone it is estimated that between 20,000 and 30,000 households may currently be using gray water systems. These households involve between 50,000 to 80,000 people with millions of gallons of potable (drinking) water saved each year. In Tucson, recent legislation was passed mandating new residential construction include a gray water infrastructure, and in parts of Cochise County plumbing for residential gray water reuse is also required. Statewide, Arizona residents and home builders who install gray water systems are eligible for a one-time tax credit of 25 percent of the total cost of the system up to a maximum of $1,000 (residents) or $200 (home builders).

Some of the factors that motivate people to utilize gray water include environmental sensitivity, water conservation ethics, desire to reduce water/sewer bills, or a desire to prolong the life of their septic tanks. Gray water can be used on a variety of plants including: shrubs, grass, potted plants, wild flowers, compost, shade and ornamental trees, nut trees and annual/bedding plants. Additionally, gray water systems can be constructed to best accommodate irrigation needs. Some of the ways that gray water can be applied to landscapes for irrigation include flood or with fine filtration, drip irrigation systems.

In addition to the added benefit of water savings through gray water reuse, nitrogen and phosphorus are present in recycled water which is beneficial to plant growth. This increased nutrient content may reduce the need to purchase and apply artificial fertilizers to landscaped plants.

Among the concerns with gray water is the use of certain chemicals or detergents that may remain in the water prior to application. Special detergents which have been formulated to easily degrade in the environment should be used in order to prevent detrimental effects when applied to plants. Another concern with the use of gray water is the added salts or salinity that may have negative effects on plants (when salt accumulation occurs, plants cannot take up enough water). Compacted landscape sites that maintain poor drainage are highly susceptible locations for salt accumulation. These accumulations can be reduced by improving drainage to the irrigated site as well as by flushing the location periodically to prevent salt buildup near the root zone.

When using recycled water for landscape irrigation it is important to remember smart management practices. These include (1) irrigation; improve irrigation uniformity and utilize flood or drip irrigation practices, (2) compaction control; prevent water pooling by maintaining water movement and drainage, (3) fertilization and amendments; reduce nitrogen and phosphorus over-fertilization and (4) plant selection; select salt tolerant species for your garden. By remembering these smart management practices, you can ensure the beneficial use of recycled water for home irrigation.

In order to use gray water from your home you must adhere to the guidelines for a Reclaimed Water Type 1 General Reuse Permit from the Arizona Department of Environmental Quality (ADEQ). This permit outlines specifications for the safe application of gray water at your residence. To decrease the likelihood of water displacement, this permit requires that your home must lie outside of an active flood plain. ADEQ regulates that gray water must originate from your residence and must only be used for landscape irrigation at your residence. Only drip or flood irrigation with gray water is allowed. Spray irrigation is not permitted due to the potential for inhalation or drifting off-site. Additionally, your gray water system needs to have a way to discharge to the septic or sewer system in the event of plugging or any other problem with your gray water quality or the system itself. If above ground, be sure your gray water storage is not only childproof, but also has a secure cover for safety and mosquito control. Also, try to use stored gray water within 72 hours to reduce potential odors.

The use of gray water conserves drinking-quality water and may also delay costly expansion of water treatment facilities, which means lower water rates for city water customers. In addition, water reuse provides a readily available and reliable source of water, even during times of shortage, like a drought. **It is important to remember that every gallon of gray water used for outdoor watering represents a gallon of potable water saved for drinking.**

There are several ways you, as a citizen, can have a voice in the decisions made regarding the water systems in your community. You can attend and participate in City Council meetings or Citizen Bond Committee meetings. These forums provide ways for you to express your opinions regarding water usage in your community and allow you to learn more about the decision-making process.

You can also get involved by learning more about water sources and water uses in your area through active participation in the Master

Charles Gerba

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Watershed Stewards Program. Additionally, as part of the Extension community, one of the Water Quality Program's goals is to increase water reuse education throughout communities in Arizona. Currently, we are developing interactive programs to engage the public and inform them about the water that is being produced and recycled in various Arizona communities. Our goal is to increase awareness of water issues here in Arizona and promote sustainability through the use of recycled water.

Resources

Information on gray water reuse can be found on the ADEQ brochure at **http://www.azdeq.gov/environ/water/permits/download/graybro.pdf**

Gray water guidelines can be found through the Water Casa publication at **http://www.watercasa.org/publications/Graywater_Guidelines.pdf**

Common gray water questions are answered in the University of Arizona Cooperative Extension Water Wise website at **www.ag.arizona.edu/cochise/waterwise** as well as a gray water brochure at

http://cals.arizona.edu/cochise/waterwise/pdfgraywater_4fold_10_25_07.pdf

For more information about gray water and the use of home detergents visit **http://cals.arizona.edu/cochise/waterwise/pdf/graywater_detergent.pdf**

For tax credit application forms and further information, go to **www.azdor.gov** (click on "credit pre-certification" on the left hand side of the home page).

Roll Guard Inc.

Fencing for Wildlife

Cori Dolan, Program Coordinator and Bill Mannan, Ph.D., Professor, School of Natural Resources, University of Arizona

Fences can be an effective way to control animal movements, whether livestock or wildlife, and protect gardens and landscaping. Depending on your goal, fences can be built to completely exclude most animals from your property or be built in a way that allows access by some species while excluding others. When considering options for fencing designs, it is important to understand the potential impacts to the wildlife inhabiting the area. Where livestock and human safety are issues, fences can be designed to exclude most wild animals completely while keeping pets or livestock in. Where safety is not an issue, fences can be built that do not restrict the movement of wild animals and can benefit them by allowing movements along seasonal migration routes as well as daily movements to food, cover, and water.

WILDLIFE-FRIENDLY FENCING

While fences that limit access and movement of wild animals may be necessary to protect crops and livestock, they can impede wildlife in a way that contributes to the decline of populations. If your property contains native habitats and the fences exclude wildlife, consequences include loss of food, resting areas and travel corridors. In addition, fences that restrict movement can trap animals inside the area making it difficult to remove them. Wildlife-friendly fencing can address at least two issues for areas that have wildlife fencing needs. First, it provides fencing which excludes wildlife without harm and second, it allows wildlife to move through an area without barriers or health and safety issues. An important guideline is to fence in only

the area you wish to protect, and avoid fencing in native habitat that the animals need. For example, pet areas, crops, gardens or special landscaping can be fenced differently than other areas.

Some animals, like pronghorn, go under fences rather than over them. For this reason, barbed wire fences can be dangerous because they can entangle, scratch, puncture, or kill animals crawling under them. Smooth wire is safer for wildlife. Smooth wire should be placed between 16 and 40 inches from the ground to prevent antelope, deer, and elk from catching their feet and hanging on the fence. The top two wires should be kept tight with a 12-inch gap between to keep animals from getting tangled. This will also reduce potential damage to the fence. Because deer will avoid fences that are not flat or regular, using a staggered fence or one with a sloping top is another option to keep deer out.

FENCING TO KEEP WILDLIFE OUT

Although never guaranteed, fencing can be an effective way to keep some wildlife species from coming around your home. Each species that you are trying to keep out may require different fencing designs and types, and many can be used for multiple species with similar habits and ability. Fences or walls should be at least 4 feet tall (over 6 feet to be most effective) and buried at least 8 inches into the ground to be a long-term, effective barrier for animals such as javelina. To exclude deer and elk, fences or walls need to be 8 feet tall. Pronghorn prefer to go under fences so in cases where you need to exclude pronghorn, a smooth wire fence with a bottom wire that is less than 12 inches from the ground will keep them out without harming them.

In cases where solid fencing is too expensive or unsuitable for an area because of rocky terrain or homeowner agreements, electric fencing is an effective substitute. Because the electric current is carried on a single strand of bare wire that is held away from the ground by insulators, birds that perch on the wire without touching the ground or another grounded object, such as a tree or fence post, do not receive a shock. After javelina or other animals have touched the fencing a few times, they learn to avoid the area. In many cases this is even true after the fence is unplugged. Electric fencing, which can generally use fewer wires than traditional wire fences, is an inexpensive way to deter wildlife from entering gardens and other important areas around a home. Electric fences are simple to install and are not visually obtrusive to the landscape. These fences have proven successful for decades on farms and ranches to control livestock and wildlife. Check your local city, county or homeowner association ordinances for regulations regarding electric fencing in your area.

Another option for exclusionary fencing is coyote rollers (photo page 12). Coyote rollers are spinning attachments that sit on top of fences to prevent animals from getting a grip on the top of the fence. Coyote rollers are effective at keeping coyotes and predators out of your yard while keeping dogs and cats in.

TIPS FOR RESPONSIBLE FENCING

Fences keep animals off roads and out of crops and can be a great addition to your landscape. When installing a new fence, it is important to begin by surveying your property lines and installing a legal fence. This will not only keep you within legal guidelines but will also maintain good neighbor relations. Some local ordinances may require permits, prohibit fence chargers, and specify fence types, heights, and setbacks next to roadways, railways, and between neighbors. Contact your local building official for more information.

The Natural Resource Conservation Service (NRCS) offers a federal cost share program that can help you with fencing issues like design, placement and use that aid in conservation of ecosystems. The NRCS can help you decide what fencing is best by considering topography, soil properties, safety, livestock management, wildlife movement, erosion problems, flooding potential, and stream crossings. If federal cost share funds are used to install fences, the fences must be maintained and/or repaired to meet the intended use. Contact a NRCS office or visit the website at http;//www.az.nrcs.usda.gov for more information on the federal cost share program for fencing.

To ensure that you are being responsible when it comes to fencing, be sure to:

- Locate underground and overhead utilities before installing a fence to make sure there are no gas, water, or electric lines where you plan to dig postholes.
- Never install electric fences under power lines. Notify neighbors, visitors, and small children about electric fences and instruct others on disconnecting the energizer in an emergency.
- Post warning signs on electric boundary fences as required by law.
- Regularly inspect fences as part of an ongoing maintenance program, especially after storm events to insure the continued proper function of the fence.

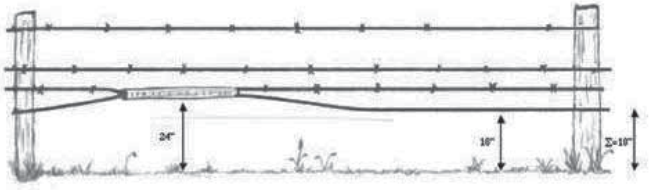
Wherever possible, locate and design fences that allow wildlife movement without injury. Arizona is designated an “open range” state, which means the property owner is responsible for fencing neighboring livestock out. Using this and other information on fencing placement and design, you can make sure that your fences help achieve your goals while not becoming a barrier to wildlife.

For More Information on Fencing

Arizona Natural Resource Conservation Service, Fencing Standards **http://www.az.nrcs.usda.gov/**

Arizona Game and Fish Department, Javelina and Electric Fences Contact your local AGFD office for copies

How to Create Wildlife Friendly Fencing **www.huntingandfishingjournal.org/MissoulaElkHerds/PDFs/Fence-WildlifeFriendlyFencing.pdf**



North Dakota Fish and Game

Bill Brandau

Planning Tips for Irrigated Pasture

Bill Brandau, Area Extension Agent, Agriculture and Natural Resources, University of Arizona Cooperative Extension, Graham and Greenlee Counties

As more people make their home in Arizona the number of homes on small acreages is increasing. Many people would like irrigated pasture where they can raise their horses, cattle or other types of livestock. However, many lack the experience and training to establish and manage irrigated pasture. Poor planning and unrealistic goals can limit their success and enjoyment. This article provides an outline of what may be needed to successfully establish and manage irrigated pasture.

SET YOUR GOALS

Realistic goals are critical to success, so make a list of goals to be accomplished. The key is to identify goals up front. Here are a few examples of questions to help in identifying your goals.

- What kinds of animals do you want and how many will be grazed?
- Do you want to produce hay or just graze?
- Are you expecting to make a profit on your property and/or from your livestock?
- Are aesthetics such as vistas and seclusion important to you?
- Are you concerned about use of non-native vegetation?
- What will you use your property for; 4-H projects, riding or roping arenas, or just raising livestock?

TAKE AN INVENTORY OF YOUR PROPERTY AND PERSONAL RESOURCES

Walk your property and make a map. Then develop a list of property resources, personal skills and other resources that you have access to. The key is walking your property and determining what you have.

- How much land do you have and are you able to irrigate it, or is it native range?
- What are your property boundaries? Is the property close to roads and easily accessible?
- Will you live on the property or will you have to drive to it for all work?
- Are there any legal restrictions on your property, such as easements?
- What are your neighbors doing and will your goals coexist?
- What facilities currently exist on the property: are there buildings, fences, corrals, wells, electricity, septic tanks, pipelines or irrigation systems?
- What are your water resources, both domestic and for irrigation? Do you have irrigation rights or an irrigation decree? What is the source – pumped from a well or from an irrigation canal? What is the delivery schedule? How is it delivered to your property and how long is the water available for irrigation? What is the available flow, and is it dependable?
- Do you have existing fields or pastures? What are the capabilities of soils, topography, and vegetation? What are the typical plant growth patterns in your area? The answers to these questions directly impact what type of pasture you can sustain.
- What are the historic weather and climate conditions in the area? Climate will have a direct impact on plant materials that can be grown. For example, the temperature and rain patterns in Flagstaff are very different than those in Phoenix. These differences will control what can be grown and what the irrigation requirements will be.
- Are there any weeds, erosion, or other environmental concerns?
- How much capital do you have to commit to this enterprise?
- How much time can you dedicate to this enterprise? How flexible is your time? Managing livestock and irrigated pasture is a 24 hour per day, 7 day per week job.
- What knowledge, skills, and ability do you have? Examples include livestock handling and care, agronomic, irrigation practices, equipment operation, and construction skills.
- Will you be doing the work or will you rely on hired labor? Is labor available in the area?

THE DECISION

It is critical that your goals are matched with resource capability. If the original goals don't match your resource inventory the goals should be adjusted, otherwise resources will be over-committed. This decision is probably the most important decision you will make for your long term success and enjoyment. Don't be afraid to ask for help from neighbors and family, Extension specialists or the local Natural Resources Conservation Service office - all can be helpful resources. Here are a few decisions that need to be made based on your goals and resource inventory.

- Are the desired goals realistic for your property and resource capability?
- Are personal knowledge, skills and ability compatible with your goals?
- Are financial and time resources compatible with your goals?
- Is there a willingness or ability to commit to learn what is needed to be successful?

MAKE YOUR PLAN

Once goals are set, property inventoried, and goals refined, it is time to make the plan. Remember you may be living with this for a while so build into the plan usability, ease of operation, ease of access, ease of maintenance, and any other ideas that provide efficiency to the operation. There is more than one way to do something, so think of alternatives for each element of your plan. As you complete this task compare your goals to the alternatives and select the ones that best meet personal needs and goals. This will customize the plan to your specific needs. Key elements of the irrigated pasture plan include the following considerations.

- Facilities: Built to suit the kind and class of livestock, the size of operation and personal preference.
- Water and irrigation management: Address irrigation methods and efficiencies. Balance the available water with the acres to be irrigated.
- Pastures: Plan pastures size and layout. Decide whether to establish new or renovate old pasture.
- Vegetation management: Plant material and species selection is tough in Arizona. The primary factors in determining your plant material will be water availability, soil capability, local weather and climate conditions, and livestock forage requirements. These factors dictate what can successfully grow in an area.
- Soil: Address health and fertility so a good growth environment is provided for pasture species selected.
- Weed management: Weed problems are often a product of poor management and must be addressed.
- Grazing management: Plan how pastures are grazed. Avoid year-long or season-long grazing by planning grazing deferment for plants and pastures. Plan where livestock can be kept and fed when pastures are wet from irrigation or deferred from grazing to provide for regrowth.
- Livestock Management: Classes of livestock require different facilities, and have different health, nutrition and feeding, and handling and marketing requirements. Build the plan around the class of livestock in your goal.
- Maps: A good map with a detailed layout of the plan is invaluable. It can depict the conceptual design and will give a vision of what the finished product may look like; it also allows visualization of problems.
- Financial plan: Be realistic with finances, time and labor.

Finally, keep in mind your level of expertise in livestock management and agronomy when making the plan. You may need some training or more experience. Be realistic with financial and time commitments and associated labor requirements for your plan. In today's environment of high input costs such as fertilizer, electricity, water, equipment, fuel and labor it is critical to be realistic. Unrealistic plans and costs can reduce your success and your general enjoyment of the enterprise. Below are some useful websites that can provide more specific information.

Extension Websites

http://www.extension.org/pages/Pasture_Management_on_Small_ Farms

http://extension.usu.edu/smac/htm/pastures

http://attra.ncat.org/attra-pub/sustpast.html

Natural Resource Conservation Websites

http://www.az.nrcs.usda.gov

http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

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