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Using Hoof Action to Control Clubmoss

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Introduction

Clubmoss (*Selaginella densa*) is a native plant in eastern Montana that has the undesirable tendency to dominate large areas of rangeland where it reduces plant community diversity. Susceptibility to clubmoss invasion is generally considered to arise from excessive utilization by livestock in past years. When clubmoss becomes established, it greatly reduces the forage productivity of the affected area. Traditional control has been mechanical, through chiseling or disking; chemicals have also been used successfully to control the plant, although residual chemical activity and decomposition of the naturally formed mat may limit recovery with desirable species for some time. Through a Grazing Lands Conservation Initiative (GLCI) grant awarded to the Wibaux County Conservation District, a demonstration trial was conducted comparing hoof action by livestock with mechanical treatment using an AerWay[tm] aerator to assess the viability of using hoof action as a method of controlling clubmoss.

Cross-sectional view of clubmoss

General Botanical Characteristics

Selaginella densa is commonly known as clubmoss.

Description

Dense clubmoss is an evergreen, nonflowering herb that forms dense, cushion-like mats that are seldom more than 1 inch (2.5 cm) in height. The short, leafy, compactly branched stems lie along the soil surface and may be 4 inches (1 dm) across. The simple, awn-tipped leaves are very small, up to about 0.1 inch (2.5 mm) long and 0.02 inch (0.5 mm) wide, and arranged in a relatively dense spiral along the stem. There is usually a single, unbranched vein. Along the same part of the stem, the leaves underneath the stem are longer than the leaves above the stem. Clubmoss has true roots that are very fine (0.008 inch or 0.2 mm in diameter) and minutely branched. The roots form a tangled mass and may comprise 86 percent of the plant dry matter. Most roots occur within 0.78 to 2.0 inches (2.0 to 5.1 cm) of the soil surface. (Crane, 1990)

Methods

244 head of cattle were confined to a 2-acre paddock for 24 hours.

An aerator was used to apply mechanical treatment to one paddock.

Site Description

The location of the study was in MLRA 54, Soft Shale Plains, approximately 20 miles south of Wibaux, in eastern Montana. Soils are the Ynot series. The ecological site is sandy (on-site investigation determined that the ecological site actually favored a loamy ecological classification) with approximately 2% slope. Vegetation consists of Wyoming big sagebrush, silver sagebrush, western wheatgrass, cheatgrass, blue grama, prairie Junegrass, threadleaf sedge, sun sedge, and fringed sagewort.

Soil profile from the study site

Four acres were divided into two 2-acre fenced paddocks. One 2-acre paddock received hoof-action (HA) treatment from 244 head of cattle for 24 hours. One acre inside the second paddock received a single-pass mechanical (M1P) treatment using an AerWaytm aerator; the other acre inside the paddock received a two-pass mechanical (M2P) treatment using an AerWay[tm] aerator. As the control, one acre outside the paddocks was maintained without treatment.

Point-intercept-cover transects were established in each paddock and were read prior to treatment to establish baseline levels of surface cover by clubmoss. Because the mechanical treatment paddock received two different treatments, a second transect was established post-treatment to capture the effects of the M1P and the M2P aeration. Clippings from two 4.8-square-foot hoops per transect for total forage production were collected for each treatment and control. Transects were read annually for 3 years post-treatment.

Clubmoss on the site before treatment

Effect of one pass with aerator

Effect of hoof action

Climatic Conditions

In the sedimentary plains of eastern Montana, climatic factors play a major role in plant community dynamics and stability. During the test period of 2004 through 2007, dramatic fluctuations in precipitation occurred as seen in the following table from the National Oceanic and Atmospheric Administration.

The greatest amount of clubmoss cover was in 2004, the treatment year—a year when total annual precipitation was only 9.5 inches. Annual total precipitation in subsequent years was closer to historical long-term averages of 13.89 inches.

Wibaux 2 E, Montana, Monthly Total Precipitation (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2003	0.19	0.32	1.78	0.70	3.22	2.77	1.19	0.70	2.92	0.75	0.25	0.25	15.04
2004	0.22	0.21	0.22	0.71	1.12	0.57	2.15	0.29	1.42	2.22	0.12	0.22	9.47
2005	0.16	0.00	0.57	0.56	4.72	6.10	1.92	2.16	0.62	1.91	0.78	0.31	19.81
2006	0.18	0.05	0.45	3.31	0.75	2.18	0.36	1.34	3.37	1.31	0.08	0.27	13.65
2007	0.06	0.38	1.33	1.41	4.90	1.98	2.57	1.39	1.19	0.86	0.11	0.20	16.38

Source: National Oceanic and Atmospheric Administration

Results

Clubmoss surface cover expressed in percentage change from pretreatment in 2004 to post-treatment in 2007:

Percentage Reduction in Clubmoss Surface Cover

	Pre Treatment 2004	Post Treatment 2007	Percent Reduction
Control	37%	14%	62%
M1P	50%	15%	70%
M2P	50%	14%	72%
HA	30%	2%	93%

Total forage production by year per treatment:

Approximate Total Production (lbs/ac)

	2003	2004	2005	2006	2007
Control	222.3	267.5	1032	764.4	955.4
M1P	220.8	418	537.7	782	977.5
M2P	220.8	418	1207.9	1263.4	1680
HA	222.3	134	1637.9	1365	1706.3

Conclusions

The HA treatment was most effective in reducing clubmoss surface cover. There was not an appreciable difference between the two different mechanical treatments tested in this study. However, mechanical treatment does appear to provide a level of reduction in clubmoss surface cover as well.

The most interesting result was the 62% reduction of clubmoss surface cover in the control. This result was most likely due to the increase in precipitation received and the resultant competition from the increase in vegetation. This cause and effect has been recognized by Clarke in his study of the effects of climate and grazing practices on short-grass prairie vegetation (Clarke, 1943).

When examining total vegetation cover, the authors concluded that climate rather than moderate grazing use was the principal factor affecting plant cover between 1928 and 1939. Their results also support the concept of management-induced drought.

HA treatment may be a viable option for patches of clubmoss located in areas of rough terrain, inaccessible to mechanical treatment.

The degree of disturbance is important when the management goal includes increased biomass production. It should be noted that the M2P treatment was much more effective than the M1P treatment in increasing biomass production even though there was minimal difference in clubmoss control.

Proper management is critical in preventing grazing-induced drought and the persistence of clubmoss-dominated rangelands. Although an increase in clubmoss surface cover during drought is likely, high levels of clubmoss when precipitation is relatively normal probably is management induced.

References

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