

### Supporting Literature

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## Succession in Sagebrush

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### Editor's Note:

To truly make progress in research it is necessary to be aware of information found in the past. All too frequently we keep rediscovering the wheel. The following article is a case in point. During the past few years there have been several articles on plant succession published in the *Journal of Range Management*. I selected one article for reprinting. There is much good information in this article on factors which affect plant succession. I wonder what would have been concluded if the study had been for only 5 years at some period during the 31 years that this study represents.

Common sagebrush (*Artemisia tridentata*) on the grasslands of the Beaverhead National Forest in southwestern Montana apparently will maintain itself indefinitely under natural conditions. This conclusion is the result of a 31-year-old study conducted by the Forest Service to determine the possibility of sagebrush giving way to grass under good management of rangeland.

The study area occupies a basin of deep loam soil at the head of Cherry Creek on the east side of the Gravelly Range. Before and during the period of early settlement of this section of the State, this entire range was grazed by herds of buffalo during the summer months. The last buffalo in the adjoining valley was killed in 1882. At this time the heads of the streams and the gently sloping grasslands had been reduced to areas of bare soil pocked with the wallows of the buffalo. On these areas they rolled, pawed, and threw dust for protection against insects. The wallows are still a feature of the landscape.

From 1882 until about 1914, little grazing use was made of the range and the bare soil was allowed to revegetate almost unhindered. During this period sagebrush gained a foothold and became established in favorable locations. Since 1914 the area has been grazed by sheep. In 1926 it was placed under systematic management, following a range survey.

Sagebrush plants in the stand had an average age of 61 years in 1945, by growth ring count. They became established, therefore, in 1885, and in 1915 when the study began, they were 31 years old. At that time they were 24 to 30 inches tall, and were thick and thrifty. A 30-foot square area supported 167 mature plants, having 659 basal branches extending from the plant bases. No other shrubs were present.

In 1932, 18 years after the study started, the plants had decreased in number to 114, with 224 basal branches, a loss of 32% and 66%, respectively. No new plants were present. In 1936 only 93 old plants with 200 basal branches remained. However, the stand was beginning to show openings, and 5 seedlings were present in the open spots. The appearance of seedlings marked the turning point between sustained loss over a long period of years and the beginning of replacement of the stand. At this time the reduction of old plants had reached 44% and the loss of basal branches 70%.

In 1945, 88 old plants with 151 basal branches remained. In addition, the seedlings of 1936 had become well-established plants. The old plant loss since 1915 amounted to 47%, and the basal branch loss 77%.

Total vegetation density and percentages composition of sagebrush, grasses and grasslike plants, and weeds present on the plots for each of the periods were as follows:

	1915	1932	1936	1945
Total vegetation density .....	.8	.7	.65	.5
Sagebrush (% composition) .....	40	57	44	27
Grasses and grasslike plants (% composition) .....	40	32	40	58
Weeds (% composition) .....	20	11	12	15

Studies were made also of sagebrush invasion on a companion plot. In 1932 all the sagebrush on this plot was

pulled, leaving it fully open to the sun. After 5 growing seasons, 2 new sagebrush plants were present on the plot, one 10 inches tall, the other 20 inches. In 1945, 14 years later, there were 33 plants present averaging 24 inches tall, and 243 other plants varying from established seedlings to 4 inches tall. The latter averaged 4 years old. Location of the seedlings, most of which were close to older plants, indicated they came from seed of the older plants rather than from seed stored in the soil. The principal new stand was established in about 1941 and should reach the decadent condition of the older stand in about 50 years.

More general studies elsewhere on this range in 1945 showed a distinct trend toward increase of sagebrush in the grassland association. Many new seedlings and small plants now occupy areas formerly free of sagebrush except for a few scattered old plants. Once established, such new plants increase the density of sagebrush cover and reduce the production of forage.

### Discussion

It was apparent that the thick, thrifty stand of 1915 had to age sufficiently to break down into a more open stand before conditions were right for new plants to come in. As the age of the plants increased, they became brittle and decay developed at the ground level. Basal branches succumbed first and later the plants would die. Because the plants were very thick in 1915, many plants died before the stand was open enough for sunlight to reach the ground and permit seedlings to come in. This point was reached in 1936 when the number of plants had been reduced by 44% and the number of basal branches by 70%. Seedlings began to appear then, and by 1945 these were firmly established. Fifty-two years elapsed, therefore, before new seedlings gained a foothold.

If the old plants had continued to die without replacement, the stand would eventually have passed out of existence, of course. However, with the stand opening up to the sun, new plants established themselves and maintenance began. At the present stage of this study the facts point toward continued replacement by new plants as the old ones die.

It may be concluded that the development of sagebrush in an established stand under the conditions described is

inversely proportional to the thickness of cover present; therefore, the less cover of sagebrush, the greater the amount of new growth which occurs. Also, unless the habitat is disturbed unduly, sagebrush on sites favorable for growth probably will continue to reproduce itself indefinitely.

Correlation of the 61-year-old stand with periodic weather conditions indicates that its establishment in 1885 coincides with a period of growing conditions favorable for seedling establishment and that the new stand in the companion plot established itself during a period of favorable moisture conditions. It may be concluded, therefore, that moisture conditions favorable for seedling establishment are necessary for the beginning of development of a thick stand of sagebrush, and also for its maintenance once the turning point of an established stand is reached.

At the elevation of this area, 8,300 feet, droughts are of little consequence and are not as destructive to sagebrush as they have been demonstrated to be at lower elevations in this latitude.

### Application of Results

In many of the high producing grassland areas where often only a few old sagebrush plants are found, numerous seedlings and small plants have become established, and more are coming in. If these are allowed to continue growth, it may be expected that the area of sagebrush will increase materially in the future. This will result in a decrease of forage, and also grazing capacity.

Eradication of the parent plants and the new seedlings by grubbing, pulling, or by toxic sprays, represents a comparatively small task in many areas; whereas, if they are left until the problem becomes one of large areas occupied by dense sagebrush, the job becomes a major one which will involve appreciable amounts of time, labor, and money. Also the reduction of grazing capacity, and the management problems which are involved, will increase costs and reduce financial return to the dependent communities. Clearly, action is needed immediately in order to forestall a large scale job in the future and the inevitable reduction of numbers of livestock on those ranges where sagebrush dominance is now in its incipient stages. (Reprinted from *Journal Range Management* 1(1):19-21 1948).