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Montana Noxious Weed Survey and Mapping System

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Explains how individual landowners can participate in a statewide noxious weed-mapping project; gives detailed instructions for doing so.

The primary objective of weed surveying and mapping is to accurately identify and delineate land with populations of unwanted plants. These surveys are conducted so scientists and managers can predict those areas potentially subject to weed invasion; understand the biology of the invasion process and determine means by which weeds spread; develop, implement and evaluate weed management plans; assess the economic impact of weed invasion and increase public awareness, education and weed management efforts.

Weed survey information is collected and compiled into maps showing the distribution and severity of infestation. Weed monitoring involves repetitive surveys to track weed populations over time. A standardized system of weed surveying and mapping is necessary to provide consistently reliable information that can be compared from year to year. Further, a standardized system allows weed survey data to be incorporated into a statewide weed survey database for the production of statewide noxious weed maps.

In Montana, representatives from federal, state and county agencies—as well as industry and private individuals—developed guidelines and standards for a statewide noxious weed survey and

mapping system. This MontGuide introduces the Montana Noxious Weed Survey and Mapping System. It discusses the standardized mapping procedures developed for the system, including type and scale of base maps to be used, how to designate infested areas on the map, symbols to use for percent cover, codes for indicating weed species and the type of drawing instruments to use when hand-drawing weed infestations on base maps.

Additional information on data recording methods, computer mapping systems, the Global Positioning System (GPS), combining data collected by different methods, software compatibility considerations and digital base layers available for computer mapping will be available in a forthcoming Extension Bulletin. We are also working on establishing standards for mapping biological control releases. Contact us for more information.

The specific objectives of the Montana Noxious Weed Survey and Mapping System are:

- to determine and record locations of noxious weeds in Montana,
- to accurately calculate the total number of acres infested for each weed on the state noxious weed list,
- to determine how fast noxious weeds are spreading by comparing weed inventories from year to year.

This effort represents the beginning of a noxious weed inventory for the state of Montana that can be continually updated. As more weed managers participate in the program, a greater portion of the state will be accurately mapped. The ultimate goal of this project is a complete inventory of all noxious weeds in the state, a process that will take several years.

Statewide mapping procedures

Type and scale of base maps

Weed survey maps may be created by hand-drawing infestation boundaries on base maps, using a computerized mapping system such as ArcView or CountyCAD, or by collecting location coordinates of weed infestations using Global Positioning System (GPS) technology. For those who are hand-drawing weed infestations on base maps, USGS 1:24,000 scale (7.5 minute series) maps should be used. This scale is appropriate for weed management planning and can easily be consolidated into 1:100,000 scale county and statewide maps.

In counties where detailed soil surveys have been completed, aerial photographs may be available (contact the Natural Resources Conservation Service for information). Aerial photographs show good detail and can be used to locate your position and draw in surveyed weed

infestations. However, unless they are geodetically corrected¹, it will be difficult to incorporate the infestations into statewide maps because they cannot be digitized. Orthophotos are geodetically corrected aerial photographs. They are distortion-free and can be digitized. If the aerial photographs are not geodetically corrected, the weed delineation could be drawn on them and then later transferred to a topographic map which can be digitized.

Weed managers have also considered using satellite imagery for base maps. At this time, most available satellite imagery does not have high enough resolution to be used for weed mapping. Satellite imagery with high spatial resolution will probably be available at a reasonable cost sometime in the next five to ten years.

Berol® Verithin® color pencils should be used to designate weed infestations on hand-drawn maps


A problem with hand-drawn maps is that the accuracy of mapping can be affected by the size of the drawing instrument. A line $\frac{1}{32}$ of an inch wide (1 mm) on a 1:24,000 scale USGS map is equal to 62.5 feet on the ground. If a felt pen is used to mark the perimeter of a weed infestation, it may appear larger than if a No. 2 pencil is used. Therefore, a standardized size of drawing instrument should be used to delineate weed infestations. For the Montana Noxious Weed Survey and Mapping System, Berol® Verithin® color pencils were chosen. If the pencils are kept sharp, the line width is about $\frac{1}{64}$ of an inch (0.5 mm). This line width represents about 30 feet on a 1:24,000 scale map. The pencils come in sets of 24 colors (15 of these will be used to designate Montana's category 1, 2 and 3 noxious weeds), have strong, long-lasting lead and are light-fast and waterproof. They work well with both paper maps and mat

acetate or Mylar overlays. They are erasable. Berol® Verithin® pencils can be purchased at many office supply and art supply stores. Mat acetate and Mylar can be purchased at most art supply stores and copy centers. A convenient size to use with 7.5 minute topographic maps is 18" x 24". The overlay should be smaller than the topographic map so it can be taped to the map. Be sure to use drafting tape to avoid tearing the map. Mylar overlays should be sprayed with a map fixative so pencil markings don't smear. Topographic maps usually have four "+" marks that can be used for lining up the overlay on the map. These should be marked carefully on the overlay.

Symbols for designating infested acres

Before mapping weed infestations, **outline** the survey area on the map and write the **date** of the survey in the upper right corner of the outlined area. Areas inside the survey boundary without size and location designations will be considered weed free. Map the infested areas using the following symbols to designate the size and locations of the infestations (symbols should be centered over the infestation sites).

Infestation Size

- x = less than 0.1 of an acre
- △ = 0.1 to 1 acre
- = 1 to 5 acres
-  = areas larger than 5 acres should be outlined directly on the map
- ~ = infestations that follow linear features such as roads and streams should be designated by drawing lines on the map

In addition to drawing the line on the map, record the following information:

1. Width of line. Record the width of the weed infestation in meters or yards next to the line drawn on the

base map.

2. Direction of weeds from line. Next to the line, write an L, R, or C depending on where the weeds are located (i.e. are the weed infestations to the left, right or in the center of the line you have drawn on the base map?)

Each weed species should be designated by the WSSA 5 letter code and the appropriate color.

Noxious weeds should be designated by their Weed Science Society of America-approved computer codes from the **Composite List of Weeds**, Revised 1989, available from WSSA, 1508 West University Ave., Champaign, IL 61821-3133 (and shown for some common Montana weeds in Table 1). Each plant on Montana's state noxious weed list should also be color coded according to Table 1. Standardized color coded designations by weed species facilitate map interpretation.

Indicate percent cover by species

Mapping systems for weed management planning must be simple and the data must be easy to collect. Weed cover has been determined to be the most important standard data to be collected for the statewide system. Cover may be estimated as a percent of the ground covered by a particular weed species. Estimates are categorized by cover class. Cover class should be indicated directly on the map next to the infested acres symbol. Use the following symbols to indicate infestation cover class.

Cover Class

- T = (Trace; rare): less than 1% cover.
- L = (Low; occasional plants): between 1 and 5% cover.
- M = (Moderate; scattered plants): between 5 and 25% cover.
- H = (High; fairly dense): between 25 and 100% cover.

Additional information (such as weed density or growth stage) is optional and can be noted on either base maps or clear overlays.

¹ There are changes in scale across an aerial photograph due to the particular configuration of platform altitude, camera system alignment and topography. The image must be rectified so it matches with a "correct" map of the earth. This process is called rubber-sheeting and results in a geodetically correct image that can be reliably used in a GIS.

Table 1. Five-letter codes and color designations for the 15 Montana noxious weeds.

Noxious weed species Common name	Scientific name	WSSA 5-letter code	Designated color (Berol Verithin/ white box) ¹	Designated color ¹ (Prismacolor Berol Verithin/black box) ¹
Category 1				
leafy spurge	<i>Euphorbia esula</i>	EPHES	Green (739)	Peacock Green (739)
Canada thistle	<i>Cirsium arvense</i>	CIRAR	Tuscan Red (746 ^{1/2})	Tuscan Red (746 ^{1/2})
Russian knapweed	<i>Centaurea repens</i>	CENRE	Carmine Red (745)	Terra Cotta (745 ^{1/2})
spotted knapweed	<i>Centaurea maculosa</i>	CENMA	Lavender (742 ^{1/2})	Parma Violet (742 ^{1/2})
diffuse knapweed	<i>Centaurea diffusa</i>	CENDI	Light Grey (734 ^{1/2})	Warm Grey (734 ^{1/2})
field bindweed	<i>Convolvulus arvensis</i>	CONAR	Pink (743)	Deco Pink (743)
whitetop (hoary cress)	<i>Cardaria draba</i>	CADDR	Sky Blue (740 ^{1/2})	Peacock Blue (740 ^{1/2})
Dalmatian toadflax	<i>Linaria dalmatica</i>	LINDA	Canary Yellow (735)	Canary Yellow (735)
St. Johnswort (goatweed)	<i>Hypericum perforatum</i>	HYPPE	Olive Green (739 ^{1/2})	Olive Green (739 ^{1/2})
sulfur cinquefoil	<i>Potentilla recta</i>	PTLRC	Orange (737)	Orange (737)
Category 2				
dyer's woad	<i>Isatis tinctoria</i>	ISATI	Grass Green (738)	Grass Green (738)
purple loosestrife	<i>Lythrum salicaria</i>	LYTSA	Purple (752)	Dahlia Purple (752)
purple loosestrife	<i>Lythrum virgatum</i>	LYTVI	Black (747)	Black (747)
Category 3				
yellow starthistle	<i>Centaurea solstitialis</i>	CENSO	Ultramarine (740)	Ultramarine (740)
common crupina	<i>Crupina vulgaris</i>	CJNVU	Violet (742)	Violet (742)
rush skeletonweed	<i>Chondrilla juncea</i>	CHOJU	Scarlet Red (744)	Scarlet Red (744)
¹ Because of a change in ownership there are two versions of the Berol® VERITHIN® pencil packs. The original set comes in a white box. The new set comes in a black box. There are slight differences in the color names and numbers. Please use the colors listed in the column that refers to your box. Please choose different colors for mapping other county-designated noxious weeds not listed here.				

Density (optional)

Note number of plants per square yard or square meter

Growth Stage (optional)

- S = Seedling Fl = Flower
- B = Bolt SS = Seed Set
- Bd = Bud M = Mature

Using weed survey data for county-level management

Weed data and maps can be used to develop a county weed management plan based on land-use objectives. Critical management and environmental information such as weed species present, extent and severity of weed infestations, and environ-

mental conditions (e.g. sensitive areas) can be determined from maps. Maps can also be used to direct the implementation of the weed management plan. They show the location of areas needing attention and can be used to set priorities, estimate needs for equipment, supplies and labor, and to guide action crews. Once the plan is implemented, maps can be used to evaluate weed management strategies by comparing initial maps with subsequent maps to find out how weed infestations have changed over time. This information should be used to identify portions of the plan which do not meet management objectives and to adjust management

strategies.

Maps can also be used to predict those areas potentially subject to weed invasion and guide surveys of land adjacent to infested areas. In addition, they can be used as communication tools for public awareness and education, and for calculating the economic and ecological impacts of noxious weed invasion.

Submitting data to the statewide weed mapping system

Weed survey data collected according to the procedures described in this document can be incorporated into the Montana Noxious Weed Survey and Mapping System statewide weed database. The consoli-

dated statewide database is the basis for maps showing areas in Montana infested with noxious weeds, and for calculations of the total number of acres known to be infested with each weed. The spread of noxious weeds will be tracked by comparing weed inventories from year to year. This information facilitates assessment of weed management programs and can help identify areas with successful weed management strategies.

The statewide weed maps will be based on a scale of 1:100,000 and show county boundaries, towns, major roads and waterways, as well as locations of weed infestations. Weed data may be submitted to the statewide system as hand-drawn infestations on topographic maps or orthophotos, or as digital files in one of the formats described under "Software Compatibility Considerations" in the forthcoming Extension Bulletin. All data submitted to the statewide system must be accompanied by a completed "Metadata Form" which is available from Diana

Cooksey at the address below. Hand-drawn maps will be digitized, then incorporated into the statewide geographic database. The Montana Noxious Weed Survey and Mapping System will use ARC/INFO and ArcView software to maintain the weed inventory and produce maps.

Education and training will be available each year for interested weed managers and supervisors. A weed mapping workshop will include training on standardized mapping procedures, survey methods and mapping techniques. Field exercises will include weed mapping using topographic maps, orthophotos and GPS receivers. The workshop will also provide hands-on use of desktop mapping programs, and information for making GPS and GIS purchasing decisions. Take-home training materials will be given to workshop participants.

Where to submit weed data and maps

Data to be incorporated into the Montana Noxious Weed Survey and Mapping System should be sent,

along with a completed Metadata Form, to Diana Cooksey, Department of Plant, Soil and Environmental Sciences, MSU-Bozeman, Bozeman, MT 59717. Questions about the system should be directed to Diana Cooksey at (406) 994-5684 or Roger Sheley at (406) 994-5686.

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For more information about noxious weeds, see the MSU Extension Service MontGuide *Understanding Montana's Noxious Weed Law* (MT 9605 AG).

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