

# Survey for Spotted Knapweed in North Dakota

Paul M. Bultsma and Rodney G. Lym

Spotted knapweed (*Centaurea maculosa* Lam.) is a noxious weed of pasture and rangeland in many states and Canada. The weed reduces forage production, decreases range carrying capacity (Maddox, 1982), and forms solid stands because of allelopathic effects on other plants (Fletcher and Renney, 1963). The flower shoots are utilized in over grazed areas but have high fiber content and little nutrient value (Watson and Renney, 1974). The rosettes are not grazed. Forage production often is decreased by 50 to 75 percent and reseeding of desirable species usually is required after an infestation has been controlled (French and Lacey, 1983). The growth inhibitor in spotted knapweed is found in the leaves and does not persist once the plant is controlled (Fletcher and Renney, 1963).

Spotted knapweed is native to Europe (Frankton and Mulligan, 1970) and was first introduced into British Columbia as a contaminant in alfalfa seed about 1890 (Maddox, 1982; Cranston, 1981). It has since spread to over 4 million acres in Washington, Oregon, Idaho and Montana. Spotted knapweed currently is found in all 56 counties of Montana and infests over 2 million acres (French and Lacey, 1983). Spotted knapweed was discovered in Alberta, Canada, in 1974 but an active control program has limited its spread to only 375 acres in that province, most of which is found along transportation routes and adjacent rangeland (Ali, 1984). It also is found in Minnesota, Wisconsin, and Michigan.

The rate of spread of spotted knapweed may be of greater concern than the present acreage infested. Lacey (1983) calculated that between 1920 and 1980 spotted knapweed spread at an average rate of 27.4 percent per year in Montana. Since much of North Dakota has a climate similar to eastern Montana, spotted knapweed also could become a serious problem in North Dakota.

A survey was conducted during the summer of 1984 to determine the level of infestation of spotted knapweed in North Dakota. Counties in the southwestern part of the state were emphasized since they border Montana counties with known infestations. Also, the presence of other perennial and persistent weeds was noted.

## DESCRIPTION

Spotted knapweed is a biennial or short-lived perennial reproducing by seeds (Figure 1). Seeds are brownish, 1/8

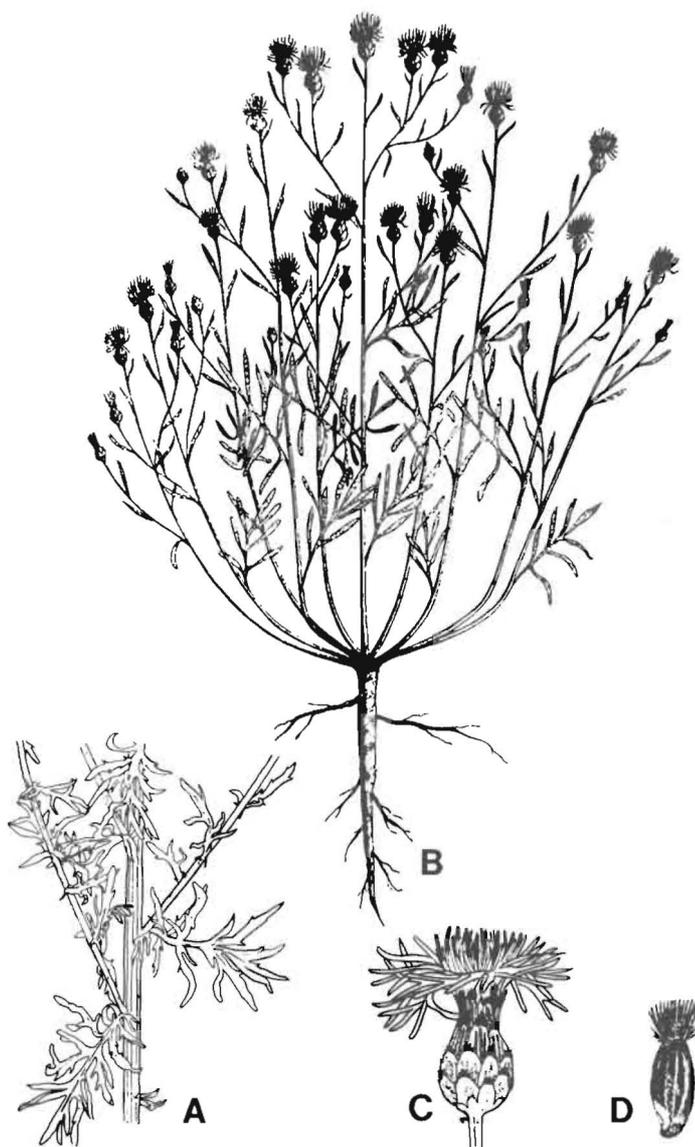


Figure 1. Spotted knapweed including A. portion of stem showing deeply divided leaves; B. entire plant with tap root and flower heads; C. single flower head with black bracts; and D. seed with notched base and tuft of bristles at tip.

Bultsma is area grasslands agent, Cooperative Extension Service, Dickinson and Lym is assistant professor, Department of Agronomy. Tom Ward is acknowledged for many hours of field work related to the 1984 North Dakota Knapweed Survey.

inch long, with a short tuft of bristles at the tip. Seeds may germinate from spring to fall and seedlings over-winter as a rosette. The following spring, the plant will produce a flower stalk 2 to 4 feet tall. The leaves are alternate, deeply divided, bluish green and smaller in size near the top of the stalk. Flowers are usually purple to lavender and are produced from late June through September. The flower petals are surrounded by stiff, black-tipped bracts, giving the flower head a spotted appearance.

### SURVEY METHODS

Bowman and Slope counties were systematically surveyed in 1984. Six hundred and eighty-five survey stops were made at two-mile intervals along all improved roads in the two counties as well as that portion of Interstate 94 (I-94) between Belfield and Beach, North Dakota. All railroad and road intersections were surveyed. The Little Missouri River was surveyed in four random one-mile by 100 feet sections between where the river enters the state and where it intersects I-94. Other counties in southwestern North Dakota were surveyed through public service announcements (PSAs), news releases and county agent announcements at public meetings that encouraged land owners to report locations of spotted knapweed. Thirteen additional weeds, generally perennials, were surveyed during the Bowman and Slope county portion of the study.

Eastern North Dakota was surveyed less intensively. Data were exchanged with the North Dakota Public Land Department which was conducting a concurrent survey, and state herbarium specimens were searched for previous records of spotted knapweed locations. Herbariums surveyed included those at Dickinson State College, Minot

State College, Northern Prairie Wildlife Research Center, University of North Dakota and North Dakota State University.

### RESULTS AND DISCUSSION

Spotted knapweed was found at 34 locations in North Dakota during the 1984 survey (Figure 2). All sites were small with only a few plants except for the sites near Stump Lake in Nelson county and at Marmarth in Slope county which covered 2 and 20 acres, respectively. Approximately 25 total acres of spotted knapweed were found in North Dakota.

Spotted knapweed was not found along the banks of the Little Missouri River. Weed species that were found along the river included common cocklebur (*Xanthium strumarium* L.), curlycup gumweed, downy brome (*Bromus tectorum* L.) and fringed sage. No effort was made to determine the density or distribution of each weed. In general, the surveyed area bordering the Little Missouri River was more weed free than were road ditches.

Thirteen locations of spotted knapweed were found in Morton County (Figure 2). All but one were found along I-94. Most were very small patches or scattered individual plants, usually on the road shoulder rather than in the right-of-way. The other locations in Morton County consisted of three subsites found initially in 1983 on the Northern Great Plains Research Center. These patches were along the route of a buried telephone cable installed in 1979.

Characteristics common to all spotted knapweed infestations were soil disturbance and a large volume of public

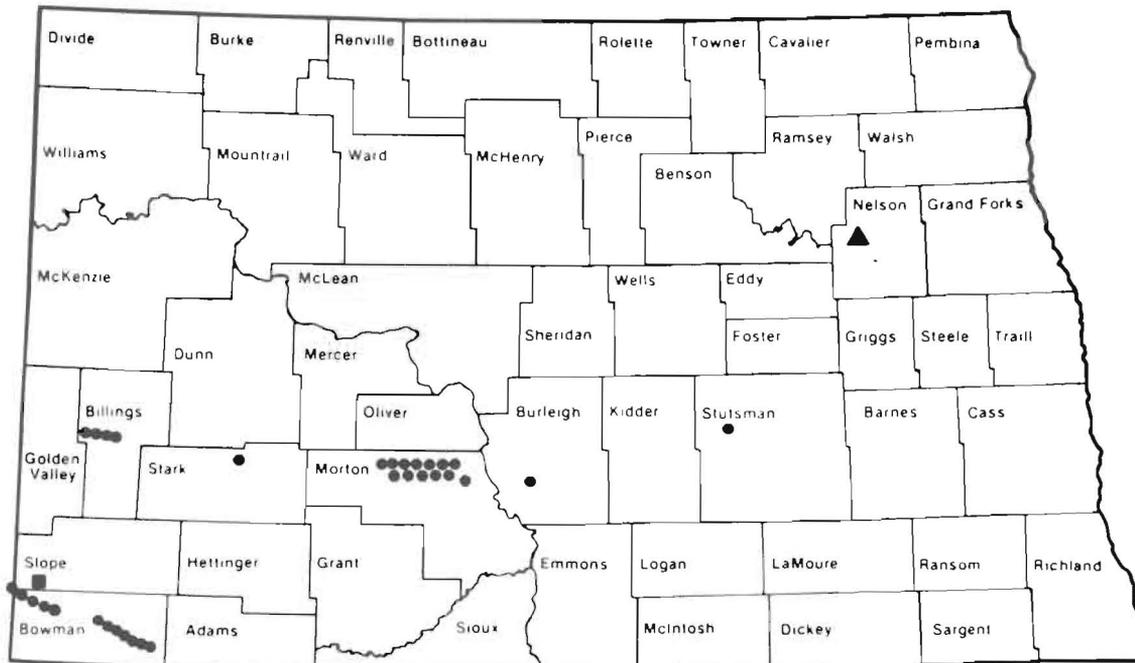


Figure 2. Locations of known spotted knapweed infestations in North Dakota in 1984. All infestations consisted of less than 12 plants except the Marmarth (■) and Stump Lake (▲) locations which were 20 and 2 acres, respectively.

traffic. Spotted knapweed was found associated with I-94 and other paved road shoulders, livestock sales barns, parking lots, grain elevators, railroad and utility right-of-ways. Many locations were within city limits. Spotted knapweed was not found on any grassland areas or associated with any gravel or dirt roads.

Spotted knapweed is easily caught in the undercarriages of vehicles and spread for great distances. It also is spread by transporting contaminated hay to non-infested areas. Several infestations found along I-94 and State Highway 12 had been partially cut for hay. Movement of this hay could cause a rapid spread of knapweed seed throughout the state. The disturbed soil at livestock feeding sites provides a very suitable location for establishment.

The Northern Prairie and the North Dakota State University botanical herbariums were the only herbariums with voucher specimens of spotted knapweed. The Northern Prairie herbarium contained a specimen of spotted knapweed collected along a railroad track near Woodworth, North Dakota in 1970. The infestation was still present in 1984. Spotted knapweed specimens at the North Dakota State University herbarium and year collected included Cass County, 1956; Stark County, 1960; Nelson County, 1966 and 1968; Cavalier County, 1974 and Kidder County, 1977. Collection data with these specimens indicated five came from road sides and one from near a grain elevator. Soil disturbance at the site in Nelson county included a lake inlet, an unused roadbed and a water line.

Other weeds found during the survey included curlycup gumweed, which was the most common weed found in Bowman and Slope counties and was observed at 248 survey locations (Table 1). Fringed sage and field bindweed were found at 112 and 101 locations, respectively. Leafy spurge was only found at 15 of the survey locations and 10 were along unpaved roads.

## CONTROL

The best spotted knapweed "control" is prevention. The plant generally is easy to control with herbicides but an area must be monitored for several years after treatment and retreated as necessary for seedling control.

Picloram (Tordon) at 0.25 to 0.5 pound (1 pint to 1 quart) per acre will control spotted knapweed plants and seedlings for two or three years. The residual control period may be shorter on gravel soils, in wet areas, and where soil organic matter is high. The best application time is when the plant is in the rosette growth stage in the fall or in the bud to bloom stage in the spring.

Dicamba (Banvel) at 1 to 2 pounds (1 to 2 quarts) per acre gives good control of spotted knapweed but residual control of seedlings is less than with picloram. A follow-up treatment after two years or more with 2,4-D at 1.0 pound (1 quart of a 4-pound-per-gallon concentration) per acre may be needed to prevent reinfestation by seedlings. The optimum application time is similar to picloram.

Spotted knapweed can be controlled in the rosette stage in the fall or early spring by 2,4-D at 2 pounds (2 quarts of a 4-pound-per-gallon concentration) per acre. Application of 2,4-D is not very effective when applied after stem elongation of spotted knapweed. There is no residual control with 2,4-D so annual spraying for several years is necessary until spotted knapweed seed is no longer viable.

Spotted knapweed should be treated as soon as detected to prevent it from spreading. The granular formulations of picloram and dicamba are convenient for treating small, well defined infestations. Granular picloram at 0.5 pounds per acre and dicamba at 2 pounds per acre (1/8 cup of Tordon 2K or Banvel 10G per 100 square feet) are needed for spotted knapweed control. Treatment should be extended 10 to 15 feet beyond the border of the spotted knapweed patches to control roots and seedlings.

## SUMMARY

Spotted knapweed was noticed most frequently on disturbed sites like road ditches and railroad right-of-ways and associated with recently installed utility lines. The weed then apparently spreads to adjoining grassland areas. Rangeland in poor condition is susceptible to spotted knapweed invasion. Historical observations from other states indicate spotted knapweed can spread rapidly, causing damage to a large number of acres in a short time.

Eradication of spotted knapweed from North Dakota may be possible because only small areas are currently infested. Uninfested areas must be protected in the state by preventing spread and eradicating spotted knapweed where it currently exists. The weak link in preventing spread will probably be finding existing patches before rapid expansion begins. The presence of spotted knapweed in surrounding states and provinces dictates that a continuing preventive control program will be necessary, even if the current instate infestations are eliminated. Spotted knapweed has the potential of becoming a worse problem than leafy spurge in North Dakota because of its rapid rate of spread. However, since control programs are being implemented 20 to 30 years earlier than with leafy spurge, it can be prevented from becoming a serious weed problem in North Dakota.

## LITERATURE CITED

- Ali, Shaffeek. 1984. Knapweed eradication program in Alberta. Proc. Knapweed Symposium. Plant and Soil Sci. Dept. and Coop. Ex. Service. Montana State Univ. Bull. 1315.
- Cranston, R. 1981. Knapweed, its cause and effect in British Columbia. 12 pp. Ministry of Ag. and Food. Parliament Buildings, Victoria, B.C. B8W 227.
- Fletcher, R.A. and A.J. Renney. 1963. A growth inhibitor found in *Centaurea* spp. Can. J. Plant Sci. 43:475-481.

Frankton, C. and G.A. Mulligan. 1970. Weeds of Canada. Can. Dept. Agric. Publ. 948. 217 p.

French, R. and J. Lacey. 1983. Knapweed, its cause, effect and spread in Montana. Coop. Ex. Service. Montana State Univ. Circ. 307.

Lacey, J. 1983. A complete takeover by knapweed in 2001. Montana Farmer - Stockman.

Maddox, D.M. 1982. Biological control of diffuse knapweed (*Centaurea maculosa*). Weed Sci. 30:76-82.

Watson, A.K. and A.J. Renney. 1974. The biology of Canadian weeds Part 6. *Centaurea diffusa* and *C. maculosa*. Can. J. Plant Sci. 54:687-701.

**Table 1. Summary of surveyed areas during 1984 in Bowman and Slope counties, and along I-94 between Belfield and Beach, ND.**

Weed name	County roads				I-94	Total
	Bowman		Slope			
	Paved <sup>a</sup>	Unpaved	Paved <sup>a</sup>	Unpaved		
Spotted knapweed ( <i>Centaurea maculosa</i> Lam.)	6	0	5	0	4	15
Russian knapweed ( <i>Centaurea repens</i> L.)	0	0	0	2	0	2
Curlycup gumweed ( <i>Grindelia squarrosa</i> (Pursh) Dunal)	34	123	16	101	24	298
Fringed sagebrush ( <i>Artemisia frigida</i> Willd.)	5	42	4	60	1	112
Field bindweed ( <i>Convolvulus arvensis</i> L.)	24	50	7	0	20	101
Missouri goldenrod ( <i>Solidago missouriensis</i> Nutt.)	0	40	1	20	3	64
Flodman thistle ( <i>Cirsium flodmanii</i> (Rydb.) Arthur)	5	21	3	10	6	45
Leafy spurge ( <i>Euphorbia esula</i> L.)	2	5	3	5	0	15
Perennial sowthistle ( <i>Sonchus arvensis</i> L.)	4	9	0	0	0	13
Canada thistle ( <i>Cirsium arvense</i> (L.) Scop.)	3	8	0	0	2	13
Common ragweed ( <i>Ambrosia artemisiifolia</i> L.)	0	0	6	0	14	20
Absinth wormwood ( <i>Artemisia absinthium</i> L.)	1	0	0	2	1	4
Common milkweed ( <i>Asclepias syriaca</i> L.)	3	0	0	0	0	3
Foxtail barley ( <i>Hordeum jubatum</i> L.)	3	0	0	0	0	3
Kochia ( <i>Kochia scoparia</i> (L.) Schrad.)	0	0	2	0	0	2
Total stops	53	281	28	241	82	685

<sup>a</sup> Paved roads often paralleled railroad tracks, and observations from railroad tracks are included with paved road sitings.