

Circumstances that Impelled Fertilization Treatment Research on Native Rangeland

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Nitrogen fertilization research projects were conducted in the Northern Plains in an attempt to find and develop cultural management practices that could be used to recover the degraded ecological condition, to return the natural botanical composition, and to restore the herbage biomass production of deteriorated native grassland ecosystems. The deterioration of the grassland resources was caused by an accumulation of antagonistic byproducts from naive land management practices that were implemented during the progressive stages of European settlement of the region.

European settlement of western North Dakota followed the railroad. In 1864, Congress passed the Federal Railroad Land Grant Act. Under that act, the Northern Pacific Railroad was given a grant of 39 million acres of land in a checkerboard pattern from Duluth, Minnesota to Puget Sound, Washington. Construction of the railroad started in 1870 at Superior, Wisconsin and reached Moorhead, Minnesota in December 1871. The tracks reached Bismarck, North Dakota in June 1873 and halted there until 1879. The Northern Pacific Railroad sold 4,352,000 acres in North Dakota between 1875 and 1895 for an average price of \$3.90/acre. Construction of the tracks started again and reached Dickinson in 1880 and reached the Montana border in 1881. During the early stages of the settlement process, the railroad was used to move people west and to ship regional resources east.

The railroad moved about 5,000 buffalo skinners to Bismarck by 1882 and shipped 1.5 million bison hides to eastern markets between 1880 and 1884. This activity eliminated the northern bison herds west of the Missouri River in western North Dakota and eastern Montana. The last carload of hides containing the skins from the last herd of 300 free roaming bison was shipped from Dickinson, North Dakota in 1884.

While the bison herds were being removed, cattle outfits were trailing livestock from Texas into western North Dakota and eastern Montana to be fattened on the open range grass and then shipped to eastern markets by rail. Several large herds of mostly light weight 2-4 year old steers and dry cows were trailed north in 1882 and 1883. The first regional roundup in western North Dakota was conducted in the spring of 1884. The estimated population of cattle was 30 to 40,000 head in a district that was 100 by 50

miles, with Medora, North Dakota near the center. The stocking level at that time was 80 to 100 acres per head for a year of grazing. In western North Dakota, a 1200 pound cow needs 55.4 acres for a year of forage dry matter. During the fall of 1886, the stockman in western North Dakota and eastern Montana declared the district to be fully stocked and that no new outfits would be permitted to bring in cattle or horses.

The winter of 1886-1887 was very severe with numerous blizzards, very strong winds, and long spells of bitter sub-zero temperatures. By spring, 50% to 75% of the cattle were lost. Most of the absentee owner outfits pulled out. A few locally owned and operated outfits remained. The herd sizes stayed small and the numbers of grazing animals were not intensified because the financial backers considered the business of fattening cattle on western open range grass to be too risky. The cattle numbers were greatly reduced again during the drought of 1891 to 1893. The period of open range grazing of Texas cattle was not long and the grasslands were not heavily stocked. Had the grazing practices that were being developed during the open range period been permitted to progress, land management strategies in the semiarid regions of North America would have been based on low intensity pastoral philosophies similar to the other grazing regions of the world that did not have homestead activity.

The human population of western North Dakota greatly increased between 1898 to 1915 with the peak period of activity between 1900 and 1910. Title to land was transferred from the US Government to private citizens through the Homestead Act and its many revisions. The Homestead Act provided that a person could claim 160 acres of public domain lands after filing and "prove up" on it for five years. During the period that much of North Dakota was settled, there was a provision in the Homestead Act that allowed a person to commute the homestead by a preemption right and pay the regular price of \$1.25 or \$2.50 per acre anytime after six months from the date of filing. About half of the acreage changing from public domain to private ownership in North Dakota after 1900 and before 1929 were commuted acres. The proceeds from a single crop of wheat or flax produced on 5 or 10 acre fields could pay for the purchase price. The Taylor Grazing Act of 1934 removed all

unappropriated public domain lands from homestead, which included 68,442 acres in North Dakota.

The Homestead Act had many revisions in attempts to adjust the law to meet the needs of the people and the natural resources. None of the many revisions to the Homestead Act met the needs of the country west of the 100th Meridian. Failure of the lawmakers to address the requirements of natural resource management in semiarid regions created numerous long-lasting problems. This predicament was aggravated by the degradation of the grassland resources caused by the exceptionally high stocking rates suggested for use during the homestead period.

The heavy stocking rates used for cattle grazing in western North Dakota until 1934 (Whitman et al. 1943) were the suggested stocking rates ascertained from initial grassland research investigations in North Dakota. A grazing intensity study conducted from 1916 to 1929 by J.T. Sarvis at the Northern Great Plains Research Center, Mandan, North Dakota, examined 5.0-month seasonlong grazing at stocking rates that removed 75% to 80% of the total annual production and left 20% to 25% of the vegetation standing at the end of each season (Lorenz 1970). Sarvis (1941) determined these stocking rates to be neither over nor undergrazed. Whitman et al. (1943) considered the rangelands of western North Dakota to be heavily overstocked and that the livestock grazing pressure was around 67.5% heavier than the grasslands' carrying capacity that had been determined from the then recent range surveys conducted in western North Dakota by the Agricultural Adjustment Administration Office.

This widespread heavy overgrazing of Northern Plains grasslands greatly intensified the damaging effects caused by the drought conditions of 1934 and 1936. The drought damage to the grassland vegetation was severe, resulting in a 57% decrease in total cover density and a 56% reduction in plant height (Whitman et al. 1943). With cessation of the drought conditions, the favorable precipitation and a reduction of more than 60% in the stocking rates were responsible for the recovery of the vegetation in four years, with a return to the predrought densities and no change in composition of the major dominant species (Whitman et al. 1943). After 1936, the Northern Plains prairie and its soil were no longer considered to be inexhaustible.

The severe droughts of the 1930's combined with the economic depressions of the 1920's and 1930's and the low agricultural commodity prices received after 1929 created extreme hardships for the homesteaders in semiarid regions. These struggling

people did not have sufficient productivity or financial income from the degraded natural resources on 160 acres to support their families. The homesteaders living on lands declared to be submarginal were given the option to sell their land back to the federal government. The Land Utilization Project was established in 1935 and a resettlement plan was completed that same year. The Bankhead-Jones Farm Tenant Act was passed by Congress on 22 July 1937. Under these legislative acts, 1,104,789 acres were purchased by the US Government in North Dakota. Most of these repurchased lands were managed with a follow up program of land conservation and a utilization plan. The homesteaders living on marginal or better lands did not have the option to sell to the federal government and were faced with abandonment of their land or finding a private buyer with sufficient credit.

Agricultural operations that survived the calamities of the 1930's had painfully discovered that eastern farming and grazing practices did not work west of the 20 inch rainfall line; regardless of these hard lessons, the problems of low productivity from the resulting poor condition of the cropland and grazingland continued. Major efforts to develop agricultural management practices suitable for semiarid lands were started in the 1930's but had to be postponed until after World War II. Tree shelterbelts, crop rotation, and contour strip farming methods were introduced to improve the croplands. Reduced stocking rates and deferred rotation grazing management were introduced to improve the grazinglands. The stocking rate problems were solved when Crider (1955) determined that proper stocking rates removed less than 50% of the herbage and that grass tillers with 50% or more of the aboveground leaf material removed reduced root growth, root respiration, and root nutrient absorption. However, the grazing management problems had not been solved because the deferred method of grazing was found to negatively affect grassland ecosystems. After 12 years of grazing deferment research, Sarvis (1941) was unable to determine any improved benefit to grass plant density from reseeding of the grasses with deferred grazing. Manske et al. (1988), in a three year study, found that total grass basal cover decreased significantly after one year of deferred grazing treatment. Grazing management practices that were beneficial for grassland ecosystems would not be developed until the early 1980's after scientists were able to describe and understand the complex physiological mechanisms and biogeochemical processes of the herbivore-grass-soil organism symbiotic system.

Consequently, those were the circumstances leading up to the 1950's that impelled grassland ecologists and rangeland scientists to investigate fertilization treatments for possible improvement in the deteriorated grassland ecosystems of the Northern Plains.

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