



---

6-30-1981

## The 1900 invasion of alien plants into southern Idaho

Dana L. Yensen

*University of Idaho, Moscow, Idaho*

Follow this and additional works at: <https://scholarsarchive.byu.edu/gbn>

---

### Recommended Citation

Yensen, Dana L. (1981) "The 1900 invasion of alien plants into southern Idaho," *Great Basin Naturalist*. Vol. 41 : No. 2 , Article 2.

Available at: <https://scholarsarchive.byu.edu/gbn/vol41/iss2/2>

This Article is brought to you for free and open access by the Western North American Naturalist Publications at BYU ScholarsArchive. It has been accepted for inclusion in Great Basin Naturalist by an authorized editor of BYU ScholarsArchive. For more information, please contact [scholarsarchive@byu.edu](mailto:scholarsarchive@byu.edu), [ellen\\_amatangelo@byu.edu](mailto:ellen_amatangelo@byu.edu).

## THE 1900 INVASION OF ALIEN PLANTS INTO SOUTHERN IDAHO

Dana L. Yensen<sup>1</sup>

ABSTRACT.—The European annual plants *Salsola iberica*, *Sisymbrium altissimum*, *Descurainia sophia*, and *Bromus tectorum* invaded southern Idaho about 1900 and spread very rapidly into native plant communities damaged or eliminated by burning, abusive grazing, and agricultural clearing. Historic photographs reveal that the sites of initial invasion were waterway margins, railroad rights-of-way, road shoulders, city streets, agricultural areas, and construction sites. By 1915, these plants were widespread and abundant. Burning and grazing fostered their spread and dominance on millions of acres in southern Idaho.

Several European annual plants invaded southern Idaho during the few years preceding and following the turn of the century. The spread of these alien plants, especially cheatgrass, was so rapid that it often escaped recording (Leopold 1941). Four important plants—*Salsola iberica* Sennen and Pau, *Sisymbrium altissimum* L., *Descurainia sophia* (L.) Webb., and *Bromus tectorum* L.—changed the ecology and the very appearance of southern Idaho. This paper presents some new information on documenting the invasion of these plants into southern Idaho, and the means by which they came to dominate millions of acres of desert rangeland.

### PRESETTLEMENT VEGETATION

The presettlement vegetation of southern Idaho consisted largely of open-canopied communities of low-growing shrubs, especially big sagebrush (*Artemisia tridentata*), as well as winterfat (*Ceratoides lanata*), bitterbrush (*Purshia tridentata*), rabbit brushes (*Chrysothamnus* sp.), and shadscale (*Atriplex confertifolia*) and other salt-desert shrubs. Most of the Snake River Plain was dominated by communities of big sagebrush with a rich understory of perennial bunch grasses (*Stipa*, *Elymus*, *Agropyron*, *Oryzopsis*, *Poa*, and *Festuca*) and herbs (*Balsamorhiza*, *Hydrophyllum*, *Tragopogon*, and *Agoseris*), or by winterfat or other salt-desert communities (Townsend 1839, Fremont 1845, Irving 1907, Elliot 1913, Ferrin 1935, Keith 1938, Stover 1940, Vahlberry 1940, Platt and Jackman

1946, Blaisdell 1953, Root 1955, Shirk 1956, Fulton 1965, Ellison 1960, Vale 1975, Gibbs 1976, Hironaka and Fosberg 1979, Meacham 1979, Young et al. 1979). The perennial grasses and several of the shrubs, notably winterfat, saltbushes, and bitterbrush, are highly palatable and nutritious to grazing animals (Kennedy 1903, Hodgson 1948, Hutchings and Stewart 1953, Ellison 1960).

Originally, if sagebrush grasslands were burned, trampled, or otherwise severely disturbed and left wholly or partially bare of vegetation, snakeweed (*Gutierrezia sarothrae*) would appear on the disturbed areas within a year or two (Stewart and Hull 1949). Establishment of snakeweed was followed by the appearance of the short-lived perennial grasses bottlebrush squirreltail (*Sitanion hystrix*) and Sandberg's bluegrass (*Poa sandbergii*), along with big sagebrush seedlings. Finally, the large-culmed perennial grasses and the perennial broadleaved herbs would appear (Ellison 1960, Young et al. 1972). Revegetation occupied about a decade, and only occurred if the area was not significantly disturbed. In southern Idaho at the turn of the century, however, continual disturbance by fire, abusive grazing, agricultural practices, and construction (railroads, roads, towns, canals) created an environment in which presettlement patterns of secondary succession could not persist unchanged (Kennedy 1903, Piemeisel 1938, 1951). The stage was set for the invasion of alien plants (Young et al. 1979).

<sup>1</sup>Department of Biological Sciences, University of Idaho, Moscow, Idaho 83843.

### CONDITIONS LEADING TO THE INVASION OF EXOTIC PLANTS

By 1900, native plant communities had been severely damaged by overgrazing (Hodgeson 1948, Piemeisel 1938). Pickford (1932) wrote that in the 30 years after 1880, burning and abusive grazing had resulted in an 85 percent reduction in native perennial grasses and a 40 to 50 percent reduction in the carrying capacity of the range. By this time, stands of native perennial grasses had been virtually eliminated from southern Idaho desert lands (Hodgeson 1948). Burning also caused serious and widespread damage to the vegetation. Many stockmen, erroneously believing that burning the shrublands produced good stands of grasses even when grazing pressure following burning was not reduced, deliberately set range fires (Griffiths 1902, Pechanec and Hull 1945, Vale 1975). Griffiths (1902), who traveled southwestern Oregon ranges in 1901, reported that such range fires were very common, and that many of the fires were set by sheepmen. The fact that sheepmen used to set many range fires is common southern Idaho lore (Hicks pers. comm., C. L. Stewart pers. comm.).

From 1900 until the end of World War I, large numbers of prospective farmers settled in southern Idaho (Rinehart 1932, Gibbs 1976). In the words of Hultz (1934), the country was "wheat mad." Railroads offered cheap one-way home seeker fares, and many settlers took advantage of them (Stewart and Hull 1949, Gibbs 1976). Large acreages of sagebrush lands were settled and cleared for planting row crops and orchards. However, during the 1920s, an agricultural depression began in Idaho. Many farmers went bankrupt and abandoned their homestead claims (Stewart and Hull 1949, Gibbs 1976). Thousands of acres of plowed farmland, many acres of which had been dry-farm wheatfields, were left unattended (Warg 1938, Piemeisel 1938, Stewart and Hull 1949, Young et al. 1979).

Several decades of burning, trampling, overstocking, and abusive grazing not only severely damaged the perennial grass and herb understory of the big sagebrush lands, but also greatly reduced the acreage dominated by the most valuable forage shrub, winterfat. By 1900 many hundreds of

thousands of acres of big sagebrush remained, virtually bare of understory (Sweetser 1935, Chapline 1936, Stewart 1936, Taylor 1940, Hodgeson 1948, Reidl et al. 1964, Young et al. 1979). Erosion of the soil became a critical problem, both on the open range and on abandoned cropland (Clapp 1936, USDI-BLM 1974). And, with no easing of grazing pressure, rehabilitation of the weakened native plant communities was not possible (Young et al. 1979).

### HISTORY AND ECOLOGY OF INVASION

**RUSSIAN THISTLE.**— Russian thistle, *Salsola iberica* Sennen and Pau (Beatley 1973), was probably the first important invading plant (Hutchings and Stewart 1953). This spiny and compact annual herb is a native of the desert-steppe region of Russia. Russian thistle germinates in late spring or early summer, grows during the summer, and dies in the fall. The aboveground part of the plant then breaks off and is tumbled along the ground by the wind, scattering seeds (Piemeisel 1938). These ball-shaped dead plants are the "tumbleweeds" of western cowboy lore. Russian thistle was commonly called "tumbleweed" in southern Idaho, but was not present during the heyday of the cowboy (Piemeisel 1938, Hicks pers. comm.). Russian thistle does not tolerate crowding of stands, and will not continue to grow on an area unless the area is continually disturbed. Therefore, the presence of Russian thistle indicates lands which have been severely or continually disturbed within the past one to three years (Piemeisel 1938).

Russian thistle invaded the western United States just before 1900 (Hutchings and Stewart 1953). In Idaho, the seeds of Russian thistle were probably distributed via the Snake River and were further disseminated by irrigation canals and field ditches, the bare margins of the newly constructed waterways being excellent sites for colonization (Dewey 1896). Also, seeds of Russian thistle may have been distributed in alfalfa and other crop seeds (Piemeisel 1938).

Because of its large size and distinctive appearance, Russian thistle is easily identified in photographs. Photographs on file in the collection of the Idaho Historical Society

(Boise, Idaho), document the early establishment of Russian thistle in southern Idaho. Figure 1 is an example. The earliest photographs of Russian thistle in Idaho are IHS 64044.3, showing the plants growing on a railroad embankment in southeastern Idaho in 1890; IHS 73-230.23, an 1897 photograph showing plants growing in Nampa at the foot of a speaking platform on which William Jennings Bryan was standing; and IHS 74-194.4a, taken in Roswell in 1898, showing Russian thistle growing near a newly constructed farmhouse. Other Idaho Historical Society photographs reveal that Russian thistle first became established on railroad rights-of-way; on the edges of (dirt) city streets and in vacant city lots; at construction sites of buildings, bridges, and roads; in agricultural waste places and on field margins; and near waterways. At least 50 early photographs taken in southern Idaho show that Russian thistle was well established and widely distributed in southern Idaho by 1905, and was abundant by 1915. The fact that Russian thistle rapidly invaded severely disturbed big

sagebrush lands is illustrated by IHS photograph 73-221.810, taken in 1909 near Twin Falls, which shows a newly constructed church surrounded by a big sagebrush community with only a small cleared space in front of the building. The cleared area supports hundreds of Russian thistle plants, and the photograph is labeled "Three months from sagebrush."

In addition to mechanical disturbance (construction, grazing), fire also helped to establish Russian thistle in southern Idaho. Following burning, Russian thistle became the first plant to colonize newly burned lands, rapidly invading burned big sagebrush-perennial grass areas before snakeweed or other native plants could gain a foothold (Piemeisel 1938, Stewart and Hull 1949).

Russian thistle, though inferior in palatability and nutritional value to native grasses, can be used as forage by livestock. When it first appeared in abundance on the southern Idaho range, it was hailed by stockmen as a valuable new forage plant (Leopold 1941). Russian thistle can only be used by



Fig. 1. *Salsola iberica* and *Sisymbrium altissimum* (foreground). "Green's ranch," 24 August 1909, near Nampa, Canyon County, Idaho. Photograph courtesy of the Idaho Historical Society.



livestock, however, in the summer, before it dries into a spiny skeleton (Murray and Klemmedson 1968).

**MUSTARDS.**—Several European members of the mustard family also invaded disturbed southern Idaho lands. The most important of these were tansymustard (*Descurainia sophia* (L.) Webb.) (Detting 1939) and tumbledustard (*Sisymbrium altissimum* L.). These annual mustards bloom from early spring to early summer, after which they dry and die. Like Russian thistle, they have short taproots and do not protect the soil from erosion (Hull and Pechanec 1947). Tumbledustard may also break off and scatter seeds in the fall. Tumbledustard was also called “tumbleweed” in southern Idaho, but not as commonly as was Russian thistle (Hicks, pers. comm.). Mustards can tolerate more crowded conditions than Russian thistle and can persist in very dense stands for a few years, but not indefinitely. Peak demands by these plants on upper soil moisture occur before Russian thistle begins to grow. These characteristics enable the mustards to invade Russian thistle stands and replace the Russian thistle within one to three years, if not severely disturbed. However, if a mustard stand is heavily trampled or otherwise disturbed, Russian thistle will replace the mustards. Mustard stands become extremely crowded in a few years and cannot persist. If not disturbed, mustards will soon be invaded and replaced by other plants (usually cheatgrass) (Piemeisel 1951, Hironaka and Tisdale 1963).

The mustards, less distinctive in habit than Russian thistle, are much more difficult to identify with certainty in photographs. The first evidence of tumbledustard growing in Idaho is Idaho Historical Society photograph IHS 73-230.23, showing tumbledustard (with Russian thistle) in Nampa in 1897. Four 1906 Idaho Historical Society photographs show tumbledustard present along man-made waterways near Jerome and Twin Falls (IHS 73-221.781c, IHS 60-176.103, IHS 60-176.104, IHS 60-176.106). Tumbledustard also appeared between 1900 and 1917 along railroad tracks, on roadsides, at construction sites, and in agricultural areas (Fig. 1). Tansymustard is even more difficult to recognize in photographs; it probably became established at about the same times and in the

same places as did tumbledustard. The first reliable photograph evidence of tansymustard in southern Idaho is IHS photograph 68-05.45, taken at Massacre Rocks State Park along the Snake River in 1916. The mustards were widespread in Idaho by 1915. Weaver (1917:110) wrote that at that time tumbledustard or “Jim Hill mustard,” as it was then called, was “present to a degree almost unbelievable.” He stated that it has been introduced into the Pacific Northwest along railroad rights-of-way. Piemeisel (1938) reported that seeds of pinnate tansymustard and tumbledustard were distributed in alfalfa seed. These mustards also invaded depleted rangeland. They are unpalatable to livestock, a fact that favored their establishment and spread (Kennedy and Doten 1901).

**CHEATGRASS.**—The most important exotic annual to invade Idaho was the Mediterranean winter annual grass *Bromus tectorum* L., which in the West has been called cheatgrass, cheatgrass brome, downy brome, downy chess, Junegrass, bronco grass, and Mormon oats. Cheatgrass now occurs in every state except Alabama, Georgia, South Carolina, and Florida. In the eastern states it is a roadside weed, but in the West it has invaded millions of acres of rangeland and cropland (Hull and Pechanec 1947, Stewart and Hull 1949, Klemmedson and Smith 1964).

Cheatgrass germinates during fall rains and maintains small, dormant leaves during the winter. In spring, it grows rapidly and begins to form seed heads in April. In May, the seeds mature, and the plants turn purplish as they dry in the early summer heat. In June and July the seeds mature and fall to the ground, and the plants die. The dry plants, by then straw colored, persist upright in place for months (Stewart and Hull 1949, Klemmedson and Smith 1964).

Stewart and Young (1949) noted that cheatgrass was collected in Pennsylvania in 1861, in Washington in 1893, in Utah in 1894, in Colorado in 1895, in Wyoming in 1900, and was present in nearly all of its current range by 1900, though it was not as abundant as it was later to become. Stewart and Young implied that the spread of cheatgrass was from east to west. However, there is a strong possibility that the first cheatgrass

to arrive in Idaho came from awns carried in the coats of sheep trailed from California through Nevada to southern Idaho.

Cheatgrass awns catch in the coats of livestock and may be carried for miles before dropping out (Piemeisel 1938). The first instances of cheatgrass invasion in Nevada were in areas where California sheep had grazed (Kennedy 1903). Since bands of California sheep were trailed through Nevada and into Idaho (Wentworth 1948, Hanley and Lucia 1973), it seems reasonable to assume that cheatgrass awns could have been carried into Idaho by these sheep. Piemeisel (1938) notes that, as with other exotic annuals, cheatgrass seeds were often present in alfalfa seeds, and cheatgrass was also distributed in that way. An Idaho Historical Society photograph (IHS 503-F), taken at the mouth of Kuna Cave in southern Ada County in 1898, shows a dense stand of cheatgrass growing under a sparse cover of big sagebrush. This is the earliest photographic evidence of cheatgrass occurrence in Idaho, and even at the time of the photograph it appears to have been well established. Klemmedson and Smith (1964) note that cheatgrass is included in Piper and Beattie's 1907 *Flora of the Palouse*, Howell's 1903 *Flora of Northwest America*, and Piper's 1906 *Flora of Washington*. Cheatgrass, however, is not mentioned in Weaver's (1917) *Flora of South-eastern Washington and Adjacent Idaho*.

O. R. Hicks (pers. comm.) remembered that, just prior to 1906, cheatgrass occurred in south central Idaho between the towns of Glens Ferry and King Hill in what was called a "railroad line"—a line of cheatgrass invasion originating on the railroad right-of-way and extending about 300 yards into the native vegetation on either side of the railroad tracks. Hicks believed that cheatgrass was fed to the sheep in the stock cars and that seed heads fell from the cars to ground along the tracks.

In the first few years after 1900, cheatgrass gained a foothold on disturbed areas such as railroad rights-of-way, road shoulders, orchards, fallow fields, and especially in dryland alfalfa fields which were grazed after having been harvested (Stewart and Hull 1949). In photographs, cheatgrass is not distinctive in appearance at a distance and can

be positively identified only in uncommon instances. It is undoubtedly present in many photographs where reliable identification is not possible. (Cheatgrass is a relatively small, fine-textured plant, and its delicate heads are stirred by a slight breeze, often blurring the photographic image.) Idaho Historical Society photographs in which cheatgrass can be positively identified show cheatgrass to have been present in southern Idaho by 1910 in areas along railroad rights-of-way, on roadsides, and in vacant, disturbed areas within towns. Severely damaged rangeland was also invaded about this time (Stewart and Hull 1949).

Cheatgrass has been called an aggressive invader of big sagebrush lands (Platt and Jackman 1946), but Piemeisel (1938), who did classic successional studies in southern Idaho beginning in the 1920s, concluded that invasions of big sagebrush lands by cheatgrass were largely limited to voids in native vegetation. Warg (1938) concluded that cheatgrass could not invade pristine native vegetation and that invasion by cheatgrass was an indication of disturbed range. Young et al. (1979) also felt that exotic annuals, including cheatgrass, did not invade stands of healthy native vegetation.

Many stockmen were enthusiastic about the appearance of the abundant new grass, and erroneously believed it to be superior to the native perennials it had replaced (Stablein 1940, Platt and Jackman 1946). Even though cheatgrass was a poor substitute for the native grasses, at the time of its rapid establishment and spread it was a blessing for the range because it did afford quantities of forage for livestock held on depleted ranges, and afforded some protection from soil erosion when much of the range was overgrazed and denuded of soil cover (Platt and Jackman 1946).

Cheatgrass burns. Because cheatgrass is the most inflammable of the range forage plants, range fires in southern Idaho became more frequent. Cheatgrass range is 500 times more likely to burn than any other rangeland type (Platt and Jackman 1946, Stewart and Hull 1949). Leopold (1941) wrote that it is in fact impossible to protect cheatgrass ranges from fire. Burning is very damaging to big sagebrush-grass communities (Pechanec et al.

1954, Vale 1974). The presence of cheatgrass in these communities can carry fires into areas that would normally not burn (Stewart and Hull 1949, Hull 1965, Pechanec et al. 1954).

Many early stockmen believed that fire did not damage cheatgrass stands (Stablein 1940, Pechanec and Hull 1945), since, once established on an area, cheatgrass will be present the year after it has been burned because cheatgrass seeds are not usually all destroyed by fire (Warg 1938, Leopold 1941). Many southern Idaho stockmen regularly set range fires, because the following year the burned areas were not camouflaged by shrubs or by the previous year's dried growth and so appeared greener (Hicks pers. comm.). Cheatgrass on the range increased very rapidly when fire was combined with overgrazing, which was often the case (Stewart and Young 1939, Leopold 1941, Ellison 1960, Hironaka and Fosberg 1979). Cheatgrass replaced much vegetation on burned areas and came to dominate millions of acres, aided by its own flammability (Stewart and Hull 1949, Klemmedson and Smith 1964, Hironaka and Fosberg 1979).

After cheatgrass became well established in southern Idaho, the pattern of secondary succession was changed. No longer was an initial disturbance necessarily followed by the eventual appearance of native shrubs and grasses. After the invasion of the exotic annuals, the secondary succession pattern became Russian thistle invasion initially, followed by mustard invasion, and finally by cheatgrass establishment. Russian thistle dominated for a year or two, mustards for two or three years, and then cheatgrass became the dominant species (Piemeisel 1951, Hironaka and Tisdale 1963). If undisturbed, cheatgrass stands were in turn invaded by bottlebrush squirreltail and subsequently by other native plants (Hironaka and Tisdale 1963). However, if cheatgrass were burned or grazed, it was able to maintain itself indefinitely (Piemeisel 1938, 1951). Overgrazing combined with burning helped to insure a continuous stand of cheatgrass and to prevent reestablishment of native plants (Piemeisel 1938, 1951, Leopold 1941, Stewart and Hull 1949).

In the years immediately following World War I, cheatgrass made its most rapid advances, colonizing millions of acres of abandoned farmland and disturbed range (Piemeisel 1938, Wentworth 1948, Stewart and Hull 1949). By the late 1920s cheatgrass was abundant in southern Idaho. An *Idaho Statesman* article dated 1 May 1928 reported that the desert bunchgrass had been replaced by grass that "grows in a day, ripens in a day, and blows away in a day." By 1932, the most important plant on Idaho desert ranges was cheatgrass (Rinehart 1932). By 1949, about 4,000,000 acres in Idaho were dominated by cheatgrass, and cheatgrass was an important component of the vegetation on 10,000,000 to 15,000,000 additional Idaho acres (Stewart and Hull 1949). This plant is now the most important forage plant in Idaho (Klemmedson and Smith 1964). The impact of cheatgrass is difficult to comprehend, for it has literally changed the appearance of southern Idaho (Young et al. 1979).

#### SUMMARY

At the turn of the century, the alien annual plants Russian thistle, tansymustard, tumble-mustard, and cheatgrass invaded the native plant communities of southern Idaho after having first become established on canal banks, city streets, construction sites, road shoulders, abandoned farmlands, and railroad rights-of-way. Abusive grazing and burning weakened the native plant communities and opened the vegetation to invasion by these plants. The alien plants changed the patterns of secondary succession in southern Idaho and also altered the carrying capacity of the range, the amount of soil erosion, and the frequency of fires. Continued burning and excessive grazing allowed these annuals to become dominant on millions of acres of land in southern Idaho. The face of southern Idaho has been changed by the invasion of these exotic plants.

#### ACKNOWLEDGMENTS

I thank Graham Smith for his guidance and support during the course of this research. Tom Kucera, Robert Smith, and Karen Steenhof critically read the manuscript and offered



useful suggestions. The assistance of Katherine Bettis, Jane Houston, Ann Joslin, and others of the Idaho State Library was of great value in locating sources. John Lamborn of the Merrill Library, Utah State University, aided me in using the Works Progress Administration History of Grazing files and gave me access to the Stoddart literature collection. The Idaho Historical Society allowed me to use their extensive photograph file and to reprint the photograph that appears herein. This research was supported by USDI-BLM Contract 52500-CT5-1002, Dr. Donald R. Johnson, principal investigator, Department of Biology, University of Idaho, Moscow.

#### LITERATURE CITED

- BEATLEY, J. C. 1973. Russian thistle (*Salsola*) species in the western United States. *J. Range Manage.* 26:225-226.
- BLAISDELL, J. P. 1953. Ecological effects of planned burning of sagebrush-grass range on the upper Snake River Plains. USDA Tech. Bull. 1075. 39 pp.
- CHAPLINE, W. R. 1936. Excessive stocking. Pages 151-172 in USDA Forest Service. The western range. 74th Congress, 2d session. Senate document 199.
- CLAPP, E. H. 1936. The major range problems and their solutions. Pages 1-80 in USDA Forest Service. The western range. 74th Congress, 2d session. Senate document 199.
- DETTING, L. E. 1939. A revision of North American species of *Descraineria*. *Amer. Midl. Nat.* 22:481-519.
- DEWEY, L. H. 1896. Migration of weeds. USDA Yearbook, 1896. Pages 263-286.
- ELLISON, L. 1960. Influence of grazing on plant succession of rangelands. *Bot. Rev.*, 26:1-66.
- ELLIOTT, T. C., ed. 1913. Journal of John Work's snake country expedition of 1830-31. Second Half. Quarterly of the Ore. Hist. Soc., 14:280-314.
- FERRIN, T. M. 1935. Typed statement, October 21. In Works Progress Administration, History of grazing. Manuscript Files. Utah State Univ., Logan.
- FREMONT, J. C. 1845. Report on the exploring expedition to the Rocky Mountains in the year 1842 and to Oregon and north California in the years 1843-44. Gales and Seaton, Washington. 693 pp.
- FULTON, A. C. 1965. Tales of the trail. Payette Radio Ltd. 378 pp.
- GIBBS, R. 1976. Beckoning the bold, story of the dawn of Idaho. Univ. Press of Idaho, Moscow. 267 pp.
- GRIFFITHS, D. 1902. Forage conditions on the western border of the Great Basin, being a report upon investigations made during July and August 1901, in the region between Winnemucca, Nevada, and Ontario, Oregon. U.S. Bureau of Plant Industry. Bull. 38. 52 pp.
- HANLEY, M., AND E. LUCIA. 1973. Owyhee trails: the West's forgotten corner. Caxton Printers, Caldwell, Idaho. 314 pp.
- HIRONAKA, M., AND M. A. FOSBERG. 1979. Non-forest habitat types of southern Idaho. Interim report. Coll. of For., Wildl. and Range Sci. Univ. of Idaho, Moscow. In fascicles.
- HIRONAKA, M., AND E. W. TISDALE. 1963. Secondary succession in annual vegetation in southern Idaho. *Ecol.*, 44:810-812.
- HICKS, O. R. 1979. Idaho pioneer. Pers. comm.
- HODGESON, C. W. 1948. Idaho range cattle industry: early cattle days in Idaho. A manuscript prepared for classes in animal husbandry. Univ. of Idaho, Moscow. 33 pp.
- PECHANEC, J. F., AND A. C. HULL, JR. 1945. Spring forage lost through cheatgrass fires. *Nat'l Wool Grower*, 35:13.
- PECHANEC, J. F., J. D. PICKFORD, AND G. STEWART. 1937. Effects of the 1934 drought on the native vegetation of the upper Snake River Plains, Idaho. *Ecol.* 18:490-505.
- HULL, A. C., JR. 1965. Cheatgrass—a persistent homesteader. Pages 20-26 in Proceedings of the cheatgrass symposium, USDI-BLM, Oregon-Washington state offices, 27-30 July, Vale, Oregon.
- HULL, A. C., JR., AND J. F. PECHANEC. 1947. Cheatgrass—a challenge to range research. *J. Forestry* 45:555-564.
- HULL, A. C., JR., AND G. J. KLOMP. 1966. Longevity of crested wheatgrass in the sagebrush-grass type in southern Idaho. *J. Range Manage.* 19:5-11.
- \_\_\_\_\_. 1974. Yield of crested wheatgrass under four densities of big sagebrush in southern Idaho. USDA Agr. Res. Serv. Tech. Bull. No. 1483. 11 pp.
- HULTZ, F. S. 1934. Development of the range sheep industry. *Amer. Cattle Prod.* 14:3-7.
- HUTCHINGS, S. S., AND G. STEWART. 1953. Increasing forage yields and sheep production on intermountain winter ranges. USDA Forest Serv. Circ. No. 925. 63 pp.
- IDAHO STATESMAN. Anon. May 1, 1928. Mustang finds champion in veteran range rider.
- IRVING, W. 1907. The works of Washington Irving, Vol. 10: Bonneville. Jenson Soc., Portland, Oregon. 524 pp.
- KEITH, J. R. 1938. When the long horned cattle of Texas came to Idaho territory. *Idaho St. Hist. Soc. 16th Rep.* 1937-38:41-49.
- KENNEDY, P. B. 1903. Summer ranges of eastern Nevada sheep. *Nev. St. Univ. Agr. Exp. Sta. Bull.* No. 55. Reno. 55 pp.
- KENNEDY, P. B., AND S. B. DOTEN. 1901. A preliminary report on the summer ranges of western Nevada sheep. *Nev. St. Univ. Agr. Exp. Sta. Bull.* No. 51. Reno. 57 pp.
- KLEMMEDSON, J. O., AND J. G. SMITH. 1964. Cheatgrass (*Bromus tectorum* L.). *Bot. Rev.*, Apr.-June:226-262.
- KLOMP, G. J. 1965. Studies in rehabilitation of cheatgrass ranges. Pages 51-54 in Proceedings of the cheatgrass symposium, USDI-BLM, Oregon-Washington state offices, July 27-30, Vale, Oregon.
- LEOPOLD, A. 1941. Cheat takes over. *The Land* 1:310-313.



- MCARDLE, R. E. 1936. The virgin range. Pages 75-116 in USDA Forest Service. 74th Congress, 2d session. Senate document 199.
- MEACHAM, C. M. 1979. The south alternate of the Oregon Trail, in the Snake River birds of prey study area. Unpublished report. Boise District, Bureau of Land Management. 30 pp.
- MURRAY, R. B., AND J. O. KLEMMEDSON. 1968. Cheatgrass range in southern Idaho: seasonal cattle gains and grazing capacities. *J. Range Manage.*, 21:308-313.
- PECHANEC, J. F., AND A. C. HULL, JR. 1945. Spring forage lost through cheatgrass fires. *Nat'l Wool Grower*, 35:13.
- PECHANEC, J. F., J. D. PICKFORD, AND G. STEWART. 1937. Effects of the 1934 drought on the native vegetation of the upper Snake River plains, Idaho. *Ecol.* 18:490-505.
- PECHANEC, J. F., G. STEWART, AND J. P. BLAISDELL. 1954. Sagebrush burning good and bad. *USDA Farmers' Bull. No. 1948*. 34 pp.
- PIEMIESEL, R. L. 1938. Changes in weedy plant cover on cleared sagebrush land and their probable causes. U.S. Dept. of Agric., Washington, D.C. *Tech. Bull.* 654.
- . 1951. Causes affecting change and rate of change on a vegetation of annuals in Idaho. *Ecol.* 32:53-72.
- PICKFORD, G. D. 1932. The influence of continued heavy grazing and of promiscuous burning on spring-fall ranges in Utah. *Ecol.* 13:159-171.
- PLATT, K., AND E. R. JACKMAN. 1946. The cheatgrass problem in Oregon. *Oregon St. Fed. Coop. Ext. Serv. Bull.* 668, Oregon St. Coll., Corvallis.
- REIDL, W. A., K. H. ASAY, J. L. NELSON, AND G. M. TELWAR. 1964. Studies of *Eurotia lanata* (winterfat). *Wyoming Agric. Expt. Sta. Bull.* 425. 18 pp.
- RINEHART, E. F. 1932. The Idaho range, past and present. Unpublished thesis, Univ. of Idaho, Moscow. 50 pp.
- ROOT, R. 1955. Journal of travels from St. Josephs to Oregon with observations of that country together with a description of California, its agricultural interests, and a full description of its gold mines, in 1848. *Biobooks*, Oakland, California.
- SHIRK, D. 1956. The cattle drives of David Shirk from Texas to the Idaho mines, 1871 and 1873. *Champeog Press*, Portland, Oregon. 148 pp.
- STABLEIN, J. E. 1940. Regional grazer typed statement. In *Works Progress Administration, History of grazing*. Manuscript files. Utah State Univ., Logan.
- STEWART, C. L. 1979. Idaho resident. Pers. comm.
- STEWART, G. 1936. A history of range use. Pages 119-134 in USDA Forest Service. 74th Congress, 2nd Session. Senate Document # 199.
- STEWART, G., AND A. C. HULL, JR. 1949. Cheatgrass (*Bromus tectorum* L.)—an ecologic intruder in southern Idaho. *Ecol.* 30:58-74.
- STOVER, J. M. 1940. Statement by J. M. Stover regarding range and grazing history in and surrounding the Weiser National Forest. Typed manuscript. In *Works Progress Administration, History of grazing*. Manuscript files. Utah State Univ., Logan.
- SWEETSER, L. H. 1935. Narrative of the livestock history and range conditions of that area surrounding and within the Minidoka National Forest. Type-written statement. In *Works Progress Administration, History of grazing*. Manuscript files. Utah State Univ., Logan.
- TAYLOR, R. C. 1940. Idaho Statesman, February 4. Nampa's white sage fed cattle for Boise Basin's miners in 1864.
- TISDALE, E. W., M. HIRONAKA, AND M. A. FOSBERG. 1969. The sagebrush region in Idaho, a problem in range management. *Idaho Agric. Expt. Sta. Bull.* 512. 15 pp.
- TOWNSEND, J. 1839. Narrative of a journey across the Rocky Mountains to the Columbia River, reprinted. Pages 107-639 in Thwaites, R., ed., 1906. *Early western travels*. Vol. 2. Arthur H. Clarke Co., Cleveland, Ohio.
- USDA FOREST SERVICE. 1936. The western range. 74th Congress, 2nd Session. Senate Document # 199. 620 pp.
- USDI, BUREAU OF LAND MANAGEMENT. 1965. Proceedings of the cheatgrass symposium. Oregon-Washington state offices. July 27-30, Vale, Oregon.
- . 1947. Idaho range management program report. In fascicles.
- VAHLBERRY, E. C. 1940. Special range report R-4. Statement of E. C. Vahlberry concerning range and game conditions and range use on the public domain adjacent to the Boise, Payette and Weiser National forests. In *Works Progress Administration, History of grazing*. Manuscript files. Utah State Univ., Logan.
- VALE, T. R. 1974. Sagebrush conversion projects: an element of contemporary environmental change in the western United States. *Biol. Cons.* 6:274-284.
- WARG, S. A. 1938. Life history and economic studies on *Bromus tectorum*. Unpublished thesis, Univ. of Montana, Missoula. 38 pp.
- WEAVER, J. E. 1917. A study of the vegetation of southeastern Washington and adjacent Idaho. *Univ. Studies*, Vol. 17. 114 pp.
- WENTWORTH, E. N. 1948. America's sheep trails. Iowa State College Press, Ames. 667 pp.
- WORKS PROGRESS ADMINISTRATION. 1941. History of grazing. Manuscript files. Utah State Univ., Logan.
- WRIGHT, H. A., AND C. M. BRITTON. 1976. Fire effects on vegetation in western rangeland communities. Pages 35-41 in Utah State Univ., Div. of Forestry and Fire Control. *Utah Agric. Expt. Sta. Use of prescribed burning in western woodland and range ecosystems, a symposium*. March 18-19. Logan, Utah. 90 pp.
- WYLIE, M. C. 1976. Melba—seed heart of America, an historical review. Melba Bicentennial Commission and the Owyhee County Historical Society. 27 pp.
- YOUNG, J. A., R. E. ECKERT, JR., AND R. A. EVANS. 1979. Historical perspectives regarding the sagebrush ecosystem. *USDA Sci. and Ed. Admin. Fed. Res. Renew. Res. Cntr.*, Univ. of Nevada, Reno. 13 pp.
- YOUNG, J. A., R. A. EVANS, AND J. MAJOR. 1972. Alien plants in the Great Basin. *J. Range Manage.* 25:194-201.