North American Invasive Plant Mapping Standards

Approved by:
North American Weed Management Association
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Endorsed by:
Federal Interagency Committee for the Management of Noxious and Exotic Weeds

Who Has Signed on?

NPS	**Arizona**	**Nevada**
USFS	**California**	**New Mexico**
USFWS	**Colorado**	**Oregon**
BLM	**Idaho**	**Utah**
USGS	**Montana**	**Wyoming**

Individual Counties within:
North Dakota, South Dakota, Minnesota
Discussions with:
Washington
Alaska
Pennsylvania
The New England States
Alberta, Canada

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Chapter 1

Introduction

The efforts to control invasive plants have often been described as a war on weeds. By many estimates, we are losing this war. In order to be more effective, many weed managers are adopting a more strategic approach. One of the most overlooked, and often most critical determinant of who wins a war is the intelligence gathered prior to any action occurring on the field. The same holds true for improving the efficiency and success of invasive weed management.

The Benefits of Invasive Species Inventories

With limited budgets for weed management, it can seem hard to justify spending money on weed inventories or maps. Wouldn't that money be better spent toward actual weed management? The best justification can be found in Steve Dewey's brochure, *Noxious Weeds: A Biological Wildfire*. Dewey applies wildfire management principles to invasive weed management. When fighting fires, the first priority is to contain the fire and extinguish spot fires outside the perimeter of the fire. Trying to fight a wildfire without any idea of its size, direction of spread, rate of spread, and other relevant information, would jeopardize the lives of the fire fighters. Correspondingly, trying to manage an invasive weed infestation without similar information jeopardizes the efficiency of control efforts and wastes time and money. With maps or inventory information, a strategy focused on removing new and isolated infestations and containing the principle infestation can be developed, the same principle used for wildfires. Once contained, the size of the infestation is reduced, working from the outside in.

In addition to enabling weed managers to prioritize which part of an infestation to treat first, the use of invasive weed inventories can increase the efficiency of almost any method of weed management. Combining weed inventories with other layers of information, such as soil types and water table depths, helps weed managers select the most safe and effective herbicide for a location. By utilizing weed inventories to help with biological management of noxious weeds, distribution of the control agents can be optimized. Inventory information can be used to help plan volunteer weed pulling efforts. Invasive species inventories will not kill weeds, but are an invaluable planning tool to help get the most out of limited weed management dollars.

Inventories can also be useful in the planning phases of management efforts, maps and inventory information are critical to monitoring efforts. No matter what tool is used to manage weeds, monitoring should be done to evaluate the effectiveness and make sure the area has not been re-infested. Many of the invasive plant species have a seed viability extending past what realistically can be committed to memory. There are many county weed supervisors who know by

heart where every weed infestation in their county is located. Should anything happen to these people, the epitaph on their headstone could read, "Here lays the county's entire weed inventory". By putting this information onto paper maps or into computer databases, weed management efforts can continue past the duration of a particular person's career.

The information gleaned from invasive weed inventories can also be used to help fit weed management into the larger picture of maintaining the health and integrity of an ecosystem. Currently, invasive species are the second largest contributor to native species becoming threatened and endangered species. Invasive weed inventories provide the data necessary to further quantify impacts of invasive weeds on native ecosystems.

One of the most important benefits of weed inventories lies in their use as a tool for generating awareness. If a picture is worth a thousand words, a map is worth at least that many. Whether the audience is county commissioners, state legislators, congressmen, special interest groups, or the general public, being able to tie the problem back to their area of interest dramatically increases their receptiveness and interest in the problem.

When invasive species awareness projects are discussed, the need for heightened awareness among elected officials is almost always mentioned. Obviously, it's important for the people who control the funds for managing public lands to understand one of the biggest threats to the health of those public lands. Even among weed scientists and other invasive species experts, there is uncertainty about the exact size of the problem we are facing. It is estimated that an additional 5000 acres of public land in the west are infested each day by invasive weeds. However, it can be incredibly difficult to find figures showing the acreage of infestation for a specific national forest or national park. Finding infested acreage figures for areas that span jurisdictional boundaries, such as a county or watershed, can be even more difficult. Without inventory information it is almost impossible to provide policy makers with realistic figures on what types and amounts of resources are necessary to combat invasive species successfully.

This effort should be supported and encouraged by elected officials for several reasons. First, it will provide better policy-making information. Resources and money can be allocated according to the severity of infestations in an area. Second, it improves the ability to predict spread and implement appropriate prevention measures *before* infestations require costly management programs. Lastly, making it easy for agencies to share inventory information instead of different agencies collecting the same data over and over reduces costs.

Coordinated Mapping

The benefits of weed inventories laid out in the previous section are nothing new to weed managers. In fact, most weed managers already use some form of weed

inventory. The various forms range in complexity from simple stick pens in maps hanging on the wall of their office to GIS based inventories on a computer.

The reason for NAWMA's effort to create the minimum standards outlined in this document is to increase the ability to share information. This effort is not intended to create a single database, but rather to create minimum standards so that all information being collected is compatible. Furthermore, these are intended to be the *minimum* standards. The standards address the most basic information necessary to compare invasive species problems across tribal, county, state, national, and even international borders.

This minimum level of information is not intended to discourage individual counties, agencies, or other entities from collecting additional information. For example, inventories done for research purposes will collect a whole range of information not mentioned in these standards, such as soil type, a description of the vegetative community being invaded, and perhaps the slope of the site. The research objectives would determine the amount of additional information needed. If the researcher is not using a standardized inventory protocol, then the information collected is useful only to the research project. By using these standards, the information collected for the research project could be incorporated with inventories serving other purposes, thereby widening the usefulness of the collected information. By collecting similar information that can be shared across the nation, more money is made available to treatment efforts instead of duplicated inventories done on the same weed infestations.

Who Should Use These Standards?

These standards were designed to be compatible with most existing invasive species inventories. Their purpose is not to add another level of work to weed managers, but to lighten their workload by making it possible to share information across boundaries. Of course, for the full benefit of the standards to be realized, everyone involved in weed management needs to adopt the standards.

Realizing that the most critical part of standards lies in their acceptance, these standards were developed with consultation from a wide range of representation from those involved in invasive species issues. Hopefully, any concerns that you have with these standards were addressed in the review process. Every effort was made to make these standards as user friendly as possible, while still providing information that is essential at every level of weed management form the site of the infestation to national and international levels. NAWMA sincerely hopes that you will find these standards to be useful and adopt them as the minimum standard for your invasive species inventories.

Chapter 2

Inventory and Monitoring Standards

This chapter describes the basic information necessary to inventory and monitor invasive plant populations. These data and mapping standards have been agreed to by a group of weed professionals and scientists and represent the minimum or core information necessary to characterize a weed infestation.

There are three basic elements of a weed inventory: what is the weed; where is it located; and finally how large is the infestation. This chapter contains the data fields that are required to satisfy these basic inventory elements. A sample field form is located in Appendix F or can be obtained at the NAWMA web site, www.NAWMA.org. In many instances you may wish to collect additional information about the site and the environment that the weeds inhabit; such other plants in the area, elevation, aspect and soils. Some suggestions for additional information are located in the following chapter.

This chapter is organized into basic data fields. Each of the data field/subject area is divided into the following subheadings:

Data Field Name: This is name that will appear on the inventory form and on requests for information between agencies, states and weed management areas. It will be name that is used to share like information between users. It will provide common vocabulary for sharing information.

Definition: Provides a description and explanation of the data field.

Why it is Useful? Describes why this information may be important and how it will be useful in describing weed infestations.

Core Element: This tells you whether this is a core or required data field. Some data elements are very common and useful for weed inventories but will not be required for the information sharing; these will be called optional fields. Only required fields will be used for integrating and sharing information across ownerships.

Coding: Describes the proper way information should be entered

Data Value: This tells you whether the field is made up of numbers, numeric. The field can also be made up of text or a combination of text and numbers, called alphanumeric. The number sequence that follows indicates how many digits (field width) and decimal points are allowed in the field.

Example: Provides a sample of the proper coding.

Collection Date

Field Name: Collection Date

Definition: The date the weed infestation was observed in the field. It does not refer to the date information was entered into the computer.

Why is it useful: This field tells you when the inventory was conducted. It provides information on the time of year plants were observed. A weed infestation may look very different in the spring of the year or in the fall of the year after flowering and seed formation. This field also tells you how old your information is; last month, last year, or ten years ago. These cues will help you decide how reliable the information is and whether a follow-up visit to the site may be warranted. Changes in the size and density of a weed population from one visit to the next form the basis of monitoring.

Core Element: Yes, this is a required field.

Coding: Enter the date where YYYY equals the four digits or numbers of the year (2002), mm equals the two digit representation of the month (10) and dd stands for the two digit representation for the day of the month (03). The date will be in the following format yyyymmdd.

Data Value: Numeric (8,0)

Example: A knapweed site was visited on October 3, 2002. You would record:

Collection date: 20021003

Examiner

Field Name: Examiner

Definition: The individual who collected the information in the field, at the site of the infestation.

Why is it useful: This is useful information when several individuals may have contributed to an inventory. Within a countyor a Weed Management Area, private landowners, the public, road crews, county

agents, scout troops and government employees may all have contributed to the survey. A name allows the person compiling the inventory to verify and correct any questions on the information.

Core Element: Optional, this is useful at the field office level but is not a core element and will not shared between entities.

Coding: Enter the full name of the individual who collected the data.

Data Value: Alphanumeric (50,0)

Example:

Examiner: Ronald J. Weed

Plant Name

Field Name(s): Genus, Species, Intra specific (optional), Authority

Definition: These fields will contain the scientific or species name of the weed. The scientific name consists of the genus name followed by the species name, in Latin. Some plants are further classified into subspecies or variety. Lastly, the individual who first classified the plant and assigned the scientific name is called the authority.

Why is it useful? Scientific names are in Latin and can be intimidating and cumbersome to learn, but they have a decided advantage over common names. These Latin, scientific names provide a universal code or language for naming plants, so people all over the world will use the same name. Even when the name changes due to new discoveries or new information, a trail of synonyms or conserved names is retained so the plant can still be identified. Scientific names also show how groups of plants are related.

Core Element: Genus and species are required elements. Subspecies and authority are optional.

Coding: Enter the Genus and species name as it appears in either your plant key, the PLANTS Database (http://plants.usda.gov/plants/index.html) or from the tables that appear in Appendix A.

Data Value(s):

Genus: Alphanumeric (2,0)
Species: Alphanumeric (30,0)
Intraspecific: Alphanumeric (30,0)
Authority: Alphanumeric (20,0)

Example: The scientific name for yellow star thistle is: Centaurea soltitialis L. You would record:

Genus: Centaurea **Species**: soltitialis **Authority:** L.

Common Name

Field Name: Common name

Definition: The English or Spanish name for the plant.

Why is it useful: These are the weed names most commonly used in conversation. They are often descriptive like yellow star thistle and are always in the spoken language of the country. The common names are easy to pronounce and remember. Unfortunately, there is no consistency in common names and there may be several regional names for the same plant. Conversely, the same name may refer to several different plants.

Core Element: This is an optional field; common names will not be part of the core data elements. There will be continuing attempts by the Weed Science Society of America, the Plants database and others to list all of the known common names for each species. These efforts will allow an easy crosswalk between the commonly used and the scientific name.

Coding: Enter the common name as it appears your plant field guide, the name you have been taught or from the table that appears in Appendix A.

Data Value: Alphanumeric (25,0?)

Example: One of the common names for: Centaurea biebersteinii is spotted knapweed, you would record:

Common Name: Spotted Knapweed

Plant Codes

Field Name: Plant Code

Definition: 3-10 digit codes for scientific names.

Why is it useful: Plant codes are useful, short cut method for recording plant names in the field. There are many different coding systems in use. Many use some combination of the first two or three letters of the genus and species names. Unfortunately, there have been so many different codes developed over the years it is difficult to agree on a single system, therefore we will continue to rely on the full scientific name for identifying the weed name.

Within the United States, the PLANTS database is attempting to bring consistency to coding plant names. Use of codes from the PLANTS database are highly encouraged. PLANTS is maintained and operated by the United States Department of Agriculture. Tables are available from PLANTS database that will convert these plant codes back to the full scientific name. The Integrated Taxonomic Information System (ITIS), a joint effort between Canada, the United States and Mexico may also be a useful source of plant codes in the future.

Core Element: This is an optional field.

Coding: There are no standardized codes for this data field. The codes used in the PLANTS database can be found at: http://plants.usda.gov/plants/index.html.

Data Value: Alphanumeric (8,0)

Example: The PLANTS database code for Yellow starthistle, Centaurea soltitialis would be as follows:

Plant Code: CENSOL

Infested Area

Field Name(s): Infested Area, Unit of Measure

Definition: Area of land containing one weed species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Areas containing only occasional weed plants per acre do not equal one acre infested. Generally, the smallest area of infestation mapped will be 1/10th (.10) of an acre or 0.04 hectares.

It is highly recommended that only a single weed species be entered for each infested area.

These standards will be applied across North America. Canada and Mexico commonly use hectares to measure land. In the United States acres are the common land measure. Since acres and hectares are not equivalent, it is important to know which system was used to measure the infestation. This field is called the *Unit of Measure*.

Why is it useful: An area of weeds can be defined in many ways and there is little consistency between individuals, counties, states and countries. Is an acre of weeds one weed plant in an acre, an acre covered with weeds or all the lands threatened with invasion from an existing infestation? This definition provides a consistent and common method of describing weed populations. This is the data field that will be used to sum and report weed acres across all ownerships.

Core Element: Both *Infested Area* and *Unit of Measure* are required fields.

Coding: Infested Area: Enter the number of acres/hectares
Unit of Measure: Enter hectares or acres

Data Value: Infested Area: Numeric (9,2)
Unit of Measure: Alphanumeric (9,0)

Example: A 1.6-hectare infestation of oxeye daisy (Chrysanthemum leucanthemum L.) was found outside Vancouver, BC.

Infested Area: 1.6 **Unit of Measure:** hectares

Gross Area

Field Name: Gross Area, Unit of Measure

Definition: This field is intended to show general location and population information. Like *Infested Area* it is the area of land occupied

by a weed species. Unlike *Infested Area,* the area is defined by drawing a line around the general perimeter of the infestation not the canopy cover of the plants. The gross area may contain significant parcels of land that are not occupied by weeds.

Gross area is used in describing large infestations. When a value is entered for gross area, the assumption is that the area within the perimeter of the weed population (area perimeter) is an estimate or the product of calculating the area within a described perimeter. It is *not* a measured value. If a value for *Gross Area* is entered a value for *Infested Area* must still be entered. The value for *Infested Area* is derived from estimating the actual or percentage of land occupied by weed plants.

Why is it Useful? It is useful in describing large infestations or discontinuous infestations on the landscape. For larger weed populations it is very time consuming to plot the actual perimeter of the weed population. The increase in accuracy of plotting individual plants may not be enough to compensate for the increase in cost or manpower. An estimate of land area may be sufficient to meet the inventory and treatment requirements.

Core Element: This is an optional field. A value for *Gross Area* and *Unit of Measure* must both be entered. If a value is entered under *Gross Area* a value must also be entered under *infested area*.

Coding: Gross Area: Enter the number of acres/hectares
Unit of Measure: Enter hectares or acres

Example: A large spotted knapweed infestation is in the West Fork drainage. By driving around the area and looking at aerial photos the weed population is an approximate gross area of 600 acres. There are significant portion of the area that are not infested. It is estimated that approximately 40% of the area is actually occupied, or an estimated 240 acres infested. The value entered in Gross Area is 600 and value entered in Infested Area is 240. .

Gross Area: 600
Unit of Measure: acres
Infested Area**: 240**
Unit of Measure: acres

Canopy Cover

Field Name: Canopy Cover

Definition: Canopy cover will be estimated as a percent of the ground, covered by foliage of a particular weed species. Cover will be recorded as a numeric value. If inventory procedures includes the use of cover classes such as the Greater Yellowstone Area, 10 point codes, Daubenmire codes the mid point of the cover class will be entered as the cover value.

Why is it Useful? Canopy cover is a way to estimate the amount or severity of a weed infestation. Area tells you the extent of the population across the landscape. Canopy cover tells how that weed dominates the vegetation within that area. The greater the canopy cover the more the weeds there are. It is a monitoring tool, providing information on the changes in weed population from year to year.

Core Element: This is a required field

Coding: This field is percent canopy cover and therefore only numbers are an appropriate entry. The field should not exceed 3 digits or numbers. If you are using a cover classes like the Greater Yellowstone Area, 10-point class codes or the Daubenmire cover class codes; enter the mid point of the cover class. There are some examples of these cover classes and the mid point conversion located in Appendix B.

Data Value: Numeric (3,1)

Example:

Canopy Cover: 14

Ownership

Field Name: National Ownership

Definition: The ownership of the land where the infestation is located. Ownership will consist of two, tiered groups. The first tier, National Ownership, will identify broad categories of land ownership, such as federal, provincial, state, county, city and private lands. Codes are available for the various federal agencies and should be entered here. Individual private landowners will not be identified.

Individual state and provincial land management agencies will not be coded in this field. The second ownership field, Local Ownership is reserved for these codes and is described in the following section.

Why is it useful? This field allows information to be grouped or displayed by broad ownership patterns.

Core Element: This is a required field

Coding: Record one of the codes listed in Appendix C

Data Value: Alphanumeric (8,0)

Example: Bureau of Land Management

National Ownership: BLM

Canadian Park Service

National Ownership: CPS

Field Name: Local Ownership

Definition: This second ownership field is reserved for state and local users. There is no consistency in the naming of state and provincial agencies, nor is there consistency in which branch of government manages these lands. It would therefore be difficult to create useful coding conventions for these entities at this time. This field will be available to regional or local entities to define and establish useful codes.

It is also important to maintain the confidentiality for private landowners. The names, addresses and other like information of private individuals; landowners or corporations will not be part of any common data set.

Why is it useful? This field has been requested by and is most useful to state, county and local entities. It will allow information to be grouped by state agencies or local entities like weed management associations.

Core Element: This is an optional field

Coding: Codes for this field will be determined at the local level

Data Value: Alphanumeric (10,0)

Example: Montana Department of Fish, Wildlife and Parks

Local Ownership: MTDFWP

Alberta Sustainable Resource Development (Public Lands)

Local Ownership: ABSRD

Source of the Data

Field Name: Source of the Data

Definition: This field refers to the owner or manager of the data. This may be a different person or entity from the landowner or the person who collected the data. It may be an office manager or a database specialist. This entity that will be responsible for answering questions about the data or be responsible for data requests.

Why is it useful? This provides a contact point for questions about the data and a means to consolidate and coordinate requests for information. This field bridges the gap between the folks that are collecting the information and those that will be managing the data.

Core Element: Required

Coding: This field using the same coding system as for national ownership, described in a previous section.

Data Value: Alphanumeric (5,0)

Example: Banff National Park has been mapping invasive plants. In databasing the inventory information the Canadian Park Service was entered as the data source**.**

Joseph P. Knapson has been given the task of preparing a map showing the spread of Yellow Star Thistle across North America. Joseph finds a record for star thistle north west of Calgary, Alberta. All other information indicates that the farthest north yellow starthistle has been located was in Montana. He would like to validate this finding. Information in the Data_Source field tells him, he should contact Banff National Park and confirm this observation.

Source of Data: CPS

Country

Field Name: Country

Definition: The nation or country in which the infestation is located. Separate records or mapping polygons will be created for infestations that cross international boundaries.

Why is it Useful? This information will facilitate the free exchange of information across international boundaries. Information can be separated or summed based on national affiliations. Statistics on acres of weeds or acres of an individual weed species can easily be obtained. It will result in information such as acres of spotted knapweed in Canada.

Core Element: Required

Coding: Enter the two-digit code for the country. These are the same as postal codes.

Data Value: Alphanumeric (6,0)

Example: An African rue infestation was found on the Sonoran desert in northern Mexico. The information would be entered as follows:

Country: MX

State or Province

Field Name: State_Province

Definition: The state or province where the infestation is located.

Why it is useful? This allows the infestation to be located in a geographic area. It also allows the easy and quick summation of information on weeds at the state or provincial level.

Core Element: This is a required field and must be completed for each infestation or data record.

Coding: This field will use the standard postal codes, which is a two-letter abbreviation for the state or province. A complete list of codes is located in Appendix D.

Data Value: Alphanumeric (2,0)

Example: A dalmation toadflax (Linaria dalmatica (L.) infestation is found outside Vancouver, British Columbia.

State or Province: BC

County or Municipality

Field Name: County_Muncipality

Definition: The county (US, Mexico and Canada) or municipality (Canada) where the infestation is located.

Why is it Useful? This allows the infestation to be located in a local geographic area. It also allows the easy and quick summation of information on weeds at the county or municipality level.

Core Element: This is a required field for all inventories.

Coding: In the United States these are three digit numeric codes, called FIPS. A complete list of county codes is located in Appendix E. Examples of codes from Canada and Mexico are yet to be obtained.

Data Value: Alphanumeric (5,0) (Canada??)

Example: There is an infestation in Humboldt County, Nevada.

County: 013

Hydrologic Unit Code

Field Name: HUC_ Number

Definition: The Hydrological Unit Code or HUC number is a unique number assigned to the 2,000 major watersheds in the United States and Puerto Rico. The United States Geological Survey (USGS) has divided the all the water systems in the US into watersheds using the following system.

1st Level - The first division is into 21 major regions.
2nd Level - The 21 major regions are further subdivided in 222 subregions
3rd Level - The 222 sub regions are further subdivided into 352 accounting units or basins
4th Level – The 352 basins are further subdivided into 2000 cataloging units or subbasins
5th Level – USGS only maintains a numbering system for levels 1-4. Local areas often subdivide 4th level subbasins into watersheds.
6th Level – Local areas often further subdivide 5th Level watersheds into subwatersheds. For more information on HUC see http://water.usgs.gov/GIS/huc.html.

Why is it Useful? Aquatic invasive plants move quickly in streams and rivers. An infestation from a single site can quickly infest an entire watershed. The polygon and point location system to locate weed populations at upland or terrestrial sites does not easily apply itself to aquatic organisms moving in riverine systems. Mapping based on hydrologic boundaries is a more useful way to display these infestations.

Core Element: This is a required field only for aquatic species that are found in streams and rivers. It is an optional field for all terrestrial weed infestations and for aquatic infestation found in lakes and ponds.

Coding: Each hydrologic unit, region, subregion, basin, subbasin, watershed and subwatershed are represented by a two-digit code for a possible total of twelve digits. USGS maintains a standards nationwide coding for only the first four levels; region, subregion, basin and subbasin. You can locate your area and the appropriate code at: http://www.epa.gov/win/address.html

Data Value: Numeric (12, 0)

Example: An infestation a Eurasian water milfoil is located in the South Fork of the Salmon River.

Using USGS standards, the local area has further subdivided this subbasin into the watershed, East Fork of the South Fork of the Salmon River. In this case the HUC number would be as follows:

HUC_Number: 1706220804

Location

Data Field(s): Legal, Latitude and Longitude (Lat-Longs), Universal Transverse Mercators (UTMs)

Definition: The location of an infestation will refer to the center of the infestation or the center of the polygon, which defines it. Today location can be described using a variety of tools; any of the following methods may be used; legal; metes and bounds; Lat-Longs, and; UTMs.

Why is it useful? Location information is essential for invasive species mapping. It allows weed sites to be located on a map, be plotted across landscapes and allows users to relocate a site.

Core Element: Location is a required field. There are four acceptable methods; the user can chose any one of the methods described below. If GIS is used to locate the polygons, the user must also create a data field and enter the center location information for the center of the polygon.

Coding: Use the coding conventions for the chosen location. The designations behind a data field indicate whether or not a field is required for the individual method.

Legal Location:

Data Field: ¼, ¼, ¼, ¼, (optional)
Data Value: alphanumeric (2)
Data Field: ¼, ¼, ¼, (optional),
Data Value(s): alphanumeric (2)
Data Field: ¼, ¼ section (optional)
Data Value(s): alphanumeric (2)
Data Field: ¼ section (optional)
Data Value(s): Alphanumeric (2)
Data Field: Section (required)
Data Value(s): Numeric (2)
Data Field: Township (required)
Data Value(s): alphanumeric (6,1)
Data Field: Range (required)

Data Value(s): alphanumeric (6,1)
Data Element: Meridian (required)
Data Value(s): alphanumeric (20)

Example: An infestation is located along trail in southwest Idaho at NW, NE Section 13, T3N, R2E

Legal Location:
¼, ¼, ¼, ¼:
¼, ¼, ¼,
¼, ¼: NW
¼: NE
Section: 13
Township: 03 N
Range: 02E
Meridian: Boise

An infestation of musk thistle is found in the Province of Alberta in the northwest ¼ of Section 2, Township 26, Range 28, west of the 4th meridian. It would be coded as follows:

Legal Location:
¼, ¼, ¼, ¼:
¼, ¼, ¼,
¼, ¼:
¼: NW
Section: 02
Township: 26
Range: 28
Meridian: W04

Metes and Bounds

Data Element: Metes and Bounds
Data Value(s): Comment field 200+ characters

Example: The same Idaho weed infestation is located using metes and bounds. Metes and bounds is a written description of the boundaries of the site. It is the system often used to describe property boundaries or in the eastern half of the United States where section, townships and ranges have not been described.

Comment Field: Proceed in a NE direction for 100 yards, turn SW for 20 feet …and thence back to the

Latitude and Longitude

Data Field: Datum (required)
Data Value(s): Alphanumeric (15)
Data Field: Latitude Degrees (required)
Data Value(s): Numeric (2,0)
Data Field: Latitude Minutes (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Seconds (required)
Data Value(s): Numeric (2,2)
Data Field: Latitude Direction (required)
Data Value(s): N (all sites in North America are in the North (N) Latitudes Alphanumeric (1)
Data Field: Longitude Degrees (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Minutes (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Seconds (required)
Data Value(s): Numeric (2,2)
Data Field: Longitude Direction (required)
Data Value(s): (All sites in North America are West (W) of Greenwich
Example: The same Idaho infestation is located using Lat/Longs

Latitude/Longitude		**Datum** NAD 1927 Conus		
Latitude:	**Degrees** 4 3	**Minutes** 3 5	**Seconds** 6. 9	**Direction**: N
Longitude:	**Degrees** 1 1 6	**Minutes** __ 9	**Seconds** _4 9. 0	**Direction:** W

UTM

Data Field: UTM Zone (required)
Data Value(s): Alphanumeric (5)
Data Field: UTM_Datum (required)
Data Value(s): Numeric (4,2)
Data Field: UTM Easting (required)
Data Value(s): Numeric (8,2)
Data Field: UTM Northing (required)
Data Value(s): Numeric (10,2)

Example: This same infestation in Idaho is described using UTMs

UTM: UTM Datum Zone 1 1 **UTM Year** 1 9 2 7
UTM Easting 5 6 7 5 0 3. 6 **UTM Northing** 4 8 2 7 8 6 7. 7

Quad Number

Field Name: Quad Number

Definition: This is the identification number, which appears on the corner of the quadrangle (quad) map. In the United States this refers to maps published by the United States Geological Survey (USGS). In Canada these maps are part of the National Topographic System maintained by Geological Survey of Canada

Why is it useful? Quad is an abbreviated name for quadrangle. Quad maps are readily available from USGS, GSC, sporting good stores and other government offices. They show roads, lakes streams and other natural features. Quads are also topographic maps depicting elevations across the landscape. Quads are often available at the NAWMA International Data mapping standard scale of 1:24,000, making them a good base for weed mapping. They also provide a useful link to GIS, since the coordinates for latitude and longitude can be derived from the maps. It is an also an easy way to locate an infestation and its surrounding area on a map.

In Canada a very similar system is used. Showing topography, roads trails, water systems and other man made systems. These maps are available in at the NAWMA International Data mapping standard scales For Canada of 1:20,000 and 1:50,000 in Canada. These maps are available as both paper maps an their electronic equivalent from the National Topographic Data Base (NTDB).

Core Element: This is an optional field

Coding: This is a combination of numbers and letters found on each Quad map.

Data Value: Alphanumeric (15,0)

Example: An infestation is found at Papose Creek in southwest Montana. The infestation is located on the Hilgard Peak Quad.

Quad_Number: 44111-H4-TF-024

An infestation of dalmation toadflax is found at Seven Persons in southeast Alberta. The infestation was located on the Seven Persons quad with the following identification number.

Quad_Number: 072E15

Quad Name

Field Name: Quad Name

Definition: This is the name that appears on the quadrangle map. It often refers to a prominent geographic feature, town or identifiable point in the area.

Why is it useful? See Quad Number in the previous section.

Core Element: This is an optional field

Coding: The is an optional field

Data Value: Alphanumeric (40,0)

Example: An infestation is located in Madison County, Montana. The local weed district has plotted the dalmation toadflax (Linaria dalmatica) infestation on the Hilgard Peak quad map.

Quad_Name: Hilgard Peak, Montana

Chapter 3

Survey Standards

Surveying or mapping for invasive plants can be an expensive and time-consuming activity. It is important to know where and when surveys have occurred, even if no invasive plants were found. Information on the absence of weeds can be as valuable as information on the presence of weeds. For these reasons a number of organizations would like to track areas that have been surveyed and record information related to the survey. This chapter on survey standards is entirely optional and is not part of the international data standards for inventory and monitoring of invasive plants but offers guidelines for consistent collection of this information. The following set of data fields are related only to weed surveys.

Area Surveyed

Field Name: Area_Surveyed

Definition: The field refers to the entire land area that was surveyed for weeds, whether weeds were found or not. Information will be recorded in two data fields, the Area surveyed and a Unit of Measure.

Why is it useful? These fields record information on the extent, or the total area that was surveyed. It allows landowners and land managers to maintain records or the areas that have been looked at/surveyed for weeds and those areas where no surveys have occurred.

Core Element: This is not a required field.

Coding: Area Surveyed: Enter the number of acres/hectares surveyed.
Unit of Measure: Enter hectares or acres

Data Value: Area Surveyed: Numeric (9,2)
Unit of Measure: Alphanumeric (9,0)

Example: In the summer of 2000 Jasper National Park completed surveys in and around park headquarters facilities. The 1,750 hectare survey revealed that no weeds were present.

Area Surveyed: 1750 **Unit of Measure:** Hectares

Type of Survey

Field Name: Type_of_Survey

Definition: This field refers to the survey method. At his time only two survey methods are recognized, observed and remote. Observation refers to surveys that were conducted by direct observation or visiting the site of infestation. The observations can be made in many ways helicopters, vehicles, horseback or on foot. The second option is remote sensing. This refers to any survey that was conducting by using aerial photography, satellite imagery or any method where the infestation was not directly observed.

Why is it useful: Information in this field tells you how the survey was conducted. It can give you information on the relative reliability of the survey. Surveys taken via remote sensing may be relatively accurate but may not give you good site specific information. It tells you whether someone actually was at the site of the infestation and directly observed such things as the species present and the extent of the infestation.

Core Element: This is an optional field

Coding: Enter the type of survey.

Data Value: Alphanumeric (50,0)

Example:

Type of Survey: remote

Date of Survey

Field Name: Survey Begin Date

Definition: This field refers to the date the survey was started. It does not refer to the date that information was entered into the database.

Why is it useful: This field tells you when the survey was conducted. It provides information on the time of year plants were observed. A weed infestation may look very different in the spring of the year or in the fall of the year after flowering and seed formation. Surveys conducted at certain times of year may not reveal certain plants that have already dried up or have yet to emerge in the spring. This field also tells you how old your information is; last month, last year, or ten years ago. These cues will help you decide how reliable the information is and whether a follow-up survey may be warranted.

Core Element: This is an optional field

Coding: Enter the date where YYYY equals the four digits or numbers of the year (2001), mm equals the two digit representation of the month (04) and dd stands for the two digit representation for the day of the month (12). The date will be in the following format yyyymmdd.

Data Value: Numeric (8,0)

Example: A survey of northwest Harney County, Oregon was begun in the spring of 1999.

Survey Date: 19990412

Field Name: Survey Completion Date

Definition: This field refers to the date the survey was completed. It does not refer to the date that information was entered into the database.

Why is it useful: This field tells you when the survey was concluded. It provides information on the time of year plants were observed. The combination of the Survey start Date and the Completion Date tell you how long the survey book to complete and over what season(s) of the year the inventory occurred. A weed infestation may look very different in the spring of the year or in the fall of the year after flowering and seed formation. Surveys conducted at certain times of year may not reveal certain plants that have already dried up or have not yet

emerged in the spring. This field also tells you how old your information is; last month, last year, or ten years ago. These cues will help you decide how reliable the information is and whether a follow-up survey may be warranted.

Core Element: This is an optional field

Coding: Enter the date where YYYY equals the four digits or numbers of the year (2002), mm equals the two digit representation of the month (07) and dd stands for the two digit representation for the day of the month (23). The date will be in the following format yyyymmdd.

Data Value: Numeric (8,0)

Example: The Harney County survey was completed in July of the same year, 1999.

Survey Date: 19990723

Location

Data Field(s): Legal, Latitude and Longitude (Lat-Longs), Universal Transverse Mercators (UTMs)

Definition: The location of a survey will refer to the center of the polygon, which defines it. Today location can be described using a variety of tools; any of the following methods may be used; legal; metes and bounds; Lat-Longs, and; UTMs.

Why is it useful? Location information is essential to identify where the survey has occurred. It allows the survey to be located on a map, be plotted across landscapes and allows users to relocate the survey.

Core Element: There are four acceptable methods, the user can chose any one of the following methods. If GIS is used to locate the polygons, the user must also create a data field and enter the center location information for the center of the polygon.

Coding: Use any of the coding conventions listed below.

Legal Location:
Data Field: ¼, ¼, ¼, ¼, (optional)
Data Value: alphanumeric (2)
Data Field: ¼, ¼, ¼, (optional),

Data Value(s): alphanumeric (2)
Data Field: ¼, ¼ section (optional)
Data Value(s): alphanumeric (2)
Data Field: ¼ section (optional)
Data Value(s): Alphanumeric (2)
Data Field: Section (required)
Data Value(s): Numeric (2)
Data Field: Township (required)
Data Value(s): alphanumeric (6,1)
Data Field: Range (required)
Data Value(s): alphanumeric (6,1)
Data Element: Meridian (required)
Data Value(s): alphanumeric (20)

Example: An infestation is located along trail in southwest Idaho at NW, NE Section 13, T3N, R2E

Legal Location:
¼, ¼, ¼, ¼:
¼, ¼, ¼,
¼, ¼: NW
¼: NE
Section: 13
Township: 03 N
Range: 02E
Meridian: Boise

An infestation of musk thistle is found in the Province of Alberta in the northwest ¼ of Section 2, Township 26, Range 28, west of the 4th meridian. It would be coded as follows:

Legal Location:
¼, ¼, ¼, ¼:
¼, ¼, ¼,
¼, ¼:
¼: NW
Section: 02
Township: 26
Range: 28
Meridian: W04

Metes and Bounds

Data Element: Metes and Bounds
Data Value(s): Comment field 200+ characters

Example: The same Idaho weed infestation is located using metes and bounds. Metes and bounds is a written description of the boundaries of the site. It is the system often used to describe property boundaries or in the eastern half of the United States where section, townships and ranges have not been described.

Comment Field: Proceed in a NE direction

Latitude and Longitude

Data Field: Datum (required)
Data Value(s): Alphanumeric (15)
Data Field: Latitude Degrees (required)
Data Value(s): Numeric (2,0)
Data Field: Latitude Minutes (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Seconds (required)
Data Value(s): Numeric (2,2)
Data Field: Latitude Direction (required)
Data Value(s): N (all sites in North America are in the North (N) Latitudes Alphanumeric (1)
Data Field: Longitude Degrees (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Minutes (required)
Data Value(s): Numeric (2,0)
Data Field: Longitude Seconds (required)
Data Value(s): Numeric (2,2)
Data Field: Longitude Direction (required)
Data Value(s): (All sites in North America are West (W) of Greenwich

Example: The same Idaho infestation is located using Lat/Longs

Latitude/Longitude		**Datum** NAD 1927 Conus		
Latitude:	**Degrees** 4 3	**Minutes** 3 5	**Seconds** 6. 9	**Direction**: N
Longitude:	**Degrees** 1 1 6	**Minutes** __ 9	**Seconds** _4 9. 0	**Direction:** W

UTM

Data Field: UTM Zone (required)
Data Value(s): Alphanumeric (5)
Data Field: UTM Datum (required)
Data Value(s): Numeric (4,2)
Data Field: UTM Easting (required)
Data Value(s): Numeric (8,2)
Data Field: UTM Northing (required)
Data Value(s): Numeric (10,2)

Example: This same infestation in Idaho is described using UTMs

UTM:	**UTM Datum Zone** 1 1 **UTM Year** 1 9 2 7
UTM Easting 5 6 7 5 0 3. 6	**UTM Northing** 4 8 2 7 8 6 7. 7

Quad Number

Field Name: Quad Number

Definition: This is the identification number, which appears on the corner of the quadrangle (quad) map. In the United States this refers to maps published by the United States Geological Survey (USGS). In Canada these maps are part of the National Topographic System maintained by Geological Survey of Canada

Why is it useful? Quad is an abbreviated name for quadrangle. Quad maps are readily available from USGS (need Canadian equivalent), sporting good stores and other government offices. They show roads, lakes streams and other natural features. Quads are also topographic maps depicting elevations across the landscape. Quads are often available at the NAWMA International Data mapping standard scale of 1:24,000, making them a good base for weed mapping. They also provide a useful link to GIS, since the coordinates for latitude and longitude can be derived from the maps. It is an also an easy way to locate an infestation and its surrounding area on a map.

Core Element: This is an optional field

Coding: This is a combination of numbers and letters found on each Quad map.

Data Value: Alphanumeric (15,0)

Example: An infestation is found at Papose Creek in southwest Montana. The infestation is located on the Hilgard Peak Quad.

Quad_Number: 44111-H4-TF-024

An infestation of Dalmatian toadflax is found near Seven Persons in southeast Alberta. The infestation was located on the Seven Persons quad, with the following identification number.

Quad_Number: 072E15

Quad Name

Field Name: Quad Name

Definition: This is the name that appears on the quadrangle map. It often refers to a prominent geographic feature, town or identifiable point in the area.

Why is it useful? See Quad Number in the previous section.

Core Element: This is an optional field

Coding: The is an optional field

Data Value: Alphanumeric (40,0)

Example: An infestation is located in Madison County, Montana. The local weed district has plotted the Dalmatian toadflax (Linaria dalmatica) infestation on the Hilgard Peak quad map.

Quad_Name: Hilgard Peak, Montana

Chapter 4

Glossary of Terms

Attributes: The information used to describe a map feature.

Collection Date: The date the weed infestation was observed in the field. It does not refer to the date information was entered into the computer.

Compass: A device for determining directions by means of a magnetic needle or group of needles turning freely on a pivot and pointing to the magnetic north.

Contour line: A line on a map connecting points that are the same elevation above mean sea level.

Datum: A model of the earth's shape. Geodetic datums define the size and shape of the earth and the origin and orientation of the coordinate system used to map the earth.

Declination (specifically Magnetic Declination): The angle that represents the difference in direction between magnetic north and true north. Declination will vary from place to place and through time. A compass needle aligns itself with the magnetic forces of the earth where as most maps indicate true north.

Features: Objects represented on maps. Usually, points, lines, and areas. Points are often symbolized.

GIS (Geographic Information System): A computerized system for the collection, storage, management, retrieval, changing, modeling, analysis and display of spatial data used to create a representation of the real world.

GPS (Global Positioning System): A global navigation system based on a system of high orbiting satellites. The GPS receiver uses at least 4 satellites to compute position.

Gross Area: This field is intended to show general location and population information. Like *Infested Area* it is the area of land occupied by a weed species. Unlike *Infested Area,* the area is defined by drawing a line around the general perimeter of the infestation not the canopy cover of the plants. The gross area may contain significant parcels of land that are not occupied by weeds.

Gross area is used in describing large infestations. When a value is entered for gross area, the assumption is that the area within the perimeter of the weed population (area perimeter) is an estimate or the product of calculating the area within a described perimeter. It is *not* a measured value. If a value for *Gross Area* is entered a value for *Infested Area* must still be entered. The value for

Infested Area is derived from estimating the actual or percentage of land occupied by weed plants.

Infested Areas: Area of land containing one or more weed species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Areas containing only occasional weed plants per acre do not equal one acre infested. Generally, the smallest area of infestation mapped will be 1/10th (.10) of an acre or 0.04 hectares.

Latitude: The angular distance (distance measured in degrees) north or south of the equator. Latitude is 0 degrees at the equator, 90 degrees at the north pole and –90 degrees at the south pole. Latitude is also described by direction north or south of the equator instead of + or -.

Longitude: The angular distance (distance measured in degrees) east or west of the prime meridian. Longitude is 00 at the prime meridian, and is measured + 180 going east and –180 going west. Longitude is also described by direction east or west of the prime meridian instead of + or -.

Map: A general representation of the real world.

Meridian: A meridian is one half of a great circle on the globe connecting all points of equal longitude; all meridians connect at the North and South poles. The Prime meridian is the reference meridian for latitude and longitude. For UTM designations, each UTM zone has a central meridian from which Eastings are measured. For the Township and Range System (PLSS), the principal meridians are selected north-south lines from which land was divided into parcels.

Partial Township: A block of the Public Lands Survey System that is less than 36 miles square created to compensate for the error created by the curvature of the earth.

Prime Meridian: A great circle passing through the north and south pole and through Greenwich, England. Its longitude is 0 degrees.

Public Lands Survey System (Township and Range System): The Public Lands Survey System (PLSS) was proposed as an aid to parceling out for sale the public land west of Pennsylvania. The PLSS system divides land into parcels based upon selected north-south lines called principal meridians and east-west lines called base lines. The north-south meridians, though perpendicular to the base lines, had to be adjusted periodically to counteract the effects of the curvature of the earth. The result of this system is a pattern of nearly square blocks, called townships, laid out in horizontal tiers north and south of the base lines. Townships are generally 36 square miles but because of the adjustments made to compensate for the curvature of the earth, partial townships were designated. A township is generally represented by a township and range designation from the

principal meridian. Range: The location of the Township east or west of the principal meridian of the Public Lands Survey System.

Scale: The ratio between distance as measured on the earth and the same distance as measured on a map, globe, or other representation of the earth.

Section: One (1) mile square (640 acre blocks) divisions of a township. There are 36 sections in each township.

Topographic Map: A map that displays both the horizontal and vertical positions of the features represented. It uses contours or other symbols to represent mountains, valleys, and plains.

Township: The primary block of the Public Lands Survey System. Generally, an area of 6 miles on a side (36 square miles). *(See Partial Township)* Also, the north/south location designation of the PLSS blocks.

Universal Transverse Mercator (UTM) Coordinate System: UTM Coordinate System defines two dimensional, horizontal positions using a grid system. The UTM grid is divided into UTM zones that designate 6 degree longitudinal strips extending from 80 degrees South latitude to 84 degrees North latitude. Each zone has a central meridian