TECHNICAL NOTE

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Review of the Lawson Aerator for Brush Management

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A Lawson Aerator used to reduce sagebrush cover. Photo from USDI-BLM.

This Technical Note provides a review of the Lawson Pasture Aerator® for use in rangeland brush management practices. The Aerator has been shown to be effective at reducing sagebrush cover and opening spaces for grasses and forbs to increase. The Lawson Aerator creates less ground disturbance or soil erosion than other methods and provides an aesthetically pleasing finished treatment. This does not constitute an endorsement from NRCS. Other brands may exist which perform similarly.

Uses

- Brush control
- Pasture/Hay field aeration
- Reseeding of perennial grasses

Requirements

- 120-350 horsepower tractor (depending on size and weight of aerator, tree/shrub size and terrain)

Advantages

- Less ground disturbance or soil erosion than other methods
- Aesthetically pleasing (does not look disturbed one year post-treatment)
- Effective with trees and shrubs with stems <6 inches in diameter
- Creates catchments for water infiltration
- Increases herbaceous cover and available forage
- Creates good seeding conditions for perennial grasses (when competition is minimal)
- Can stimulate new growth of certain shrub species

Disadvantages

- Less effective on rocky ground
- Retreatment required periodically to maintain desired shrub densities
- Not effective to introduce forbs via seeding

A Lawson Aerator treating sagebrush in Nevada. Photo by NRCS Nevada.

Introduction

Historical overgrazing of sagebrush steppe habitat has led to reductions in cool-season perennial grasses and forbs and increases in sagebrush cover. The result in some cases is a dense stand of similarly-aged sagebrush with little understory. Proper management of shrub communities targets an assortment of shrubs, forbs and perennial grasses selected to support a diversity of wildlife. In these instances, it is desirable to introduce prescribed disturbance into sagebrush stands to create openings for forbs and grasses and for the revitalization of the shrub component.

Fire has been used historically to treat large areas of sagebrush steppe; however recovery can take many decades (Bunting et al. 1987). Chemical treatment is also a suitable alternative and is often more cost effective than mechanical control (Dahlgren et al, 2006; Greenwood, 2004). This paper focuses on the Lawson Pasture Aerator as a means for reduction of shrub cover with the intent of increasing forage value and plant diversity.

Spiral-Blade Choppers

The use of spiral-blade choppers, often called aerators or renovators, has gained popularity since the 1990s, especially in brush-dominated landscapes. They are commonly used as alternatives to chaining, harrowing or herbicide treatment for reduction of shrub cover and for increasing grass or forb components. They are also used in pasture settings to increase water infiltration and reduce soil compaction.

The Lawson Pasture Aerator features one or two drums mounted on a frame similar to an offset disk. Spiral-blade choppers differ from conventional roller choppers in that they use small blades welded to the heavy drums in a staggered, spiral pattern around the drum rather than the elongated, longitudinally mounted blades. Drum diameters vary from 18 to 42 inches and can be filled with water to provide additional weight. The standard width is 12 feet, but options are available to increase widths.

Hand-sized blades on the roller drums of the Lawson Pasture Aerator cut brush and roots. They also aerate the soil and create pockets to catch seed and moisture. Photo by Derek Tilley.

Most aerators are equipped with rubber tires allowing for easy transportation from site to site. Spiral-blade choppers are pulled by a crawler tractor or a four-wheel drive tractor with special tire protection. Tractor horsepower requirements vary between 120 and 350 hp and depend on

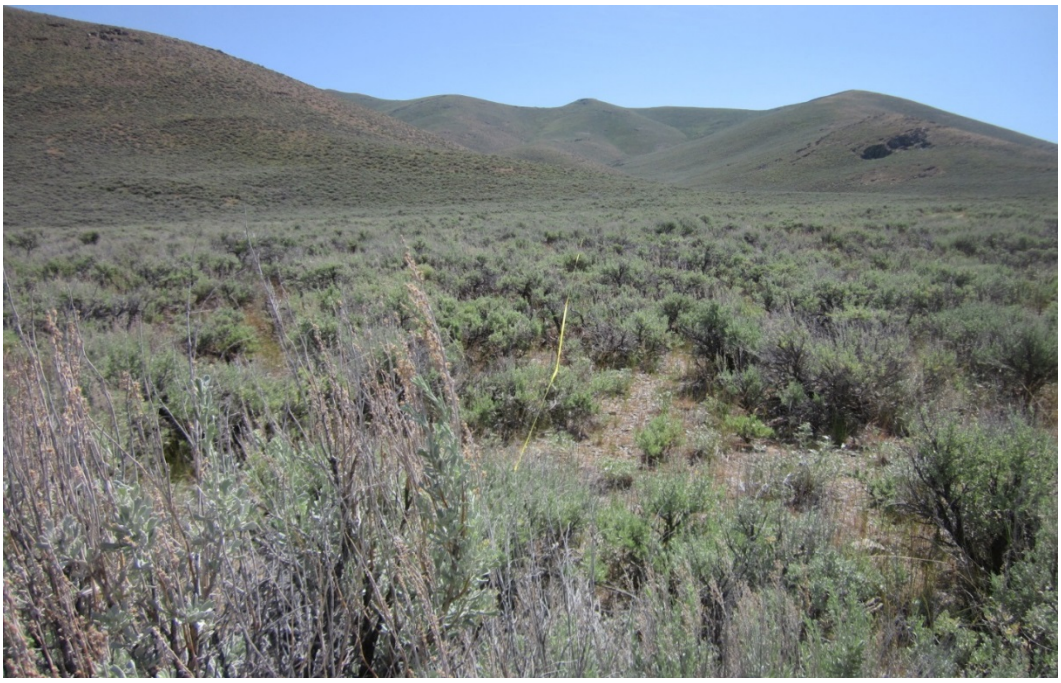
the size and weight of the unit, tree/shrub size, and type of terrain (Cox, 2015). Blade wear can be a problem, especially when used in rocky and sandy soils (Cox, 2015).

Aerators can be equipped with an optional seed box. Seeding is typically used to increase the presence of perennial grasses and forbs; however, most of the increase in herbaceous species results from the reduction of canopy cover, allowing growth of plants in the existing seedbank. Thus seeding may, in many cases, be unnecessary. Introducing seed into areas without adequately controlling or reducing competition can cause problems and lead to poor stands. In sites with a long history of a diminished understory, however, seeding may be required to establish the desired suite of species.

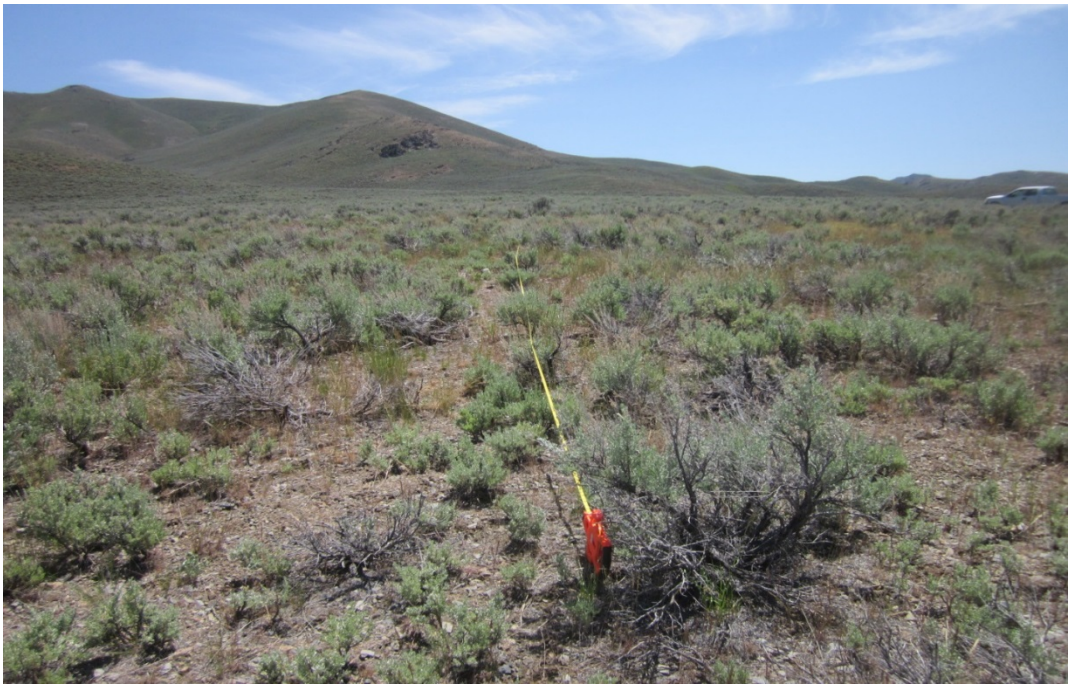
Double-drum Lawson Aerator with optional seed box. Seed is placed into the divots created by the first drum and then pressed in with the second roller. Photo by Derek Tilley.

Passes of an aerator crush sagebrush and other shrubs leaving some plants or partial plants alive (Dahlgren et al, 2006). Dixie harrows, chains and other control methods, in comparison, rip brush out of the ground leaving exposed soil. Aerators thus can provide brush control over relatively large expanses while conserving soil by leaving the residue behind. Bitterbrush plants respond positively to aerator treatment and produce many young shoots. Aerator treatments also leave enough cover and standing brush to provide a more aesthetically pleasing image than many other brush control measures.

Costs for brush control depend largely on the horsepower equipment required to operate the machinery. Dahlgren et al (2006) estimated the cost of running a double drum Lawson Aerator at $30/ac. In comparison, a Dixie Harrow costs between $25 and $30/acre to operate (Dahlgren et al, 2006; Greenwood, 2004). Chemical treatments may be cheaper on a per acre basis. Tebuthiuron applications cost approximately $19/acre (Dahlgren et al, 2006).



Lava Lake, Idaho site untreated area. Photo by Scott Engle.



Lava Lake site, three years post-treatment. Note that the site appears relatively undisturbed. Photo by Scott Engle.

Case Study Results

Pahsimeroi Valley, East-Central Idaho

Yeo (2012) reported data from an experimental treatment of a Wyoming big sage/bluebunch wheatgrass community in central Idaho. Mechanical crushing of sagebrush and other shrubs was accomplished by two passes of a Lawson Aerator during November 2003 after snow had fallen. A rangeland drill was used to seed a mixture of 90% bluebunch wheatgrass and 10% Indian ricegrass at a rate of 10-12 lbs/acre immediately after crushing was completed.

Mechanical crushing with an aerator reduced Wyoming big sagebrush cover 63% from an average of 19% in 2003 to an average of 7% in 2005. By 2012, nine growing seasons post-treatment, average sagebrush cover had increased to 11% cover. Crushing and seeding resulted in substantial increases in bluebunch wheatgrass cover from about 1-2% cover in 2003 to an average of 33% in 2012. The reduction in competition from sagebrush also resulted in increases in squirreltail and needle-and-thread cover, particularly in areas open to livestock grazing. As these grasses were not seeded, their increase is due solely to the reduction of the over story cover.

The percentage of exposed soil in areas treated with crushing fell below pretreatment levels on most treatments (except controls open to livestock grazing) with increased vegetative cover. Biological crusts suffered limited impact from crushing and increased cover with protection from livestock grazing.

Yeo's recommendations for using a mechanical crushing and seeding approach for range improvement in depauperate Wyoming big sagebrush/bluebunch wheatgrass communities include the following: (1) provide a period of nonuse of ~ 4-5 years following crushing and seeding (even longer if special circumstances occur such as drought),(2) institute conservative livestock management for the first 10 years or more, that prioritizes recovery and establishment of vigorous native plant communities in treated areas (e.g. light grazing in mid to late summer following seed set of bluebunch wheatgrass), and (3) in areas where cheatgrass invasion is a concern, managers should consider not implementing this restoration approach unless other methods are available for controlling cheatgrass.

Parker Mountain, South-Central Utah

Dahlgren et al (2006) compared treatments by a Lawson Aerator treatment, Dixie harrow and chemical treatment of Tebuthiuron in a mountain big sagebrush community. Mechanical treatments occurred in autumn 2001. Aerator treatments reduced shrub cover from 39 to 15% after four years, while Dixie Harrow treatment reduced shrub cover from 38 to 19%. The Dixie harrow was more effective than the Lawson Aerator at improving forb cover. Dahlgren et al concluded that the aerator was less effective on rocky soil as the drums "bounced" across the surface. They also noted that the aerator equipment was damaged due to the large rocks encountered.

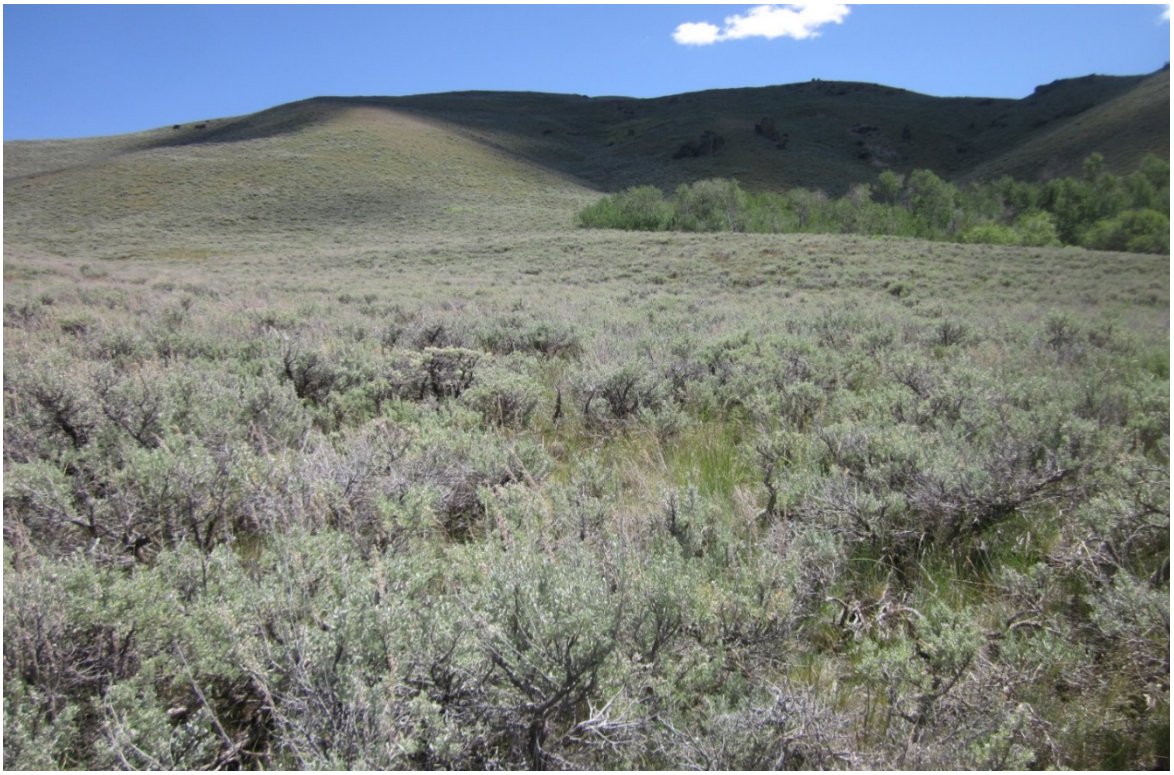
Multiple Sites, Utah
Utah Division of Natural Resources has monitoring data for several aerator treated sites throughout the state of Utah (Gunnel, 2015). Six of those sites had pretreatment shrub cover exceeding 20% and met NRCS standards from shrub treatment. Three of the six sites were dominated by big sagebrush. The remaining sites were dominated by: yellow rabbitbrush, black sagebrush, or greasewood. The sites were all treated with simultaneous aerating and seeding. Averaged across all sites, shrub cover decreased two years post treatment from an average of 32% cover to 16%. After seven years, shrub cover had increased slightly to 19%.

Perennial grasses increased after the Lawson and seeding treatment from 7% to 14% after two yrs. By year seven, the grasses maintained an average of 12% cover. Annual grasses increased 10x in two years after treatment going from 0.1% to 1%. Annual grass cover was still at 1% after seven years. Perennial forbs increased slightly from 3% to 4% after two years and increased slightly to 5% at year seven. Annual forbs increased from 2% cover to 6% cover in two years after treatment but by year seven had decreased back to 2% cover.

Lava Lake, South-Central Idaho
In 2011 NRCS treated a mountain sagebrush site with a double-drum Lawson Pasture Aerator in Blaine County, ID. The site received an average of approximately 16 inches of annual precipitation in gravelly soil. Prior to treatment, the site was recorded as having 32% living sagebrush cover, 10% dead sagebrush cover, 25% perennial herbaceous cover (15% of which was Sandberg bluegrass). No forbs were recorded in the evaluation. The treatment included simultaneous seeding with a forb mix consisting of alfalfa, sainfoin, yarrow, small burnet and flax.

Three years after treatment and seeding, mountain sagebrush live canopy cover was measured at 17%, a 50% decrease. Mountain sagebrush dead canopy cover remained the same at 10% cover. Perennial herbaceous cover increased to 35%, while Sandberg bluegrass cover remained essentially unchanged at 18%.

Very few seeded forbs were seen established in the following years, presumably due to the competition from existing plants. Gains in forage and perennial grasses resulted largely from the opening of the sagebrush canopy. However there was enough competition from the surviving sagebrush and existing forbs and grasses to exclude seeded forbs from establishing.



Lava Lake, Blaine County Idaho untreated. Photo by Scott Engle.

Lava Lake, Blaine County Idaho 3 years after treatment and forb seeding. Photo by Scott Engle.

Conclusions and Considerations

Several options for mechanical brush treatment exist. Know your objectives before selecting which tool to apply, as each option has different limitations and advantages. The selected equipment should be suited to the treatment site. Before any treatment there are several items to consider including, but not limited to: wildlife nesting/brooding, pollinator use, the condition and composition of the herbaceous understory, and the possibility of invasion or spread of cheatgrass, medusahead or other exotic annuals. Steep slopes should be avoided and are generally not recommended for treatment. NRCS Brush Management standards recommend treating areas with slopes of less than 25%.

Brush treatment in sage-grouse habitat requires additional consideration. NRCS practice standards indicate that, for areas of native rangeland identified as sage-grouse habitat, brush management will not be considered for any woody species, unless the percent composition of the target species within the present plant community significantly exceeds that listed as potential on the associated ecological site description, and/or the percent cover using line-point intercept exceeds 25 percent. To provide optimum breeding and brood rearing habitat for sage-grouse, treatments should be designed to thin the sagebrush canopy; remove patches of sagebrush to provide a mosaic of early seral vegetation within mature sagebrush stands; reduce the competition between mature sagebrush and the herbaceous understory; and increase the vigor, productivity, and diversity of herbaceous species. When planning within sage-grouse habitat, NRCS will utilize guidelines identified in the Idaho State Sage-grouse Plan.

To minimize unwanted negative effects on wildlife nesting, fawning or calving, most land managers recommend conducting brush control treatments in the fall (Greenwood, 2004). Fall treatments can broadcast and plant mature seed from on-site grasses and forbs, and it is the recommended time for additional seeding. NRCS standards prescribe conducting treatments during periods of the year that accommodate reproduction and other life-cycle requirements of target wildlife and pollinator species. Treatments must also be in accordance with specifications developed for Wetland Wildlife Habitat Management and Upland Wildlife Habitat Management. In areas of sage-grouse leks, nesting, and brood rearing habitat, mechanical treatments will only be conducted in the fall or early winter.

Mechanical disturbance of sagebrush communities for wildlife habitat should be done in a mosaic pattern. Sage-grouse favor edges, where plant communities change from dense shrub cover to open areas with abundant forbs and grasses. Dahlgren et al (2006) recommends treated swaths 30-160 m wide and untreated swaths 30-80 m wide for sage-grouse habitat. Greenwood (2004) recommends 50:50 or 60:40 treated to untreated ratios to meet multiple use values. Similarly, Yeo (2012) recommends 30 m treated and 30 m untreated swaths.

Choose a method of control that results in the least amount of soil disturbance if soil erosion potential is high and revegetation is slow or uncertain leaving the site vulnerable to long-term exposure to soil loss. Use Ecological Site Description (ESD) State and Transition models to determine if proposed actions are ecologically sound and defensible.

Disturbance and revitalization are only partial measures. Adjustments in management are often required to produce long-term changes in plant community composition. Without changes in management, treated sagebrush will likely slowly revert back to dense stands in several years.

Appendix 1. Comparison of brush removal equipment

	Lawson Pasture Aerator	Dixie Harrow	Anchor Chains	Offset Disks	Brush Mowers	Flail Shredders and Masticators
Tree removal			X			Depends on size (6+ in)
Brush removal	X	X	Ely and disk *	X	X	X
Land smoothing			X	X		
Seedbed prep	X	X	X	X		
Aeration	X			X		
Tractor	Single tractor or crawler	Single tractor or crawler	Two Crawlers	Single tractor or crawler	Single tractor	Single tractor
Required HP	120-350	45-425	140-350	70-350	35-150+	35-150+
Effective treatment width	12-16 ft	27-43 ft	100-200 ft	8-15 ft	5-20 ft	
Limitations	Not effective on rocky ground	Poor control of flexible shrubs	Non-selective treatments of large areas	Not good with excessive timber or rocks; highly destructive	Generally limited to brush <6 in in diameter	
Positive Points	Aeration; simultaneous seeding; selective treatment	Removes small shrubs; selective treatment	Tree removal; good on uneven terrain	Excellent seedbed preparation		
Comparative Ground disturbance (1-10)*	2	5	3 (smooth); 5-8 (Ely)	5-10	1	1

*Anchor chains come in three varieties: smooth or non-modified chains, Ely chains with small sections of railroad iron welded on every other segment, and disk chains with agricultural disks welded to the segments.
**1 minimal disturbance, 10 severe disturbance.

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