were either too small and dried up before appropriate utilization of the pasture was reached or they were too large and animals lingered in the vicinity causing excess forage depletion and damage to the surrounding rangeland.

These cases illustrate that even a single small operation in range management requires careful planning. In reality water potential of the region is enormous. It needs only to be carefully assessed, properly developed, and soundly managed. Thus water development programs could be included in a rangeland improvement program to enhance the overall productivity of the region.

It was not until November 1976 that the Cameroon government realized the seriousness of the lack of a range management agency. By decree the Division of Range Management and Division of Range Water Resource Development were created in an attempt to fill the gap. These divisions are in charge of:

- Range water resource research.
- Development and management of range water resources.
- Study and management of rangeland.

The creation of these divisions was an important step towards the improvement of the whole system and the objectives assigned to each of them realistic. However, these objectives can be achieved only if financial means and qualified staff are provided to support these activities.

Although multiple and complex problems have to be solved in order to stabilize the livestock industry in the Lake Chad region, history shows us that the range use pattern of the region had a colorful past. The region south of Lake Chad has been inhabited and exploited by men and women with vision and culture which will not fade away as a dream. Livestock production is still viable but sooner or later it will remain only for those who care and provide effort and hard work.

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Perennial Broomweed and Texas Ranching

Allan McGinty and Tommy G. Welch

Perennial broomweed is a toxic plant that occurs throughout most of the western United States and northern Mexico. This plant is also called slinkweed, turpentine weed, broom snakeweed, threadleaf broomweed, and perennial snakeweed. To further complicate matters, two species of perennial broomweed are found in Texas, *Xanthocephalum sarothrae* and *X. microcephalum* (Correll and Johnston 1970).

Ranchers began to suspect that perennial broomweed was toxic to livestock in the early 1900's. In 1936 perennial broomweed was shown experimentally to cause illness and death in cattle and sheep (Matthews 1936). Clinical signs of broomweed poisoning described included loss of appetite, listless attitude, an arched back, drooping head, and in severe cases, pronounced blood in the urine 24 to 48 hours after the initial signs appeared. No mention was made of the abortive properties of the plant.

A series of feeding trials with perennial broomweed utilizing various classes of livestock were conducted near Marfa, Texas, from 1953 to 1957. Results of these trials expanded the clinical signs of broomweed poisoning to include constipation, periodic vulvar swelling in pregnant cows, an abnormally early udder development in most instances, and a periodic mucous nasal discharge (Dollahite and Anthony 1956 and 1957, and Dollahite and Allen 1959). Also, for the first time abortion was linked to the consumption of perennial broomweed and experimental evidence was obtained to show that plants growing on sandy soils were more toxic than those growing in loams or clays.

Mature perennial broomweed begins its seasonal growth in late winter to early spring. The early growth and production of over 9,000 seeds per plant places perennial broomweed at a significant competitive advantage over perennial grasses (Ragsdale 1969). Ueckert (1979) and McDaniel et al. (1982) reported herbage production on short grass range to be severely reduced under dense stands of perennial broomweed. Ueckert (1979) reported grass production increased from 976 lb/acre to 2,024 lb/acre during the first year after complete control of perennial broomweed. During the second year, grass production on the treated area was 2,569 lb/acre compared to only 606 lb/acre on an adjacent untreated area. Similar work conducted by McDaniel et al. (1982) on a heavily grazed range in poor condition showed grass production increased 36 lb/acre to 373 lb/acre in the first year of complete control of perennial broomweed. During the second and third years after control, production on the treated area

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was 1,216 lb/acre and 904 lb/acre respectively, compared to 390 lb/acre and 226 lb/acre on an adjacent untreated area.

Economic losses from toxic plants are difficult to quantify. Losses may be classified as either direct or indirect. Direct losses include death and abortion loss of livestock. Indirect losses are reduced weaning weights, low conception rates, or reduced production of desirable forage due to competition with the toxic plant. Direct losses can be estimated with some accuracy; however, indirect losses are often obtained by more subjective procedures.

Dollahite and Allen (1959) stated that abortions due to perennial broomweed consumption occurred regularly among grazing cattle in western Texas, with losses of 10 to 60 percent of the calf crop common. They estimated the average annual abortion loss was as high as $500,000 in some counties, with the average loss for Texas at $2 to $3 million per year.

Perennial Broomweed Survey

In 1984, a Texas A&M University System advisory committee of west Texas ranchers identified perennial broomweed as the plant having the greatest negative economic impact on the west Texas ranching industry. They requested a survey to update the information available on the distribution of perennial broomweed in Texas and to determine the impact of the weed on the livestock industry.

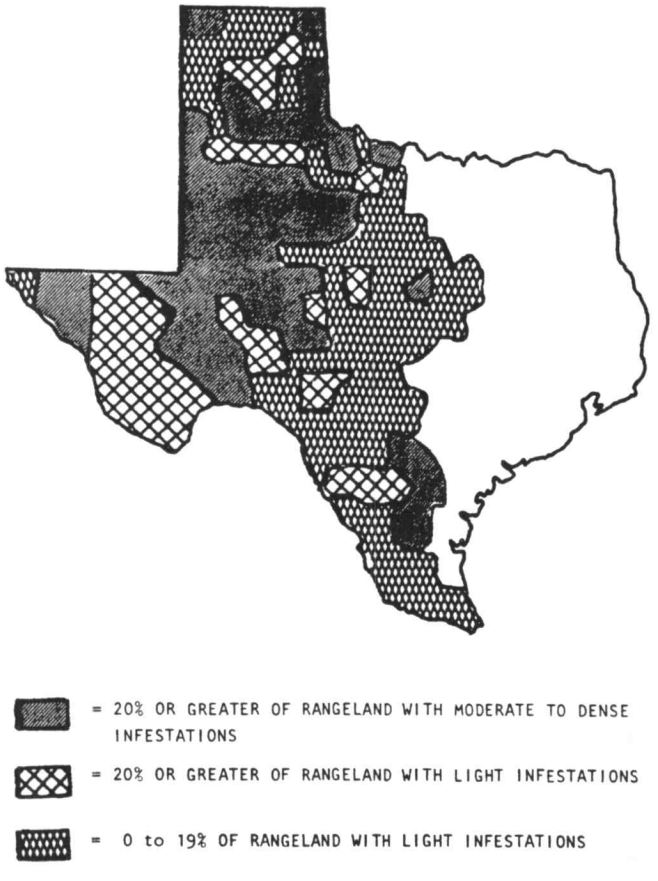

Fig. 1. *Distribution of perennial broomweed in Texas.*

A survey consisting of 16 questions was mailed to the county Extension agents of 148 counties in the western half of Texas. Over 95 percent of the survey forms were returned. The area surveyed represented the general range of distribution of perennial broomweed within the state. The survey requested information on the amount of perennial broomweed within each county, its effect on livestock forage production, animal health problems associated with the plant, and perennial broomweed control measures utilized within the county.

Each County Extension Agent was encouraged to obtain input from his county range and livestock committee and the Soil Conservation Service. Livestock prices and statistics for 1984 were used to calculate the economic impact of perennial broomweed (Texas County Statistics 1984).

Distribution and Forage Impact

The survey results showed that 21.8 million acres of the approximately 100 million acres of Texas rangeland were infested to some degree with perennial broomweed. This represents 22 percent of the total rangeland in Texas, and 35 percent of the 148 central and western counties surveyed.

Three categories were used to define the degree of infestation: (1) dense infestation (perennial broomweed dominates total vegetation), (2) moderate infestation (perennial broomweed significant part of vegetation) and, (3) light infestation scattered plants). Survey data showed 4 million acres classified as densely infested, 7.2 million acres moderately infested and 10.6 million acres with a light infestation. This represents 4, 7.2 and 10.6 percent of Texas rangeland, respectively. Areas of greatest density of perennial broomweed are in the High Plains and Trans-Pecos regions of the state (Figure 1).

Severe forage loss was reported on 4.3 million acres of Texas rangeland. Moderate forage loss occurred on 6.1 million acres and 10.0 million acres suffered only small losses of range forage. Expressed as a percentage of the total Texas rangeland this represents 4.3, 6.1, and 10.0 percent, respectively. These results relate very closely to the areas classified as dense, moderate, and lightly infested by perennial broomweed.

Livestock Health Problems

Livestock health problems, related to perennial broomweed, occurred on less than 50 percent (9.5 million acres) of the total acreage of rangeland infested. Presumably, this is a result of lower toxicity of perennial broomweed on fine textured soils.

When classified according to degree of livestock health problems, 0.69 million acres had severe livestock losses (death and abortion) due to perennial broomweed. Moderate losses were found on 2.1 million acres and small losses on 6.7 million acres. The southern High Plains and Trans-Pecos regions of the state had the greatest livestock health problems caused by perennial broomweed (Figure 2). This is the area with the greatest perennial broomweed density and acreage of sandy soils.

Cattle death loss caused by perennial broomweed in the 148 county area averaged 0.96 percent (approximately 21,120 head) annually. Losses for individual counties ranged from 0 to 10 percent. The abortion rate for cattle averaged 2.86 percent or approximately 24,550 calves. For

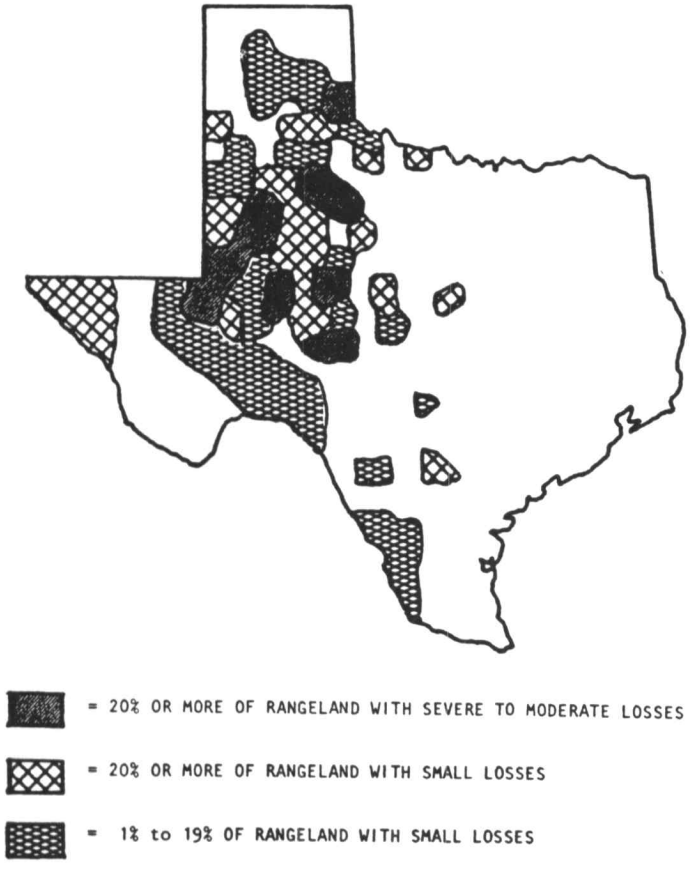

Fig. 2. *Distribution in Texas of livestock health problems associated with perennial broomweed.*

individual counties this figure ranged from 0 to 20 percent.

Both death and abortion losses were somewhat lower for sheep as compared to cattle. Death loss in the sample area averaged 0.72 percent (12,270 head) with a range of 0 to 7 percent for individual counties. Abortion losses for sheep were estimated at 1.3 percent (13,900 lambs) with individual counties ranging from 0 to 15 percent.

Goats, which have a relatively high resistance to perennial broomweed poisoning (Dollahite and Allen 1959), had an estimated death and abortion loss of only 0.38 and 0.7 percent (870 and 1,985 head, respectively). Individual county estimates for both ranged from 0 to 5 percent.

Data on death and abortion loss for each county sampled were combined with 1984 Texas county livestock statistics and 1984 livestock prices to estimate the total direct economic impact of perennial broomweed on the Texas livestock industry. The direct annual loss was calculated to be $16.9 million. This loss estimate is conservative for most years because livestock numbers were lower as a result of severe drought during 1983 and 1984.

Indirect losses such as forage reduction and poor animal performance, can be estimated to be at least a similar amount, resulting in a total annual loss of $34 million. The economic impact may be expected to increase in the future because 57% of the counties surveyed reported the extent and severity of problems associated with perennial broomweed were increasing.

Table 1. Reasons ranchers do not attempt to control perennial broomweed. Frequency of responses reported by counties surveyed.

Reason	% of Total
Expense	75%
Do Not Recognize Problem	26%
Lack of Control	22%
No Problem	18%
Lack of Concern	16%
Miscellaneous	7%

Control

Only 5.3% of the producers with perennial broomweed infestations utilized control practices. Cost was the major reason listed for not utilizing control methods (Table 1). Also listed were lack of control, lack of concern, do not recognize the problem, or there is no problem.

The survey requested information on the cost ranchers would be willing to pay for both short-term (1 to 2 years) and long-term (5 to 7 years) control. The average maximum that would be paid was $2.79/acre for short-term control, and $6.46/acre for long term control. Currently commercial applicators charge more than $9.00/acre for herbicide and application.

Table 2. Methods used to control perennial broomweed. Frequency of responses reported by counties surveyed.

Method	% Using
Picloram (Grazon PC)	44%
2,4-D	35%
Dicamba (Banvel)	12%
Tebuthiuron (Graslan/Spike)	10%
2,4,5-T	6%
Picloram (Grazon 10K)	4%
Shredding	13%
Fire	10%
Rootingplowing	6%
Miscellaneous	10%

The survey showed that the herbicide picloram (Grazon PC) was the most popular control practice used by ranchers (Table 2). The next most popular practice was 2,4-D, Banvel (dicamba), Graslan (tebuthiuron), 2,4,5-T, Grazon 10K (10 percent picloram pellets), shredding, fire, and rootplowing were also listed.

Summary

Perennial broomweed is a toxic plant that infests almost 22 million acres of Texas rangeland. Livestock health problems associated with this plant were reported on 9.5 million acres. Only 5% of Texas ranchers with perennial broomweed problems used control practices. The herbicide picloram was the most popular treatment. Expense was the major reason for not controlling perennial broomweed. Counties surveyed reported ranchers were willing to pay $2.79/acre for 1 to 2 years of control and $6.46/acre for 5 to 7 years of control. Direct economic loss (death and abortion) caused by perennial broomweed in Texas was estimated at $16.9 annually. The survey indicated the infestation of perennial broomweed

and problems associated with this plant are increasing. Research and educational programs are needed to help ranchers manage perennial broomweed infestations more effectively.

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Knapweed Infestation

Darcy A. Yule

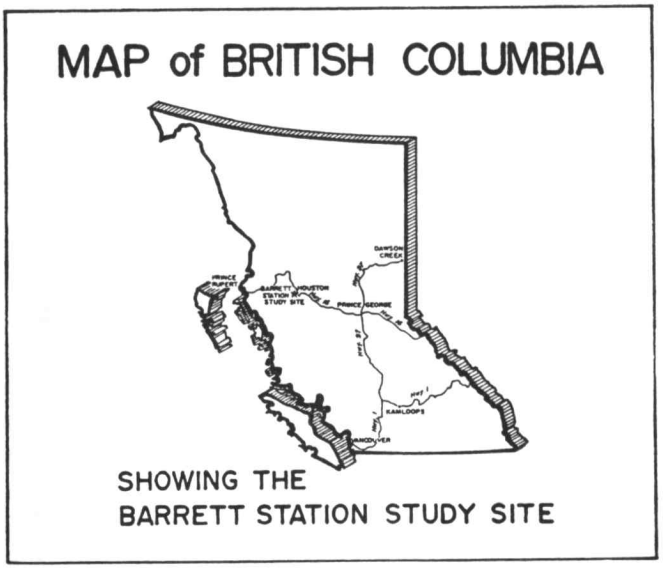
Spotted knapweed is a rangeland pest of south and central British Columbia and of the northwest United States. The plant has invaded rangelands in an overgrazed condition and areas of soil disturbance. Fortunately, knapweed has never gained a foothold on the forested rangelands of west central B.C. (Prince George to Prince Rupert). Periodically, however, small infestations have been observed along the main highway (#16) and railway corridors. These infestations have been identified and eradicated, using picloram, as quickly as possible by the Provincial Ministries of Highways or Agriculture, Regional Districts (counties), or the Canadian National Railway (C.N.R.).

Mrs. E.R. Jaarsma, an adjacent ranch owner, first reported an infestation of spotted knapweed at the Barrett Station C.N.R. siding in the fall of 1983. This siding is located 5 miles west of Houston, B.C., on District Lot 712, CR5. At the time of discovery, all stages of knapweed development—dead mature, rosette with stems, and rosette—were present.

Knapweed can over-winter as a rosette or as seed. In the following year, the plant may produce one or two flowering stems. However, in future years as the plant matures, a bushy, multi-stemmed plant develops.

Based on knapweed's development habits and the initial discovery year (1983), the time of initial seed introduction had to have occurred prior to or during the 1981 growing season. Thus, at the time of this study (July 1984), the infestation had begun its fourth growing season. There was an interest in assessing the rate of spread of knapweed in terms of the area covered since initial infestation.

The author at the time of this study was the Regional Range Officer, B.C. Forest Service, Smithers, B.C. He is now the B.C.F.S. District Manager at Box 40, McBride, B.C., Canada V0J2E0.



Site Description

The Barrett Station siding is about 5 hectares in size. There are three sets of railway tracks: the main line, the primary siding, and the secondary siding. The three tracks are roughly 2 meters apart and cover a strip of land, 12 meters wide, centered in the middle of the right of way. Along the secondary siding there was a small portable sawmill which milled railway ties for the C.N.R.

The plant cover of the area varies, with native plants such as willow, fireweed, cow parsnip, wildrye, and fringed brome dominating the undisturbed area and tame grasses and legumes (Kentucky bluegrass, creeping red fescue, Timothy,