

**Spicewood Ranch After 23 years of Restoration:
What We Have Accomplished and Learned
2012**

David Mahler
Ecologist
Environmental Survey Consulting
4602 Placid Place
Austin, TX 78731
(512)458-8531
dvmahler@envirosurvey.com

When restoration on the 1200 acre Spicewood Ranch started in 1988, the vegetation was typical of much of the Texas Hill Country. Most of the palatable native grass species were gone or greatly reduced with KR bluestem dominating, and the surviving forb and woody plants were reduced to unpalatable species such as Mexican hat, horsemint, live oak and Texas persimmon.

Restoration practices, including controlled burns, cedar removal, deer reduction, high fencing, seeding, exotic species control, and deer exclosures for research have significantly improved conditions. Successful reestablishment of woody species and perennial forbs has been dependent on developing a sequence for their reintroduction. We start with those species that are only slightly palatable to the reduced deer population, and then gradually add more palatable species as allowed by the increase of available forage and decrease in deer browse pressure. Locally harvested wild seed is often used for these reintroductions, with planting sometimes starting within exclosures to increase available seed quantities.

Background

Spicewood Ranch is located approximately 30 miles West of Austin between Spicewood, Texas and the Colorado River. The Harte family acquired the first parcel of Spicewood Ranch in 1972. At the start of active restoration in 1988 it included 540 acres, and now, with the acquisition of adjacent and nearby tracts, it includes 1200 acres. The underlying geology of the ranch is Hensel Sand, Cow Creek Limestone, alluvial terraces and recent alluvial soil. Alligator Creek runs through the ranch, providing year-round water in places. In addition to prairies and live oak (*Quercus fusiformis*) woodlands, the original plant

communities were most likely live oak savannas and cedar (*Juniperus ashei*) breaks on the Hensel Sands; a pecan (*Carya illinoensis*)/elm(*Ulmus* spp.) riparian woodland along upper Alligator Creek; a very open rocky riparian community where lower Alligator Creek cuts through the Cow Creek limestone; xeric ferns and other fissure adapted species supported on steep rocky cliffs along lower Alligator Creek; and post oak (*Quercus stellata*) savannas in the patches of deeper gravel alluvial terrace soils. Along the Colorado River, in geologically recent alluvial soils, there was a riparian community that was eliminated by the construction, filling and extreme fluctuations of Lake Travis.

As with most of the Texas Hill Country, the ranch vegetation was drastically altered through management practices of immigrants of European heritage after their conquest of Texas. The ranch lost a significant percent of its plant species to the combined effects of fencing, heavy grazing and browsing by goats, sheep, cows and horses, elimination of burns traditionally set by indigenous peoples, suppression of natural fire, and a large reduction or elimination of key species such as buffalo, wolves, mountain lion and screw worm.

At the start of restoration, the woody component of the ranch was reduced almost exclusively to such species as live oak, Texas persimmon (*Diospyros texana*), agarita (*Mahonia trifoliolata*), snakewood (*Colubrina texensis*), cedar, mesquite (*Prosopis glandulosa*) and prickly pear (*Opuntia* spp.), which are inedible to browsers with the exception of their fruits. The few individuals of other more edible woody species found in small numbers on the ranch provide clues to the composition of original vegetation and the cause of its demise. Large post oak, deciduous yaupon (*Ilex decidua*), and a few Mexican

plums (*Prunus mexicana*) surviving on the ranch are old individuals with their main growth above the browse line of deer, their suckers and lower branches browsed off and with no new seedling production. Other species have only survived in locations inaccessible to goats, sheep and deer, such as two evergreen sumac (*Rhus virens*) bushes and several rock roses (*Pavonia lasiopetala*) found hanging off sides of the cliffs, or the creek plum (*Prunus rivularis*) tucked between an old fence and a greenbriar (*Smilax bona-nox*) thicket. Likewise, the forb component was reduced to inedible species such as Mexican hat (*Ratibida columnifera*), horse mint (*Monarda citriodora*), Indian blanket (*Gaillardia pulchella*), camphorweed (*Heterotheca subaxillaris*) and broomweed (*Gutierrezia* spp.). Grazing pressure almost eliminated palatable little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), eastern gamagrass (*Tripsacum dactyloides*), and many other native grasses. As these disappeared, ranchers were encouraged by “experts” to replace them with KR bluestem (*Bothriochloa ischaemum*), kleingrass (*Panicum coloratum*) and, more recently, with Wilman love grass (*Eragrostis superba*).

Restoration

In 1988 restoration of Spicewood Ranch was initiated by Kay Wagenknecht Harte, who became interested in and wrote about habitat restoration in the mid 70’s while a graduate student at UT Austin and later Texas A&M. Since her death, restoration work at the ranch has been continued by Chris Harte and their son Will. The first goal for the management program is to learn the potential for native plant species and their habitats in the various niches of the ranch. The second goal is to restore individual species, communities

and processes as we discover the critical details of the restoration process, especially as to how they can be utilized on large land parcels.

This process has included controlled burns, cedar management, exotic species management, harvesting wild seed, seeding, high fencing, test exclosures, experimental research and monitoring.

Controlled burns

Controlled burns were initiated in 1988 on several open fields to determine if fire could be used on the ranch to reduce cedar encroachment and open up the thatch of KR bluestem in the farm fields for the seeding of native species. Since that first effort, controlled burns have been utilized for 18 years, mostly in January- February but twice in June. Over the years the size of areas where burns were conducted has increased based on our improving ability to safely use this tool, our better understanding of its proper use, the acquisition of new properties and in response to other ranch activities such as cedar cutting. In February 2011 our first annual public burn was conducted on a 20-acre field as an educational demonstration for ranch neighbors and other visitors who were invited to watch and, for some, participate in the burn. This event was cancelled in 2012 because of the drought and burn ban, but is planned to be offered again in February 2013.

Cedar Management

In fields being restored to prairie, cedar trees are being eliminated through controlled burns. In other parts of the ranch there are scattered large live oak trees which appear to be

remnant savannas with a significant encroachment of mid-size cedar. Here we are using a skid steer tree axe shear to first cut out the thick cedar which, if burned in a crown fire, would probably kill the large oaks and create a more dangerous fire. After removal of cedar, the open soils (no KR bluestem) provide an ideal seed bed for our grass and forb seed mixes. Within a year or two these areas often have enough fuel to carry a slow burn under the oaks, sometimes lifting the oak canopy through scorching, but not killing them.

However, in selected areas of the ranch, dense cedar breaks are being left for several purposes. One area of approximately 100 acres dominated by large cedar is big enough to potentially become golden-cheek warbler territory, although monitoring has so far not located this species here. These large cedars are being left to meet their nesting requirements, and we have initiated improvements to the other vegetation of this area to provide more food for this bird. The second reason that some large blocks of cedar are being left is to eventually provide a nursery for many species of woody plants targeted for reintroduction to the ranch. Our observations and research in our deer-exclosure test plots indicate that many of the desirable woody species are mostly dependent on the soil niche under cedars to germinate and grow to a certain size. Then, after a crown fire through the cedars (or mechanical removal), a diverse collection of these woody species resprout in a circle around the remaining cedar stump. Therefore, we believe these cedar break nurseries are a critically important piece of our restoration plan for the eventual restoration of the missing woody component of the ranch.

Exotics Species Management

Some exotic invasive species which have limited distribution on the ranch, such as Johnson grass (*Sorghum halepense*), Bermuda grass (*Cynodon dactylon*), Wilman love grass, Vasey grass (*Paspalum urvillei*) and bull thistle (*Cirsium* sp.), we are treating with glyphosate. KR bluestem and kleingrass are being combated with the planting of larger native grass species. Several exotic woody invasives, such as Chinaberry (*Melia azedarach*) and bamboo (*Phyllostachys aurea*), are being cut and the fresh cuts painted with glyphosate. Feral hogs are being both trapped and hunted.

Deer Management

Some parcels of the ranch have been high fenced to facilitate the reduction of the deer population so restoration of browse plant species can proceed more efficiently. Hunting has also been used as an income source for the restoration effort. We are determining the appropriate deer level based on what we observe about their utilization and/or elimination of restoration species we are monitoring and attempting to restore. We have reduced the effect of deer browse on our target species in two ways: first by reducing deer numbers and second by increasing the number and quantity of more desirable browse species. Improving available browse will allow us to either increase deer population or to successfully reintroduce additional plant species that are even more vulnerable to deer browse. We have a long way to go with restoration before we choose to increase deer population.

Grass Reintroduction

In 1995 cattle were removed from most of the ranch parcels to facilitate conversion of the grasslands from non-native to native. The old cleared farm fields have been seeded with mixes of prairie grasses and forbs purchased from commercial growers and wild harvested especially for the restoration effort.

Forb Species Reintroduction

Our initial seedings of forb species appeared to have almost no success, and this spurred our efforts to create deer exclosures to learn what would survive within them. The results eventually led us to high fencing most sections of the ranch and reducing the deer population. The results of this process were transformative. A year after we reduced the deer herd, in one five acre field we noticed in late summer a giant oval of sunflowers around the field. We could see exactly where our tractor had driven around the field four years before, where we had seeded an oval strip with a mix that contained several forbs, including Maximilian sunflower (*Helianthus maximiliani*). The Maximilian had sprouted years before but, since browsing pressure was so high, no flowers had been seen.

So now in most of the ranch it has been our goal to lower the deer population to a point where species which were likely once present on the ranch can be restored. There is no single deer population level that will allow all target species to survive reintroduction. Rather, for these plant species there is a range of edibility from basically poisonous to extremely palatable, and likewise, a continuum of browse pressure levels that will allow survival of different species. Our strategy for reintroducing forbs and woody species has been

to test and find which species can just barely survive the current existing browse conditions, get seed for those species of suitable local genotype, increase our seed quantities in plots in our exclosures if necessary, and then introduce those species in our next annual seeding. We then try to build up a large enough population of those species to both withstand and provide some deer browse. In the early years of reintroduction these forbs can be severely browsed, but eventually they are strong enough to produce and drop seed so that single plants become small colonies. In time these colonies provide enough seed for us to harvest for our next seeding of additional new areas and parcels. We have succeeded in the reestablishment of some very important forb species in this manner, including plateau goldeneye (*Viguiera dentata*), gay feather (*Liatris mucronata*), standing cypress (*Ipomopsis rubra*), bush sunflower (*Simsia calva*), purple prairie clover (*Dalea purpurea*), and Engelmann daisy (*Engelmannia peristenia*).

Each species that successfully enters this process increases the available browse. This means with the same deer population and the same weather conditions (!), new species of slightly higher edibility might be able to survive outside our exclosures, and other previous introductions might be less severely impacted. Improved browse conditions have also meant some other species which were virtually gone from the site have started to reappear and increase on their own. These are species which were still present in small quantities on the ranch, such as winecup (*Callirhoe involucrata*) and prairie larkspur (*Delphinium carolinianum*), but were not seen for two decades. They were perhaps protected deep in a prickly pear patch, perhaps dormant in the seed bank, or possibly not quite as edible as other species that seem to have been completely eliminated on the ranch.

Woody Plant Species Reintroduction

Restoration of the ranch's woody species takes the most patience. Our goal is to develop a method usable on a large scale which is not dependent on planting, watering and putting protective cages around individual containerized plants. However, we sometimes do exactly that at first, to learn how an individual species will grow, reproduce and survive deer browse. An example is our 13-year experimentation with evergreen sumac. In an enclosure we planted 30 seeds of sumac in a row, each seed approximately one foot apart, 2/3 in cedar needle duff under a cedar grove and 1/3 extending away from the cedar duff into full sun. Half of the seeds under cedar were within our enclosure and half outside the fence. Most of the seeds under cedar inside the enclosure have grown to sizable plants. No seedlings outside the cedar canopy have ever appeared, essentially confirming our observations and theory about the nursery effect of the soil niche under cedar. Two seedlings appeared outside the enclosure under cedar, but quickly disappeared, presumably from deer browse. After 6 years some of these new sumacs were producing seed, and the next year we were finding tiny seedlings 4 to 18 feet away from the parent plants, but only under cedars and not outside the canopy. Several would occasionally appear outside the fence, but until recently they would never survive existing browse conditions. As of three years ago evergreen sumac seedlings have started to survive outside this and other exclosures, although in last year's drought we seem to have lost half of those. We infer from this that browse conditions are improving, and we believe it is because of the increase in available browse we are providing with the successes we have had with our reintroduced forb species. In November of 2010 we harvested approximately 60,000 evergreen sumac seeds from a nearby site (in approximately

3 hours of hand harvesting). In January 2011 we hand scattered that seed throughout an approximately 8-acre cedar break outside any enclosure and waited for rains which never came. In 2012, however, we have started seeing tiny sumac seedlings where we scattered seed. It is too early to know whether they will survive the summer weather and whether deer will browse them after they grow bigger than ½ inch tall. If they don't survive the deer it will only mean that the site is not quite ready for evergreen sumac, but it will be soon. We are in earlier stages of the same process with other selected woody species.

The ranch has approximately 50 acres of large, old growth post oak scattered in 5-15 acre patches in deeper gravel soils. In all these areas, with diligent searching, not a single post oak younger than perhaps 75 years or more has been located. When a 30-acre parcel was acquired in 2001 which was 50% post oak habitat, it was decided to high fence the whole parcel and remove all deer. Several years later our first post oak seedlings on the entire ranch were found near the dripline of the large old trees. In February of 2010 a slow controlled burn was allowed to go through an area containing about a third of the known seedlings, which were several years old and 1-2 feet tall. This fire burned most of the seedlings down to or near ground level. Even after the drought of summer 2011, virtually all of the burned seedlings survived and are very close in size range to the nearby unburned seedlings. The post oak populations on the ranch were in fact slowly dying out through the combination of old trees dying through the normal aging process and no recruitment of post oak seedlings because of the unnatural imbalance of the deer population and available browse on the ranch. We now know for certain we have options for reviving this post oak habitat on the ranch.

These dying post oak communities have also been observed in many ranches and public lands in the Hill Country.

Seeding Program

In February–March of each year we initiate a seeding program on selected areas of the ranch. We try to seed any area that has been cleared of cedar during the past year. After our burns we evaluate the results, and sometimes for the first time we can seed an area which has been made accessible by the burn. In our larger fields, where a burn has removed last year's grass thatch, we may do an additional seeding even if we have seeded parts of that field previously. When we seed a large field, we do not try to seed the whole field because of limited resources, including seed. Instead we make passes through the field 20 to 50 feet apart, choosing to get narrow strips of new species all over the field rather than getting a smaller section continuously covered. Then we hope for some slow spreading from those strips. We usually spread seed manually from a tractor while towing a drag harrow behind to improve seed soil contact. In this manner we are able to seed brushy areas where in places we can barely get a tractor through. Sometimes in the old farm fields we are able to disc prior to seeding in part to disrupt the root system of the dominant KR bluestem of these areas.

Seed harvesting

For some grass and forb species we are attempting to reestablish, there are reasonable options to purchase commercial seed of appropriate genotype. For some of these species, such as standing cypress, we have found once we have established reasonable stands on the

ranch, it is cost efficient to hand harvest these species rather than purchase the seed for the next sections of the ranch. For many species the only source is to harvest locally. For harvesting we use three methods, (1) by hand, (2) using a Grin Reaper, a collecting box and bag attached to a string trimmer that we invented and patented in 1988, and (3) a tractor reaper we constructed in 1990 for large scale cutting and collecting of tops of grasses and forbs. We process seed minimally, only trying to shatter seed heads into individual seed, but not trying to separate seed from plant debris. For some species such as Simpson's rosinweed (*Silphium simpsonii*) and Texas green-eyes (*Berlandiera texana*), local remnants are so rare we might actually start with only a handful of seed, conservatively collected. We have currently planted these two species in two of our exclosures using 4 inch potted plants which were propagated from seed in our nursery. Soon we will try a small seeding of these species outside an exclosure to see how they do under current browse conditions, and hopefully we will be able to harvest reasonable amounts of seed for larger seedings when conditions are appropriate.

Remarks

The great reduction of browse of high quality native species, the over grazing of the grasslands, the high deer population and the presence of some very persistent exotic species on Spicewood Ranch clearly present great challenges. Unfortunately, these problems in fact also represent the dominant current conditions of a high percent of the Hill Country. Our experiences on the Spicewood Ranch have demonstrated what may be possible for restoration in the Texas Hill Country, and the patience and perseverance required for the job.