U.S. Fish and Wildlife Service

National Wildlife Refuge Volunteer Weed Mapping Manual

Weed Working Group
National Wildlife Refuge System
Regions 1-7

National Wildlife Refuge Volunteer Weed Mapping Manual

Manual Developed by:
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NWRS – Regions 1, 2, 3, 4, & 6
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FORWARD

The purpose of this manual is to provide volunteers and staff members with a basic understanding of how to map infestations of invasive plants on refuge lands using the Refuge Lands GIS (RLGIS) weed module system. It brings together training and technical assistance materials to help guide users in their efforts.

Invasive species are one of the greatest threats to ecosystem integrity within the National Wildlife Refuge System (NWRS). In a 2002 survey, refuges and wetland management districts were asked to identify threats or conflicts affecting their operations. Of the 444 field stations responding, seventy-five percent identified invasive or exotic species to be of significant concern. Despite recognition of the problem, most refuges have no detailed inventory or maps of invasive distributions and no means to accomplish either.

In light of the growing threat of invasive species, the Refuge System's National Invasive Species Program launched the Collaborative Volunteer Invasive Monitoring Project (CVIMP) in fiscal year 2003. This project is designed both to provide a tool for generating quantitative data that will help refuge staff prioritize areas for control of invasive plants and to engage volunteers in mapping new and established infestations on refuge lands. Thus far it has been funded by a special Congressional appropriation directing the Refuge System to integrate Friends groups and volunteers in the control of invasive species. CVIMP was developed in partnership with the National Wildlife Refuge Association (NWRA), The Nature Conservancy (TNC), and USGS's National Institute of Invasive Species Science (NIISS). More information about the project can be found at: www.refugenet.org/new-invasives/vimp.html.

A primary goal of the project is to increase the number of field observers among the public who are trained to identify new infestations on invasive plants. Early detection of incipient infestations is crucial because eradication of new, yet-to-become-established populations of invasive species is generally more successful and cost effective than efforts to control large, well-established populations. Complete eradication of a well-entrenched population can present a sometimes insurmountable challenge to land managers and run into the thousands, sometimes millions, of dollars. In addition to producing maps at the level of the individual refuge, the data collected will contribute to the development of a nationwide invasive plant data layer for the Refuge System, which, in turn, will form part of a nationwide, multi-agency invasive species forecasting system coordinated by USGS' National Institute of Invasive Species Science in Ft. Collins, Colorado (www.niiss.org).

Mapping conducted by volunteers and refuge staff as part of this program is performed in ESRI ArcPad software on handheld computers (Dell Axim X50) with attachable GPS units, or with Trimble GPS devices. The intention is to map the initial location of an infestation and monitor its change over time through collection of treatment and follow-up data. Several of the refuges participating in CVIMP have piloted the use of a weed mapping application developed as a special module of the Refuge Lands GIS (RLGIS) Geodatabase.

This manual was created by the NWRS's National Invasive Species Program, Region 1 Remote Sensing Laboratory and Region 6 Habitat and Population Evaluation Team (HAPET) to formally integrate the RLGIS data model components for weed mapping and treatment into the CVIMP. It has been designed to compile training and technical assistance materials for volunteers and refuge staff using the RLGIS weed mapping module. The module conforms to the North American Weed Mapping Association (NAWMA) standards (nawma.org).

<u>Acknowledgements</u>

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Introduction

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The spread, impact, and treatment of alien, invasive, or noxious plants (hereafter referred to as weeds) are issues of concern for federal and state agencies as well as private landowners. The USFWS has a history conducting weed control activities on lands that are owned and managed by the National Wildlife Refuge System. Weed control activities generally consist of identifying invaded areas and applying varying types of control measures including manual, mechanical, chemical, biological, grazing, and fire to reduce weed infestations. Over time, methods for inventorying, treating, and monitoring the success of weed control efforts have been improved but have often been implemented locally across the Refuge System. Currently, several independent but organized efforts have been initiated or are ongoing that relate to weed mapping and control within the Fish & Wildlife Service (FWS).

Ongoing efforts by Refuge Field Station personnel cannot be overlooked as a long-standing effort to control weeds on Refuge Systems Lands (RSLs). Relatively recent efforts to integrated GIS technology in the inventory, treatment and monitoring of weeds have been undertaken and the Refuge Lands GIS (RLGIS) has emerged as a core data model that can be used to facilitate the utilization of information collected during weed management activities by various programs including the Collaborative Volunteer Invasive Monitoring Program and the USFWS Weed Strike Teams by the Field Station where weed management is occurring.

1.1 Data Model

The RLGIS data model is a spatially explicit, comprehensive, relational data model developed within ESRI's geodatabase file structure that has been designed to store information for real property and other features, management units, inventory, habitat and vegetation, and management that exist or take place on lands that are owned and managed by the USFWS Refuge System. There are 2 primary components to the data model for weeds, the mapping/inventory databases that represent and track infestations and function as a baseline for the distribution and extent of weed occurrences, and management databases that capture information on treatments that are applied to control and reduce weeds. Repeated mapping activities for a given location result in the ability to monitor the response over time and treatments.

1.2 Integrated Technology

The relatively recent emergence of integrated GPS and computer technology, and the positional quality of the resulting data has greatly simplified and enhanced the capability of users to both capture the spatial representation of weed infestations or treatment activities and populate associated databases in the field. The RLGIS data model takes full advantage of this functionality by operating within ArcGIS and companion ArcPad Software.

1.3 Desktop GIS

The RLGIS model is constructed as an ESRI ArcGIS geodatabase and requires the use of ArcGIS version 9.0 or higher. An "auto-populate" feature exists that utilizes a spatial query between the mapping feature classes and the FWSInterest feature class in the FWSCadastral geodatabase. To utilize this capability the FWSInterest feature class must be completed and populated.

1.4 Field Mapping

A variety of methods exist for mapping vegetation that range from field visits, aerial photography, and satellite imagery. The National Wildlife Refuge VWMP will generally employ field visits to map weed occurrences and infestations. Maps including basic information such as Refuge boundaries, management units, infrastructure (e.g., fences, roads), imagery, and access points are useful for the mapper to orient their activities.

1.5 Implementation

Utilizing the RLGIS data model can be implemented on a Field Station by Field Station basis. In addition to a common data model among field stations, the RLGIS program provides a consistent approach to the collection and management of weed data. This will facilitate the "roll up" of information among Field Stations to provide Regional and National summaries of weed information.

1.6 North American Weed Mapping Association

In designing RLGIS data model, mapping standards were followed from the North American Weed Management Association (NAWMA). NAWMA is a network of individuals involved in preserving natural resources from the threat of invasive noxious weeds and non-native exotic vegetation. In 2002, NAWMA approved the North American Invasive Plant Mapping Standards document. The North American Invasive Plant Mapping Standards outlines ways for managers to prioritize which part of a weed patch to treat first, monitor the health and integrity of an ecosystem, generate awareness, and coordinate mapping efforts. These standards were designed to be compatible with most existing invasive species inventories to reduce duplication.

1.7 Positional Accuracy of the RLGIS geodatabase

All feature classes within the RLGIS geodatabase have the projection of geographic (latitude / longitude) and a datum of North American Datum 1983 (NAD83). In ArcMap, data is projected on the fly any time a data frame contains a layer whose coordinate system is defined as something different from the coordinate system definition of the data frame. A data frame's coordinate system can be defined manually or by adding data with a defined coordinate system. ArcMap will not project data on the fly if the coordinate system for the dataset has not been defined. A dataset with an undefined coordinate system will simply be displayed in its native coordinate system.

The first layer added defines the data frame's coordinate system. This is true whether the data is projected or geographic. For example, if the first layer added contains a Lambert Conformal Conic projected coordinate system, all other layers will project on the fly to match this. Similarly, if the first layer added to the data frame contains data that uses a WGS84 geographic coordinate system, all other layers will adjust to match this. Even data that uses a projected coordinate system will unproject on the fly.

1.8 Positional Accuracy for ArcPad

ArcPad has the inability to use base layers in different coordinate systems. When files are brought into ArcPad, the first file has its projection file read and it sets the map projection to that coordinate system. If other base layers are desired and have different coordinate systems, they will have to be re-projected to match the map projection. Therefore, if you want to use other base layers, i.e. imagery as a background, it needs to be in the same coordinate system/datum as the RLGIS geodatabase..
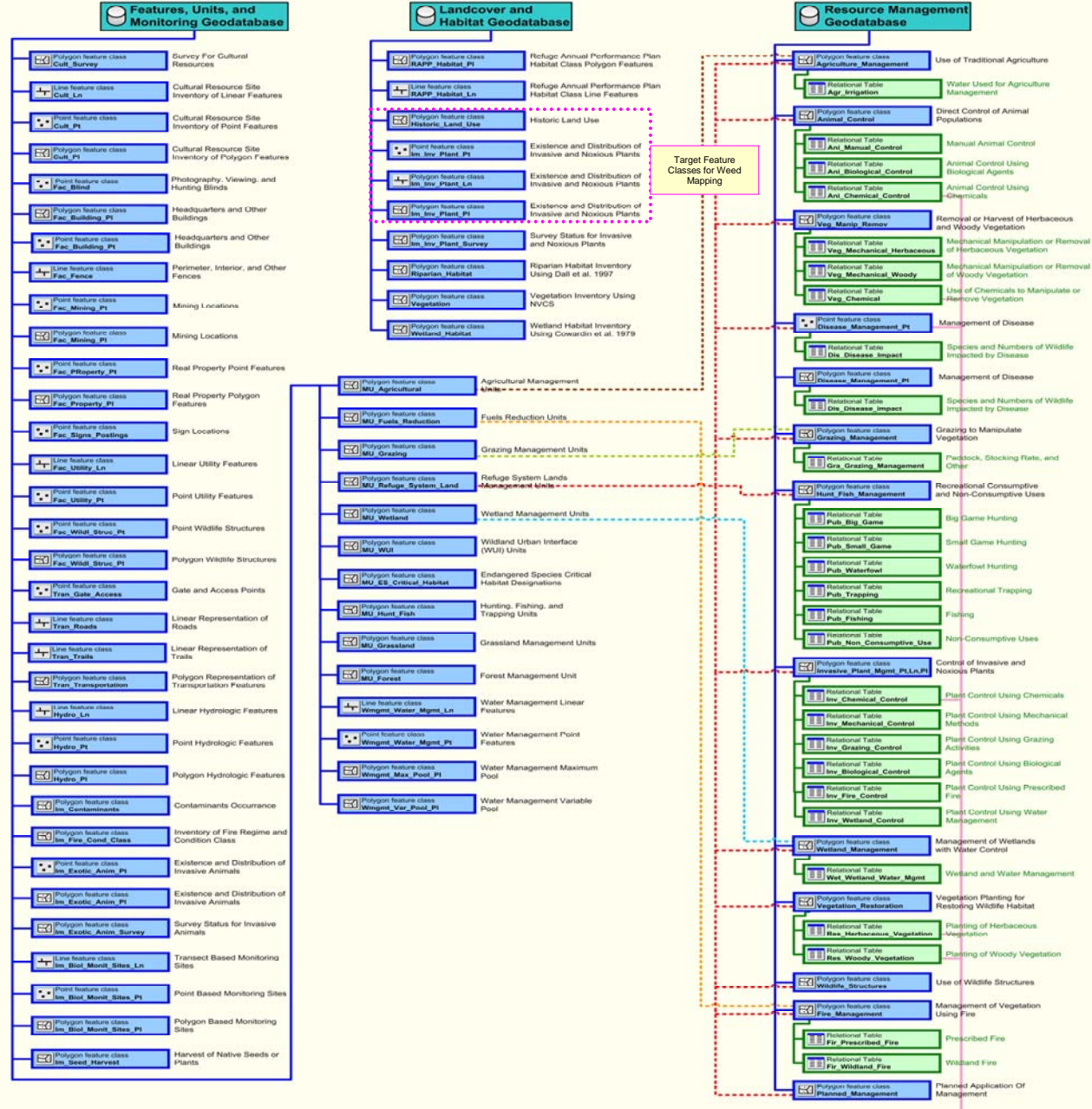
Figure 1

Geodatabase Schema Diagram
Refuge Lands GIS Data Model

Database Developed by Spatial Information Management Working Group; USFWS
Regions 1, 2, 3, 4, 5, 6 and 7

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General Data Management

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The nature of using multiple individuals or crews using multiple GPS units to populate a single database requires the development of a system to manage the GIS databases. One of the advantages of using the ArcGIS software is the fact that it integrates a fairly simple process that allows the users to check out several copies of all or portions of the databases for editing simultaneously, while maintaining the integrity of the database upon the re-integration of the edited data. Because the data collected or edited by all users will need to be integrated back into the main GIS databases, it is imperative that a process be adopted by the Field Station for accomplishing this task.

There are 2 options available for managing the RLGIS geodatabase's. The first utilizes a single individual to manage all aspects of data access and reintegrating into RLGIS. A data manager would be required at each Field Station that is populating a stand-alone RLGIS geodatabase. The second option is allowing each individual that is collecting data in the field to be responsible for extracting and then reintegrating new information or edits back into RLGIS.

The primary consideration for choosing a data management option is the experience of the users and the number of GPS units that will be utilized to collect field data. Figure 2 illustrates a data flow that reflects a single GPS for data collection. This represents the simplest data flow in which there is only a single copy of the data checked out.
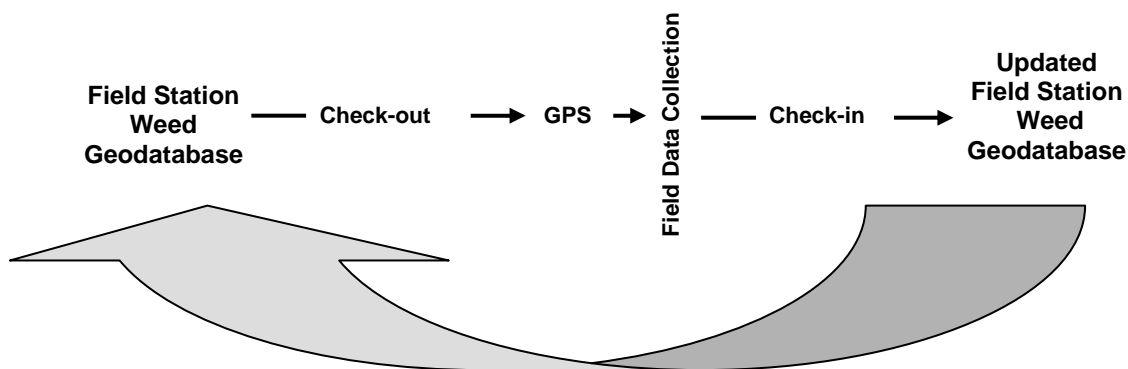
Field Station Weed Geodatabase —— Check-out → **GPS** → Field Data Collection —— Check-in → **Updated Field Station Weed Geodatabase**

Figure 2. Single GPS used to collect weed information in the field.

Figure 3 illustrates multiple GPS units being utilized at a single Field Stations. The GPS units are local and data can be obtained directly from the computer or network that the primary RLGIS is stored on. The complexity occurs because multiple copies of the databases must be extracted and managed. A single data manager should be utilized to manage the data.
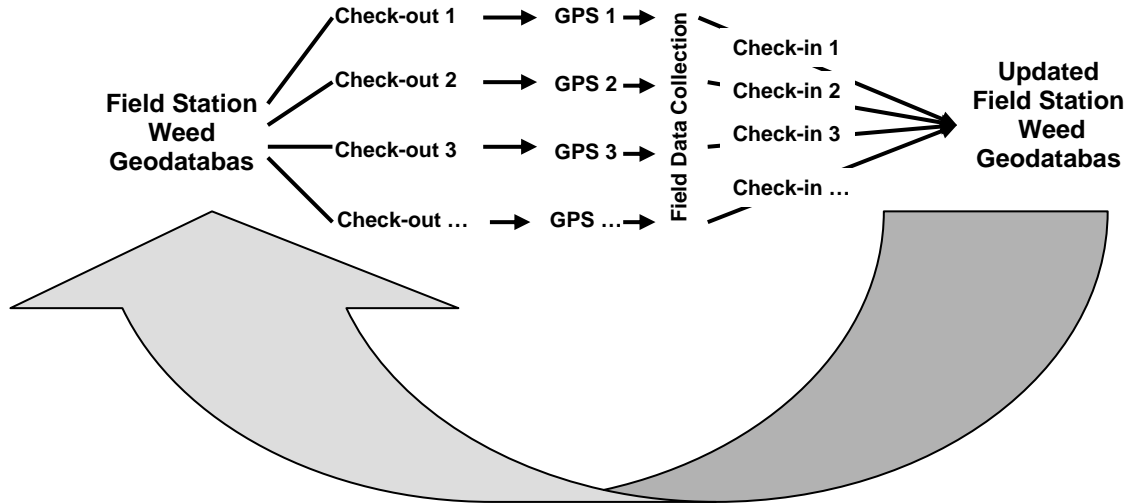
Figure 3. Multiple GPS at a single location usage to collect weed information in the field.

Figure 4 illustrates a more complex distribution of both GPS units and consequently data management. This scenario is being used by an Invasive Plant Strike Team where multiple distributed teams are using multiple GPS units per team. The primary database is being managed at a Field Office and sessions are being extracted and distributed via email to distribute members on a standard week day and data is being collected and sent back to the data manager for reintegration and subsequent redistribution to the field members.
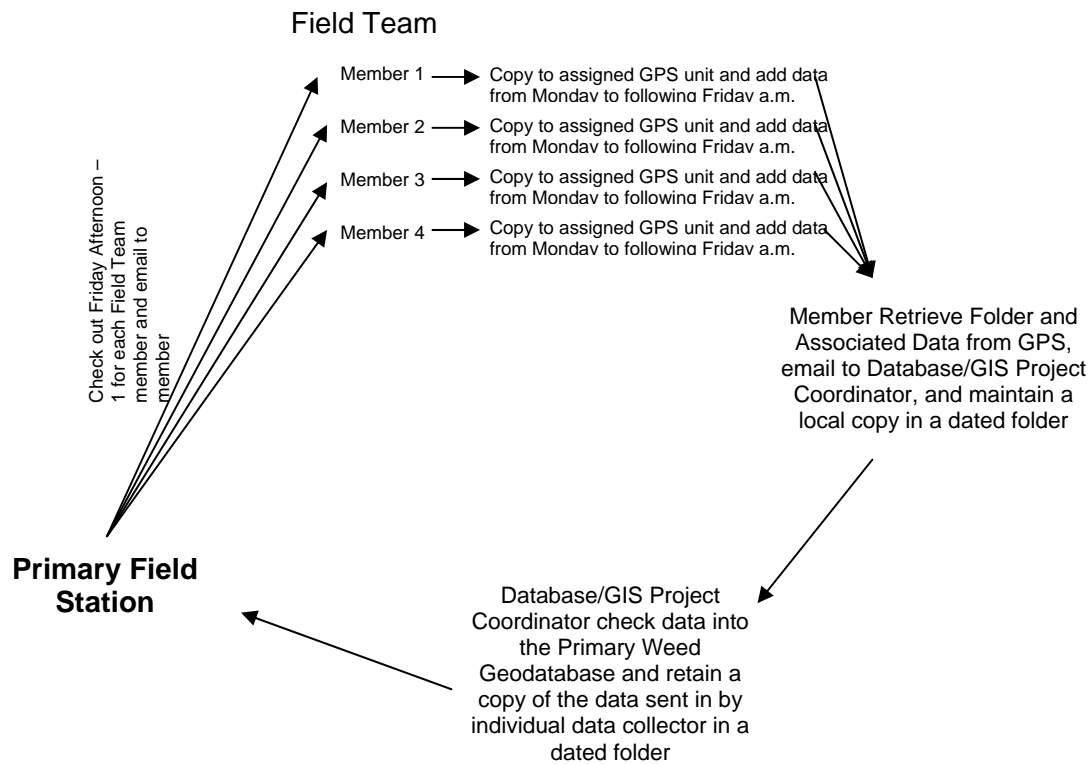

Figure 4. Multiple distributed teams with multiple GPS units per team.

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2.1 Managing extracted data with GPS units

The extraction of data from a geodatabase within ArcGIS for usage in ArcPad is called a "check-out". The check out process converts the data being checked-out into shapefiles and stores them in folder that is created during the process. The shapefiles created should not be edited independent of each other, i.e., in the field with ArcPad and on the local computer with ESRI or other software. Similarly, if a check-out feature classes are renamed in the master geodatabase, that operation does not rename the checked-out data. The name of a check-out in a master geodatabase does not have to match the name of the check-out in the corresponding check-out geodatabase. If a check-out is renamed in the master but not the check-out geodatabase, the data can still be checked in by following some additional steps. However, it is much simpler to not make naming changes when data is checked out.

2.2 Restrictions for checked-out data

There are some important restrictions relative to checking out data. First, the version created in the master geodatabase should not be edited while the data it represents is still checked out. Because this check-out version in the master geodatabase is public and, therefore, editable when created, any changes made to this version may be overwritten during the check-in process, since no conflict reconciliation is undertaken at this point.

Second, it is not possible to append data to or refresh an existing check-out. You cannot check out an updated version of the same data to a check-out geodatabase while it contains a check-out. You must first check in the original check-out and make a second check-out. Once data has been checked back in, the check-out geodatabase no longer participates in any check-out or check-in relationship with a master geodatabase.

Finally, the check-out model does not support schema modifications to data that has been checked out. If the schema is altered in any way, either in the master or check-out geodatabase, for example, by adding a field to a table or feature class, the check-out is rendered invalid, and any attempts to check in the modified schema and data will fail. If a new table has been created in the check-out geodatabase, it will be ignored when the rest of the data is checked in.   This should not be a problem since alterations to the data model will not occur in the field but rather as a distributed revision with instructions for installation.

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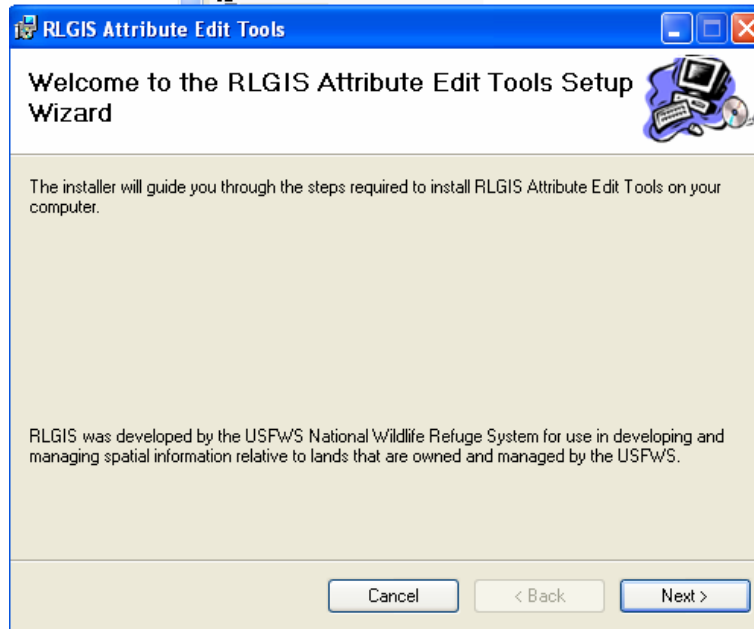**National Wildlife Refuge System**
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Installing the RLGIS Geodatabase

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3.1 Installing the RLGIS Geodatabase:

1. When getting the RLGIS install package, double click on the Setup.exe file to run the install.

2. An Install Wizard dialog will come up………Welcome to the RLGIS Attribute Edit Tools Setup Wizard. Click **Nex**t to continue:

3. Choose the radio button "Everyone", this should alleviate any problems with multiple users or administrative privilege issues that may occur. Notice that the installation destination is "C:\Program Files\RLGIS\RLGIS Attribute Edit Tools\". Choose **Next** to continue:
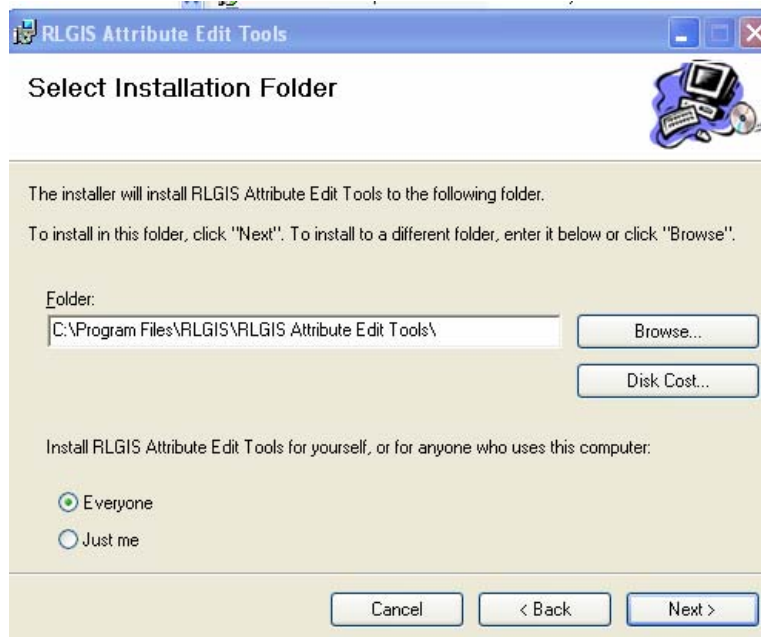
4. Confirm the installation by choosing **Next**. It should take 30 seconds or so to install.
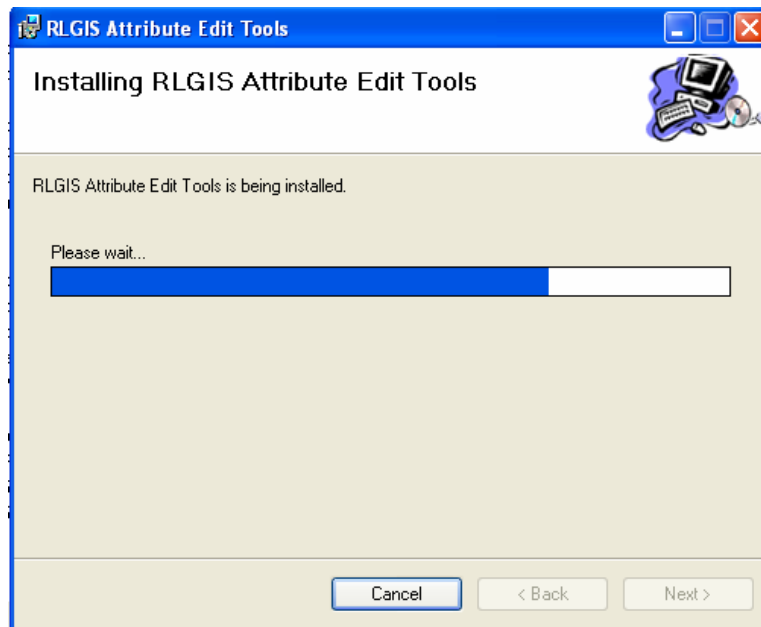
5. Choose **Close** to complete the install application.
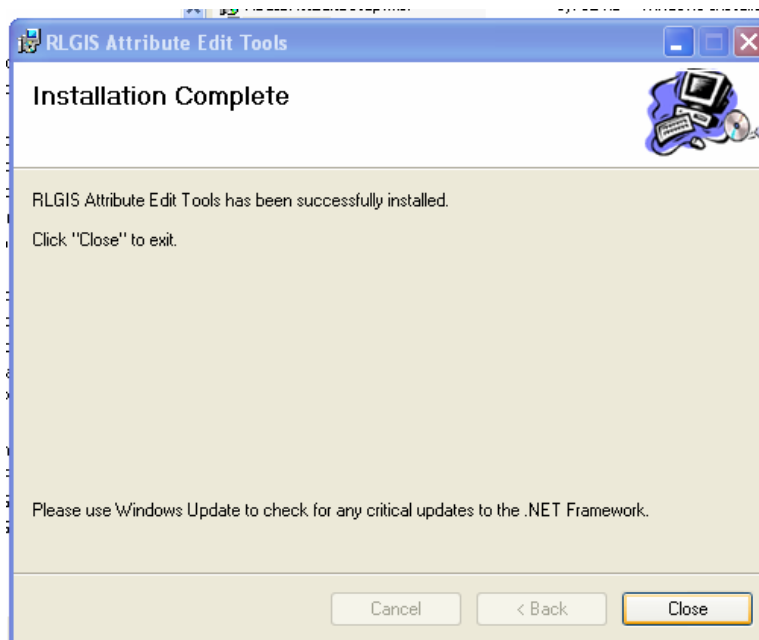
The RLGIS Attribute Editor Tool and the data model template have been installed on the computer. The data models and the data dictionary are stored in "C:\Program Files\RLGIS\RLGIS Attribute Edit Tools\Databases". The 3 geodatabases should be maintained as an empty template and working versions should be copied to a destination chosen by the user.
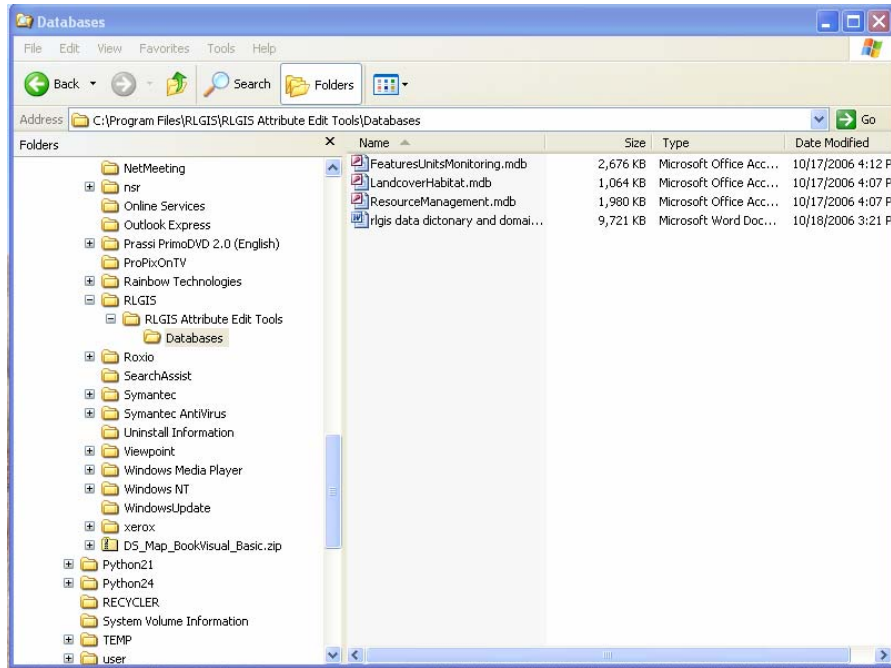
The SETTINGS.INI is used only by the "AddData" function and needs to be edited to reflect the location of the working copies of the geodatabases. The SETTINGS.INI file is located in the "C:\Program Files\RLGIS\RLGIS Attribute Edit Tools" directory and can be edited with any text editor.
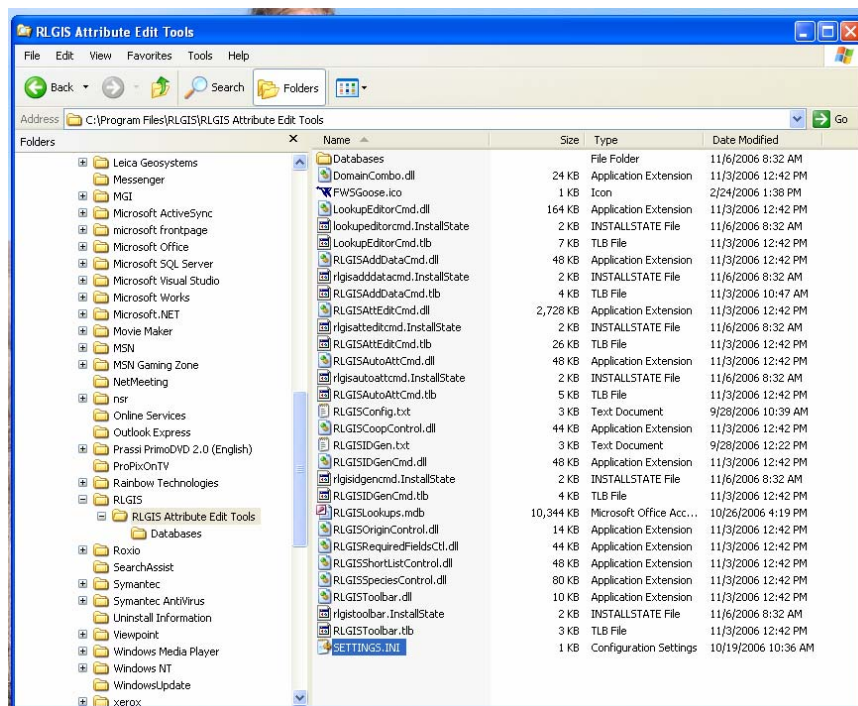
The SETTINGS.INI file will appear as below and needs to be edited to reflect the location of the working copies of the geodatabases.
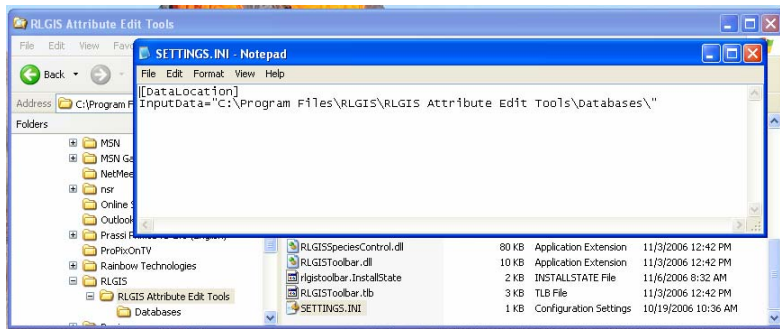
RLGIS has been successfully installed. When ArcMap is opened, a RLGIS toolbar should be present. If not, enable the toolbar as you would any existing toolbar in ArcMap.
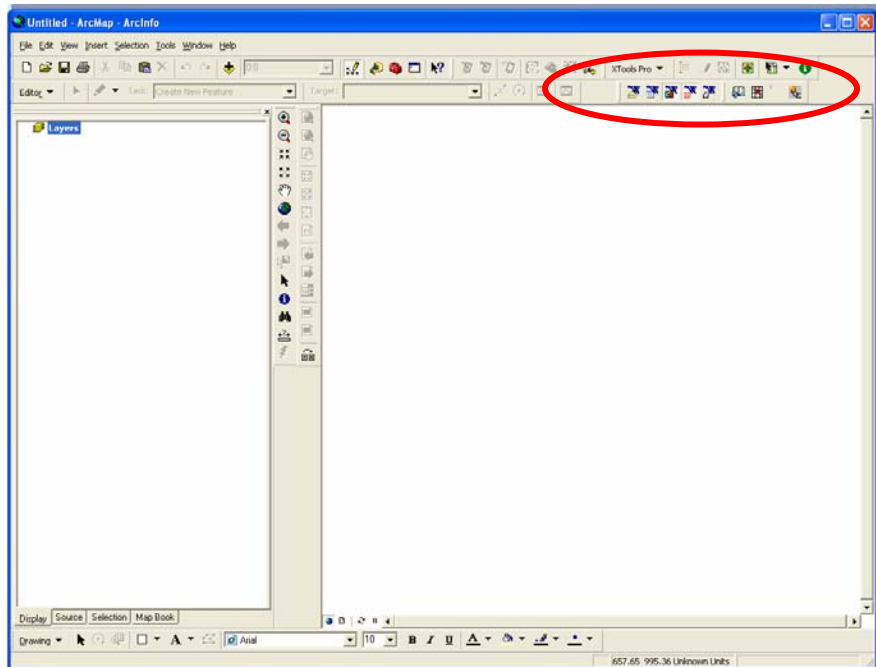
The RGLIS Toolbar consists of 5 buttons:

From left to right the buttons are:

Add Data – adds feature class to the map document

Attribute Editor – enables forms for attributing created features

Automatic Attributes – forces required fields to be populated for data created previous to the development of RLGIS or outside or ArcMap i.e., ArcPad field data

RLGIS ID Generator - forces RLGIS_ID to be created for each feature for data created previous to the development of RLGIS or outside or ArcMap i.e., ArcPad field data

List Editor – Allows the user to customize local or refuge-specific lists outside of an edit session.

3.2 RLGIS Geodatabase Templates:

When RLGIS is installed, it creates a folder located in "**C:\Program Files\RLGIS\RLGIS Attribute Edit\Database**" that contains 3 geodatabases of RLGIS (*FeaturesUnitsMonitoring, LandcoverHabitat, and ResourceManagement*)**.** These 3 geodatabases should be maintained as an empty templates and working versions should be copied to a destination chosen by the user. For the ex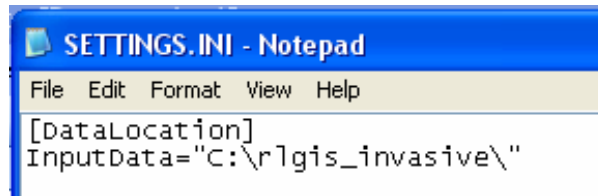ercises contained in this manual, the 3 geodatabases will be copied from their original folder to one located on the C: drive. The destination folder for the exercises in this manual will be **"C:\rlgis_invasive"**

1. Open Windows Explorer and copy the **rlgis_invasive** folder from the CD provided to the **C:** drive (The rlgis_invasive folder contains the training data for the exercises in this manual).

2. With Windows Explorer still open, navigate to where the empty templates of RLGIS are located, "C:\Program Files\RLGIS\RLGIS Attribute Edit\Database" and copy all three geodatabases and the rlgis data dictionary to the "C:\rligs_invasive" folder**.**
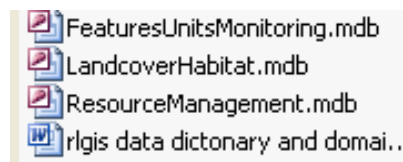
3. When the geodatabases are copied to the **rlgis_invasive** folder, the next step is to change the SETTINGS.INI file.

4. Go to "C:\Program Files\RLGIS\RLGIS Attribute Edit" and select the SETTINGS.INI file. Open it with Notepad or Wordpad and set the InputData = "C:\rlgis_invasive\"

5. Save the SETTINGS.INI file and close it.

3.3 **FWSCadastral Geodatabase**:

Each Region will have a FWSCadastral geodatabase that will contain all tracts of lands with in a particular region. The FwsInterest feature class will contain acquired service tracts, fee title or less than fee title; includes all Service managed tracts. RLGIS uses the FwsInterest feature class to fill in "required fields" within each feature class. To obtain a copy of your FWSCadastral geodatabase, please contact your regional support person. For the exercises within the manual, a FWSCadastral geodatabase is provided. Please copy the FWSCadastral geodatabase from the training folder provided by your instructor to the rlgis_invasive folder.

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ArcMap Interface

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4.1 ArcMap Interface

The ArcMap component of ESRI's ArcGIS software is the primary interface for accessing, displaying, and managing the Weed Mapping Geodatabase. An understanding of basic ArcMap processes by the user is necessary to effectively use the Geodatabase. This section is intended to identify and walk the user through the basics of using the Geodatabase in ArcMap.
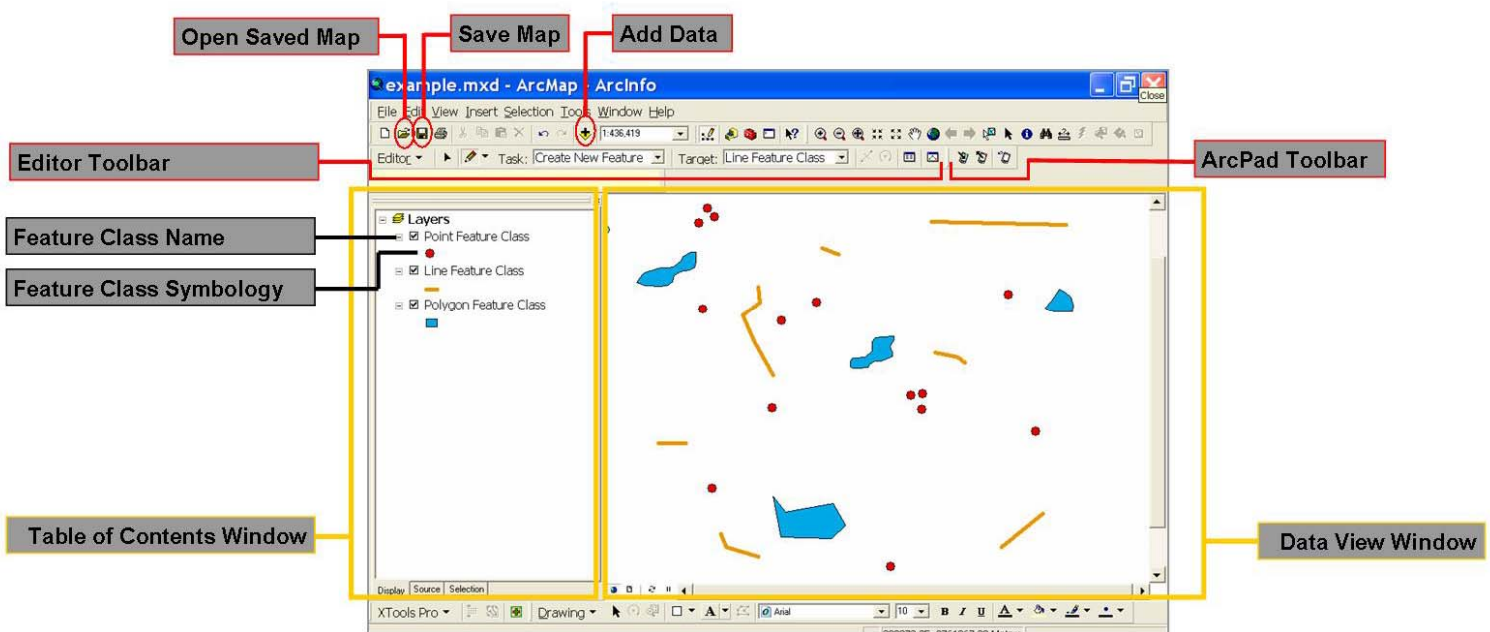
The above graphic is an example of a map project in ArcMap and illustrates the typical ArcMap interface along with commonly used tools, toolbars and commands. Three *Feature Classes* have been added to *the Table of Contents* window representing each of the three different feature types that can be mapped as lines, points and polygons. The *Table of Contents* contains the names of the feature classes and their representative *symbology,* and the *Data View* window graphically displays in the geometry of the feature classes.

4.1a Feature Class

A Feature Class is a layer of features with the same type of geometry - lines, points or polygons. Feature classes allow similar features to be grouped into a single layer for data storage purposes.

4.1b Feature Class Symbology

The Symbology of a feature class is the graphical representation of each feature class – what you see on the display or map. The color or size of the symbology can be manipulated to better illustrate the data. In the above example, the point symbology is red, the line symbology is orange and the polygon symbology is blue.

4.1c Data View Window

The area within the ArcMap GUI that displays the layers (or feature classes) that are added to the map document.

4.1d Table of Contents

The Table of Contents (TOC) contains entries for the data that are added to the map. It lists all the layers on the map by their Feature Class Name and displays the **Symbology** for each layer. The TOC is used to turn layers on and off, and access the properties of layers. Layers can be rearranged by dragging and dropping them up or down in the list to change their drawing order. Layers are stacked beginning with the bottom and progressing upward. Background layers such as images should occur at the bottom of the table of contents. The check box next to each layer indicates whether or not the layer is currently visible on the map. By default, the table of contents is located on the left side of the ArcMap window.

4.1e Add Data

The Add Data button allows you to add spatial data (i.e. Feature classes, images, shapefiles) to your map. To add a feature class, click Add Data in the dialog that appears, navigate to the location of the layer to be added. The name of the layer will be added to the Table of Contents. If the feature class contains geographic data, it will display in the Data View Window.

4.1f ArcPad Toolbar

The ArcPad Toolbar contains tools to perform ArcPad functions. The Get Data button executes a process to transfer/prepare data for layers in the data frame for use on a mobile device (i.e. GeoXT). After the data has been collected or modified, the Check in Edits button can be use to integrate the updates into the respective feature classes.

4.1g Editor Toolbar

The Editor Toolbar contains the different commands used to edit the geographic features displayed in the data view.

Adding Data Layers to ArcMap

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5.1 Adding data layers to ArcMap and preparing layers for field data collection

In this section you will learn how to add data layers, and edit layer properties to prepare data (feature classes) for "check out" in ArcPad. Rocky Mountain Arsenal National Wildlife Refuge will be used to demonstrate how this process can be applied to the RLGIS Geodatabase to inventory and attribute invasive weed locations and conditions.

1. From the Windows desktop, double click on ArcMap to launch the program.

2. In the ArcMap dialog, under Start using ArcMap with, select **A new empty map**, click **OK**.
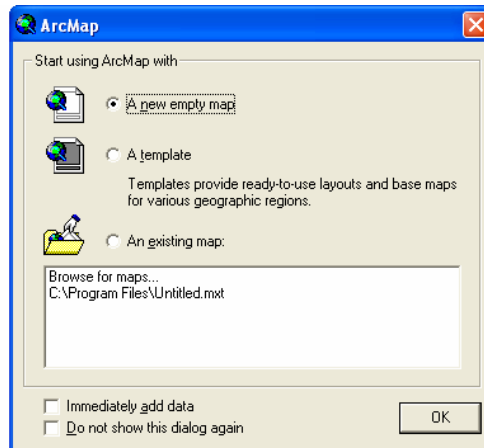
3. Add the NWR or WMD boundary to the map.

NOTE: Your FwsCadastral geodatabase will be supplied by your regional support person, please contact them. However, for this exercise, please use the one provided. (It is stored in the c:\rlgis_invasive folder)

Option 1: RLGIS ADD DATA tool

The first option is to use the **RLGIS Add Data** button on the RLGIS toolbar. Selecting this button will open the **Add RLGIS Data** dialog. In the dialog, select the **Cadastral** button. This will open the list of feature classes available in the **FWSCadastral** geodatabase. Check the box to the left of the **FwsInterest** feature class and select the **Add Data** button.
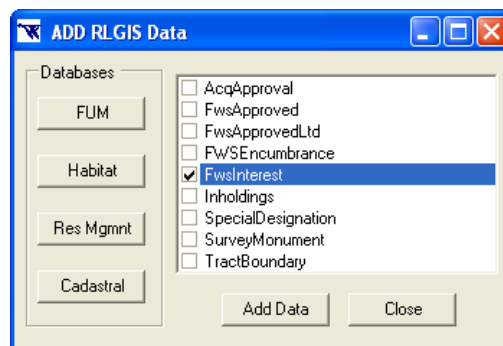
The boundary of your refuge should now appear on your ArcMap project

Option 2: Arc Map ADD DATA tool

The second option for adding data is using the **Add Data** [icon] button located on the Standard toolbar in ArcMap. In the **Add Data** dialog that appears, click on the drop down arrow in the **Look in:** window to navigate to the location containing the refuge or WMD boundary information. (c:\rlgis_invasive) Select the appropriate boundary feature class and hit the **Add** button.
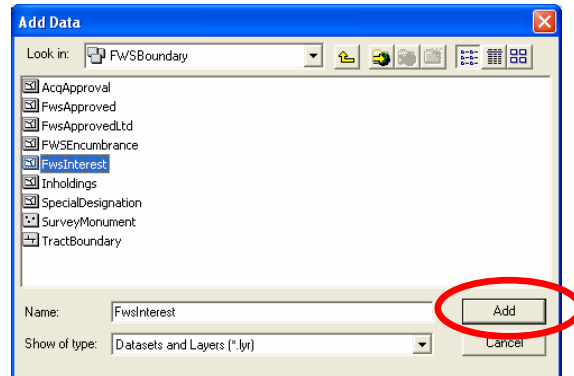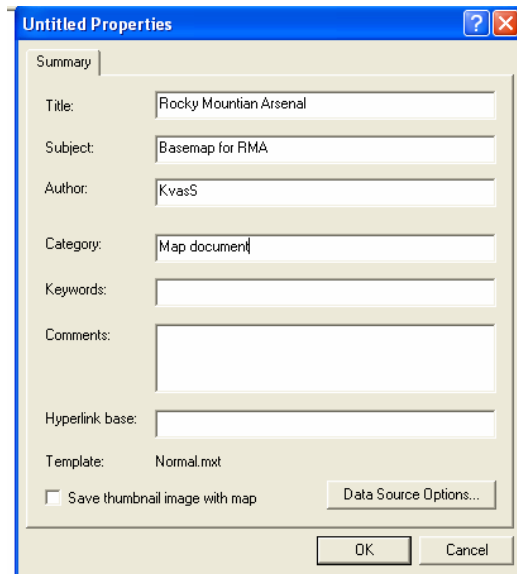
4. In the **Data View**, change the *FWSInterest* symbol to hollow with an outline color of black and a size of 1. To change the outline color, double click on the symbol for the *FWSInterest* layer. In the <u>Symbol Selector</u> dialog, select **Hollow** and change the outline width to **1**, click **OK.**

5. Using the **RLGIS Add Data** [icon] button again on the RLGIS toolbar, select the **Habitat** button. This will open the list of feature classes available in the **LandcoverHabitat** geodatabase. Check the boxes to the left of the **Invasive Plant Monitoring Line, Point, Polygon and Survey** feature class and select the **Add Data** button.
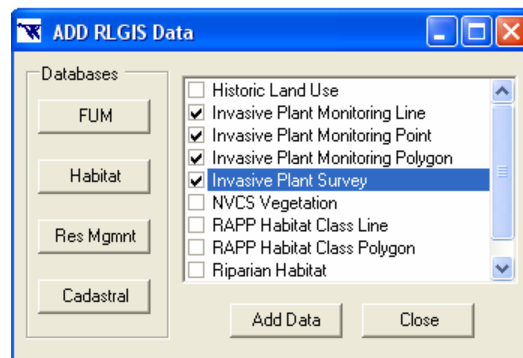
The four feature classes should now appear on your ArcMap project

6. Next, click the **Add Data** [icon] button, use the arrow [icon] up button to go to the *Training* folder located in c:\rlgis_invasive. Select image1.jpg and image2.jpg (use the "shift" key to select multiple items), click **Add**.

7. In ArcMap, right mouse click on image1, select [icon] Zoom To Layer

8. Using the Pan [icon] tool, make the images centered on the screen.

9. Change the name of the *Data Frame* to **Rocky_Mtn_Arsenal** by selecting **Map Properties** from the File Menu.

10. Enter the following *Summary* information about your map. Use your name as the Author.

11. Click on the **Data Source Options** button.

12. Ensure **Store relative path names** are checked. Click **OK**.

TIP: If you plan on distributing your tools to others, they'll need access to the sources of information they reference. To make it easier to distribute all information sources with your tool, you can store relative pathnames to sources of information. All pathnames within the tool will be stored relative to the toolbox containing the tool. For example, if you set relative pathnames for your tool, then distribute it with the data in the same directory, the references stored in the tool would be correct regardless of their placement on disk. This ensures your map documents open will all of your data even if they are moved to another drive letter or packaged onto a CD.

13. Click **OK** to close the Untitled Properties dialog.

14. From the **File** menu, choose **Save**. Assign the name as *RMK.mxd* and store the file in the *c:\rlgis_invasive\training* folder.

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Making Invasive Species Lists – List Editor

6

Data is entered into the RLGIS geodatabase a number of ways. Two common ways are either direct user entry, or the use of the RLGIS List Editor (pick-lists). The use of pick-lists is desirable because it facilitates the standardization of data entered. Pick-list content can be managed by utilizing either domains or look up tables. Domains will be used when selections are standardized across the Refuge System. Lookup Tables will be used where Field Station specific content is needed.

As of now, domains have not been standardized across the Refuge System for invasive species, so lookup tables will be used.

Using the RLGIS List Editor

In order to add invasive species to your drop down lists in ArcMap, select the RLGIS List Editor button. (The reason for creating the drop down lists is to have standardized selections out in the field when transferred to your GPS data logger – however, at this time, the lookup tables will not transfer to the data logger. Please continue to add information to the dropdown lists and in the next section, we will show you how to bring your table into a domain). The two main list that will be modified are the **Invasive Plant Species Names** and the **Data Origin Names**.

1. Adding an Invasive species to your list. Select the RLGIS List Editor tool.

2. A RLGIS List Editor dialog box appears.

3. On the left hand side of the editor, select Invasive Plant Species Names.
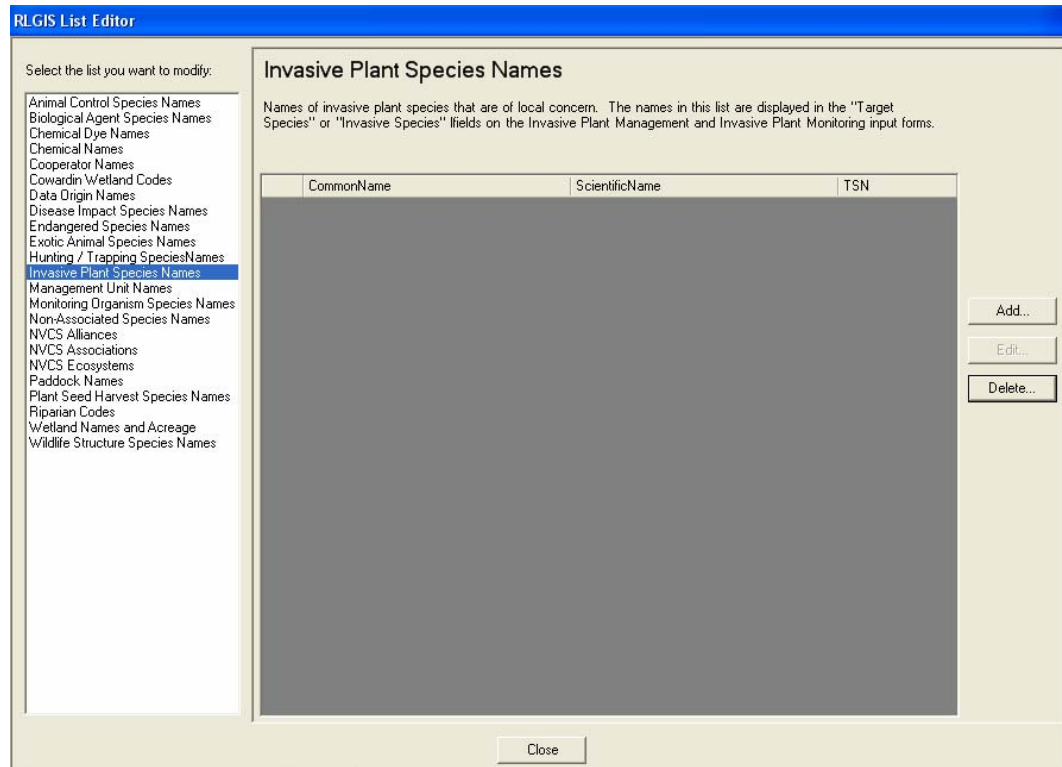
4. Select the Add…. Button.

5. Notice an <u>Add a Species</u>……….dialog appears.
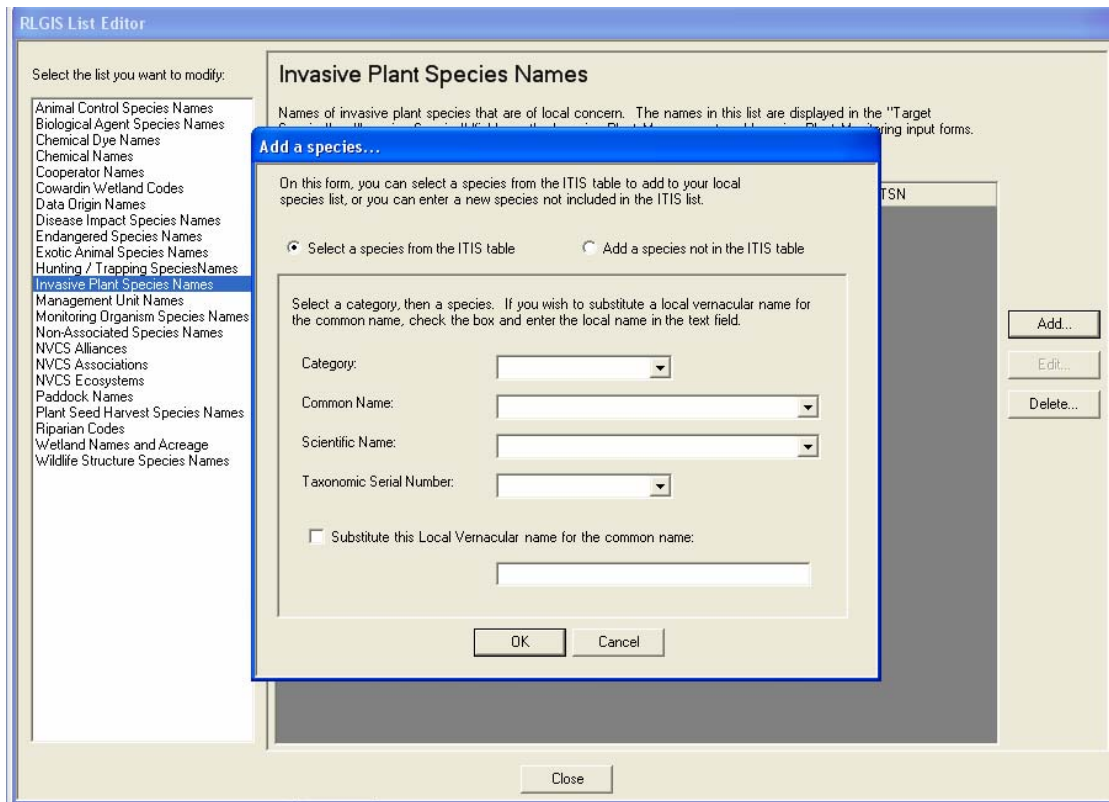
6. From the dropdown menu in Category, select **Vascular Plant**.

7. In the Common Name, select **wormwood** and notice that the scientific name and taxonomic serial number automatically get populated.
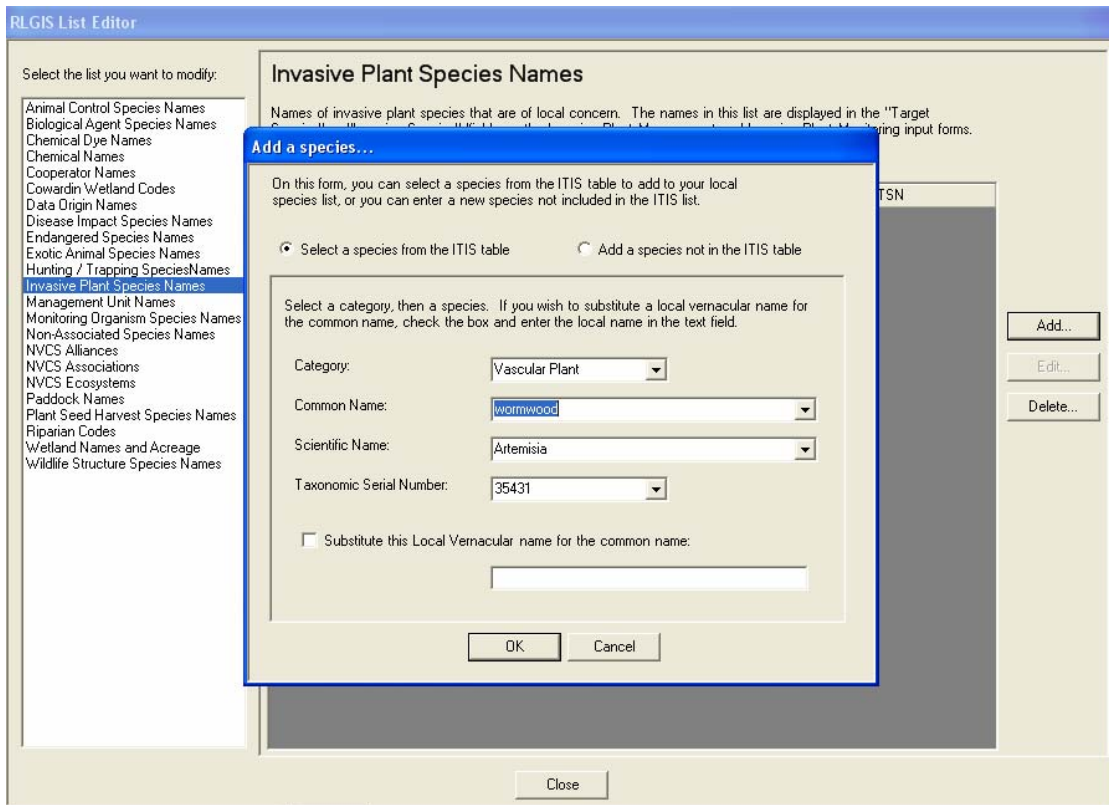
8. When finished entering a species, click add and notice "wormwood" is now listed in the Invasive Plant Species Name table.
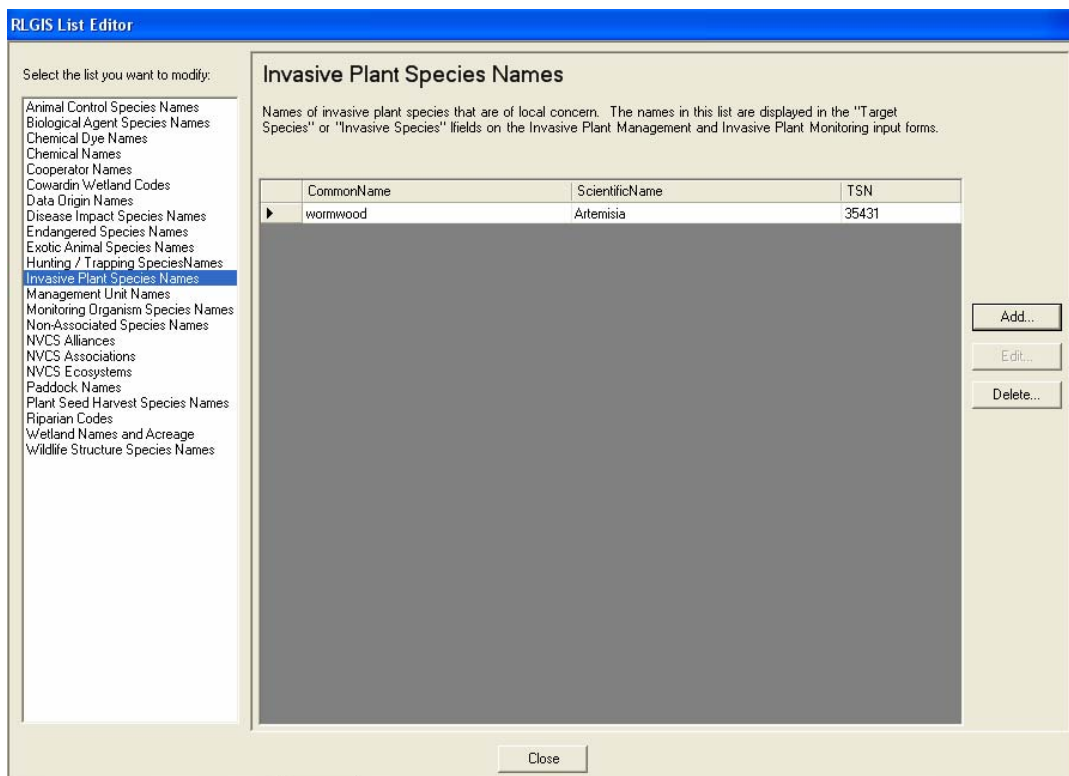
9. Keep adding the number of plant species desired. Because you have put these selections into the List Editor, all of the species will now be part of the dropdown menus in the InvasivePlant feature classes. When finished with the invasive species, select **Data Origin Name** and add the data collector names. Then, select **NVCS Formations** and add the formations in your area and click **Clos**e when finished.

The List Editor function does not currently work with checking out data into ArcPad. However, adding all your species to the list will help provide a standardization across the field station for species selections and in doing so, we can make a domain out of those lists that can be used in ArcPad. We will be using the Table to Domain command in the Section 8.

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RLGIS Attribute Editor

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7.1 Adding data using the RLGIS Attribute Editor.

In this section, you will digitize weeds from a Digital Ortho Quad (DOQ) on your computer.

1. From the Windows desktop, double click on ArcMap to launch the program.

2. Open the **RMK.mxd** file located in the **c:\rlgis_invasive\training** folder**,** click **OK.**

3. Open the **Editor Toolbar** if it is not already open. Go to the **View** button on the main menu, select **Toolbars** and place a check next to **Editor**.
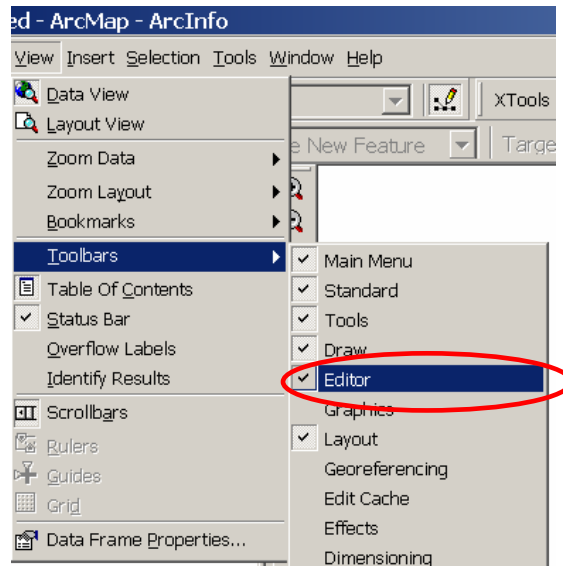
4. The **Editor Toolbar** will open. Dock the **Editor Toolbar** by dragging it.

5. Start an edit session by selecting the **Editor** button on the **Editor Toolbar**.
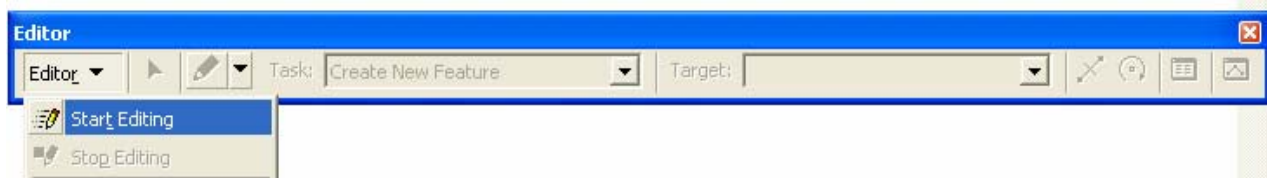
6. Select **Start Editing** from the drop down menu that appears.

7. In the Start Editing dialog, select the geodatabase that contains the feature classes to be edited. (**c:\rlgis_invasive\LandcoverHabitat.mdb***).* Click **OK**.

8. From the **Editor Toolbar**, select which **Target** feature class to edit. For this session, select *Invasive Plant Monitoring Polygon* feature class.
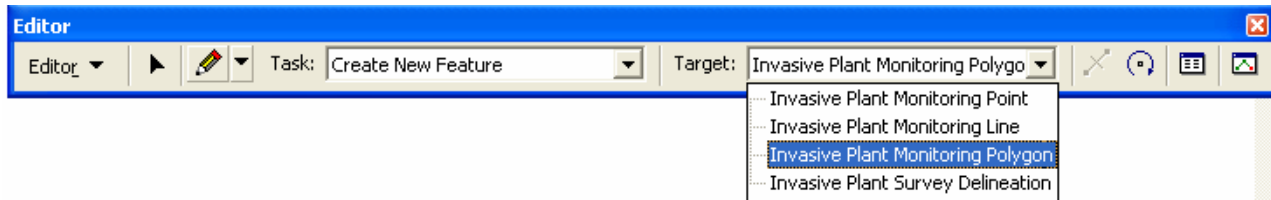
9. Zoom in to the area around the large body of water in the southwest corner of the imagery.

Select the **Sketch Tool** and draw a polygon on the screen. To complete the polygon, double click.

10. When the polygon is completed, select the **RLGIS Attribute Editor** button from the menu bar.

11. The <u>RLGIS Invasive Plant Monitoring Polygon</u> dialog will appear.

12. Notice that the **Organization Name** is automatically fill in with *Rocky Mountain Arsenal National Wildlife Refuge*. The **Organization Name** is read from the **FwsInterest** layer.

13. In the **Invasive Plant Monitoring tab**, fill in the fields;

Origin = John Doe
Observation Date = automatically filled in
Cover Type Invaded =
Collection Method = Pan Ortho

14. Click the **Species 1 tab**

15. Click on Common Name and notice the species of invasive plants that were entered in Section 6, List Editor. If a species was not added to the List Editor, you can add it in the More Species option.

16. Assuming that an invasive species was not added to the List Editor that should have been, click **More Species**….To select a species, first select a Category;

Category = Vascular Plant
Common Name = canada thistle (or another not added to your list)
Scientific Name = automatically fill in
Taxonomic Serial Number = automatically fill in

17. When finished, click **OK**.

18. Notice that in the **Species 1** tab, the *Common Name, Scientific Name* and the *Taxonomic Serial Number* are filled in.

19. Next, from the drop down menu, select the Percent Cover and Growth Stage.

20. Click on the **Species 2** tab and enter a second weed. Notice on the Common Name drop down menu that canada thistle is added to pick list.

21. In the Species 2 tab, select;

Common Name = wormwood
Scientific Name= automatically fill in
Taxonomic Serial Number = automatically fill in

22. From the drop down menus, select the Percent Cover and Growth Stage and fill in.

23. Before clicking **OK**, go to the **Required Fields** tab. These fields should automatically be reading from the FwsCadastral geodatabase and be filled in accordingly. However, for the first time, you will have to select a **State**: *Colorado*.

24. When finished, click **OK**.

25. When done entering data for the Invasive Plant Polygon feature class, stop editing and save.

26. Go to the Editor Toolbar, from the drop down menu, select **Stop Editing**. A <u>Save</u> dialog appears, click **Yes** to save edits.

27. Once your edits are saved, save the **RMK.mxd**. Go to **File** and click **Save**.

28. Congratulations! You have entered and saved data using the RLGIS Attribute Editor Tools supplied with the setup.exe file for the Volunteer Weed Mapping Geodatabase.

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Table to Domain

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In the section 6, you have used the List Editor to create your standardized lists (lookup tables). In order to view these "lists" in ArcPad, the "table to domain" option must be used in ArcCatalog. (In the future, the "table to domain" option will not have to be used, the functionality that will check out the lookup tables in RLGIS to ArcPad is not completed yet.)

1. Once the lists are created using the List Editor in ArcMap, open ArcCatalog.

2. In ArcCatalog, select the ArcTool Box button

3. In the ArcTool Box window, select the **Search** button and type in "table to domain" and click search.
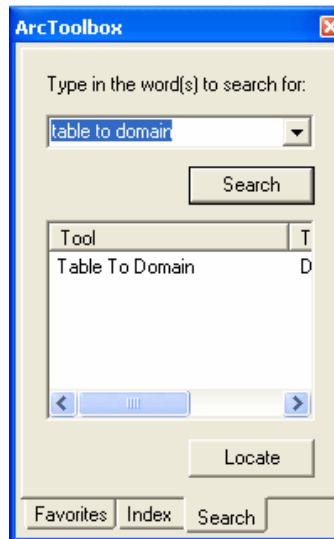
4. Under Tool, **Table to Domain** pops up. Double click on it. A Table to Domain dialog appears.
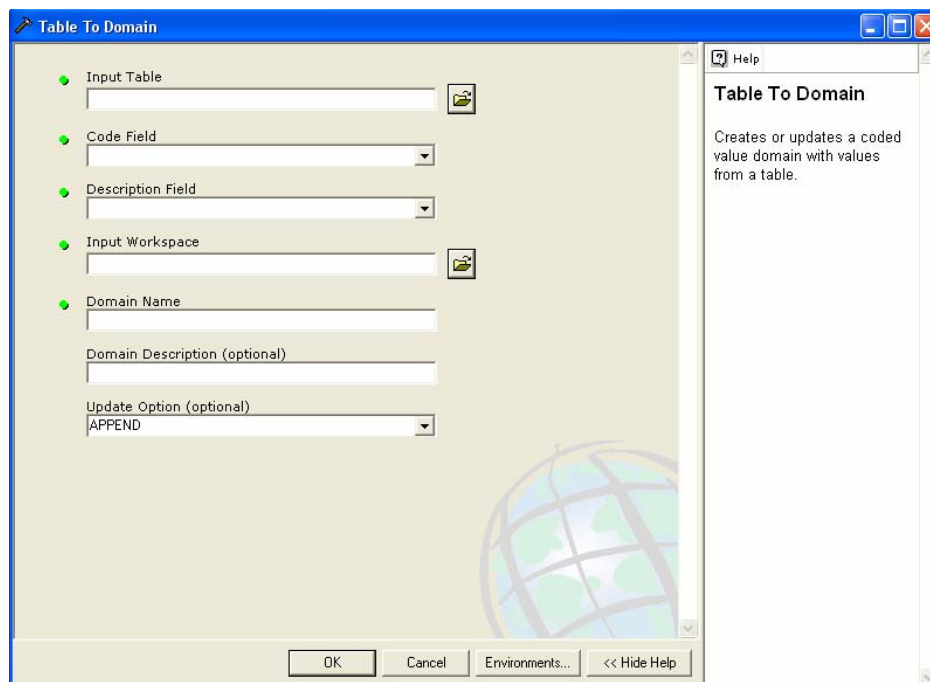
5. In the **Input Table** selection, navigate to "C:\Program Files\RLGIS\RLGIS Attribute Edit" folder, and click on the RLGISLookups.mdb and select the **InvasivePlantNames** table.

6. Under the **Code Field**, select Common Name

7. In the **Description Field**, select Common Name

8. In **Input Workspace**, navigate to the c:\rlgis_invasive folder and select the *LandcoverHabitat.mdb*. (The Domain Name and the Domain Description (optional) should be CommonName).
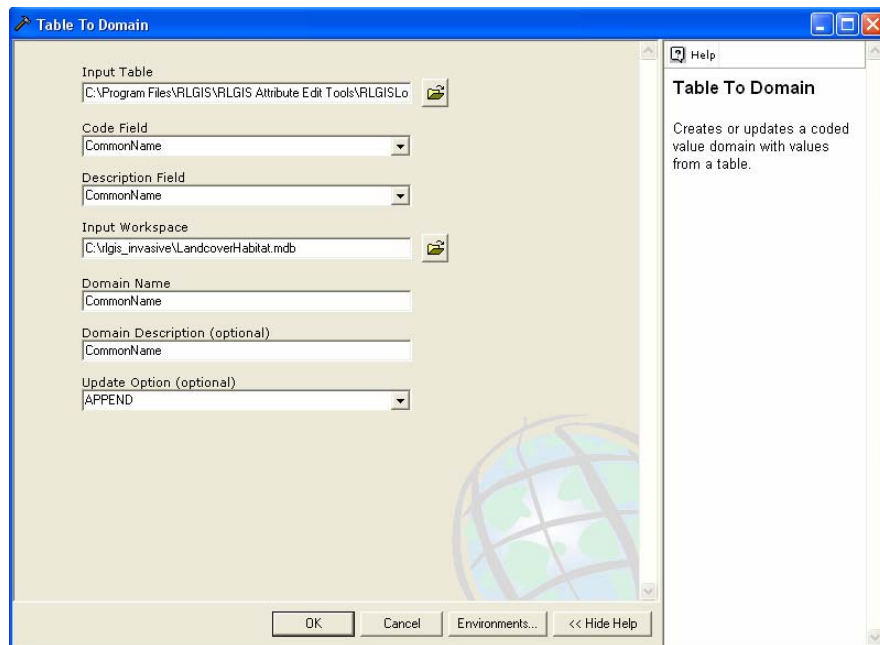
9. Click **OK**. The Table to Domain command will run, when finished click **Close**.

10. In ArcCatalog, navigate to the c:\rlgis_invasive\LandcoverHabitat geodatabase. Right mouse click on the LandcoverHabitat geodatabase and select **Properties**.
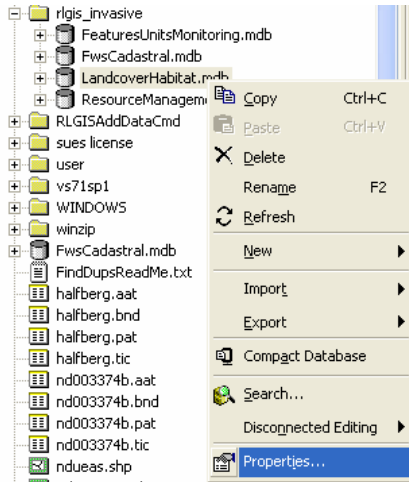
11. A <u>Database Properties</u> dialog box appears, select CommonName in the **Domain Names** tab and check out the **Coded Values** listed at the bottom of the dialog box. All the species entered into the **List Editor** are now listed in the CommonName domain.
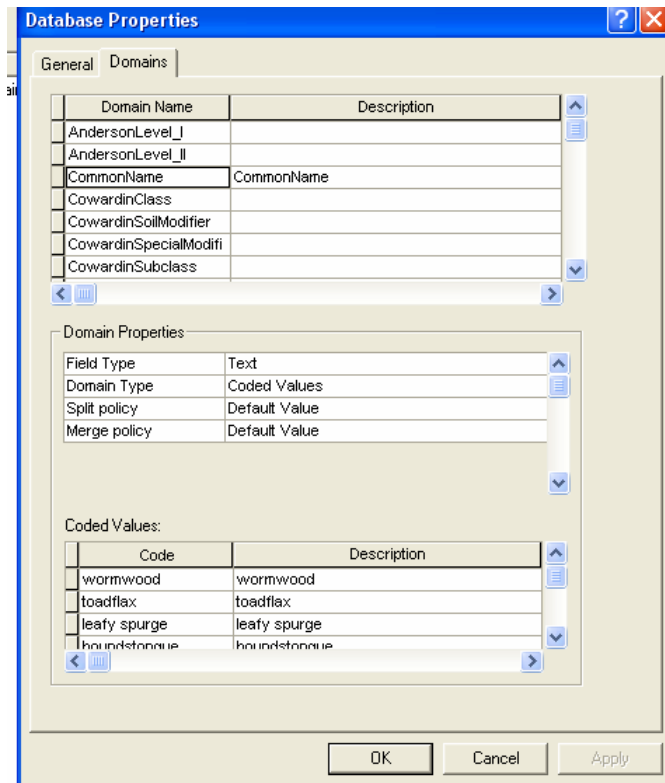
12. Once verified, click **OK**.

13. Now, the domains have to be assigned to the feature classes that are going to use them.

14. In ArcCatalog, select the LandcoverHabitat geodatabase. In the view to the right, all the feature classes within the geodatabase are listed. Select the Im_Inv_Plant_Pl feature class and right mouse click on it and select **Properties**.

15. Scroll down through the **Fields** until Com_Name_1, click on it. Notice in the **Field Properties**, the Domain option is empty. Click on the empty space to the right of Domain, and select CommonName from the dropdown menu. Click **Apply**.
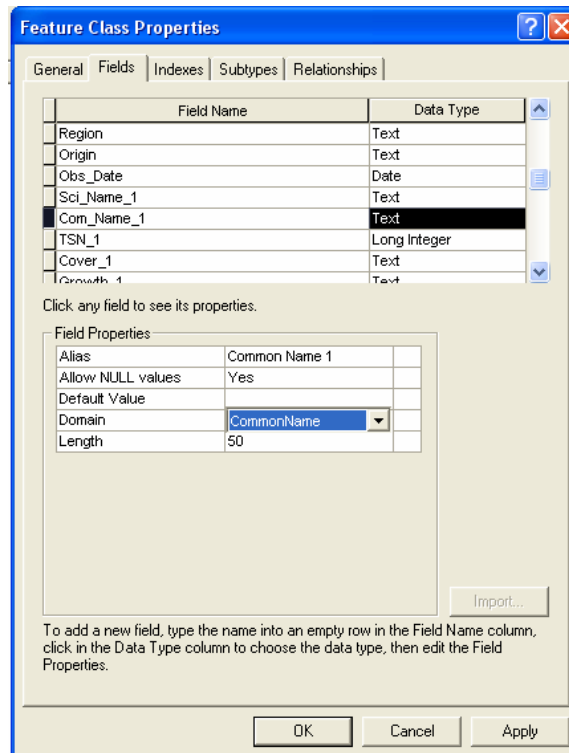
16. Apply the CommonName domain to the Com_Name_2 and the Com_Name_3 fields to and click **OK**. Because we assigned a domain to the Com_Name_1, 2, and 3 fields, those values will be listed in the forms when exported to ArcPad.

17. Repeat steps 1-16 for Scientific Names and/or TSN number if desired.

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Viewing Data Entered in the Invasive Feature Classes
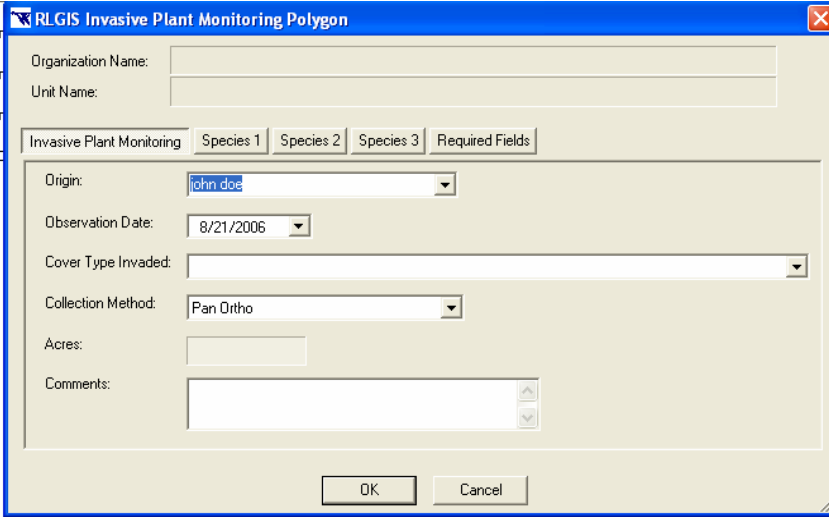
9

9. Viewing data entered in the Invasive feature classes

When done entering data into selected feature classes, you will want to look at the data occasionally. To view the data entered for a polygon, point, or line, there are three ways:

1. Make sure the polygon is selected, using the select feature ⬚ tool, and click on the **RLGIS Attribute Editor** ⬚ tool. Notice that the RLGIS Invasive Plant Monitoring Polygon dialog box appears with the data entered in it.
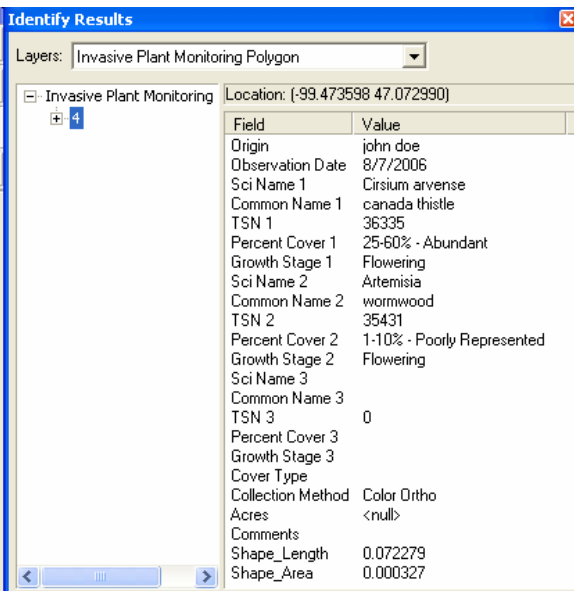
2. Select the **Identify** ⓘ tool and click on the polygon. An Identify Results dialog comes up. In the **Layers** dropdown menu, select *Invasive Plant Monitoring Polygon*.

- Notice all the data entered into the <u>RLGIS Attribute Editor</u> dialog is displayed.

- When finished, click the in the right hand upper corner to close.

3. By right mouse clicking on the Im_Inv_Plant_Polygon feature class in ArcMap, select **Open Attribute Table**. An <u>Attributes of Invasive Plant Monitoring Polygon</u> dialog is opened. By scrolling through the table, you can see data that a selected feature has been given.

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Checking Out Data Layers for ArcPad 7.0

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In this section, you will learn how to transfer checked-out data layers to the GPS data logger for use in field data collection with ArcPad. The example below is using **ArcPad 7.0**. If you are using ArcPad 6.0.3 or lower, please refer to **tab 13** for instructions. The software used to transfer data between your GPS data logger device and PC is called ActiveSync. This software is free and can be downloaded from:

http:\\www.microsoft.com\windowsmobile\resources\downloads\pocketpc\default.mspx

1. Open the *RMK.mxd* file located in the **c:\rlgis_invasive\training** folder.

2. Let's make some changes to our basemap before we extract data layers to ArcPad. First, <u>right click</u> on the *Invasive Plant Monitoring Polygon* layer and choose **Properties**.

3. Click the **Fields** tab. Uncheck the following fields: Shape, Object_ID, RLGIS_ID**,** Lit, OrgCode, OrgName, Cmplx_Name, Dvsn_Name, Unit_Name, Subunit_Name, RSL_Type, and StateAbbr. Click **OK.**

Unselecting Fields in Layer Proprieties: *Unselecting fields in Layer Properties causes them to not be displayed in the digital field forms generated in ArcPad. This is generally done for 2 reasons; first the data required by these fields tends to be static and can be entered simultaneously for all records collected after the data has been checked back into ArcMap. Second, removing data fields that do not apply to the specifics of the variables being recorded make the field form shorter and reduce the number of key strokes or screen taps required to enter the data, making data collection less cumbersome and more efficient.*

4. Repeat **Step 3** for the *Invasive Plant Monitoring Point,* the *Invasive Plant Monitoring Line* and the *Invasive Plant Monitoring Survey Delineation,* click **OK.**

5. From the **View** menu, select **Toolbars** tab and put a check next to *ArcPad*. This loads the ArcPad Tools for ArcGIS toolbar. Dock or move the toolbar if desired.

6. Click on the **Get Data for ArcPad 7.0** button.

7. For our field data collection scenario, we will be editing the *Invasive Plant Monitoring Polygon*. However, we would like additional data layers brought into the field as well. Put a check next to all layers. See example below. Click **Next**.

8. In the Get Data For ArcPad dialog, choose the layer(s) you wish to check out. (Only data layers from one geodatabase can be checked out for editing). Attribute forms will be created for the layers you specify. You will be collecting data for all layers using ArcPad. Therefore, put a check next to these layers. Click **Next** when finished.

9. Assign the name of the new folder to be **RMK_Weeds** and specify **c:\rlgis_invasive\training** as the location to store the new folder. This new folder will contain all of the layers you specified above. Click **Finish**.

10. After several seconds, you will be notified that your operation was successful. Click **OK**.

11. If your mobile device is connected to the computer, it will automatically ask you if you would like to transfer the checkout files to your mobile device. Click **Yes**.
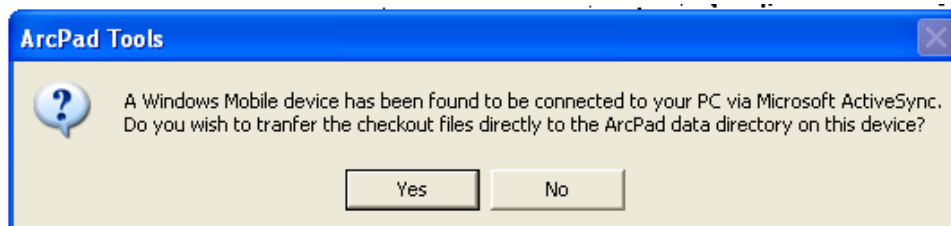
12. From the Windows Mobile checkout folder dialog, navigate to where you would like the RMK_Weeds folder to reside on your GPS unit, once selected, click **OK**.

Considerations and Errors when checking out data to ArcPad

      a. **Checking out the same data to multiple GPS data loggers**:
         If multiple data loggers are to be used to collect the same data, an individual dataset must be checked out for each unit. Each dataset checked out must have a different name following the suggested naming convention outlined above. This will allow the project manager to track edits more efficiently and prevent data loss.
         (*Refer to* **Section 2** *– Generate Data Management*)

b. **Data projection errors when checking out data for ArcPad:**
      ArcPad does not support reproject on the fly. Because of this limitation, all data being checked out to ArcPad must be in the same projection. If they are not in the same projection, you will receive an error message during the check out process.

   c. **Raster errors when checking out data for ArcPad:**
      ArcPad has file size limitation for encoding raster data.   All users of ArcMap can only encode individual, uncompressed raster smaller than 50 MB. The 50 MB size rule will be evaluated as follows: <u>Image Width</u> ***** <u>Image Height</u> ***** <u>Number of Bands</u> **cannot be greater than 50 million**.   If you purchase the MrSid extension from Lizard Tech, then your limit is 500 MB with the added ability to mosaic images.

U.S. Fish and Wildlife Service

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Transferring Checked Out Data Layers with ArcPad 7.0

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11. Transferring checked-out data layers with ArcPad 7.0

These instructions were developed using ActiveSync version 4.2 and assume that you have **not** established a partnership between the GPS data logger device and your PC. The GPS data logger used in this example is a Trimble **GeoXT**, however, these steps should work with most GPS data loggers capable of running ArcPad. Refer to **tab 14** for transferring data for **ArcPad 6.0.3**.

The software used to transfer data between your GPS data logger device and PC is called ActiveSync. This software is free and can be downloaded from:

http:\\www.microsoft.com\windowsmobile\resources\downloads\pocketpc\default.mspx

1. Ensure the cradle of your GeoXT data logger is connected to the USB port of the computer containing the ArcPad data.

2. Place your GeoXT onto the cradle. ActiveSync software should detect your device. If it doesn't, check cabling or try another USB port and then lift your device off the cradle, turn it off and then place back on the cradle.

3. A Microsoft ActiveSync dialog appears, the ArctiveSync icon should be turning and trying to connect. If connected properly, it will come up as **Connected**.
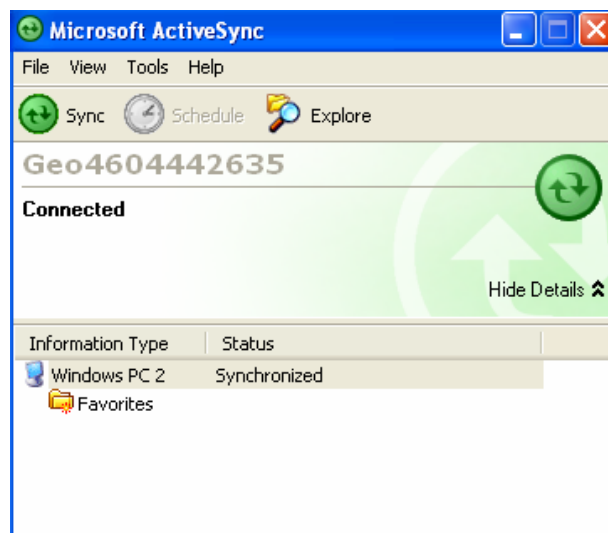
4. From the Microsoft ActiveSync dialog, select the **Explore** button.

5. Windows Explorer will launch. Using the **Up** tool, navigate on your computer to the folder **c:\rlgis_invasive\training**

6. Copy the folder RKM_Weeds and paste it on to the mobile device.

<u>Copy from computer</u>   <u>Paste to Geo XT</u>

7. In the <u>File Conversion</u> dialog, click **OK**. A <u>Copy and Convert to mobile device format</u> dialog will come up and copy your data across.

8. Congratulations! The data from your computer should now be transferred to your GPS unit.

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Activating the GPS in ArcPad 7.0

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In this section you will learn the basics of activating the global positioning system (GPS) on your data logger. You will also learn to set the configuration of the GPS device and adjust the GPS options in ArcPad. The GPS data logger used in this example is a Trimble GeoXT.

Since each GPS devise may have a unique configuration, there are really no standard procedures for configuring GPS device with ArcPad. However, an outline of the four basic steps are given below:

- Determine cables and hardware required fro connecting GPS devices
- Connect the GPS device to the mobile device
- Set the configuration of the GPS device
- Set the GPS options in ArcPad

Procedures for configuring several commonly used GPS devices with ArcPad are provided below.

Trimble GeoCE series GPS unit running WAAS

Configuring ArcPad

1. Select **the ArcPad Options** icon from the main toolbar.

2. An ArcPad Options dialog opens.

3. Tab over to the **AUX** tab.

4. In the **Port** option, select **COM2:NMEA Serial port**

5. Set **Baud** to 4800.
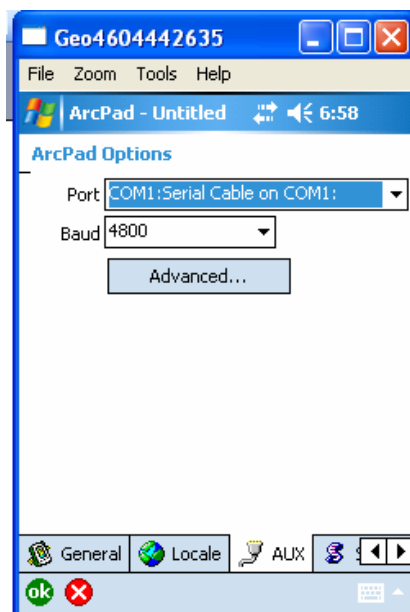
6. Select the **Advanced** …. button and view the settings:

Port: Com2:NMEA Serial port
Baud = 4800
Parity = None
Data Bits = 8
Stop Bits = 1

7. Click **OK, OK** when finished.

8. Next, from the main menu in ArcPad, select the arrow next to **the GPS Position Window** button.

9. From the drop down menu, select **GPS Preferences**

10. In the GPS Preferences dialog, select the **GPS** tab. Settings should be as follows:

Protocol = NMEA 0183
Port = COM2:NMEA Serial Port
Baud = 4800
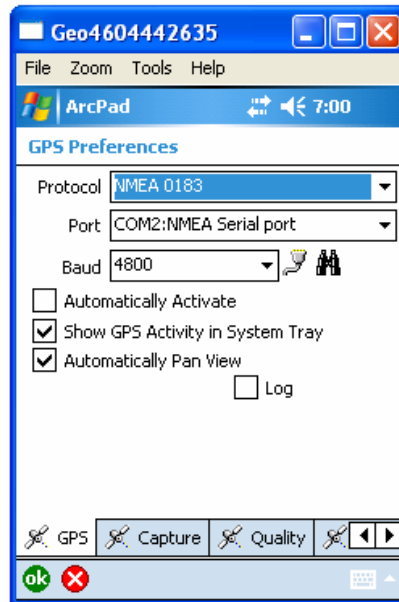
11. Once the GPS settings are set, arrow over to the **Datum** tab.

12. In the **GPS Datum** box, select **D_North_American_1983** from the drop down menu.

13. Click **OK** when finished.

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Checking Out Data Layers using ArcPad 6.0.3

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13. Checking out data layers using ArcPad 6.0.3

In this section, you will learn how to transfer checked-out data layers to the GPS data logger for use in field data collection with ArcPad 6.0.3. The software used to transfer data between your GPS data logger device and PC is called ActiveSync.   This software is free and can be downloaded from:

http:\\www.microsoft.com\windowsmobile\resources\downloads\pocketpc\default.mspx

1. Open the **RMK.mxd** file located in the **c:\rlgis_invasive\training** folder.

2. Let's make some changes to our basemap before we extract data layers to ArcPad. First, <u>right click</u> on the *Invasive Plant Monitoring Polygon* layer and choose **Properties**.

3. Click the **Fields** tab. Uncheck the following fields: Shape, Object_ID, RLGIS_ID**,** Lit, OrgCode, OrgName, Cmplx_Name, Dvsn_Name, Unit_Name, Subunit_Name, RSL_Type, and StateAbbr. Click **OK.**

<u>Unselecting Fields in Layer Proprieties:</u> Unselecting fields in Layer Properties causes them to not be displayed in the digital field forms generated in ArcPad. This is generally done for 2 reasons; first the data required by these fields tends to be static and can be entered simultaneously for all records collected after the data has been checked back into ArcMap. Second, removing data fields that do not apply to the specifics of the variables being recorded make the field form shorter and reduce the number of key strokes or screen taps required to enter the data, making data collection less cumbersome and more efficient.

4. Repeat **Step 3** for the *Invasive Plant Monitoring Point, Invasive Plant Monitoring Line and Invasive Plant Monitoring Survey Delineation,* click **OK.**

5. From the **View** menu, select **Toolbars** tab and put a check next to *ArcPad.* This loads the ArcPad Tools for ArcGIS toolbar. Dock or move the toolbar if desired.

ArcPad 6.0.3 Toolbar

6. Click on the **Get Data for ArcPad** button.

7. For our field data collection scenario, we will be editing the I*nvasive Plant Monitoring Polygon* layer. However, we would like additional data layers brought into the field as well. Put a check next to all layers. See example below. Click **Next**.

8. In the Get Data For ArcPad dialog, choose the layer(s) you wish to check out. (Only data layers from one geodatabase can be checked out for editing). Attribute forms will be created for the layers you specify. You will be collecting data for all layers using ArcPad. Therefore, put a check next to these layers. Click **Next** when finished.

9. Assign the name of the new folder to be **RMK_Weeds** and specify **c:\rlgis_invasive\training** as the location to store the new folder. This new folder will contain all of the layers you specified above. Click **Finish**.

10. After several seconds, you will be notified that your operation was **successful.** Click **OK.**

11. Congratulations! You are ready to put your ArcMap data onto your GPS unit.

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Transferring Data to the Data Logger Using ArcPad 6.0.3

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14. Transferring data to data logger using ArcPad 6.0.3

These instructions were developed using ActiveSync version 4.2 and assume that you have **not** established a partnership between the GPS data logger device and your PC. The GPS data logger used in this example is a Trimble **GeoXT**, however, these steps should work with most GPS data loggers capable of running ArcPad.

The software used to transfer data between your GPS data logger device and PC is called ActiveSync. This software is free and can be downloaded from:

http:\\www.microsoft.com\windowsmobile\resources\downloads\pocketpc\default.mspx

1. Ensure the cradle of your GeoXT data logger is connected to the USB port of the computer containing the ArcPad data.

2. Place your GeoXT onto the cradle. ActiveSync software should detect your device. If it doesn't, check cabling or try another USB port and then lift your device off the cradle, turn it off and then place back on the cradle.

3. Check **NO**, when asked to set up a partnership and connect as a guest. Select **Next >**.
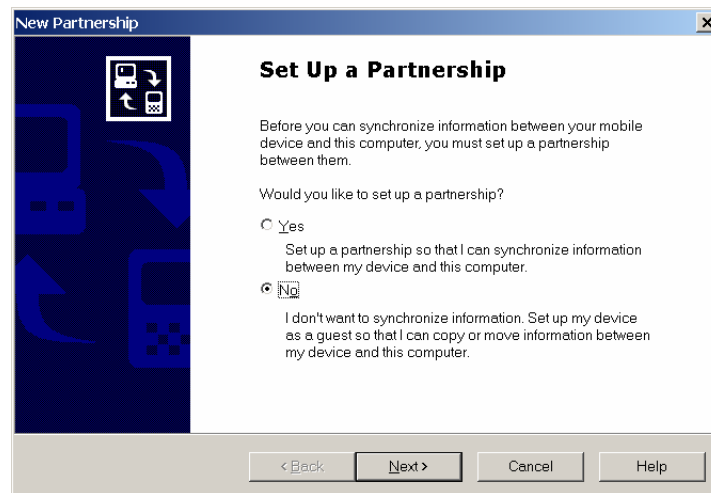
4. The Microsoft ActiveSync dialog appears and your connection status is displayed in the window below **Guest**. ("Connected" appears below Guest in the dialog window).
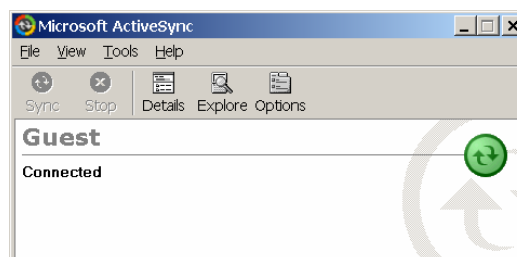
5. Windows Explorer will launch. Using the **Up** tool, navigate on your computer to the folder **c:\rlgis_invasive\training**

6. Copy the folder RKM_Weeds and paste it on to the mobile device.

<u>Copy from computer</u>   <u>Paste to Geo XT</u>

7. In the <u>File Conversion </u>dialog, click **OK**. A <u>Copy and Convert to mobile device format</u> dialog will come up and copy your data across.

8. Congratulations! The data from your computer should now be transferred to your GPS unit.

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Activating the GPS using ArcPad 6.0.3

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In this section you will learn the basics of activating the global positioning system (GPS) on your data logger. You will also learn to set the configuration of the GPS device and adjust the GPS options in ArcPad. The GPS data logger used in this example is a Trimble GeoXT.

Since each GPS devise may have a unique configuration, there are really no standard procedures for configuring GPS device with ArcPad. However, an outline of the four basic steps are given below:

- Determine cables and hardware required fro connecting GPS devices
- Connect the GPS device to the mobile device
- Set the configuration of the GPS device
- Set the GPS options in ArcPad

Procedures for configuring several commonly used GPS devices with ArcPad are provided below.

Trimble GeoCE series GPS unit running WAAS

Configuring ArcPad

1. Select the tools icon from the main toolbar.

2. An ArcPad Options dialog opens.

3. Select the Protocol tab. Select NMEA 0183

4. In the **GPS Datum** box, select **D_North_American_1983** from the drop down menu.
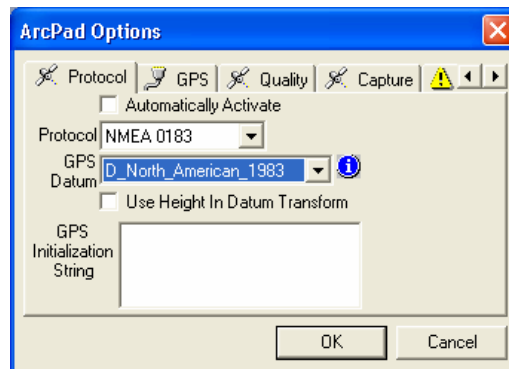
5. Select the **GPS** tab. Fill in as below.

Port = Com2
Baud = 4800
Parity = None
Infra Red is checked on
Data Bits = 8
Stop Bits = 1
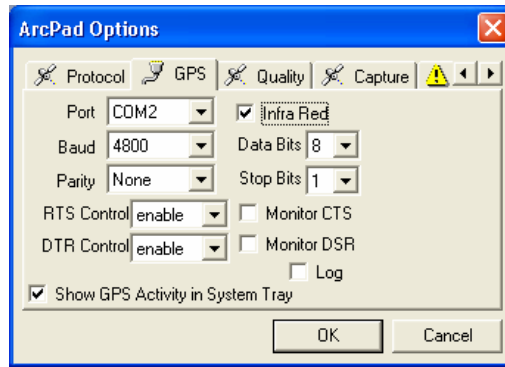
6. Select **OK** once complete. These setting are now saved and should not need to be reset.

<u>Configuring the GPS device</u>

1. Select the **F1** button in the upper right corner of the screen. This will launch the GPS Controller.

2. Click the arrow next to Skyplot and select Real-time from the drop-down menu.

3. Once Real-time is selected, a screen will come up displaying ***No real-time source has been set up*** or ***Integrated WAAS ……waiting***.

4. Select the wrench   at the bottom of the screen.

5. The Real-time setting should be as below:

    <u>Choice 1</u>: ***Integrated WAAS***
    <u>Choice 2</u>: ***Use Uncorrected GPS***
    <u>Real-time Age Limit</u>: ***4 min***

6. Click **OK**. The GPS Controller has been set up for Real-time corrections. Exit out of the GPS Controller.

<u>Trimble GeoCE series running GPSCorrect</u>

Step 1 – Configuring ArcPad

1. Select the tools icon from the main toolbar.

2. An <u>ArcPad Options</u> dialog opens.

3. Select the Protocol tab. Select Trimble GPSCorrect

4. In the **GPS Datum** box, select **D_North_American_1983** from the drop down menu.
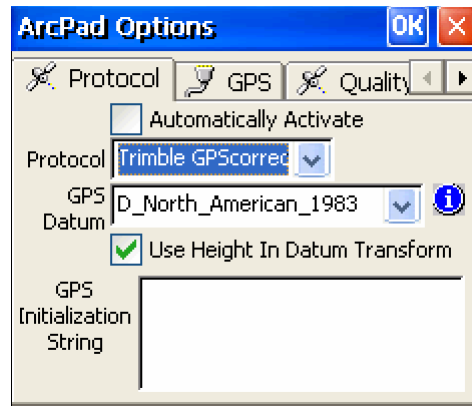
5. Select the **GPS** tab. Fill in as below.

Port = Com3
Baud = 9600
Parity = Odd
Infra Red is checked on
Data Bits = 8
Stop Bits = 1
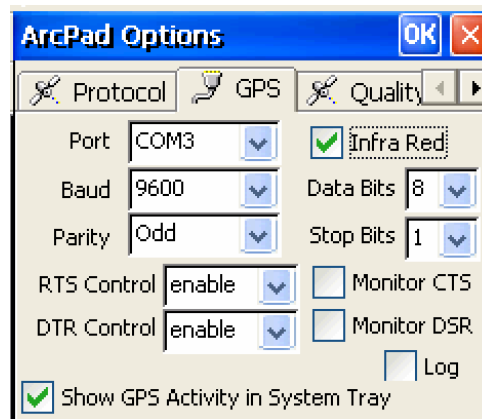
6. Select **OK** once complete. These setting are now saved and should not need to be reset.

Step 2 – Configuring the GPS device (GPS controller)

1. Select the **F1** button in the upper right corner of the screen. This will launch the **GPS Controller**.

2. Change the display to *Setup*

3. Tap on *Logging Settings*

4. Turn **Log GPS to SSF** to **ON**

5. **For Data Type, choose SuperCorrect.** This allows you to post-process data that is collected using real-time such as WAAS.

NOTE: The Trimble GPSCorrect extension for ESRI ArcPad software lets you take full control of differential correction to ensure you have the most reliable and accurate data for your GIS.

Because the GPSCorrect extension lets you record detailed GPS information, you can improve the accuracy of your GPS positions from 10 meters to submeter or even subfoot (30 cm), depending on the environment and your GPS receiver. For differential correction of your Shapefiles you have a choice of post processing software. GPSCorrect is a purchased extension for ArcPad as well as the software (GPS Pathfinder Office 2.9 or higher) for data processing.

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Creating Point Features on a GPS unit

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In this section, you will open an ArcPad map that was created in the previous section and edit a point feature. (This exercise is using a Trimble GeoXT GPS unit)

1. From the GPS unit, select ArcPad 7.0 from the Start Menu (It may take a few seconds to launch).

2. Once in ArcPad, from the *Main Toolbar*, click the **Open Map** button. Navigate to where the folder *RMK_Weeds* is and double click on the *ArcPad.apm* file. (This will take a few seconds to load).

3. From the *Main Toolbar*, click the **Layers** button and ensure the point file is present.

4. Put a check in the view column , the identify column and the edit column for the *Invasive Plant Monitoring Point* layer*.*
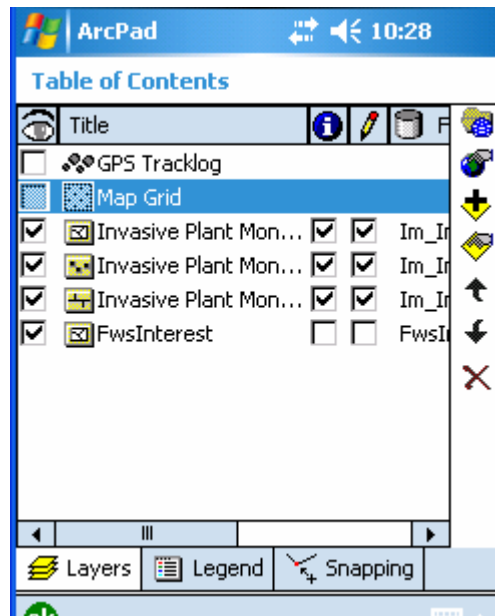
.

5. Click **OK** when finished.

6. From the **Main Toolbar**, click on the **GPS Position Window** icon. Choose **Yes** when asked to activate your GPS.
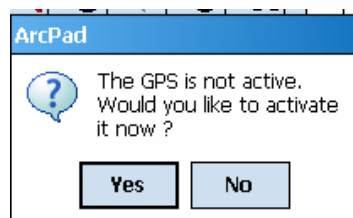
7. A Position Window will appear, when satellites are found, a red circle with cross hairs will be representing your position. (It may take several minutes).

8. From the *Main Menu*, select the arrow next to the **Edit/Drawing** toolbar to create a point feature.

9. When ready to collect a GPS point of a weed infestation, tap the **Point** tool, it will become suppressed.

10. Click the **Capture Point Using GPS** button.

11. A data entry form automatically appears. Click **OK** when finished.

12. When finished editing, select the save project button and exit from ArcPad.

13. This can be done by selecting the (arrow) dropdown menu next to the **Open Map** button. Select **E<u>x</u>it** from the menu to close ArcPad.

TIP: You can have one point, one line and one polygon layer in edit mode at any given time.

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Creating Line Features on a GPS Unit

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In this section, you will open an ArcPad map that was created in the previous section and edit a line feature. (This exercise is using a Trimble GeoXT GPS unit)

NOTE: Capturing Line and Polygon Features: There are two methods that can be used when capturing vertices for line and polygon features.

- **Add GPS Vertex**
- **Add GPS Vertices Continuously**

The Add GPS Vertex method allows you to collect each vertex individually and is much more accurate when averaging is used. Each time you would like to place a vertex in your polyline or polygon feature, you must tap the GPS Vertex button   . The data logger will place a vertex at that point. This works really well for straight line features like weeds along ditches.

The "Add GPS Vertices Continuously" method automatically captures vertices for a polyline or polygon feature. Unlike the "Add GPS Vertex" method, you do not have to manually tap the screen to collect each vertex. Once you have selected this method by pressing the   button, the data logger will automatically and continuously collect the vertices. This works best for polygon features or irregular shaped areas.

1. From the GPS unit, select ArcPad 7.0 from the Start Menu (It may take a few seconds to launch).

2. Once in ArcPad, from the *Main Toolbar*, click the **Open Map** button.   Navigate to where the folder *RMK_Weeds* is and double click on the *ArcPad.apm* file. (It will take several seconds to load).

3. From the *Main Toolbar*, click the **Layers** button and ensure the four files you prepared using **ArcPad Tools** in ArcMap are present in your map.

4. Put a check in the View Column   , the Identify Column   and the Edit Column   for Invasive Plant Monitoring Line layer.
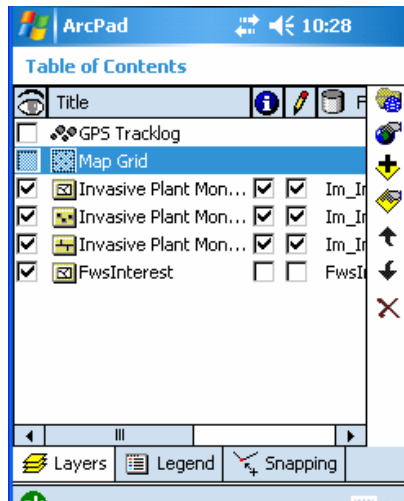
5. Click **OK** when finished.

6. From the **Main Toolbar**, click on the **GPS Position Window** icon. Choose **Yes** when asked to activate your GPS.
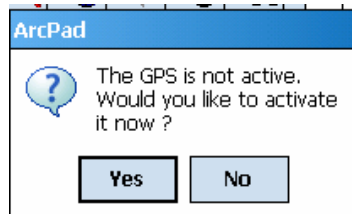
7. A Position Window will appear, when satellites are found, a red circle with cross hairs will be representing your position. (It may take several minutes).

8. From the *Main Menu*, select the arrow next to the **Edit/Drawing** toolbar to create a line feature. Select the **Polyline** tool and GPS an area that represents a hypothetical weed infestation that was sprayed.

9. When ready to collect a GPS line of a weed infestation, tap the **Polyline** button to start editing a line feature. (It will become suppressed)

10. Tap the **Add Vertex** button to capture a single vertex or tap the **GPS Vertices Continuously** button to capture streaming vertices.

11. Tap the **Polyline** button when you are ready to complete the capture of the line feature using 6.0.3. If using ArcPad 7.0, tap the green arrow at the bottom of the page to close the file and proceed to the forms.

12. A data entry form appears. Fill in the form. Click **OK** when finished.

13. When finished editing, select the **save project** button and exit from ArcPad.

14. This can be done by selecting the (arrow) dropdown menu next to the **Open Map** button. Select
E<u>x</u>it from the menu to close ArcPad.

TIP: You can have one point, one line and one polygon layer in edit mode at any given time.

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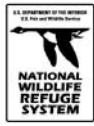
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Creating Polygon Features on a GPS Unit

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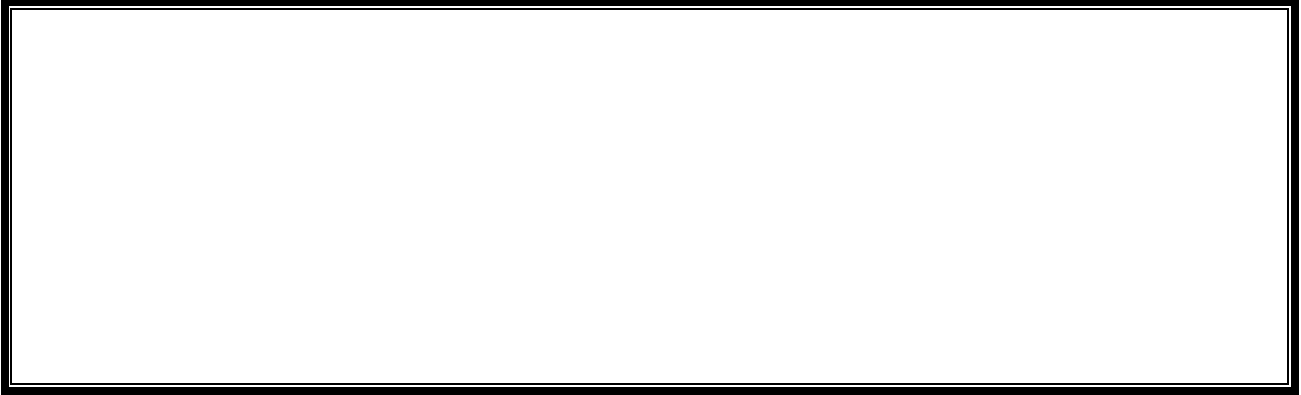
18. Creating Polygon Features on a GPS unit

In this section, you will open an ArcPad map that was created in the previous section and edit a polygon feature. (This exercise is using a Trimble GeoXT GPS unit)

1. From the GPS unit, select ArcPad 7.0 from the Start Menu (It may take a few seconds to launch).

2. Once in ArcPad, from the *Main Toolbar*, click the **Open Map** button.   Navigate to where the folder *RMK_Weeds* is and double click on the *ArcPad.apm* file. (This will take a few seconds to load).

3. From the *Main Toolbar*, click the **Layers** button and ensure the four files you prepared using ArcPad Tools in ArcMap are present in your map.

4. Put a check in the view column, the identify column and the edit column for the *Invasive Plant Monitoring Polygon* layer.

5. Click **OK** when finished.

6. From the **Main Toolbar**, click on the **GPS Position Window** icon. Choose **Yes** when asked to activate your GPS.

7. A Position Window will appear, when satellites are found, a red circle with cross hairs will be representing your position. (It may take several minutes).

8. From the *Main Menu*, select the arrow next to the **Edit/Drawing** toolbar to create a polygon feature.
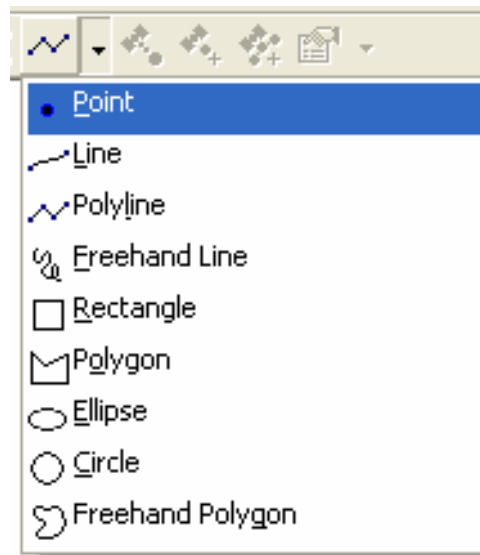
9. When ready to collect a GPS polygon of a weed infestation, tap the **Polygon** button to start editing a polygon feature.

10. Tap the **Add Vertex** button to capture a single vertex or tap the **GPS Vertices Continuously** button to capture streaming vertices.

11. Tap the **Polygon** button to start capturing a polygon feature.

12. Tap the **Add Vertex** button to capture a single vertex or tap the **GPS Vertices Continuously** button to capture streaming vertices.

13. Tap the **Polygon** ⌷ button when you are ready to complete the capture of the polygon feature. The last vertex will automatically connect to your first vertex and close the polygon when using

6.0.3. If using ArcPad 7.0, tap the green arrow ➡ at the bottom of the page to close the file and proceed to the forms.

14. A data entry form appears. Fill in the form. Click **OK** when finished.

15. When finished editing, select the **save project** button 💾 and exit from ArcPad.

16. This can be done by selecting the (arrow) dropdown menu next to the **Open Map** button. Select **Exit** from the menu to close ArcPad.

TIP: You can have one point, one line and one polygon layer in edit mode at any given time.

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Transferring Data from the GPS Unit to the PC

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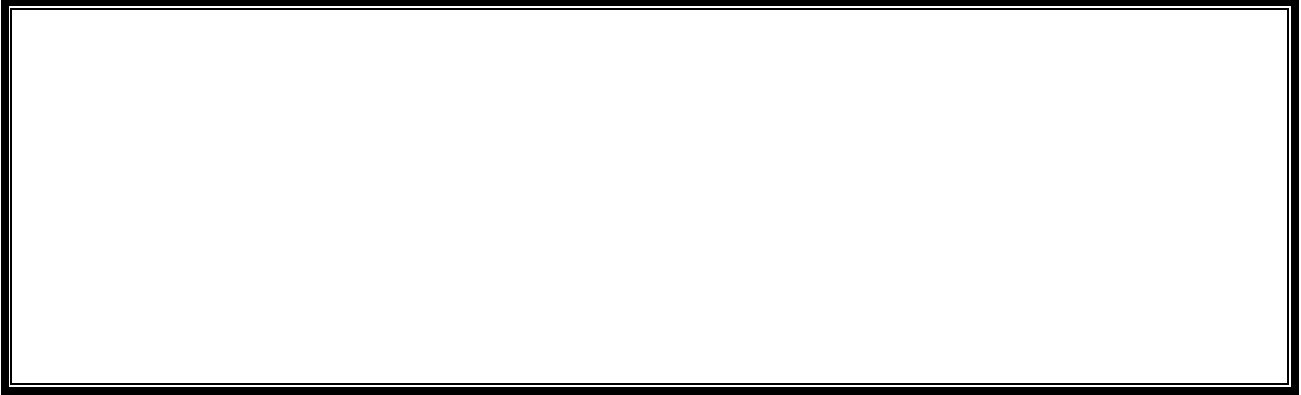
19. Transferring data from the GPS unit to the PC

In this section, you will transfer the data collected in the field back to your computer. If using ArcPad 6.0.3, start at step 1, if using ArcPad 7.0, start at step 5.

19.1 ArcPad 6.0.3 or lower

1. Ensure the cradle of your GeoXT data logger is connected to the USB port of the computer containing the ArcPad data.

2. Place your GeoXT onto the cradle. ActiveSync software should detect your device. If it doesn't, check cabling or try another USB port and then lift your device off the cradle, turn it off and then place back on the cradle.

3. A <u>New Partnership</u> dialog appears, check **NO** when asked to set up a partnership and connect as a guest. Select **Next**.

4. The Microsoft ActiveSync dialog appears and your connection status is displayed in the window below **Guest.**
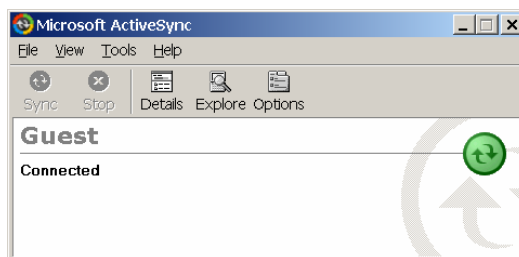
19.2 ArcPad 7.0 & ArcPad 6.0.3 or lower

5. From the Microsoft ActiveSync dialog, select the **Explore** button.

6. Windows Explorer will launch. Navigate on the Geo XT to the folder *My Windows Mobile-Based Device\RMK_Weeds* folder.

7. Click on the **RMK_Weeds** folder, right mouse click and select copy.

8. Be sure to place the checked out folder from the GeoXT containing the edits in the same location on the PC as it was copied from.

9. When in the folder*,* **c:\rlgis_invasive\training\RMK_Weeds***,* right mouse click and hit paste*.* When this is done you should be asked if you would like to overwrite the existing folder and all of its contents. Select **Yes to Alll**.
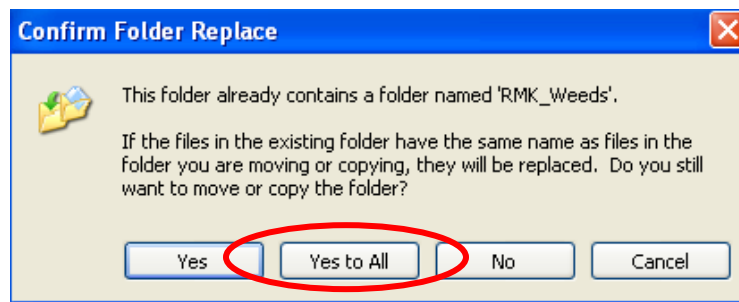
10. Close Windows Explorer.

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Opening Data Transferred from the GPS Unit In ArcMap

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20. Opening Data Transferred from the GPS unit in ArcMap

In this section, you will be looking at the data collected out in the field and bring it into the LandcoverHabitat Geodatabase within RLGIS.

1. From the Windows desktop, double click on ArcMap to launch the program.

2. Open the **RMK.mxd** file located in the **c:\rlgis_invasive\training** folder**.**

3. Open the **Editor Toolbar** if it is not already open. Go to the **View** button on the main menu, select **Toolbars** and place a check next to **Editor**.
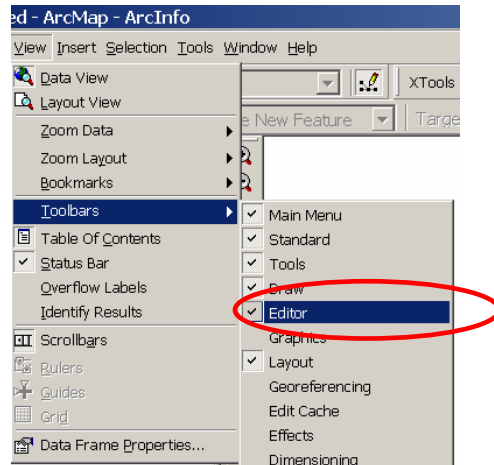
4. The **Editor Toolbar** will open. Dock the Editor Toolbar by dragging it.

5. Start an edit session by selecting the **Editor** button on the Editor Toolbar.

6. Select **Start Editing** from the drop down menu that appears.

7. In the Start Editing dialog, select the Invasive.mdb Geodatabase located in **c:\rlgis_invasive\training\\RMK_Weeds** folder. Click **OK**.
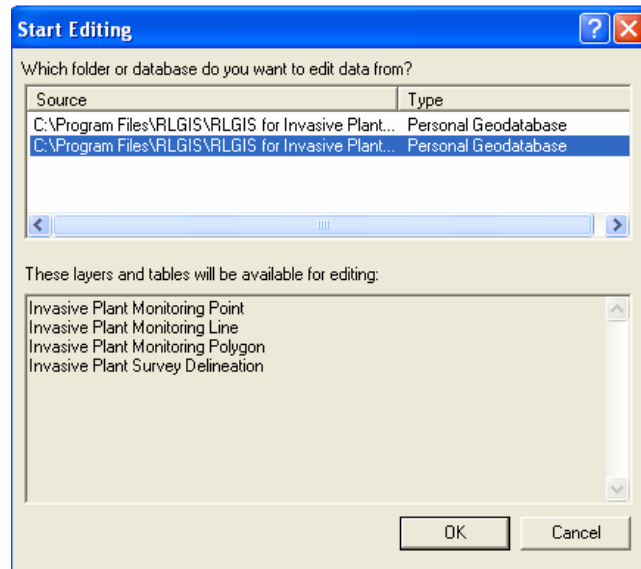
8. From the ArcPad toolbar, select the **Check In Edits From ArcPad** [icon] button. (This button is activated only when you are in an edit session)

9. In the Check In Edits From ArcPad dialog, select the edits you would like to check in from ArcPad and select **Check in**.

10. After the check in, your data should appear in your project.

11. From the Edit Toolbar select the **Editor** button and **Save Edits** from the drop down menu that appears.

12. Congratulations! You have completed the check in process.

20.1Considerations and Errors when checking out data to ArcPad

a. **Checking out the same data to multiple GPS data loggers**:
   If multiple data loggers are to be used to collect the same data, an individual dataset must be checked out for each unit. Each dataset checked out must have a different name following the suggested naming convention outlined above. This will allow the project manager to track edits more efficiently and prevent data loss.
   (*Refer to* **Section 2** *– Generate Data Management*)

b. **Data projection errors when checking out data for ArcPad:**
   ArcPad does not support reproject on the fly. Because of this limitation, all data being checked out to ArcPad must be in the same projection. If they are not in the same projection, you will receive an error message during the check out process.

c. **Raster errors when checking out data for ArcPad:**
   ArcPad has file size limitation for encoding raster data.   All users of ArcMap can only encode individual, uncompressed raster smaller than 50 MB. The 50 MB size rule will be evaluated as follows: Image Width ***** Image Height ***** Number of Bands **cannot be greater than 50 million**.   If you purchase the MrSid extension from Lizard Tech, then your limit is 500 MB with the added ability to mosaic images.

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Mapping Invasive or Noxious Plants

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21. Mapping Invasive or Noxious Plants

21.1 Local Issues

Initiating an invasive plant management effort that incorporates the use of volunteers requires that Refuge personnel address management needs, consider Field Station objectives, and prioritize mapping efforts. Doing so should allow volunteers to focus their efforts as well as provide a foundation for the background work necessary by the Field Station.

Management Considerations for identifying species to be mapped and/or treated include:

1. Will all invasive or noxious plants be mapped or will a subset be targeted?
2. Is there a set of species to be managed?
3. Is there a 'watch" list of species to be on the lookout for?
4. Should naturalized species be mapped, e.g., smooth brome, crested wheatgrass?
5. Are there plants of local concern?

These criteria should allow target and priority species to be identified and supporting field materials can be prepared to assist field personnel in plant management activities. Valuable field materials information includes:

1. Plant common and scientific names.
2. Photograph or drawing of plant, flower, growth stages.
3. Life history information including preferred growth and site conditions.
4. Common pathways for invasion.
5. Local occurrence information based on Refuge personnel experience.

21.2 Standardizing the Mapping Process

A challenge with any mapping project is standardizing how individuals make decisions both among sites and observers. How an observer characterizes a site is usually related to issues of landscape context, often referred to as scale; and resolution – "how small of an area should be mapped?" It is important to map the target feature, whether it is a patch or a point, as it relates to issues of management. It is very common to map extensive infestations of a particular weed species in a more general fashion. While discrete infestations of high profile, readily seen and identifiable species are mapped more meticulously and at a higher resolution. Only Refuge personnel can determine which is most appropriate and relay that information to individuals responsible for mapping.

Site-specific information such as the surrounding vegetation is also characterized within the data model because it is useful when making management decisions. It is tempting to manually pull single occurrences before mapping, however, it is extremely important to map the occurrence of invasive or noxious plants prior to treatment to allow for follow-up monitoring to assess the effectiveness of management efforts.

Up to 3 invasive plant species can be identified for each mapped feature. In addition to identifying the species, the external bounds of the patch, and the vegetation community being impacted, it is also necessary to characterize the infestation of the 1-3 invasive plant species with an ocular estimate of the percent canopy cover occupied by the respective species. Figures 1-10 provided for reference in making the ocular estimates.
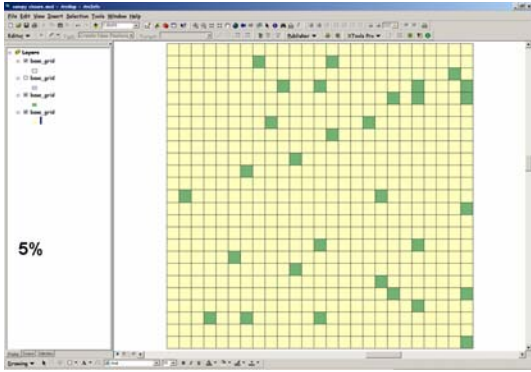
Figure 1 - 5 % Canopy Cover

Figure 2 – 10% Canopy Cover

Figure 3 – 20% Canopy Cover

Figure 4 – 25% Canopy Cover

Figure 5 – 30% Canopy Cover
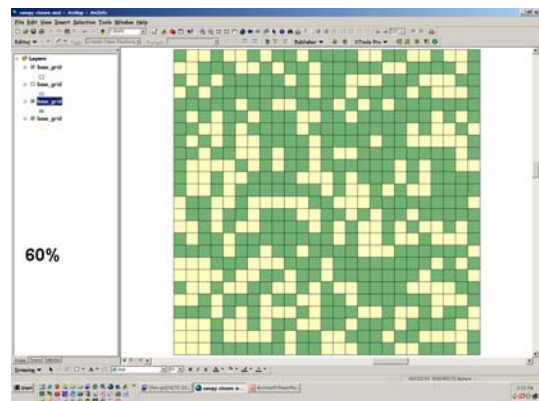
Figure 6 – 60% Canopy Cover
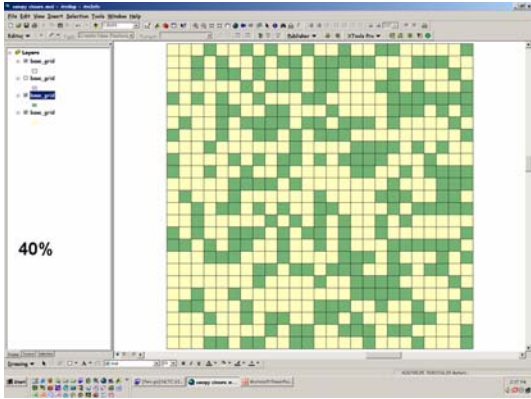
Figure 7 – 40% Canopy Cover
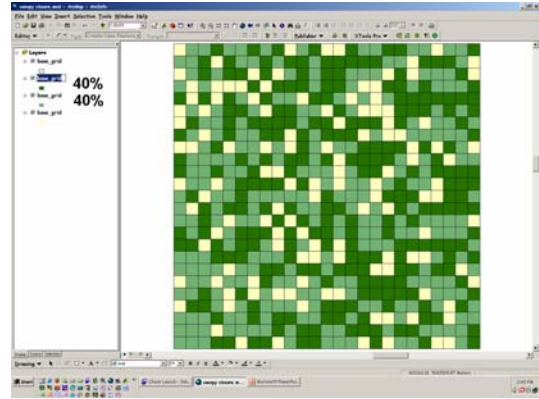
Figure 10 - 40% Canopy Cover one species
40% Canopy Cover another species
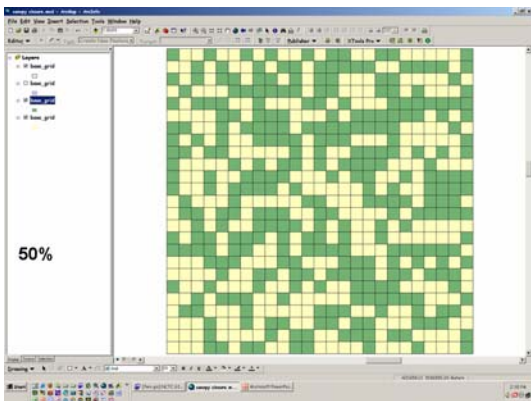
Figure 8 – 50% Canopy Cover
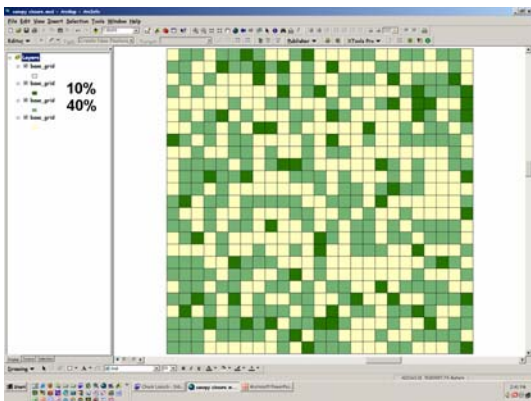
Figure 9 – 40% Canopy Cover for one species
10% Canopy Cover for another species

21.3 Unit Surveys

In addition to identifying and mapping invasive plant occurrences, it is important to retain information on where, within a RSL unit, surveys have been conducted to inventory invasive and noxious plants, regardless of if infestations were found. The Invasive Plant Survey feature class is provided to store survey information. Essentially an area is attributed for survey status (i.e. yes/no) and year of survey. Strategy for unit surveys is variable and at the discretion of Field Station personnel, but options include: using existing administrative or management boundaries, habitat or vegetative communities, a public land survey network, or an arbitrarily created fishnet overlay.

21.4 Field Data Collection

In addition to identifying and mapping invasive plant occurrences, it is important to retain information on where, within a RSL unit, surveys have been conducted to inventory invasive and noxious plants, regardless of if infestations were found. The Invasive Plant Survey feature class is provided to store survey information. Essentially an area is attributed for survey status (e.g., yes/no) and year of survey. Strategy for unit surveys is variable and at the discretion of Field Station personnel, but options include: using existing administrative or management boundaries, habitat or vegetative communities, a public land survey network, or an arbitrarily created fishnet overlay.

The materials needed to perform a mapping mission vary considerably from site to site. Resources at the disposal of the personnel performing the mapping should include some or all of the following:

1. Field map of work area or site. This can range from a detailed map of vegetation, imagery, and/or important features such as fences or access gates to a simple work area boundary. At the very least it should assist the worker in staying within the desired area.
2. GPS unit. A fully charged, functional unit with the necessary software, base data, and feature classes.
3. "Cheat sheets" for software, database, and GPS usage
4. Plant identification materials and list of priority species, preferably with photographs
5. Binoculars for long range observations or scans for invasive plants.
6. Flagging for marking reference locations such as starting points.
7. Plastic bags for storing field clothes infested with plant seeds, seeds removed from clothing, and/or seed heads from hand pulled plants.
8. Hip boots or waters for wetland environments.
9. Gloves if pulling isolated or single plant occurrences.

21.5 **Mapping Occurrences or Patches of Weeds**

In addition to identifying and mapping invasive plant occurrences, it is important to retain information on where, within a RSL unit, surveys have been conducted to inventory invasive and noxious plants, regardless of if infestations were found. The Invasive Plant Survey feature class is provided to store survey information. Essentially an area is attributed for survey status (e.g., yes/no) and year of survey. Strategy for unit surveys is variable and at the discretion of Field Station personnel, but options include: using existing administrative or management boundaries, habitat or vegetative communities, a public land survey network, or an arbitrarily created fishnet overlay.

Mapping invasive plant infestations is a fairly obvious and intuitive process, however, there are a number of issues that should be kept in mind. Doing so helps in standardizing the process and as a result makes the results of several observers over a number of RSL's more comparable.

1. Mapping requires travel to the occurrence site and should not be done remotely unless necessary.
2. Conduct a patch reconnaissance to determine if the feature should be mapped as a point, line, or polygon feature..
3. If the site is to be mapped as a polygon feature, flag the starting point..
4. If not already on, turn on the GPS, activate ArcPad, enable the GPS.
5. Load the respective layers in ArcPad if not already done and enable the editing mode for the proper layers.
6. Collect the point, or traverse the linear or polygon feature.
7. For polygon features navigate back near the flagging identifying the starting point and complete the GPS data collection.
8. Attribute the feature by completing ALL data fields.
9. Remove the flagging if used.
10. Proceed to the next occurrence.

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Weed Mapping, Treatment, and Monitoring RLGIS Data Model and Structure for USFWS Volunteer Weed Mapping and Invasive Plant Strike Teams

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Preface

The Weed Mapping, Treatment, and Monitoring data model has been developed to assist and guide the collection, storage, and management of spatial and tabular information important to managing invasive and noxious plants on U.S. Fish and Wildlife Service Refuge System Lands (RSL). The Collaborative Volunteer Invasive Monitoring Program and Strike Teams are 2 independent FWS initiatives that are intended to supplement existing invasive plant control efforts by Refuge Field Stations. It is imperative that the these efforts work in concert with Refuge personnel efforts and that information collected be readily integrated for the future use by Field Stations. To do so, we utilized portions of the Refuge Lands Geographic Information System (RLGIS) data model currently being developed by representatives from each of the FWS Regions.

TABLE OF CONTENTS FOR WEED GEODATABASE

22. Introduction for the RLGIS Geodatabase

22.1 Overview

This document defines the database structure of portions of the RLGIS data model, primarily the LandcoverHabitat geodatabase. It provides detailed information on the database fields (e.g., names, definitions, etc.) and content when it can be standardized in a pick list or domain.

23. General Data Format and Standards

23.1 Projection, Positional Accuracy and Taxonomy

Projection:
Projection: Geographic (latitude/longitude)
Units: Decimal Degrees
Spheroid: GRS 1980
Datum: North American Datum 1983 (NAD83)

When setting the XY domains for feature classes or datasets in the WM GDB Model, the guidelines outlined in **Figure 1.0** are recommended.
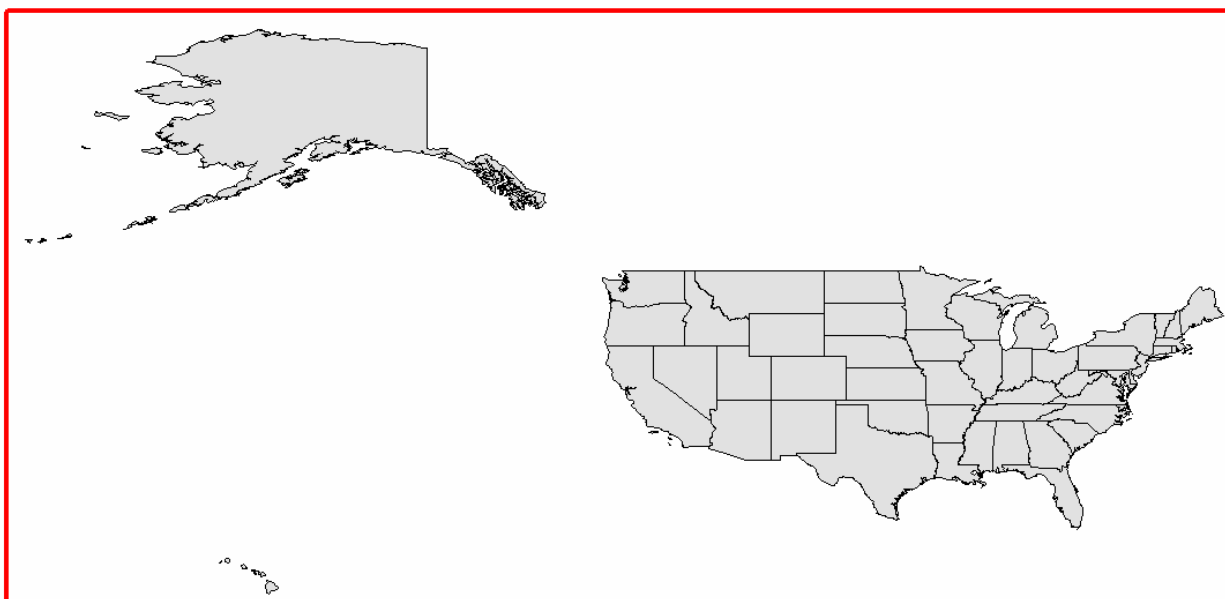
Figure 1.0. Feature dataset XY domain extent.

Specific Spatial Reference Properties for the bounding coordinates are:

MinX:	-180	MaxX:	-65
MinY:	18	MaxY:	73

Positional Accuracy:
The spatial databases will have a horizontal positional accuracy that meets National Map Accuracy Standards at the 1:24,000 scale. This means that each well-defined object in the spatial database will be within 1/50 of an inch of its actual location or 40 feet (12.2 meters).

Taxonomy:
The naming of plant species is a complex task and national standards must be used to ensure that plant names are consistent and meet the highest scientific standards. The Integrated Taxonomic Information System (ITIS) is an on-line, scientifically credible, list of biological names focusing on the biota of North America. All plant names used in the development of the classification system are consistent with ITIS standards.

23.2 File Formats

Vector and raster file formats fall within the compatibility of common software packages used by the Service. In some circumstances, alternative file formats may be required when dealing with third party data sources.

Vector: ESRI Geodatabase feature class

Raster: ERDAS Imagine *.img, Tiff (projected) *.tif, Mr. Sid *.sid

22.3 Required Data Fields

The 11 standard data fields listed below are included in every feature class listed within the RLGIS GDB with the exception of the Boundary Polygon and Line Feature Classes. These fields must be added in order 1-11.

Data Fields:

1. Name: Global_ID
    Alias: global id
    Type: ESRI globalid
    Definition: computer generated unique record/feature id

2. Name: Lit[*]
    Alias: station literal
    Type: text
    Length: 8
    Definition: USFWS 3 character literal of the National Wildlife Refuge or 2 character literal plus wmd for Wetland Management District lands.
    Domain name: 3LetterLiteral

3. Name: OrgCode*
    Alias: organization code
    Type: long integer
    Definition: USFWS 5 character numeric organizational code assigned to NWR
    Domain name: OrganizationalCode

4. Name: Cmplx_Name
    Alias: complex or wmd name
    Type: text
    Length: 50
    Definition: Name of complex or wetland management district the unit is associated with
    Domain name: ComplexWMDName

5. Name: OrgName*
    Alias: organization name
    Type: text
    Length: 50
    Definition: Official name of the National Wildlife Refuge if applicable.
    Domain name: OrganizationalName

6. Name: Dvsn_Name
    Alias: division or district name

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[*] USFWS adopted national standard.

Type: text
Length: 50
Definition: Division or District name if applicable
Domain name: ComplexWMDName

7. Name: Unit_Name
   Alias: unit name
   Type: text
   Length: 50
   Definition: Name of the individual WPA, WMA, etc in a Wetland Management District if applicable.
   Domain name: Name

8. Name: Subunit_Name
   Alias: subunit name
   Type: text
   Length: 50
   Definition: name of the subunit

9. Name: RSL_Type
   Alias: rsl type
   Type: text
   Length: 8
   Definition: Identifies type of refuge lands; i.e. waterfowl production area (WPA), wildlife development area (WDA), etc…
   Domain name: RSLType

10. Name: StateAbbr*
    Alias: state
    Type: text
    Length: 8
    Definition: Two letter postal abbreviation of the state the feature lies within.
    Domain name: State

11. Name: Region*
    Alias: fws region
    Type: long integer
    Definition: Identifies the number of the region who administers the land unit.
    Domain name: Region

12. Name: Origin
    Type: text
    Length: 50
    Definition: Identifies the originator of the data

23.4 Cooperator Field Standards for Relational Database Structure

Cooperator or contactor (i.e. name, address, phone number) record level metadata fields have been standardized and included in feature classes requiring the collection of these data.

1. Name: coop_name
   Alias: cooperator name
   Type: text
   Length: 50
   Definition: Identifies name of individual or operator responsible for action.

2. Name: area_code
   Alias: cooper area code
   Type: long integer
   Precision: 0
   Definition: Area code of phone number with associated record.

3. Name: telephone
   Alias: cooperator telephone
   Type: long integer
   Precision: 0
   Definition: Telephone number with record.

4. Name: address
   Alias: cooperator address
   Type: text
   Length: 50
   Definition: Street address associated with record.

5. Name: coop_city
   Alias: cooperator city
   Type: text
   Length: 30
   Definition: City associated with record.

6. Name: coop_state
   Alias: cooperator state
   Type: text
   Length: 8
   Definition: State abbreviation associated with record.
   Domain name: state

7. Name: zip_code
   Alias: cooperator zip code
   Type: long integer
   Precision: 0
   Definition: Zip code associated with record.

8. Name: zip_code_4
   Alias: cooperator 4 digit zip code
   Type: long integer
   Precision: 0
   Definition: Four character zip code with associated record.

24.1 Invasive Plant Monitoring Feature Class

The Invasive Plant Monitoring Feature Class defines invasive plant infestations on refuge lands and stores basic information necessary to inventory and locate these populations (To obtain management actions information related to invasive plant control please refer to the invasive plant control feature class and relationship table).

Data Collection:
This feature class should be populated to describe the activities associated with invasive plant monitoring on an annual basis. Every management year should have a separate feature class associated with it. This process will provide an annual depiction and historic record of the application and objectives of invasive plant monitoring on refuge lands.

Feature Class Name:
> Im_Inv_Plant_Pt
> Im_Inv_Plant_Ln
> Im_Inv_Plant_Pl

Topology Type: Point, Line, Polygon

Data Fields:

1. Name: RLGIS_ID
   Alias: RLGIS ID
   Type: text
   Length: 40
   Definition: script generated unique record/feature id - GUID

2. Name: Lit[*]
   Alias: Station Literal
   Type: text
   Length: 8
   Definition: USFWS 3 character literal of the National Wildlife Refuge or 2 character literal plus wmd for Wetland Management District lands.
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

3. Name: OrgCode*
   Alias: Organization Code
   Type: long integer
   Precision: 0
   Definition: USFWS 5 character numeric organizational code assigned to NWR
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

4. Name: Cmplx_Name
   Alias: Complex or WMD Name
   Type: text
   Length: 85
   Definition: Name of complex or wetland management district the unit is associated with
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

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[*] USFWS adopted national standard.

5. Name: OrgName*
   Alias: Organization Name
   Type: text
   Length: 75
   Definition: Official name of the National Wildlife Refuge if applicable.
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

6. Name: Dvsn_Name
   Alias: Division or District Name
   Type: text
   Length: 85
   Definition: Division or District name if applicable
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

7. Name: Unit_Name
   Alias: Unit Name
   Type: text
   Length: 75
   Definition: Name of the individual WPA, WMA, etc in a Wetland Management District if applicable.
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

8. Name: Subunit_Name
   Alias: Subunit Name
   Type: text
   Length: 50
   Definition: name of the subunit
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

9. Name: RSL_Type
   Alias: RSL Type
   Type: text
   Length: 8
   Definition: Identifies type of refuge lands; i.e. waterfowl production area (WPA), wildlife development area (WDA), etc…
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

10. Name: StateAbbr*
    Alias: State
    Type: text
    Length: 8
    Definition: Two letter postal abbreviation of the state the feature lies within.
    Domain name: State

11. Name: Region*
    Alias: FWS Region
    Type: text
    Length: 10
    Definition: Identifies the number of the region who administers the land unit.
    Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

12. Name: Origin
    Type: text
    Length: 50
    Definition: Identifies the originator of the data
    Domain / lookup table name: Origin

Lookup table: RLGISLookups.mdb:Origins

13. Name: Obs_Date
    Alias: Observation Date
    Type: date
    Definition: Identifies date the data was collected.

14. Name: Sci_Name_1
    Alias: Scientific Name 1
    Type: text
    Length: 80
    Definition: Identifies scientific or species name of the invasive plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

15. Name: Com_Name_1
    Alias: Common Name 1
    Type: text
    Length: 50
    Definition: Identifies common name of the plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

16. Name: TSN_1
    Alias: TSN 1
    Type: long integer
    Precision: 0
    Definition: Taxonomic serial number of invasive plant species
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

17. Name: Cover_1
    Alias: Percent Cover 1
    Type: text
    Length: 12
    Definition: Identifies class of canopy or ground cover estimated as a percent of the area
    (polygon) containing the infestation.
    Domain name: VegetationPercentCover

18. Name: Growth_1
    Alias: Growth Stage 1
    Type: text
    Length: 30
    Definition: Identifies stage of plant growth at the time of management action.
    Domain name: PlantGrowthStage

19. Name: Sci_Name_2
    Alias: Scientific Name 2
    Type: text
    Length: 80
    Definition: Identifies scientific or species name of the invasive plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

20. Name: Com_Name_2
    Alias: Common Name 2
    Type: text
    Length: 50
    Definition: Identifies common name of the plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

21. Name: TSN_2
    Alias: TSN 2
    Type: long integer
    Precision: 0
    Definition: Taxonomic serial number of invasive plant species
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

22. Name: Cover_2
    Alias: Percent Cover 2
    Type: text
    Length: 12
    Definition: Identifies class of canopy or ground cover estimated as a percent of the area (polygon) containing the infestation.
    Domain name: VegetationPercentCover

23. Name: Growth_2
    Alias: Growth Stage 2
    Type: text
    Length: 30
    Definition: Identifies stage of plant growth at the time of management action.
    Domain name: PlantGrowthStage

24. Name: Sci_Name_3
    Alias: Scientific Name 3
    Type: text
    Length: 80
    Definition: Identifies scientific or species name of the invasive plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

25. Name: Com_Name_3
    Alias: Common Name 3
    Type: text
    Length: 50
    Definition: Identifies common name of the plant.
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

26. Name: TSN_3
    Alias: TSN 3
    Type: long integer
    Precision: 0
    Definition: Taxonomic serial number of invasive plant species
    Lookup table name: RLGISLookups.mdb:InvasivePlantNames (local)

27. Name: Cover_3
    Alias: Percent Cover 3
    Type: text
    Length: 12
    Definition: Identifies class of canopy or ground cover estimated as a percent of the area (polygon) containing the infestation.
    Domain name: VegetationPercentCover

28. Name: Growth_3
    Alias: Growth Stage 3
    Type: text
    Length: 30

Definition: Identifies stage of plant growth at the time of management action.
Domain name: PlantGrowthStage

29. Name: Cover_Type
    Alias: Cover Type Invaded
    Type: text
    Length: 50
    Definition: Identifies general vegetative type invasive plant control has invaded as defined by the Formation Class of the National Vegetation Classification Standard (NVCS).
    Domain name: NVCSFormation (local)

30. Name: Col_Meth
    Alias: Collection Method
    Type: text
    Length: 60
    Definition: Identifies the data collection method used to delineate infestation.
    Domain name: SourceID

31. Name: Acres (polygon feature class only)
    Alias: Acres
    Type: double
    Precision: 0
    Scale: 0
    Definition: Number of acres in occupied by infestation.

32. Name: Width (line feature class only)
    Alias: Width
    Type: double
    Precision: 0
    Scale: 0
    Definition: Number of acres in occupied by infestation.

33. Name: Comments
    Alias: Comments
    Type: text
    Length: 255
    Definition: Describes any additional information important to the associated record that is not contained within the existing fields.

24.2 Invasive Plant Survey Delineation Feature Class

The Invasive Plant Survey Delineation Feature Class defines areas that have been surveyed for alien, invasive, and noxious plant infestations on refuge lands and stores basic information necessary to inventory and locate these populations (to obtain management actions information related to invasive plant control please refer to the invasive plant control feature class and relationship table).

Data Collection:
This feature class should be populated to describe the activities associated with invasive plant monitoring on an annual basis. Every management year should have a separate feature class associated with it. This process will provide an annual depiction and historic record of the application and objectives of invasive plant monitoring on refuge lands.

Feature Class Name:
lm_Inv_Plant_Survey

Topology Type: Polygon

Data Fields:

1. Name: RLGIS_ID
   Alias: RLGIS ID
   Type: text
   Length: 40
   Definition: script generated unique record/feature id - GUID

2. Name: Lit[*]
   Alias: Station Literal
   Type: text
   Length: 8
   Definition: USFWS 3 character literal of the National Wildlife Refuge or 2 character literal plus wmd for Wetland Management District lands.
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

3. Name: OrgCode*
   Alias: Organization Code
   Type: long integer
   Precision: 0
   Definition: USFWS 5 character numeric organizational code assigned to NWR
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

4. Name: Cmplx_Name
   Alias: Complex or WMD Name
   Type: text
   Length: 85
   Definition: Name of complex or wetland management district the unit is associated with
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

5. Name: OrgName*
   Alias: Organization Name
   Type: text
   Length: 75
   Definition: Official name of the National Wildlife Refuge if applicable.

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[*] USFWS adopted national standard.

Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

6. Name: Dvsn_Name
   Alias: Division or District Name
   Type: text
   Length: 85
   Definition: Division or District name if applicable
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

7. Name: Unit_Name
   Alias: Unit Name
   Type: text
   Length: 75
   Definition: Name of the individual WPA, WMA, etc in a Wetland Management District if applicable.
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

8. Name: Subunit_Name
   Alias: Subunit Name
   Type: text
   Length: 50
   Definition: name of the subunit
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

9. Name: RSL_Type
   Alias: RSL Type
   Type: text
   Length: 8
   Definition: Identifies type of refuge lands; i.e. waterfowl production area (WPA), wildlife development area (WDA), etc…
   Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

10. Name: StateAbbr*
    Alias: State
    Type: text
    Length: 8
    Definition: Two letter postal abbreviation of the state the feature lies within.
    Domain name: State

11. Name: Region*
    Alias: FWS Region
    Type: text
    Length: 10
    Definition: Identifies the number of the region who administers the land unit.
    Data Source: FWSInterest Feature Class of FWSCadastral Geodatabase

12. Name: Origin
    Type: text
    Length: 50
    Definition: Identifies the originator of the data
    Domain / lookup table name: Origin
    Lookup table: RLGISLookups.mdb:Origins

13. Name: Start_Date
    Alias: Start Date
    Type: date
    Definition: Identifies the date that surveying was initiated.

14. Name: End_Date
    Alias: End Date
    Type: date
    Definition: Identifies the date that surveying was completed.

15. Name: Surv_Yr
    Alias: Survey Year
    Type: long integer
    Precision: 0
    Definition: Identifies the year that the survey was conducted.

16. Name: Col_Meth
    Alias: Collection Method
    Type: text
    Length: 60
    Definition: Identifies the data collection method used to delineate survey.
    Domain name: SourceID

17. Name: Acres
    Alias: Acres
    Type: double
    Precision: 0
    Scale: 0
    Definition: Identifies number of acres in area surveyed for invasive plants.

18. Name: Surv_Area
    Alias: Area Surveyed
    Type: text
    Length: 5
    Definition: Identifies area as being surveyed.
    Domain name: Yes/No

19. Name: Comments
    Alias: Comments
    Type: text
    Length: 255

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Geodatabase Domains

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Domain name: 3LetterLiteral
Domain description: USFWS 3 character literals of the National Wildlife Refuges or 2
character literals plus wmd for Wetland Management District lands.
Type: text
Domain type: coded values
Merge policy: default values
Source: http://www.fws.gov/stand/standards/de_literals_WWWrev2.html
Values: http://www.fws.gov/stand/standards/LIT_ActiveUnits_101802.txt

Coded Value	Description

Domain name: NVCSFormation
Domain description: Identifies NVCS formation classes.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description
I.A.1.C.a.	I.A.1.C.a. plantations (planted timber stands, christmas trees)
I.A.1.C.b.	I.A.1.C.b. orchards and groves (fruit and nut trees)
I.A.1.C.c.	I.A.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.1.N.a.	I.A.1.N.a. lowland tropical or subtropical rainforest
I.A.1.N.b.	I.A.1.N.b. submontane tropical or subtropical rainforest
I.A.1.N.c.	I.A.1.N.c. montane tropical or subtropical rainforest
I.A.1.N.d.	I.A.1.N.d. montane tropical or subtropical cloud forest
I.A.1.N.e.	I.A.1.N.e. subalpine tropical or subtropical rainforest
I.A.1.N.f.	I.A.1.N.f. temporarily flooded tropical or subtropical rainforest
I.A.1.N.g.	I.A.1.N.g. semipermanently flooded tropical or subtropical rainforest
I.A.1.N.h.	I.A.1.N.h. saturated tropical or subtropical evergreen rainforest
I.A.1.N.i.	I.A.1.N.i. tidal tropical or subtropical rainforest
I.A.1.N.j.	I.A.1.N.j. seasonally flooded tropical or subtropical rainforest
I.A.2.C.a.	I.A.2.C.a. plantations (planted timber stands, christmas trees)
I.A.2.C.b.	I.A.2.C.b. orchards and groves (fruit and nut trees)
I.A.2.C.c.	I.A.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.2.N.a.	I.A.2.N.a. temperate evergreen rainforest
I.A.2.N.b.	I.A.2.N.b. subpolar evergreen rainforest
I.A.2.N.c.	I.A.2.N.c. temporarily flooded temperate evergreen rainforest
I.A.2.N.d.	I.A.2.N.d. seasonally flooded temperate evergreen rainforest
I.A.3.C.a.	I.A.3.C.a. plantations (planted timber stands, christmas trees)
I.A.3.C.b.	I.A.3.C.b. orchards and groves (fruit and nut trees)
I.A.3.C.c.	I.A.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.3.N.a.	I.A.3.N.a. lowland tropical or subtropical seasonal evergreen closed tree canopy
I.A.3.N.b.	I.A.3.N.b. submontane tropical or subtropical seasonal evergreen closed tree canopy
I.A.3.N.c.	I.A.3.N.c. montane tropical or subtropical seasonal evergreen closed tree canopy
I.A.3.N.d.	I.A.3.N.d. subalpine tropical or subtropical evergreen closed tree canopy
I.A.3.N.e.	I.A.3.N.e. temporarily flooded tropical or subtropical seasonal evergreen closed tree

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	canopy
I.A.3.N.f.	I.A.3.N.f. seasonally flooded tropical or subtropical seasonal evergreen closed tree canopy
I.A.3.N.g.	I.A.3.N.g. semipermanently flooded tropical or subtropical seasonal evergreen closed tree canopy
I.A.4.C.a.	I.A.4.C.a. plantations (planted timber stands, christmas trees)
I.A.4.C.b.	I.A.4.C.b. orchards and groves (fruit and nut trees)
I.A.4.C.c.	I.A.4.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.4.N.a.	I.A.4.N.a. lowland temperate seasonal evergreen closed tree canopy
I.A.4.N.b.	I.A.4.N.b. submontane temperate seasonal evergreen closed tree canopy
I.A.4.N.c.	I.A.4.N.c. montane temperate seasonal evergreen closed tree canopy
I.A.4.N.d.	I.A.4.N.d. subalpine temperate evergreen closed tree canopy
I.A.4.N.e.	I.A.4.N.e. temporarily flooded temperate seasonal evergreen closed tree canopy
I.A.4.N.f.	I.A.4.N.f. seasonally flooded temperate seasonal evergreen closed tree canopy
I.A.4.N.g.	I.A.4.N.g. saturated temperate seasonal evergreen closed tree canopy
I.A.5.C.a.	I.A.5.C.a. plantations (planted timber stands, christmas trees)
I.A.5.C.b.	I.A.5.C.b. orchards and groves (fruit and nut trees)
I.A.5.C.c.	I.A.5.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.5.N.a.	I.A.5.N.a. lowland tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy
I.A.5.N.b.	I.A.5.N.b. temporarily flooded tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy
I.A.5.N.c.	I.A.5.N.c. seasonally flooded tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy
I.A.5.N.d.	I.A.5.N.d. semipermanently flooded tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy
I.A.5.N.e.	I.A.5.N.e. saturated tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy
I.A.5.N.f.	I.A.5.N.f. tidal tropical or subtropical broad-leaved evergreen sclerophyllous closed tree canopy (e.g. mangroves)
I.A.6.C.a.	I.A.6.C.a. plantations (planted timber stands, christmas trees)
I.A.6.C.b.	I.A.6.C.b. orchards and groves (fruit and nut trees)
I.A.6.C.c.	I.A.6.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.6.N.a.	I.A.6.N.a. giant lowland or submontane winter-rain evergreen sclerophyllous closed tree canopy (over 50 m tall, e.g. eucalyptus in australia)
I.A.6.N.b.	I.A.6.N.b. lowland or submontane winter-rain evergreen sclerophyllous closed tree canopy (under 50 m tall, e.g. live oak in california)
I.A.7.C.a.	I.A.7.C.a. plantations (planted timber stands, christmas trees)
I.A.7.C.b.	I.A.7.C.b. orchards and groves (fruit and nut trees)
I.A.7.C.c.	I.A.7.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.7.N.a.	I.A.7.N.a. lowland or submontane tropical or subtropical needle-leaved evergreen closed tree canopy
I.A.7.N.b.	I.A.7.N.b. montane or subalpine tropical or subtropical needle-leaved evergreen closed tree canopy
I.A.7.N.c.	I.A.7.N.c. temporarily flooded tropical or subtropical needle-leaved evergreen closed tree canopy
I.A.8.C.a.	I.A.8.C.a. plantations (planted timber stands, christmas trees)
I.A.8.C.b.	I.A.8.C.b. orchards and groves (fruit and nut trees)
I.A.8.C.c.	I.A.8.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.8.N.a.	I.A.8.N.a. giant temperate or subpolar needle-leaved evergreen closed tree canopy (e.g.

	redwood and douglas fir)
I.A.8.N.b.	I.A.8.N.b. rounded-crowned temperate or subpolar needle-leaved evergreen closed tree canopy (e.g. pines, western juniper)
I.A.8.N.c.	I.A.8.N.c. conical-crowned temperate or subpolar needle-leaved evergreen closed tree canopy (e.g. spruce, eastern juniper, cedar)
I.A.8.N.d.	I.A.8.N.d. cylindrical-crowned temperate or subpolar needle-leaved evergreen closed tree canopy (e.g. boreal spruce forests in alaska)
I.A.8.N.e.	I.A.8.N.e. temporarily flooded temperate or subpolar needle-leaved evergreen closed tree canopy
I.A.8.N.f.	I.A.8.N.f. seasonally flooded temperate or subpolar needle-leaved evergreen closed tree canopy
I.A.8.N.g.	I.A.8.N.g. saturated temperate or subpolar needle-leaved evergreen closed tree canopy
I.A.8.N.h.	I.A.8.N.h. tidal temperate or subpolar needle-leaved evergreen closed tree canopy
I.A.9.C.a.	I.A.9.C.a. plantations (planted timber stands, christmas trees)
I.A.9.C.b.	I.A.9.C.b. orchards and groves (fruit and nut trees)
I.A.9.C.c.	I.A.9.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.A.9.N.a.	I.A.9.N.a. sclerophyllous extremely xeromorphic evergreen closed tree canopy
I.A.9.N.b.	I.A.9.N.b. succulent extremely xeromorphic evergreen closed tree canopy (assumed to be evergreen)
I.B.1.C.a.	I.B.1.C.a. plantations (planted timber stands, christmas trees)
I.B.1.C.b.	I.B.1.C.b. orchards and groves (fruit and nut trees)
I.B.1.C.c.	I.B.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.B.1.N.a.	I.B.1.N.a. lowland or submontane drought-deciduous closed tree canopy
I.B.1.N.b.	I.B.1.N.b. montane or cloud drought-deciduous closed tree canopy
I.B.2.C.a.	I.B.2.C.a. plantations (planted timber stands, christmas trees)
I.B.2.C.b.	I.B.2.C.b. orchards and groves (fruit and nut trees)
I.B.2.C.c.	I.B.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.B.2.N.a.	I.B.2.N.a. lowland or submontane cold-deciduous closed tree canopy (e.g. broadleaf forests of the midwest)
I.B.2.N.b.	I.B.2.N.b. montane or boreal cold-deciduous closed tree canopy (e.g. broad leaf forests of the mountains)
I.B.2.N.c.	I.B.2.N.c. subalpine or subpolar cold-deciduous closed tree canopy
I.B.2.N.d.	I.B.2.N.d. temporarily flooded cold-deciduous closed tree canopy (e.g. alluvial bottomland hardwoods)
I.B.2.N.e.	I.B.2.N.e. seasonally flooded cold-deciduous closed tree canopy (e.g. deciduous larch forests in alaska, peat forests)
I.B.2.N.f.	I.B.2.N.f. semipermanently flooded cold-deciduous closed tree canopy (e.g. cypress swamp)
I.B.2.N.g.	I.B.2.N.g. saturated cold-deciduous closed tree canopy
I.B.2.N.h.	I.B.2.N.h. tidal cold-deciduous closed tree canopy
I.B.3.C.a.	I.B.3.C.a. plantations (planted timber stands, christmas trees)
I.B.3.C.b.	I.B.3.C.b. orchards and groves (fruit and nut trees)
I.B.3.C.c.	I.B.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.B.3.N.a.	I.B.3.N.a. extremely xeromorphic deciduous thorn closed tree canopy
I.C.1.C.a.	I.C.1.C.a. plantations (planted timber stands, christmas trees)
I.C.1.C.b.	I.C.1.C.b. orchards and groves (fruit and nut trees)
I.C.1.C.c.	I.C.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.C.1.N.a.	I.C.1.N.a. lowland tropical or subtropical semi-deciduous closed tree canopy
I.C.1.N.b.	I.C.1.N.b. cloud or montane tropical or subtropical semi-deciduous closed tree canopy

I.C.1.N.c.	I.C.1.N.c. seasonally flooded tropical or subtropical semi-deciduous closed tree canopy
I.C.1.N.d.	I.C.1.N.d. saturated tropical or subtropical semi-deciduous closed tree canopy
I.C.2.C.a.	I.C.2.C.a. plantations (planted timber stands, christmas trees)
I.C.2.C.b.	I.C.2.C.b. orchards and groves (fruit and nut trees)
I.C.2.C.c.	I.C.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.C.2.N.a.	I.C.2.N.a. mixed broad-leaved evergreen - cold-deciduous closed tree canopy
I.C.2.N.b.	I.C.2.N.b. temporarily flooded mixed evergreen - cold-deciduous closed tree canopy
I.C.2.N.c.	I.C.2.N.c. seasonally flooded mixed broad-leaved evergreen - cold-deciduous closed tree canopy
I.C.2.N.d.	I.C.2.N.d. saturated mixed broad-leaved evergreen - cold-deciduous closed tree canopy
I.C.3.C.a.	I.C.3.C.a. plantations (planted timber stands, christmas trees)
I.C.3.C.b.	I.C.3.C.b. orchards and groves (fruit and nut trees)
I.C.3.C.c.	I.C.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.C.3.N.a.	I.C.3.N.a. mixed needle-leaved evergreen - cold-deciduous closed tree canopy
I.C.3.N.b.	I.C.3.N.b. temporarily flooded mixed needle-leaved evergreen - cold-deciduous closed tree canopy
I.C.3.N.c.	I.C.3.N.c. seasonally flooded mixed needle-leaved evergreen - cold-deciduous closed tree canopy
I.C.3.N.d.	I.C.3.N.d. saturated mixed needle-leaved evergreen - cold-deciduous closed tree canopy
I.C.4.C.a.	I.C.4.C.a. plantations (planted timber stands, christmas trees)
I.C.4.C.b.	I.C.4.C.b. orchards and groves (fruit and nut trees)
I.C.4.C.c.	I.C.4.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
I.C.4.N.a.	I.C.4.N.a. extremely xeromorphic mixed evergreen - deciduous thorn closed tree canopy
II. A.1.N.a.	II. A.1.N.a. tropical or subtropical broad-leaved evergreen open tree canopy
II.A.1.C.a.	II.A.1.C.a. plantations (planted timber stands, christmas trees)
II.A.1.C.b.	II.A.1.C.b. orchards and groves (fruit and nut trees)
II.A.1.C.c.	II.A.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.A.1.N.b.	II.A.1.N.b. temporarily flooded tropical or subtropical broad-leaved evergreen open tree canopy
II.A.1.N.c.	II.A.1.N.c. seasonally flooded tropical or subtropical broad-leaved evergreen open tree canopy
II.A.1.N.d.	II.A.1.N.d. semipermanently flooded tropical or subtropical broad- leaved evergreen open tree canopy
II.A.1.N.e.	II.A.1.N.e. tidal tropical or subtropical broad-leaved evergreen open tree canopy
II.A.2.C.a.	II.A.2.C.a. plantations (planted timber stands, christmas trees)
II.A.2.C.b.	II.A.2.C.b. orchards and groves (fruit and nut trees)
II.A.2.C.c.	II.A.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.A.2.N.a.	II.A.2.N.a. temperate broad-leaved evergreen open tree canopy
II.A.2.N.b.	II.A.2.N.b. seasonally flooded temperate broad-leaved evergreen open tree canopy
II.A.2.N.c.	II.A.2.N.c. saturated temperate broad-leaved evergreen open tree canopy
II.A.3.C.a.	II.A.3.C.a. plantations (planted timber stands, christmas trees)
II.A.3.C.b.	II.A.3.C.b. orchards and groves (fruit and nut trees)
II.A.3.C.c.	II.A.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.A.3.N.a.	II.A.3.N.a. tropical or subtropical needle-leaved evergreen open tree canopy
II.A.3.N.b.	II.A.3.N.b. temporarily flooded tropical or subtropical needle-leaved evergreen open tree canopy
II.A.3.N.c.	II.A.3.N.c. seasonally flooded tropical or subtropical needle-leaved evergreen open tree canopy

II.A.3.N.d.	II.A.3.N.d. saturated tropical or subtropical needle-leaved evergreen open tree canopy
II.A.4.C.a.	II.A.4.C.a. plantations (planted timber stands, christmas trees)
II.A.4.C.b.	II.A.4.C.b. orchards and groves (fruit and nut trees)
II.A.4.C.c.	II.A.4.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.A.4.N.a.	II.A.4.N.a. rounded-crowned temperate or subpolar needle-leaved evergreen open tree canopy (e.g. pine, western juniper)
II.A.4.N.b.	II.A.4.N.b. conical-crowned temperate or subpolar needle-leaved evergreen open tree canopy (e.g. spruce in the west)
II.A.4.N.c.	II.A.4.N.c. cylindrical-crowned temperate or subpolar needle-leaved evergreen open tree canopy (e.g. some spruce in alaska)
II.A.4.N.d.	II.A.4.N.d. temporarily flooded temperate or subpolar needle-leaved evergreen open tree canopy
II.A.4.N.e.	II.A.4.N.e. seasonally flooded temperate or subpolar needle-leaved evergreen open tree canopy
II.A.4.N.f.	II.A.4.N.f. saturated temperate or subpolar needle-leaved evergreen open tree canopy (e.g. black spruce bogs)
II.A.5.C.a.	II.A.5.C.a. plantations (planted timber stands, christmas trees)
II.A.5.C.b.	II.A.5.C.b. orchards and groves (fruit and nut trees)
II.A.5.C.c.	II.A.5.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.A.5.N.a.	II.A.5.N.a. sclerophyllous extremely xeromorphic evergreen open tree canopy
II.A.5.N.b.	II.A.5.N.b. succulent extremely xeromorphic evergreen open tree canopy
II.B.1.C.a.	II.B.1.C.a. plantations (planted timber stands, christmas trees)
II.B.1.C.b.	II.B.1.C.b. orchards and groves (fruit and nut trees)
II.B.1.C.c.	II.B.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.B.1.N.a.	II.B.1.N.a. lowland or submontane broad-leaved drought-deciduous open tree canopy
II.B.1.N.b.	II.B.1.N.b. montane (and cloud) drought-deciduous open tree canopy
II.B.1.N.c.	II.B.1.N.c. temporarily flooded tropical or subtropical drought- deciduous open tree canopy
II.B.1.N.d.	II.B.1.N.d. seasonally flooded tropical or subtropical drought-deciduous open tree canopy
II.B.2.C.a.	II.B.2.C.a. plantations (planted timber stands, christmas trees)
II.B.2.C.b.	II.B.2.C.b. orchards and groves (fruit and nut trees)
II.B.2.C.c.	II.B.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.B.2.N.a.	II.B.2.N.a. cold-deciduous open tree canopy
II.B.2.N.b.	II.B.2.N.b. temporarily flooded cold-deciduous open tree canopy
II.B.2.N.c.	II.B.2.N.c. seasonally flooded cold-deciduous open tree canopy
II.B.2.N.d.	II.B.2.N.d. semipermanently flooded cold-deciduous open tree canopy
II.B.2.N.e.	II.B.2.N.e. saturated cold-deciduous open tree canopy
II.B.2.N.f.	II.B.2.N.f. tidal cold-deciduous open tree canopy
II.B.3.C.a.	II.B.3.C.a. plantations (planted timber stands, christmas trees)
II.B.3.C.b.	II.B.3.C.b. orchards and groves (fruit and nut trees)
II.B.3.C.c.	II.B.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.B.3.N.a.	II.B.3.N.a. thorn extremely xeromorphic deciduous open tree canopy (may not be represented in the u.s.)
II.C.1.C.a.	II.C.1.C.a. plantations (planted timber stands, christmas trees)
II.C.1.C.b.	II.C.1.C.b. orchards and groves (fruit and nut trees)
II.C.1.C.c.	II.C.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.C.1.N.a.	II.C.1.N.a. tropical or subtropical semi-deciduous open tree canopy
II.C.2.C.a.	II.C.2.C.a. plantations (planted timber stands, christmas trees)

II.C.2.C.b.	II.C.2.C.b. orchards and groves (fruit and nut trees)
II.C.2.C.c.	II.C.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.C.2.N.a.	II.C.2.N.a. mixed broad-leaved evergreen - cold-deciduous open tree canopy
II.C.3.C.a.	II.C.3.C.a. plantations (planted timber stands, christmas trees)
II.C.3.C.b.	II.C.3.C.b. orchards and groves (fruit and nut trees)
II.C.3.C.c.	II.C.3.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.C.3.N.a.	II.C.3.N.a. mixed needle-leaved evergreen - cold-deciduous open tree canopy
II.C.3.N.b.	II.C.3.N.b. seasonally flooded mixed needle-leaved evergreen - cold-deciduous open tree canopy
II.C.3.N.c.	II.C.3.N.c. saturated mixed needle-leaved evergreen - cold-deciduous open tree canopy
II.C.4.C.a.	II.C.4.C.a. plantations (planted timber stands, christmas trees)
II.C.4.C.b.	II.C.4.C.b. orchards and groves (fruit and nut trees)
II.C.4.C.c.	II.C.4.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
II.C.4.N.a.	II.C.4.N.a. mixed evergreen-deciduous thorn open tree canopy
III.A.1.C.a.	III.A.1.C.a. fruit/nut shrubs and vines (vineyards)
III.A.1.C.b.	III.A.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.A.1.N.a.	III.A.1.N.a. tropical or subtropical broad-leaved evergreen shrubland (includes bamboos and tuft-trees)
III.A.1.N.b.	III.A.1.N.b. hemi-sclerophyllous tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.c.	III.A.1.N.c. sclerophyllous tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.d.	III.A.1.N.d. tropical or subtropical broad-leaved evergreen shrubland with a sparse broad-leaved evergreen tree layer (includes tuft trees)
III.A.1.N.e.	III.A.1.N.e. temporarily flooded tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.f.	III.A.1.N.f. seasonally flooded tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.g.	III.A.1.N.g. semipermanently flooded tropical or subtropical broad- leaved evergreen shrubland
III.A.1.N.h.	III.A.1.N.h. saturated tropical or subtropical broad-leaved evergreen shrubland
III.A.1.N.i.	III.A.1.N.i. tidal tropical or subtropical broad-leaved evergreen shrubland
III.A.2.C.a.	III.A.2.C.a. fruit/nut shrubs and vines (vineyards)
III.A.2.C.b.	III.A.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.A.2.N.a.	III.A.2.N.a. temperate broad-leaved evergreen shrubland (including bamboos and tuft-trees)
III.A.2.N.b.	III.A.2.N.b. hemi-sclerophyllous temperate broad-leaved evergreen shrubland
III.A.2.N.c.	III.A.2.N.c. sclerophyllous temperate broad-leaved evergreen shrubland
III.A.2.N.d.	III.A.2.N.d. suffruticose temperate broad-leaved evergreen shrubland
III.A.2.N.e.	III.A.2.N.e. temperate broad-leaved evergreen shrubland with a sparse broad-leaved evergreen tree layer (includes tuft trees)
III.A.2.N.f.	III.A.2.N.f. temperate broad-leaved evergreen shrubland with a sparse cold- deciduous tree layer
III.A.2.N.g.	III.A.2.N.g. temporarily flooded temperate broad-leaved evergreen shrubland
III.A.2.N.h.	III.A.2.N.h. seasonally flooded temperate broad-leaved evergreen shrubland
III.A.2.N.i.	III.A.2.N.i. saturated temperate broad-leaved evergreen shrubland
III.A.2.N.j.	III.A.2.N.j. saturated temperate broad-leaved evergreen shrubland with a sparse needle-leaved or mixed evergreen tree layer (e.g. pocosins)
III.A.2.N.k.	III.A.2.N.k. saturated temperate broad-leaved evergreen shrubland with a sparse cold-deciduous tree layer
III.A.2.N.l.	III.A.2.N.l. tidal broad-leaved evergreen temperate shrubland
III.A.3.C.a.	III.A.3.C.a. fruit/nut shrubs and vines (vineyards)

III.A.3.C.b.	III.A.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.A.3.N.a.	III.A.3.N.a. needle-leaved evergreen shrubland (e.g. krummholz)
III.A.3.N.b.	III.A.3.N.b. saturated needle-leaved evergreen shrubland (e.g. shrub bog)
III.A.4.C.a.	III.A.4.C.a. fruit/nut shrubs and vines (vineyards)
III.A.4.C.b.	III.A.4.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.A.4.N.a.	III.A.4.N.a. microphyllous evergreen shrubland
III.A.4.N.b.	III.A.4.N.b. intermittently flooded microphyllous shrubland
III.A.4.N.c.	III.A.4.N.c. temporarily flooded microphyllous shrubland
III.A.4.N.d.	III.A.4.N.d. seasonally flooded microphyllous shrubland
III.A.5.C.a.	III.A.5.C.a. fruit/nut shrubs and vines (vineyards)
III.A.5.C.b.	III.A.5.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.A.5.N.a.	III.A.5.N.a. broad-leaved and microphyllous evergreen extremely xeromorphic subdesert shrubland (e.g. creosote bush)
III.A.5.N.b.	III.A.5.N.b. facultatively deciduous extremely xeromorphic subdesert shrubland (e.g. saltbush)
III.A.5.N.c.	III.A.5.N.c. succulent extremely xeromorphic evergreen shrubland
III.A.5.N.d.	III.A.5.N.d. tidal extremely xeromorphic shrubland
III.A.5.N.e.	III.A.5.N.e. extremely xeromorphic evergreen shrubland with a sparse tree layer
III.B.1.C.a.	III.B.1.C.a. fruit/nut shrubs and vines (vineyards)
III.B.1.C.b.	III.B.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.B.1.N.a.	III.B.1.N.a. lowland drought-deciduous shrubland
III.B.2.C.a.	III.B.2.C.a. fruit/nut shrubs and vines (vineyards)
III.B.2.C.b.	III.B.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.B.2.N.a.	III.B.2.N.a. temperate cold-deciduous shrubland (e.g. serviceberry, some oaks)
III.B.2.N.b.	III.B.2.N.b. subalpine or subpolar cold-deciduous shrubland (e.g. willow, alder)
III.B.2.N.c.	III.B.2.N.c. intermittently flooded cold-deciduous shrubland
III.B.2.N.d.	III.B.2.N.d. temporarily flooded cold-deciduous shrubland
III.B.2.N.e.	III.B.2.N.e. seasonally flooded cold-deciduous shrubland (e.g. blueberry - azalea thickets)
III.B.2.N.f.	III.B.2.N.f. semipermanently flooded cold-deciduous shrubland (e.g. buttonbush thickets)
III.B.2.N.g.	III.B.2.N.g. saturated cold-deciduous shrubland (e.g. on peat)
III.B.2.N.h.	III.B.2.N.h. tidal cold-deciduous shrubland (e.g. high tide bush)
III.B.3.C.a.	III.B.3.C.a. fruit/nut shrubs and vines (vineyards)
III.B.3.C.b.	III.B.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.B.3.N.a.	III.B.3.N.a. extremely xeromorphic deciduous subdesert shrubland without succulents
III.B.3.N.b.	III.B.3.N.b. intermittently flooded extremely xeromorphic deciduous subdesert shrubland
III.C.1.C.a.	III.C.1.C.a. fruit/nut shrubs and vines (vineyards)
III.C.1.C.b.	III.C.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.C.1.N.a.	III.C.1.N.a. lowland mixed evergreen - drought-deciduous shrubland
III.C.2.C.a.	III.C.2.C.a. fruit/nut shrubs and vines (vineyards)
III.C.2.C.b.	III.C.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.C.2.N.a.	III.C.2.N.a. mixed evergreen - cold-deciduous shrubland
III.C.2.N.b.	III.C.2.N.b. mixed evergreen - cold-deciduous shrubland with a sparse needle- leaved evergreen tree layer (e.g. pitch pine-scrub oak)
III.C.2.N.c.	III.C.2.N.c. intermittently flooded mixed evergreen - cold-deciduous shrubland
III.C.2.N.d.	III.C.2.N.d. seasonally flooded mixed evergreen - cold-deciduous shrubland
III.C.2.N.e.	III.C.2.N.e. saturated mixed evergreen - cold-deciduous shrubland (e.g. on peat)

III.C.2.N.f.	III.C.2.N.f. saturated mixed evergreen - cold-deciduous shrubland with a sparse needle-leaved evergreen tree layer (e.g. pocosins)
III.C.3.C.a.	III.C.3.C.a. fruit/nut shrubs and vines (vineyards)
III.C.3.C.b.	III.C.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
III.C.3.N.a.	III.C.3.N.a. extremely xeromorphic deciduous subdesert shrubland with succulents (e.g. palo verde)
III.C.3.N.b.	III.C.3.N.b. mixed evergreen - deciduous subdesert shrubland
IV.A.1.C.a.	IV.A.1.C.a. fruit/nut shrubs and vines (vineyards)
IV.A.1.C.b.	IV.A.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.A.1.N.a.	IV.A.1.N.a. caespitose needle-leaved or microphyllous evergreen dwarf-shrubland (e.g. alpine azalea)
IV.A.1.N.b.	IV.A.1.N.b. creeping or matted needle-leaved or microphyllous evergreen dwarf-shrubland
IV.A.1.N.c.	IV.A.1.N.c. cushion needle-leaved or microphyllous evergreen dwarf-shrubland
IV.A.1.N.d.	IV.A.1.N.d. needle-leaved or microphyllous evergreen dwarf-shrubland with a sparse needle-leaved evergreen tree layer
IV.A.1.N.e.	IV.A.1.N.e. temporarily flooded needle-leaved and microphyllous evergreen dwarf-shrubland
IV.A.1.N.f.	IV.A.1.N.f. seasonally flooded needle-leaved and microphyllous evergreen dwarf-shrubland
IV.A.1.N.g.	IV.A.1.N.g. saturated needle-leaved or microphyllous evergreen dwarf-shrubland (may include sparse dwarf-shrubland, e.g. dwarf-shrub bogs)
IV.A.1.N.h.	IV.A.1.N.h. saturated needle-leaved or microphyllous evergreen dwarf-shrubland with a sparse needle-leaved evergreen tree layer
IV.A.2.C.a.	IV.A.2.C.a. fruit/nut shrubs and vines (vineyards)
IV.A.2.C.b.	IV.A.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.A.2.N.a.	IV.A.2.N.a. extremely xeromorphic evergreen subdesert dwarf-shrubland
IV.A.2.N.b.	IV.A.2.N.b. facultatively deciduous subdesert dwarf-shrubland
IV.A.2.N.c.	IV.A.2.N.c. tidal needle-leaved or microphyllous evergreen dwarf-shrubland
IV.B.1.C.a.	IV.B.1.C.a. fruit/nut shrubs and vines (vineyards)
IV.B.1.C.b.	IV.B.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.B.1.N.a.	IV.B.1.N.a. caespitose drought-deciduous dwarf-shrubland
IV.B.1.N.b.	IV.B.1.N.b. creeping or matted drought-deciduous dwarf-shrubland
IV.B.1.N.c.	IV.B.1.N.c. cushion drought-deciduous dwarf-shrubland
IV.B.2.C.a.	IV.B.2.C.a. fruit/nut shrubs and vines (vineyards)
IV.B.2.C.b.	IV.B.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.B.2.N.a.	IV.B.2.N.a. caespitose cold-deciduous dwarf-shrubland
IV.B.2.N.b.	IV.B.2.N.b. creeping or matted cold-deciduous dwarf-shrubland
IV.B.2.N.c.	IV.B.2.N.c. cushion cold-deciduous dwarf-shrubland
IV.B.2.N.d.	IV.B.2.N.d. saturated cold-deciduous dwarf-shrubland
IV.B.3.C.a.	IV.B.3.C.a. fruit/nut shrubs and vines (vineyards)
IV.B.3.C.b.	IV.B.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.B.3.N.a.	IV.B.3.N.a. extremely xeromorphic deciduous subdesert dwarf-shrubland without succulents
IV.C.1.C.a.	IV.C.1.C.a. fruit/nut shrubs and vines (vineyards)
IV.C.1.C.b.	IV.C.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.C.1.N.a.	IV.C.1.N.a. mixed evergreen - drought-deciduous dwarf-shrubland
IV.C.2.C.a.	IV.C.2.C.a. fruit/nut shrubs and vines (vineyards)
IV.C.2.C.b.	IV.C.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)

IV.C.2.N.a.	IV.C.2.N.a. mixed evergreen - cold-deciduous dwarf-shrubland
IV.C.3.C.a.	IV.C.3.C.a. fruit/nut shrubs and vines (vineyards)
IV.C.3.C.b.	IV.C.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
IV.C.3.N.a.	IV.C.3.N.a. deciduous subdesert dwarf-shrubland with succulents
IV.C.3.N.b.	IV.C.3.N.b. mixed evergreen - deciduous subdesert dwarf-shrubland
V.A.1.C.a.	V.A.1.C.a. perennial grass crops (hayland, pastureland)
V.A.1.C.b.	V.A.1.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.1.N.a.	V.A.1.N.a. tall tropical or subtropical grassland
V.A.1.N.b.	V.A.1.N.b. medium-tall sod tropical or subtropical grassland
V.A.1.N.c.	V.A.1.N.c. medium-tall bunch tropical or subtropical grassland
V.A.1.N.d.	V.A.1.N.d. short sod tropical or subtropical grassland
V.A.1.N.e.	V.A.1.N.e. short bunch tropical alpine grassland (e.g. super-paramo)
V.A.1.N.f.	V.A.1.N.f. temporarily flooded tropical or subtropical grassland
V.A.1.N.g.	V.A.1.N.g. seasonally flooded tropical or subtropical grassland
V.A.1.N.h.	V.A.1.N.h. semipermanently flooded tropical or subtropical grassland
V.A.1.N.i.	V.A.1.N.i. tidal tropical or subtropical grassland
V.A.10N.x.	V.A.10N.x. [formations have not yet been defined]
V.A.11C.a.	V.A.11C.a. perennial grass crops (hayland, pastureland)
V.A.11C.b.	V.A.11C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.11N.x.	V.A.11N.x. [formations have not yet been defined]
V.A.12C.a.	V.A.12C.a. perennial grass crops (hayland, pastureland)
V.A.12C.b.	V.A.12C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.2.C.a.	V.A.2.C.a. perennial grass crops (hayland, pastureland)
V.A.2.C.b.	V.A.2.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.2.N.a.	V.A.2.N.a. tall tropical or subtropical grassland with a sparse mainly broad-leaved evergreen tree layer (includes tuft plants and broad-leaved semi-evergreen trees)
V.A.2.N.b.	V.A.2.N.b. tall tropical or subtropical grassland with a sparse broad- leaved drought-deciduous tree layer
V.A.2.N.c.	V.A.2.N.c. medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen tree layer (includes tuft plants and semi-evergreen trees)
V.A.2.N.d.	V.A.2.N.d. medium-tall tropical or subtropical grassland with a sparse broad-leaved drought-deciduous tree layer
V.A.2.N.e.	V.A.2.N.e. medium-tall tropical or subtropical grassland with a sparse needle-leaved evergreen or mixed tree layer
V.A.2.N.f.	V.A.2.N.f. medium-tall tropical or subtropical grassland with a sparse xeromorphic or succulent tree layer
V.A.2.N.g.	V.A.2.N.g. temporarily flooded tropical grassland with a sparse broad- leaved evergreen tree layer (includes tuft plants, e.g. llanos de mojos, bolivia)
V.A.2.N.h.	V.A.2.N.h. temporarily flooded tropical grassland with a sparse broad- leaved deciduous tree layer (e.g. in northeast bolivia)
V.A.2.N.i.	V.A.2.N.i. seasonally flooded tropical or subtropical grassland with a sparse needle-leaved evergreen tree layer
V.A.2.N.j.	V.A.2.N.j. seasonally flooded tropical or subtropical grassland with a sparse needle-leaved deciduous tree layer
V.A.3.C.a.	V.A.3.C.a. perennial grass crops (hayland, pastureland)
V.A.3.C.b.	V.A.3.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.3.N.a.	V.A.3.N.a. tall tropical or subtropical grassland with a sparse broad- leaved evergreen or semi-evergreen shrub layer (includes tuft shrubs)
V.A.3.N.b.	V.A.3.N.b. tall tropical or subtropical grassland with a sparse broad- leaved drought-

	deciduous shrub layer
V.A.3.N.c.	V.A.3.N.c. medium-tall tropical or subtropical grassland with a sparse broad-leaved evergreen or semi-evergreen shrub layer (includes tuft plants)
V.A.3.N.d.	V.A.3.N.d. medium-tall tropical or subtropical grassland with a sparse drought-deciduous shrub layer
V.A.3.N.e.	V.A.3.N.e. medium-tall tropical or subtropical grassland with a sparse xeromorphic (often thorny) shrub layer
V.A.3.N.f.	V.A.3.N.f. short tropical or subtropical grassland with a sparse broad- leaved evergreen or semi-evergreen shrub layer (includes tuft plants, e.g. paramo)
V.A.3.N.g.	V.A.3.N.g. short tropical or subtropical grassland with a sparse drought- deciduous shrub layer (includes thorny shrubs)
V.A.3.N.h.	V.A.3.N.h. short alpine bunch tropical or subtropical grassland with a sparse evergreen shrub layer
V.A.3.N.i.	V.A.3.N.i. temporarily flooded tropical or subtropical grassland with a sparse evergreen broad-leaved shrub layer
V.A.4.C.a.	V.A.4.C.a. perennial grass crops (hayland, pastureland)
V.A.4.C.b.	V.A.4.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.4.N.a.	V.A.4.N.a. short bunch tropical or subtropical grassland with a sparse needle-leaved or microphyllous evergreen dwarf-shrub layer (e.g. puna)
V.A.5.C.a.	V.A.5.C.a. perennial grass crops (hayland, pastureland)
V.A.5.C.b.	V.A.5.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.5.N.a.	V.A.5.N.a. tall sod temperate grassland (includes sod or mixed sod-bunch graminoids)
V.A.5.N.b.	V.A.5.N.b. tall bunch temperate grassland
V.A.5.N.c.	V.A.5.N.c. medium-tall sod temperate or subpolar grassland (includes sod or mixed sod-bunch graminoids)
V.A.5.N.d.	V.A.5.N.d. medium-tall bunch temperate or subpolar grassland
V.A.5.N.e.	V.A.5.N.e. short sod temperate or subpolar grassland (includes sod or mixed sod-bunch graminoids, e.g. shortgrass prairie)
V.A.5.N.f.	V.A.5.N.f. short bunch temperate or subpolar grassland
V.A.5.N.g.	V.A.5.N.g. short alpine or subalpine sod grassland
V.A.5.N.h.	V.A.5.N.h. short alpine or subalpine dry bunch grassland
V.A.5.N.i.	V.A.5.N.i. intermittently flooded temperate or subpolar grassland (e.g. playa lakes)
V.A.5.N.j.	V.A.5.N.j. temporarily flooded temperate or subpolar grassland
V.A.5.N.k.	V.A.5.N.k. seasonally flooded temperate or subpolar grassland
V.A.5.N.l.	V.A.5.N.l. semipermanently flooded temperate or subpolar grassland
V.A.5.N.m.	V.A.5.N.m. saturated temperate or subpolar grassland
V.A.5.N.n.	V.A.5.N.n. tidal temperate or subpolar grassland
V.A.6.C.a.	V.A.6.C.a. perennial grass crops (hayland, pastureland)
V.A.6.C.b.	V.A.6.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.6.N.a.	V.A.6.N.a. tall temperate grassland with a sparse broad-leaved evergreen tree layer
V.A.6.N.b.	V.A.6.N.b. tall temperate grassland with a sparse needle-leaved evergreen tree layer
V.A.6.N.c.	V.A.6.N.c. tall temperate grassland with a sparse cold-deciduous tree layer
V.A.6.N.d.	V.A.6.N.d. tall temperate grassland with a sparse mixed needle- leaved evergreen or cold-deciduous tree layer
V.A.6.N.e.	V.A.6.N.e. medium-tall temperate grassland with a sparse broad-leaved evergreen or semi-evergreen tree layer (includes tuft plants)
V.A.6.N.f.	V.A.6.N.f. medium-tall temperate or subpolar grassland with a sparse needle-leaved evergreen or mixed tree layer
V.A.6.N.g.	V.A.6.N.g. medium-tall temperate or subpolar grassland with a sparse cold-deciduous tree layer

V.A.6.N.h.	V.A.6.N.h. hort temperate or subpolar grassland with a sparse broad- leaved evergreen or semi-evergreen tree layer
V.A.6.N.i.	V.A.6.N.i. short temperate or subpolar grassland with a sparse cold- deciduous tree layer
V.A.6.N.j.	V.A.6.N.j. intermittently flooded temperate or subpolar grassland with a sparse needle-leaved evergreen tree layer
V.A.6.N.k.	V.A.6.N.k. temporarily flooded temperate or subpolar grassland with a sparse broad-leaved evergreen tree layer
V.A.6.N.l.	V.A.6.N.l. temporarily flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.m.	V.A.6.N.m. seasonally flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.n.	V.A.6.N.n. semipermanently flooded temperate or subpolar grassland with a sparse cold-deciduous tree layer
V.A.6.N.o.	V.A.6.N.o. saturated temperate or subpolar grassland with a sparse needle-leaved evergreen tree layer
V.A.6.N.p.	V.A.6.N.p. tidal temperate grassland with a sparse cold-deciduous tree layer
V.A.7.C.a.	V.A.7.C.a. perennial grass crops (hayland, pastureland)
V.A.7.C.b.	V.A.7.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.7.N.a.	V.A.7.N.a. tall temperate grassland with a sparse broad-leaved evergreen shrub layer (includes tuft shrubs)
V.A.7.N.b.	V.A.7.N.b. tall temperate grassland with a sparse microphyllous evergreen shrub layer
V.A.7.N.c.	V.A.7.N.c. tall temperate grassland with a sparse cold-deciduous shrub layer
V.A.7.N.d.	V.A.7.N.d. medium-tall temperate or subpolar grassland with a sparse broad-leaved evergreen shrub layer
V.A.7.N.e.	V.A.7.N.e. medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer
V.A.7.N.f.	V.A.7.N.f. medium-tall temperate or subpolar grassland with a sparse drought-deciduous shrub layer
V.A.7.N.g.	V.A.7.N.g. medium-tall temperate or subpolar grassland with a sparse cold-deciduous shrub layer
V.A.7.N.h.	V.A.7.N.h. medium-tall temperate grassland with a sparse xeromorphic (often thorny) shrub layer
V.A.7.N.i.	V.A.7.N.i. short temperate or subpolar grassland with a sparse broad- leaved evergreen or semi-evergreen shrub layer
V.A.7.N.j.	V.A.7.N.j. short temperate or subpolar grassland with a sparse microphyllous evergreen shrub layer
V.A.7.N.k.	V.A.7.N.k. short temperate or subpolar grassland with a sparse drought- deciduous shrub layer (includes thorny shrubs)
V.A.7.N.l.	V.A.7.N.l. short temperate or subpolar grassland with a sparse cold- deciduous shrub layer
V.A.7.N.m.	V.A.7.N.m. short temperate or subpolar grassland with a sparse xeromorphic (evergreen and/or deciduous) shrub layer
V.A.7.N.n.	V.A.7.N.n. intermittently flooded temperate or subpolar grassland with a sparse xeromorphic (evergreen and/or deciduous) shrub layer
V.A.7.N.o.	V.A.7.N.o. saturated temperate or subpolar grassland with a sparse broad-leaved evergreen shrub layer
V.A.7.N.p.	V.A.7.N.p. saturated temperate or subpolar grassland with a sparse cold-deciduous shrub layer
V.A.7.N.q.	V.A.7.N.q. saturated temperate or subpolar grassland with a sparse microphyllous evergreen shrub layer
V.A.8.C.a.	V.A.8.C.a. perennial grass crops (hayland, pastureland)
V.A.8.C.b.	V.A.8.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.8.N.a.	V.A.8.N.a. short temperate or subpolar lowland grassland with a sparse needle-leaved or

	microphyllous dwarf shrub layer
V.A.8.N.b.	V.A.8.N.b. short temperate or subpolar lowland grassland with a sparse cold-deciduous dwarf shrub layer
V.A.8.N.c.	V.A.8.N.c. short temperate or subpolar alpine grassland with a sparse needle-leaved or microphyllous evergreen dwarf-shrub layer (e.g. dwarf-shrub meadows)
V.A.8.N.d.	V.A.8.N.d. seasonally flooded temperate or subpolar grassland with a sparse needle-leaved or microphyllous dwarf-shrub layer
V.A.9.C.a.	V.A.9.C.a. perennial grass crops (hayland, pastureland)
V.A.9.C.b.	V.A.9.C.b. landscaped urban/suburban/rural (residential yards, nurseries)
V.A.9.N.a.	V.A.9.N.a. short sod polar grassland (including sod or mixed sod-bunch grassland, e.g. sod grass tundra)
V.A.9.N.b.	V.A.9.N.b. short bunch polar grassland (e.g. eriophorum)
V.A.9.N.c.	V.A.9.N.c. seasonally flooded polar grassland
V.A.9.N.d.	V.A.9.N.d. saturated polar grassland with nonvascular plants admixed
V.B.1.C.a.	V.B.1.C.a. perennial forb row crops
V.B.1.C.b.	V.B.1.C.b. perennial forb close-grown crops
V.B.1.C.c.	V.B.1.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
V.B.1.N.a.	V.B.1.N.a. tall tropical or subtropical perennial forb vegetation
V.B.1.N.b.	V.B.1.N.b. low tropical or subtropical perennial forb vegetation
V.B.1.N.c.	V.B.1.N.c. semipermanently flooded tropical or subtropical perennial forb vegetation
V.B.1.N.d.	V.B.1.N.d. saturated tropical or subtropical perennial forb vegetation
V.B.1.N.e.	V.B.1.N.e. tidal tropical or subtropical perennial forb vegetation
V.B.2.C.a.	V.B.2.C.a. perennial forb row crops
V.B.2.C.b.	V.B.2.C.b. perennial forb close-grown crops
V.B.2.C.c.	V.B.2.C.c. landscaped urban/suburban/rural (residential yards, nurseries)
V.B.2.N.a.	V.B.2.N.a. tall temperate or subpolar perennial forb vegetation (e.g. tall forb meadows)
V.B.2.N.b.	V.B.2.N.b. low temperate or subpolar perennial forb vegetation (e.g. aleutian forb meadows)
V.B.2.N.c.	V.B.2.N.c. intermittently flooded temperate perennial forb vegetation
V.B.2.N.d.	V.B.2.N.d. temporarily flooded temperate perennial forb vegetation
V.B.2.N.e.	V.B.2.N.e. semipermanently flooded temperate perennial forb vegetation
V.B.2.N.f.	V.B.2.N.f. saturated temperate perennial forb vegetation
V.B.2.N.g.	V.B.2.N.g. tidal temperate perennial forb vegetation
V.B.2.N.h.	V.B.2.N.h. seasonally flooded temperate perennial forb vegetation
V.C.1.C.x.	V.C.1.C.x. [formations have not yet been defined]
V.C.1.N.a.	V.C.1.N.a. permanently flooded tropical or subtropical hydromorphic rooted vegetation
V.C.1.N.b.	V.C.1.N.b. permanently flooded-tidal tropical or subtropical hydromorphic rooted vegetation (e.g. tropical seagrass beds)
V.C.2.C.x.	V.C.2.C.x. [formations have not yet been defined]
V.C.2.N.a.	V.C.2.N.a. permanently flooded temperate or subpolar hydromorphic rooted vegetation
V.C.2.N.b.	V.C.2.N.b. permanently flooded-tidal temperate or subpolar hydromorphic rooted vegetation (e.g. temperate seagrass beds)
V.D.1.C.a.	V.D.1.C.a. annual close-grown forbs and grasses
V.D.1.C.b.	V.D.1.C.b. annual row-crop forbs and grasses
V.D.1.N.a.	V.D.1.N.a. tropical or subtropical annual grasslands
V.D.1.N.b.	V.D.1.N.b. tall tropical or subtropical annual forb vegetation.
V.D.1.N.c.	V.D.1.N.c. low tropical or subtropical ephemeral annual forb vegetation
V.D.1.N.d.	V.D.1.N.d. tidal tropical or subtropical annual forb vegetation

V.D.2.C.a.	V.D.2.C.a. annual close-grown forbs and grasses
V.D.2.C.b.	V.D.2.C.b. annual row-crop forbs and grasses
V.D.2.N.a.	V.D.2.N.a. tall temperate or subpolar annual grassland (dominated by annual graminoids)
V.D.2.N.b.	V.D.2.N.b. tall temperate or subpolar annual forb vegetation (dominated by annual forbs)
V.D.2.N.c.	V.D.2.N.c. low desert or subdesert ephemeral or episodic annual forb vegetation
V.D.2.N.d.	V.D.2.N.d. short temperate annual grassland
V.D.2.N.e.	V.D.2.N.e. low temperate intermittently exposed annual forb vegetation
V.D.2.N.f.	V.D.2.N.f. temporarily flooded temperate annual forb vegetation
V.D.2.N.g.	V.D.2.N.g. seasonally flooded temperate annual grassland
V.D.2.N.h.	V.D.2.N.h. seasonally flooded temperate annual forb vegetation
V.D.2.N.i.	V.D.2.N.i. saturated temperate annual forb vegetation
VI.A.1.C.x.	VI.A.1.C.x. [formations have not yet been defined]
VI.A.1.N.a.	VI.A.1.N.a. lowland bryophyte vegetation
VI.A.1.N.b.	VI.A.1.N.b. seasonally flooded bryophyte vegetation
VI.A.1.N.c.	VI.A.1.N.c. saturated bryophyte vegetation
VI.A.1.N.d.	VI.A.1.N.d. saturated bryophyte vegetation with a sparse tree layer (e.g. treed bogs)
VI.A.1.N.e.	VI.A.1.N.e. saturated bryophyte vegetation with a sparse dwarf-shrub layer (e.g. dwarf-shrub/moss tundra)
VI.B.1.C.x.	VI.B.1.C.x. [formations have not yet been defined]
VI.B.1.N.a.	VI.B.1.N.a. lowland lichen vegetation
VI.B.1.N.b.	VI.B.1.N.b. montane/submontane tropical or subtropical ichen vegetation
VI.B.1.N.c.	VI.B.1.N.c. lichen vegetation with a sparse tree layer
VI.B.1.N.d.	VI.B.1.N.d. lichen vegetation with a sparse dwarf-shrub layer
VI.B.2.N.a.	VI.B.2.N.a. montane/submontane tropical or subtropical lichen vegetation
VI.C.1.N.a.	VI.C.1.N.a. seasonally flooded alga vegetation
VII.A.1.C.x.	VII.A.1.C.x. [formations have not yet been defined]
VII.A.1.N.a.	VII.A.1.N.a. cliffs with sparse vascular vegetation (e.g. bromeliads in neotropics) (may have sparse to dense cructose lichens, sparse bryoids or foliose or fructicose l
VII.A.2.C.x.	VII.A.2.C.x. [formations have not yet been defined]
VII.A.2.N.a.	VII.A.2.N.a. pavement with sparse vascular vegetation (may have sparse to dense crustose lichens, sparse bryoids, or foliose or fruticose lichens)
VII.B.1.C.x.	VII.B.1.C.x. [formations have not yet been defined]
VII.B.1.N.a.	VII.B.1.N.a. lowland or submontane talus/scree
VII.B.1.N.b.	VII.B.1.N.b. montane talus/scree
VII.B.1.N.c.	VII.B.1.N.c. high mountain talus/scree
VII.B.2.C.x.	VII.B.2.C.x. [formations have not yet been defined]
VII.B.2.N.a.	VII.B.2.N.a. boulder fields
VII.B.2.N.b.	VII.B.2.N.b. cobble/gravel beaches and shores
VII.B.2.N.c.	VII.B.2.N.c. cobble/gravel flats and ridges
VII.C.1.C.x.	VII.C.1.C.x. [formations have not yet been defined]
VII.C.1.N.a.	VII.C.1.N.a. dunes with sparse herbaceous vegetation
VII.C.1.N.b.	VII.C.1.N.b. dunes with sparse woody vegetation
VII.C.2.C.x.	VII.C.2.C.x. [formations have not yet been defined]
VII.C.2.N.a.	VII.C.2.N.a. sand flats (including storm-washed beaches)
VII.C.2.N.b.	VII.C.2.N.b. intermittently flooded sand beaches and shores
VII.C.2.N.c.	VII.C.2.N.c. temporarily flooded sand flats

VII.C.2.N.d.	VII.C.2.N.d. tidal sand flats (e.g. salt pannes)
VII.C.3.C.a.	VII.C.3.C.a. agriculture field-bare soil, crop residue.
VII.C.3.C.b.	VII.C.3.C.b. non-agriculture disturbed areas
VII.C.3.N.a.	VII.C.3.N.a. moist slopes
VII.C.3.N.b.	VII.C.3.N.b. dry slopes
VII.C.4.C.a.	VII.C.4.C.a. agricultural field - bare soil, crop residue
VII.C.4.C.b.	VII.C.4.C.b. non-agriculture disturbed areas
VII.C.4.N.a.	VII.C.4.N.a. soil slumps or landslides
VII.C.4.N.b.	VII.C.4.N.b. intermittently flooded mud flats (e.g. playa lakes)
VII.C.4.N.c.	VII.C.4.N.c. seasonally / temporarily flooded mud flats
VII.C.4.N.d.	VII.C.4.N.d. tidal mud flats
VII.C.5.C.x.	VII.C.5.C.x. [formations have not yet been defined]
VII.C.5.N.x.	VII.C.5.N.x. [formations have not yet been defined]

Domain name: OrganizationalCode
Domain description: Identifies USFWS 5 character numeric organizational codes assigned to all NWRs.
Field type: long integer
Domain type: coded values
Merge policy: default values

Coded Value	Description

Domain name: OrganizationalName
Domain description: Identifies USFWS full organizational names assigned to all NWRs.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description

Domain name: PlantGrowthStage
Domain description: Identifies target invasive plant species stages of growth.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description
senesced	senesced
flowering	flowering
rosette	basal rosette
post-flowering	post-flowering
leaf off	leaf off
leaf on	leaf on
pre-flowering	pre-flowing
other	other

Domain name: Region
Domain description: Identifies USFWS Region.
Field type: long integer
Domain type: coded values
Merge policy: default values

Coded Value	Description
1	Region 1
2	Region 2
3	Region 3
4	Region 4
5	Region 5
6	Region 6
7	Region 7
8	Region 8
9	Region 9
10	Region 10

Domain name: RSLType
Domain description: Identifies RSL types.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description
COR	coordination area
FSA	farm serv agency
MBR	mig bird refuge
NFH	nat fish hatch
NWR	nat wildlife ref
RNA	res natural area
WDA	wildlife dev area
WMA	wildlife man area
WPA	watfowl prod area
WA	wilderness area

Domain name: State
Domain description: Identifies states.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description
AL	Alabama
AK	Alaska
AS	American Samoa
AZ	Arizona
AR	Arkansas
CA	California
CO	Colorado
CT	Connecticut
DE	Delaware
DC	District of Columbia
FM	Federated States of Micronesia

FL	Florida
GA	Georgia
GU	Guam
HI	Hawaii
ID	Idaho
IL	Illinois
IN	Indiana
IA	Iowa
KS	Kansas
KY	Kentucky
LA	Louisiana
ME	Maine
MH	Marshall Islands
MD	Maryland
MA	Massachusetts
MI	Michigan
MN	Minnesota
MS	Mississippi
MO	Missouri
MT	Montana
NE	Nebraska
NV	Nevada
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NY	New York
NC	North Carolina
ND	North Dakota
MP	Northern Mariana Islands
OH	Ohio
OK	Oklahoma
OR	Oregon
PW	Palau
PA	Pennsylvania
PR	Puerto Rico
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VT	Vermont
VI	Virgin Islands
VA	Virginia
WA	Washington
WV	West Virginia
WI	Wisconsin
WY	Wyoming

Domain Name: SourceID
Domain description: Identifies sources of information used to make data modifications.
Field type: text
Domain type: coded values
Merge policy: default values

Code	Description
ADAR	ADAR
Aerial Photography, Color Digitally Rectified	Color Ortho
Aerial Photography, Color Infrared Digitally Rectified	CIR Ortho
Aerial Photography, Color Infrared Print	CIR Print
Aerial Photgraphy, Color Print	Color Print
Aerial Photography, Panchromatic Digitally Rectified	Pan Ortho
Aerial Photography, Panchromatic Print	Pan Print
AVIRIS	AVIRIS
DEM Other	DEM other
DLG	DLG
DRG	DRG
GPS RTK	GPS Real-Time
GPS Uncorrected	GPS Uncorrected
GPS Post-Process	GPS Post-Process
IKONOS MS	IKONOS MS
IKONOS Pan	IKONOS Pan
IRS MS	IRS MS
IRS Pan	IRS Pan
Landsat ETM	Landsat ETM
Landsat MSS	Landsat MSS
Landsat TM	Landsat TM
LIDAR	LIDAR
Map Hard Copy	Map Hard Copy
Map Scanned	Map Scanned
MODIS	MODIS
NED	NED
Quickbird MS	Quickbird MS
Quickbird Pan	Quickbird Pan
RADAR	RADAR
SPOT	SPOT
SRTM	SRTM
Survey	Survey
Other	Other
Unknown	Unknown

Domain name: VegetationPercentCover
Domain description: Identifies classes of canopy or ground cover estimated as a percent of the area (polygon) containing non-associated plant.
Field type: text
Domain type: coded values
Merge policy: default values

Coded Value	Description
<1	<1% - scarce
1-10	1-10%- poorly represented
10-25	10-25% - well represented
25-60	25-60% - abundant
>60	>60% - luxuriant

Domain name: Yes/No
Domain description: Binary delimiter associated with field definition.
Field type: text
Length: 5
Domain type: coded values
Merge policy: default values

Coded Value	Description
Yes	Yes
No	No

National Wildlife Refuge Volunteer Weed Mapping Manual

Weed Working Group
National Wildlife Refuge System
Regions 1-7

Appendices

26

26.1 Flow Diagram of RLGIS Data Model
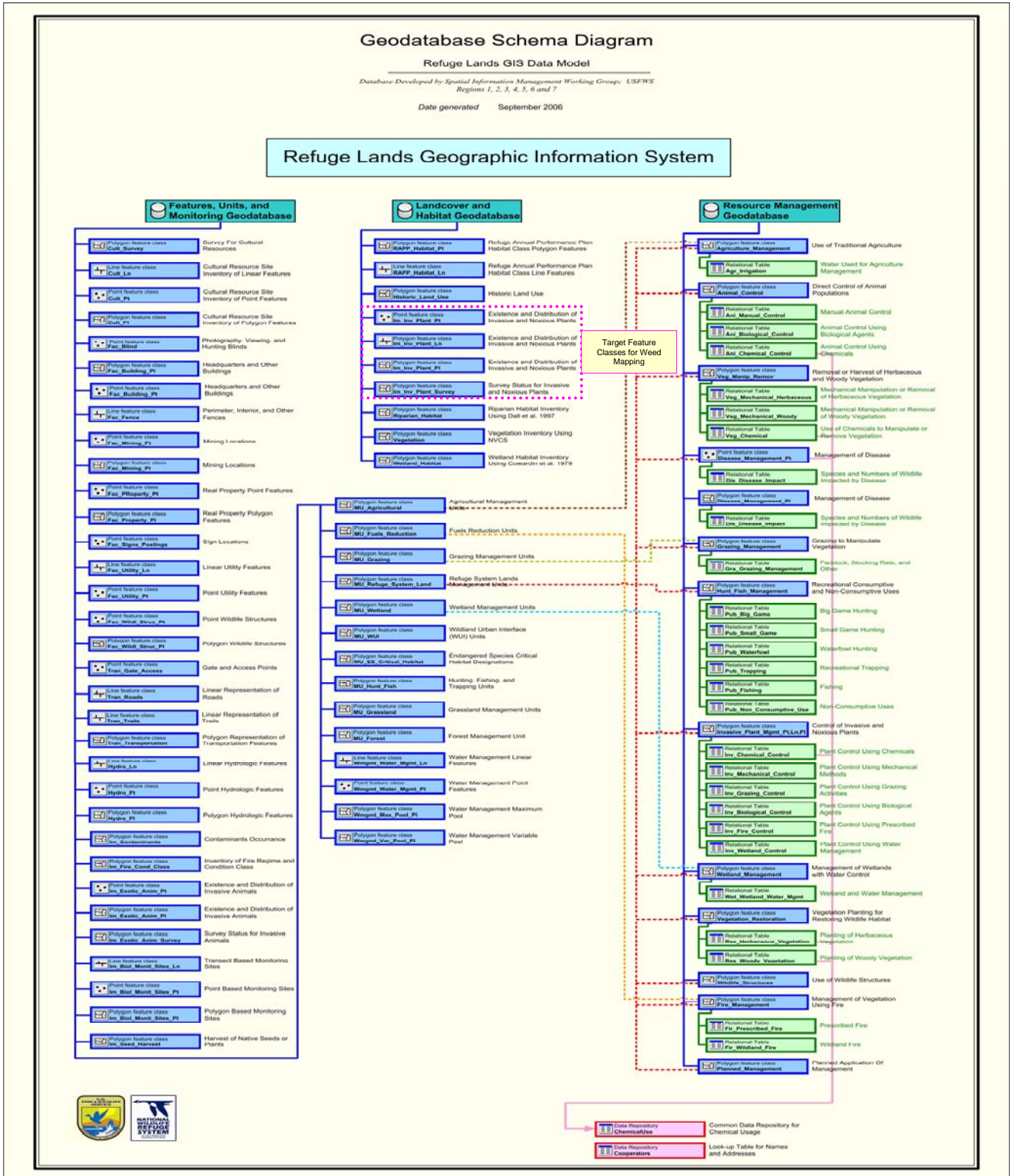
26.2 ArcPad Supported Data Formats

- Vector data is a data structure used to represent linear geographic features. Feature are made of ordered list of x,y coordinates and represented by points, lines or polygons. ESRI shapefiles are the only supported vector data in ArcPad. **Figure 1**

- Map Projection metadata (not mandatory, but highly recommended). Map projections are a mathematical model that transforms the location of features on the earth's curved surface to locations on a two-dimensional surface. **Figure 2**

- Raster data, image formats, are a spatial data model made of rows and columns of cells. Each cell contains an attribute value and location coordinates; the coordinates are contained in the ordering of the matrix, unlike a vector structure, which stores coordinates explicitly. **Figure 3**

- Spatial Index files. **Figure 4**

- ArcPad files. The APL file can contain ArcPad symbology, form definitions, simple metadata, scripts, and script references. Script references specify as associated VBS file that contains scripts used by the layer file. **Figure 5**

Vector Data:
Filename.SHP
Filename.SBX
Filename.DBF

Figure 1

Map Projection:
Filename.PRJ

Figure 2

Raster Data with World Files
JPEG (*.jpg) and (*.jgw)
MrSid (*.sid) and (*.sdw)
Windows Bitmap (*.bmp) and (*.bpm)
CADRG raster maps

Figure 3

ArcPad Files
Filename.APL
Filename.VBS

Figure 4

Spatial Index Files
Filename.SBN
Filename.SBX

Figure 5

26.3 ArcPad Interface 7.0

GPS POSITION WINDOW

SATELLITE SKYPLOT
Shows the almanac of which satellites should be available.
Black: available and used for calculating the GPS position
Blue: available but not used
Red: unavailable.
Tap the Satellite Skyplot to display the Signal Chart.

GPS POSITION COORDINATES
Tap and hold the coordinate display to change the coordinate system:
Map Projection
DMS (ddd°mm'ss.sss")
DMM (ddd°mm.mmmm')
DD (dd.dddddddd°)
UTM (Universal Transverse Mercator)
WGS84 DMS (ddd°mm'ss.sss")
WGS84 DMM (ddd°mm.mmmm')
WGS84 DD (dd.dddddddd°)
MGRS (Military Grid Reference System)

GPS MODE
NOFIX: no position
2D: x,y position
3D: x,y,z position
DGPS 2D/3D: real-time Differential GPS
RTK fix/flt: Real Time Kinematic fixed or float solution
PPS 2D/3D: Precise Positioning Service

ELEVATION
Tap and hold the elevation display to change units:
Altitude (meters or feet)
Depth (meters or feet)

NAVIGATION INFORMATION
SOG: Speed Over Ground
Tap and hold the COG display to change the reference:
TCOG: True North Course Over Ground
MCOG: Magnetic North Course Over Ground
DST: Distance to destination
BRG: Bearing to destination

POSITION MEASURE OF QUALITY
Tap and hold the display to change the measure:
PDOP: Position Dilution of Precision
HDOP: Horizontal Dilution of Precision
VDOP: Vertical Dilution of Precision
TDOP: Time Dilution of Precision

HPE: Estimated Horizontal Position Error
VPE: Estimated Vertical Position Error
EPE: Estimated Position Error
SATS: Satellites used in solution
DAGE: Differential data age
DSID: Differential reference station ID

SIGNAL CHART
Shows a bar chart of the relative signal strength of the satellites in the almanac. A red bar indicates the satellite is unavailable.
Tap the Signal Chart to display the Compass.

COMPASS
Shows the GPS direction with a black arrow and direction to destination in red.

MAIN TOOLBAR

Open Map	Open an ArcPad Map (a file with an .apm extension).
Save Map	Save the current ArcPad map.
Add Layer	Add one or more layers to the current map.
Table of Contents	Open the Table of Contents dialog box.
GPS Position Window	Open or close the GPS Position Window.
Tools	Open the ArcPad Options dialog box.
Quick Reference Help	Open the ArcPad Quick Reference.

OPEN MAP DROPDOWN LIST

New	Display a sub-menu for creating a new map, shapefile, QuickForm, graphics layer, or photo layer.
Open Map	Open an ArcPad Map (a file with an .apm extension).
Save Map	Save the current ArcPad map.
Save Map As	Save the current ArcPad map with a new name and/or in a different folder.
Map Properties	Open the Map Properties dialog box.
Recent Maps	Display the nine most recently opened maps.
Recent Layers	Display the nine most recently added layers.
Exit	Close ArcPad.

NEW SUB-MENU

Map	Close the current map and create a new map.
Shapefile	Create a new shapefile and load it into the current map.
QuickForm	Create a custom form for an existing shapefile.
Graphics Layer	Create a new graphics layer and load it into the current map.
Photo Layer	Create a new photo layer and load it into the current map.

ADD LAYER DROPDOWN LIST

Add Layer	Add one or more layers to the current map.
Add Internet Server	Add an ArcIMS image service as a layer to the current map.
Geography Network	Go to the www.geographynetwork.com website, using the default internet browser.

GPS POSITION WINDOW DROPDOWN LIST

GPS Position Window	Open or close the GPS Position Window.
GPS Active	Activate or deactivate the GPS.
GPS Tracklog	Start or stop storing GPS points in the tracklog shapefile.
Rangefinder Active	Activate or deactivate the Rangefinder.
GPS Preferences	Open the GPS Preferences dialog box.
Rangefinder Preferences	Open the Rangefinder Preferences dialog box.
GPS/Rangefinder Debug	Open or close the GPS and Rangefinder Debug window.
Automatic Map Rotation	Automatically rotates the map to "course up" when the GPS is active.

Radial Measure	Measure radial distances in the map view using the pen.
Freehand Measure	Measure distances in the map view in "freehand mode".
Hyperlink	Activate the Hyperlink tool.
Go To	Activate the Go To tool.
Advanced Select	Activate the Advanced Select tool.

FIND DROPDOWN LIST

Find Features	Open the Find tool.
Clear Selected Feature	Unselect the selected feature.

START/STOP EDITING DROPDOWN LIST

Point Features Target Layers	Display the editable point feature layers.
Line Features Target Layers	Display the editable line feature layers.
Polygon Features Target Layers	Display the editable polygon feature layers.
Multi-Features Target Layers	Display the editable layers which support multiple feature types.

EDIT TOOLBAR

Select	Activate the Select tool.
Point	Activate the point feature type for data capture.
Capture Point using GPS	Capture a point feature in the editable point layer using the current GPS position.
Add GPS Vertex	Capture a single vertex in the current polyline or polygon feature using the current GPS position.
Add GPS Vertices Continuously	Continuously capture vertices in the current polyline or polygon feature using the current GPS position.
Feature Properties	Open the Feature Properties dialog box (or custom edit form) for the selected feature.

SELECT DROPDOWN LIST

Offset Point	Activate offsets for point data capture.
Select	Activate the Select tool.

Go Back to Previous Extent	Zoom back to the previous extent you were using.
Identify	Activate the Identify tool.
Find	Open the Find tool.
Start/Stop Editing	Display a sub-menu containing all the editable layers in the ArcPad map. Tapping a layer toggles its editing state.
Refresh	Redraw the map.

ZOOM IN DROPDOWN LIST

Zoom In	Zoom in on map using the pen.
Zoom Out	Zoom out on map using the pen.
Pan	Pan the map using the pen.
Rotate Map	Set the map rotation angle.

ZOOM FULL EXTENT DROPDOWN LIST

Fixed Zoom In	Zoom in on the center of the map by 25%.
Fixed Zoom Out	Zoom out on the center of the map by 25%.
Zoom To Selected	Zoom to the extent of the selected feature.
Center on GPS	Center the map on the current GPS position.
Zoom to Full Extent	Zoom to the full extent of the map.
Zoom to Layer	Zoom to the extent of a particular layer in the map.

GO BACK TO PREVIOUS EXTENT DROPDOWN LIST

Go Back to Previous Extent	Zoom back to the previous extent you were using.
Go to Next Extent	Zoom forward to the next extent in the extent history.
Create Bookmark	Create a spatial bookmark.
Zoom to Bookmark	Zoom to an existing spatial bookmark.

IDENTIFY DROPDOWN LIST

Identify	Activate the Identify tool.
Measure	Measure distances in the map view in "point mode".

Clear Rotation	Clears the map rotation so that the map is "north up".

TOOLS DROPDOWN LIST

Options	Open the ArcPad Options dialog box.
Scale Bar	Display or hide the scale bar.
Panning Frame	Display or hide the map panning frame.
Status Bar	Display or hide the status bar.
North Arrow	Display or hide the north arrow in the map view.
Camera	Open the camera tool.
Toolbars	Display a sub-menu containing all the toolbars in ArcPad.
Utilities	Display a sub-menu containing utility tools.

UTILITIES DROPDOWN LIST

Pack Shapefile	Pack a shapefile by removing records flagged for deletion.
Reproject Shapefile	Reproject a shapefile to another projection and/or datum.
Export Projection Information	Export ArcPad's projection information into CSV and text files.
Run Script	Open the Script dialog box.

HELP DROPDOWN LIST

Quick Reference	Open the ArcPad Quick Reference.
Help	
User Guide	Open the User ArcPad guide (PC only).
Reference Guide	Open the ArcPad Reference Guide (PC only).
ESRI Support Center	Go to the support.esri.com website, using the default internet browser.
About ArcPad	Open the About ArcPad dialog box.
About Extension	Display a sub-menu listing all loaded ArcPad extensions.

BROWSE TOOLBAR

Zoom In	Zoom in on map using the pen
Zoom to Full Extent	Zoom to the full extent of the map.

26.4 ArcPad Interface 6.0.3

MAIN TOOLBAR

	Open Map	Open an ArcPad map (a file with an .apm extension).
	Save Map	Save the current ArcPad map.
	Add Layer	Add one or more layers to the current map.
	Layers	Open the Layers dialog box.
	GPS Position Window	Open or close the GPS Position Window.
	Tools	Open the ArcPad Options dialog box.
	Help	Open the online help.

OPEN MAP DROPDOWN LIST

	New Map	Close the current map and create a new map.
	New Layer	Create a new shapefile and load it into the current map.
	Open Map	Open an ArcPad map (a file with an .apm extension).
	Save Map	Save the current ArcPad map.
	Save Map As	Save the current ArcPad map with a new name and/or in a different folder.
	Map Properties	Enter the title of the current map.
	Recent Maps	Display the nine most recently opened maps.
	Recent Layers	Display the nine most recently added layers.
	Exit	Close ArcPad.

ADD LAYER DROPDOWN LIST

	Add Layer	Add one or more layers to the current map.
	Add Internet Server	Add an ArcIMS® image service as a layer to the current map.
	Geography Network	Go to the www.geographynetwork.com Web site, using the default Internet browser.

GPS POSITION WINDOW DROPDOWN LIST

	GPS Position Window	Open or close the GPS Position Window.
	GPS Active	Activate or deactivate the GPS.
	GPS Tracklog	Start or stop storing GPS points in the tracklog shapefile.
	GPS Debug	Open or close the GPS Debug window.

TOOLS DROPDOWN LIST

	Options	Open the ArcPad Options dialog box.
	Scale Bar	Display or hide the scale bar.
	Panning Frame	Display or hide the map panning frame.
	Status Bar	Display or hide the status bar.
	Toolbars	Display a submenu containing all the toolbars in ArcPad.

HELP DROPDOWN LIST

	Help Topics	Open the online help.
	About ArcPad	Open the About ArcPad dialog box.
	About Extension	Display a submenu listing all loaded ArcPad extensions.

BROWSE TOOLBAR

	Zoom In	Zoom in on the map using the pen.
	Zoom to Full Extent	Zoom to the full extent of the map.
	Go Back to Previous Extent	Zoom back to the previous extent you were using.
	Identify	Activate the Identify tool.
	Find	Open the Find tool.
	Clear Selected	Unselect the selected feature.
	Refresh	Redraw the map.

ZOOM IN DROPDOWN LIST

	Zoom In	Zoom in on map using the pen.
	Zoom Out	Zoom out on map using the pen.
	Pan	Pan the map using the pen.

ZOOM FULL EXTENT DROPDOWN LIST

	Fixed Zoom In	Zoom in on the center of the map by 25%.
	Fixed Zoom Out	Zoom out on the center of the map by 25%.
	Zoom to Selected	Zoom to the extent of the selected feature.
	Center on GPS	Center the map on the current GPS position.
	Zoom to Full Extent	Zoom to the full extent of the map.
	Zoom to Layer	Zoom to the extent of a particular layer in the map.

GO BACK TO PREVIOUS EXTENT DROPDOWN LIST

	Go Back to Previous Extent	Zoom back to the previous extent you were using.
	Go to Next Extent	Zoom forward to the next extent in the extent history.
	Set View Coordinates	Set the map extent or center the map at specified coordinates.
	Set Map Scale	Set the map scale.
	Create Bookmark	Create a spatial bookmark.
	Manage Bookmarks	Edit or delete existing spatial bookmarks.
	Zoom to Bookmark	Zoom to an existing spatial bookmark.

IDENTIFY DROPDOWN LIST

	Identify	Activate the Identify tool.
	Measure	Measure distances in the map view in "point mode".
	Radial Measure	Measure radial distances in the map view using the pen.
	Freehand Measure	Measure distances in the map view in "freehand mode".
	Hyperlink	Activate the Hyperlink tool.
	Go To	Activate the Go To tool.
	Advanced Select	Activate the Advanced Select tool.

EDIT/DRAWING TOOLBAR

	Select	Activate the Select tool.
	Vertex Edit	Activate vertex display and editing for the selected feature.
	Point	Activate the point feature type for data capture.
	Capture Point Using GPS	Capture a point feature in the editable point layer using the current GPS position.
	Add GPS Vertex	Capture a single vertex in the current line or polygon feature using the current GPS position.
	Add GPS Vertices Continuously	Continuously capture vertices in the current line or polygon feature using the current GPS position.
	Feature Properties	Open the Feature Properties dialog box (or custom edit form) for the selected feature.

SELECT DROPDOWN LIST

	Select	Activate the Select tool.
	Select at GPS Position	Select the feature at the current GPS position.

POINT DROPDOWN LIST

	Point	Activate the point feature type for data capture.
	Line	Capture a straight line feature using the pen.
	Polyline	Activate the polyline feature type for data capture and start a new line feature.
	Freehand Line	Capture a freehand line feature using the pen.

	Rectangle	Capture a rectangle polygon feature using the pen.
	Polygon	Activate the polygon feature type for data capture and start a new polygon feature.
	Ellipse	Capture an ellipse polygon feature using the pen.
	Circle	Capture a circle polygon feature using the pen.
	Freehand Polygon	Capture a freehand polygon feature using the pen.

FEATURE PROPERTIES DROPDOWN LIST

	Feature Properties	Open the Feature Properties dialog box (or custom edit form) for the selected feature.
	Zoom to Selected Feature	Zoom to the selected feature.
	Center on Selected Feature	Center the map on the selected feature without changing the current map scale.
	Go to Selected Feature	Set the selected feature to be the current destination for navigation.
	Delete Feature	Delete the selected feature.

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