Brush Management

MYTHS AND FACTS

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MYTHS AND FACTS

The clearing of "brush" species—Ashe juniper, mesquite, and saltcedar—is a popular technique to increase spring flows and improve livestock grazing and wildlife habitat. Several of the regional water planning groups have identified brush management as a "water management strategy" in their regional water plans, thus indicating their hope that the activity will help meet future water demands. Between FY 2000 and FY 2005 the State of Texas earmarked approximately $22 million in state funds from General Revenue for brush control, and $16 million in Agricultural Water Conservation Bonds.[1] The vast majority of this money has gone to clear mesquite and juniper in the North Concho Watershed, and very little has been used to clear saltcedar. Federal money has also been allocated to Texas for brush control via the Environmental Quality Incentives Program (EQIP) and the Clean Water Act Section 319 Funds.

There have been a number of field studies done in Texas in recent years to monitor the effectiveness of using brush clearing to augment water supplies and to assess the potential environmental impacts of the activity. This fact sheet is designed to provide information to policy makers, landowners, and interested citizens, about what those studies show. It contains recommendations for managing brush in an environmentally responsible way, maximizing the potential for generating available water and improving wildlife habitat and grazing conditions for livestock. In some areas of the state, if done correctly, brush management of certain species has the potential to increase spring flows. It can also be beneficial to wildlife, including white-tailed deer and the endangered Black-capped Vireo, and to livestock. However, brush management for water enhancement is not effective in certain parts of the state. Moreover, it is sometimes expensive and, if done poorly and without follow-up maintenance practices and grazing management, can harm wildlife and cause soil erosion.

MYTH ▶ Brush control will increase water anywhere that water is scarce.
FACT ▶ Brush control will work only in certain regions, and under certain rainfall conditions.

Texas is a diverse state, with a variety of climatic regions and a range of physical characteristics. Brush in Texas can be broadly categorized as either "upland" (growing on range or

Juniper and oak populate the Texas Hill Country in Uvalde County.

Young saltcedar invading the northern end of Red Bluff Reservoir on the Texas-New Mexico state line.

forest lands) or "riparian" (growing along streams or rivers). Scientists generally agree that upland brush management will only benefit areas that receive at least 18 inches of rain per year[2]; the likelihood of its effectiveness is increased in areas that enjoy significantly more rainfall than this, and in all cases will be very dependent on site-specific conditions. The parts of the state that are more arid will likely not enjoy increased water supply as a result of upland brush management. By definition, the soils in arid parts of the state are extremely dry and rainfall that reaches the ground is quickly evaporated away before most of it is able to recharge the aquifer or reach the stream. For example, in the San Angelo area, "evaporative demand"—water lost to evapotranspiration—is four times greater than annual precipitation.[3] According to Wilcox (2002), this means that "removing brush has limited chance for success, because water stored in the soil will either be evaporated or used by whatever vegetation is present. . . . The only way in which this would not be the case is if there was mechanisms whereby water would travel rapidly to the stream channel, thus minimizing opportunity for evaporation." In other words, unless there is an underground pathway or other route that will quickly channel the rainfall to an aquifer or surface stream, most of the water will evaporate.

MYTH ► Brush control always increases water yields, and the reasons why are well understood.

FACT ► The effectiveness of brush control depends on a lot of factors that vary from site to site.

Clearing brush alters the hydrology of any given area in highly site-specific ways. Reductions in brush cover do not necessarily increase water yield. In fact, in some areas an *increase* in brush is thought to *increase* water yield.[4] In addition, increases in water yield at a particular site, even with all the appropriate criteria, will most likely only occur during wet years, for the reasons cited above.[5]

Theoretically, brush management works because it removes plants that use a lot of water. However, studies done in Texas have shown that once the site is re-vegetated after

Mesquite and other woody vegetation growing in a rangeland riparian zone. Mesquite can grow along riparian as well as in upland zones. It is in a riparian zone such as this that mesquite will likely have the greatest effect on streamflow.

clearing, the grass that replaces the brush may actually have an evapotranspiration rate equal to or higher than the brush that was removed. The Texas State Soil and Water Conservation Board noted that, "It is possible to actually reduce the water yield in some areas by removing brush and replacing it with a good stand of [grass]."[6]

This was the case at a study site at Seco Creek, in northeast Uvalde County. Initial brush removal at this site led to a reduction in water lost to evapotranspiration, and researchers speculated that when the brush treatment was expanded in the basin, the result would be a significant increase in available water. However, three years post-treatment, when the treated site was re-vegetated by native grasses, there was less water recharged on the re-vegetated site than on the control site that remained covered by brush.[7] Wilcox (2002) reported on the results of other field studies conducted in Texas and found that in most cases, any initial increase in water yield following brush clearing was substantially diminished once the site was replanted with grasses.

On certain sites, brush clearing might be effective because it could enhance groundwater recharge. Brush management on sites with shallow soils that drain rapidly and are underlain by fractured material, such as the Texas Edwards Plateau, are most likely to increase groundwater recharge. Because groundwater is often the source for a stream's baseflow, it has been hypothesized that brush control would increase streamflow. However, without an obvious subsurface pathway from aquifer to stream, it is unlikely that brush control will influence streamflow.[8]

MYTH ► Studies have shown unequivocally that brush management is a cost-effective, long-term water supply strategy.

FACT ► Brush must be managed continually and it is often expensive.

Brush management on a large scale often requires heavy equipment, such as bulldozers or hydraulic shears, airplanes to distribute herbicides, or laborers with some skills. It is often expensive to carry out. Moreover, it is virtually impossible to completely control brush in one treatment. Most areas need repeat treatments every few years. In addition, when clear-

ing saltcedar from riverbanks, the cleared areas must be re-vegetated with native plants or the saltcedar may quickly return. For land to retain its value for grazing or hunting, cleared areas should be replanted with grasses. Proper grazing management is necessary to make sure that the grasses thrive.

When not done properly, brush management can negatively affect short and long-term value of the land. In some parts of Texas, rural land value is more closely tied to its recreational uses, such as hunting, rather than ranching;[9] income from these recreational uses may exceed other land-based income. The amount of clearing recommended for water enhancement can have negative impacts to quail and deer, and erosion associated with clearing can have significant long-term negative impacts on land value.

MYTH ▶ Clearing brush is detrimental to wildlife.

FACT ▶ Brush management can be very beneficial for an array of species that depend on shrubby vegetation and/or grasses, including white-tailed deer, quail, and the endangered Black-capped Vireo.

In the right locations, appropriate brush management can be beneficial to wildlife. Many species use both brush and open areas.[10] Certain species prefer low, shrubby plants that are stimulated by brush management techniques such as prescribed fire and "shearing."

Brush can be managed for multiple uses. A number of experts suggest that a 40–60% ratio of open area to brush is a desirable goal in much of Texas, though the exact ratio of open area to brush will vary by ecosystem type. A mosaic pattern, "checkerboard", or "patchwork style" of clearing is beneficial for wildlife.[11,12] Brush treatment can be designed to provide the diversity of cover needed to support a range of species.

One field-based research effort that is taking a comprehensive look at brush management is the Leon River Restoration Project. The Leon River project seeks to ". . . improve the quality and quantity of water through treatment of Ashe juniper while improving wildlife habitat and forage production for livestock."[13] The project has a comprehensive work plan that includes pre-treatment monitoring, evaluation of economic returns, wildlife and range evaluations, and water yield analysis. The project is a demonstration of the possibility of combining brush management for water yield with improvement of wildlife habitat.

Leon River Restoration Project

In the Leon River Watershed, groups are collaborating to assess the impacts of brush management on wildlife habitat, forage production, and water quality and quantity. The Leon River Watershed project, located in Hamilton and Coryell counties, is an effort being undertaken by a diverse group of federal, state and private partners, led by the Central Texas Cattlemen's Association, with input from Environmental Defense, Texas Parks and Wildlife, Natural Resource Conservation Service, US Fish and Wildlife, Nature Conservancy, and others. Scientists at the site are studying the multiple impacts of Ashe juniper removal, with a particular focus on the impacts on Black-capped Vireo and Golden-cheeked Warbler. Grazing management plans at the site will foster the development of fine fuels, which will in turn assist in the use of prescribed burns as a tool to control small Ashe juniper. The thorough pre- and post-treatment studies of site hydrology, habitat, end species populations, and economics will provide more certainty for landowners and land managers when engaging in brush management.

MYTH ▶ All brush species can be managed the same way.

FACT ▶ The appropriate management practice depends on the type of brush and a number of site-specific factors.

The appropriate management practice (bulldozing, shearing, burning, spraying, etc.) depends on the brush species, density of the stand, age of the brush, soil and slope characteristics, and other site-specific factors. The extent to which brush clearing will increase water yield depends in part on the plant species present at the site.

Saltcedar is not native to Texas and has caused extensive environmental damage, especially along some portions of the Rio Grande and the Pecos River. More than any other brush species, it is likely that eliminating saltcedar in certain areas could yield major water benefits, though actual water savings benefits from clearing saltcedar have yet to be adequately quantified. A mature stand of saltcedar has been shown to consume between 4 and 6 acre-feet of water per acre per year.[14] It reduces streamflow and increases salinity in river systems throughout the Western United States, including all the major river systems in Texas. It provides little or no food source for native wildlife.[15] Its ability to thrive in a very saline environment, and create an even more saline environment, allows it to successfully out-compete native plants and makes it very difficult to control.

A number of saltcedar control methods are currently being evaluated, including using an introduced leaf beetle (*Diorhabda elongata*), as well as herbicides and mechanical clearing. Continued monitoring of these techniques is important to determine which will be the most effective and least damaging to the environment. Any saltcedar control program should also include aggressive restoration of native species to lessen the chance that saltcedar will re-establish on its own.

Honey mesquite is the most common brush species found in Texas. It draws water from far below the surface, and it is very hard to kill because it has a dual root system.[16] Mesquite found in riparian areas will tap groundwater near streams and lakes.[17] Brush control on mesquite-dominated uplands is unlikely to effect streamflow significantly, because, among other reasons, the soils where mesquite occur are typically deep, the evaporative demand high, and the area is likely to be quickly re-vegetated.[18] Most field studies of mesquite

Saltcedar along the banks of the Pecos River near Pecos, Texas.

Skid-loader being used to clear juniper at the Leon River Restoration Project.

rangelands have found that the eradication of mesquite does not result in groundwater recharge, unless there are special conditions at the site that allow the rainfall to move rapidly through the soils to groundwater.[19] We do not recommend controlling mesquite on a large scale to increase water. It may be appropriate in certain sites where there is a high potential for groundwater recharge.

Ashe juniper is the species most commonly managed in the Texas Hill Country to increase water yield. Juniper can be controlled by shearing the green part of the plant (the plant will die if its leaves are cut off, even if the roots are left in place). Studies done by Texas Parks and Wildlife Department at the Kerr Wildlife Management Area have demonstrated the wildlife values associated with thinning stands of juniper and maintaining the thinned stands with periodic fire. It is appropriate to thin or "sculpt" juniper in places where it has invaded and formed dense stands. It may be appropriate to clear juniper in other areas, to create a habitat mosaic (as would be created by naturally occurring wildfires) and potentially increase recharge. In areas with any significant amount of topsoil, Environmental Defense recommends that juniper clearing and sculpting be done with equipment that minimizes soil disturbance, such as hydraulic shears mounted on a skid-steer loader, hammer flail machines, and hand tools such as chainsaws and loppers. In bare, rocky ground where soil erosion is not a concern, bulldozing can be very cost effective at removing juniper. Whatever the removal method, the newly restored habitat should be maintained wherever feasible with periodic controlled burns.

MYTH ▶ Juniper and mesquite are not native to Texas.
FACT ▶ Both Ashe juniper and mesquite have existed in Texas for hundreds of years.

According to historical records, both juniper and mesquite are native to Texas. However, their widespread proliferation occurred over the last 100 years. After settlement, fire suppression and overgrazing allowed juniper and mesquite to out-compete the native grasses.

MYTH ▶ Fire as a management strategy should be avoided at all costs.
FACT ▶ Prescribed burning is an effective, relatively inexpensive method of managing brush that is good for wildlife and grazing.

Prescribed burns definitely have a role in the proper management of brush. Fire is commonly known as "nature's brush control method."[20] It is a very cost-effective way to treat brush, costing only a fraction of mechanical methods.[21] Burning can benefit most species of wildlife, as it promotes the growth of desirable forbs and browse.[22]

Burning can be used as a primary control method in certain areas, or as a follow-up to chemical or mechanical treatment. Following up a chemical or mechanical treatment with a prescribed burn will lengthen the effectiveness of that treatment.[23]

MYTH ▶ Brush control always results in better grazing conditions.
FACT ▶ A variety of practices must be used to enhance grazing.

It is incorrect to assume that complete brush removal by itself immediately will provide improved grazing conditions. Simply removing brush without allowing time for the grass seeds in the soil seed bank to germinate and establish strong root systems will significantly diminish potential returns on investment. In cases where the soil is badly eroded or the seed bank is otherwise depleted, it will likely be necessary to restore soil structure and organic matter, plant native grass seeds, and allow time for grassland regeneration. Successful grassland regeneration in arid regions of the state can be especially difficult and will require thorough consideration.[24]

Following a brush treatment, grazing should be deferred long enough to allow the desirable ground cover to be established. Otherwise, overgrazed conditions leading to juniper invasion and erosion are likely.

Precipitation without adequate ground cover can be destructive, especially in Texas, which has areas with some of the highest precipitation intensity in the world. Good ground cover will break the force of precipitation on the ground and thus reduce erosion. Grass cover will also slow runoff and give water more time to percolate into the soil.

Prescribed burn in Texas.

A Golden-cheeked Warbler.

It is in the best interest of the rancher to carefully work out a plan for brush treatment that will best serve the long-term viability of his ranch. Hamilton (2000) notes "[t]he optimum approach is to plan brush, grazing, and wildlife simultaneously to identify opportunities and constraints associated with combinations of alternative treatments."[25]

MYTH ► Brush control has little or no impact on Golden-Cheeked Warbler habitat.

FACT ► Clearing of dense second growth Ashe Juniper can have a negative impact on Golden-Cheeked Warbler habitat.

Stands of second growth Ashe Juniper can in some circumstances serve as habitat for Golden-cheeked Warblers. This is especially true when these stands are in proximity to more suitable breeding habitat (mature oak-juniper woodlands and forests). Young males will in some cases use the dense second growth stands to establish territories because the older, more established males typically occupy the prime habitat. In addition, Golden-cheeked Warblers have been observed using stands of second growth Ashe juniper as foraging habitat.

When designing a brush management project, it is important to identify and delineate Golden-cheeked Warbler habitat areas prior to initiating management. Environmental Defense recommends a step-by-step process that identifies and protects primary and secondary breeding habitats, foraging and dispersal areas and adjacent buffer zones. This process will serve to avoid the possibility of clearing stands of Ashe juniper that are serving as important habitat areas.

Recommendations

Environmental Defense makes the following recommendations with respect to brush management.

1. Target the majority of funds spent on brush control to the control of saltcedar in the Rio Grande, Pecos and other Texas rivers that have been inundated with the species. This focus will result in the greatest "bang for the buck" in terms of increased water yield and improved wildlife habitat. Restoration of native riparian species and continued riparian management must also be part of these efforts.
2. With respect to brush control of other species, focus efforts in the following places:

   When done to increase water yield—
   - Areas that receive at least 18 inches of rainfall per year, and will generally be more successful in areas that receive more than 25 inches of rainfall.[26]
   - Areas where soil and geologic conditions are favorable for the transmission of surface water to groundwater. Thurow (1998) recommended two geographical areas in Texas for the recharge of aquifers through brush control: the Carrizo-Wilcox deep sand and Edwards plateau with fractured limestone; other areas such as extreme western Cross Timbers and Prairies, with similar topography and vegetation, may also have potential.[27,28]

   To improve wildlife habitat—
   - In areas where brush has choked out other vegetation, patchwork clearing can be used to create a "mosaic" of habitats;
   - In some areas where it is desirable to stimulate the growth of forbs and grasses, brush control (especially burning) can be effective.

When a landowner has determined that it is appropriate to manage brush, whether to increase water yield or to improve wildlife habitat, he/she should follow the following guidelines.

A responsible brush control project should:

1. **Demonstrate effectiveness.** Projects intended to increase water yield should be able to provide predictable and measurable water benefits. Before implementation, the project developer should establish realistic hydrologic goals considering local conditions. The project should clearly establish a system to measure its efficiency including a hydrologic baseline, monitoring stations, and evaluation of results.
2. **Be cost-effective.** When viewed as a water conservation project, a brush control strategy should only be adopted if the costs per unit of water produced by the project are equal to, or less than, the costs of water produced by other agricultural conservation practices. This is especially important if the project is to receive public funding. Other environmental costs and benefits need also to be considered.
3. **Be compatible with the natural soil profile and conditions.** Excessive removal of brush or removal of brush in areas that have thin soil profiles or steep slopes can lead to severe erosion. This can negatively impact water quality downstream and remove important soil microorganisms from the site.
4. **Be compatible with natural vegetation.** Before removal of brush, project managers should have a clear idea of what native vegetation is appropriate for restoration of the area. Managers need to assess whether or not the restoration can occur naturally or if it

needs to be augmented with planting. When choosing a management practice, the effects of that practice on non-target vegetation should be considered.

5. **Maintain or promote affected wildlife.** At a minimum, brush control plans should examine their potential effects on local wildlife communities and be designed to minimize conflicts. More positively, a properly designed brush control plan can improve habitats for a variety of wildlife.
6. **Incorporate an effective maintenance practice and grazing management plan.** Maintenance of the brush control area is critical to ensure continued benefits, including water production and habitat value. Brush control plans should be designed to require low maintenance where possible. In any case, a long-term maintenance plan should be established and committed as part of a brush control strategy.

Notes

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[16] Jensen, ibid.

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[18] Charles Hart, personal communication, January 2003.

[19] Wilcox, ibid.

[20] Blackburn, ibid.

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