SPOTTED KNAPWEED AND OTHER *CENTAUREA'S*: BIOLOGY, DISTRIBUTION, AND MANAGEMENT. Celestine A. Duncan, Consultant, Weed Management Services, PO Box 1385, Helena, MT 59624.

The genus *Centaurea* includes 37 weedy species in the United States, of which spotted knapweed, diffuse knapweed, and yellow starthistle are the most problematic. These three species are well adapted to a wide range of habitats including open forests, rangeland, wildland, roadsides, pastureland, riparian areas, and ditch banks. Yellow starthistle is native to southern Europe and western Eurasia. The weed was introduced into California about 1869 and is currently reported in 41 of 50 states infesting 14.8 million acres in the U.S. More than 98% of existing infestations occur in California, Idaho and Oregon. Diffuse knapweed is native to grassland and shrub steppes of eastern Mediterranean and western Asia, and was first reported in western North America in 1907. In the United States, the primary range of diffuse knapweed is western states including Oregon, Washington, Idaho, and Colorado that report 1.8 million acres or 99% of infested acres nationwide. Of the three species, spotted knapweed is the most problematic across the U.S. and is currently reported in all states except Alaska, Texas, Oklahoma and Mississippi. Spotted knapweed was introduced to the Pacific Northwest from Europe in 1893, and currently infests 6.9 million acres in the United States. About 75% of infested acres occur in Montana, Idaho, Oregon, and Washington with significant infestations reported in the Midwest including Kentucky, Michigan, Minnesota, Missouri, and Wisconsin. This abstract will focus on biology and management of spotted knapweed since it is the greatest concern in North Central states.

Spotted knapweed is a non-native, tap-rooted, biennial or perennial forb that can live at least 9 years. The weed reproduces entirely from seed. Seed production ranges from 465 to 3,716 seeds/ft^2, or about 1,000 seeds per plant under rangeland conditions. Seeds can survive in soil for at least 8 years and are dispersed by wildlife, livestock, humans and their vehicles, as contaminants in crop seed and hay, and by flowing water. Spread rate across the U.S. ranges from 10 to 24% annually. The plant is adapted to a wide range of environmental conditions and has been reported at elevations ranging from 98 to 9,000 ft and in precipitation zones ranging from 10 to 30 inches.

Management requires an integrated approach utilizing prevention, herbicides, biological control agents and grazing animals. There are several herbicides available to effectively control spotted knapweed and land mangers should consider site conditions and label guidelines when choosing a herbicide. Aminopyralid at 1.25-1.75 oz ae/ac, clopyralid at 4 to 6 oz ae/ac, and picloram at 4 to 6 oz ae/ac provides excellent control of spotted knapweed (and other invasive *Centaurea's*) for up to two years following treatment. Application of 2,4-D at 32 oz ae/ac and dicamba at 8 to 16 oz ae/ac will provide fair to good control of spotted knapweed for one year following treatment. Adding 2,4-D to dicamba will increase control over dicamba alone.

Cultural control includes livestock grazing, fire, and seeding desirable vegetation. Clipping spotted knapweed (either mowing or with livestock) at late bud growth stage will reduce seed production, but may not impact weed density. Hand pulling will effectively control knapweed; however it is cost prohibitive on most sites. Prescribed burning has generally been ineffective for controlling knapweeds, and may increase weed density. Establishing desirable perennial plant communities following treatment of either knapweed or starthistle is critical to maintaining long term control.

Introduction of biological agents has effectively reduced populations of spotted and diffuse knapweed. Significant reductions in spotted knapweed density has been recorded in Montana largely due to combination of effects of a root weevil (*Cyphocleonus*) on mature plants, and three seed head insects (*Larinus minutus, L. obtusus*, and *Urophora affinis*) on knapweed soil seed bank. Significant reductions of diffuse knapweed have occurred in the Pacific Northwest due primarily to the seed head weevil *Larinus minutus*. Insects alone and combined with other management methods may prove cost effective for long term management of knapweed.

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