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## *User Guide*

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# DNRSurvey *v2.30.01*

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Brian Haroldson<sup>1</sup>, Bob Wright<sup>2</sup>, and Chris Pouliot<sup>3</sup>



<sup>1</sup> Minnesota Department of Natural Resources, [Brian.Haroldson@state.mn.us](mailto:Brian.Haroldson@state.mn.us)

<sup>2</sup> MN.IT Services @ MNDNR Wildlife, [Robert.Wright@state.mn.us](mailto:Robert.Wright@state.mn.us)

<sup>3</sup> MN.IT Services @ MNDNR Wildlife, [Christopher.Pouliot@state.mn.us](mailto:Christopher.Pouliot@state.mn.us)



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# 1 Getting Started

DNRSurvey is an ArcMap AddIn toolbar which integrates geographic information system (GIS) and global positioning system (GPS) technology to display, georeference, and record observation data. It combines “moving map” functionality with the ability to record point, line, polygon, or audio features using customized data forms. DNRSurvey was developed by the Minnesota Department of Natural Resources (MNDNR), Fish & Wildlife Division, in collaboration with Minnesota Information Technology Services (MN.IT Services) to facilitate aerial surveys of wildlife. However, it is equally applicable for other aerial or ground-based observations (e.g., cover mapping, distance sampling, etc.). DNRSurvey was written using VB.NET programming language and ArcObjects, and will run on computers using the Windows 7 Operating System. It is designed to work with GPS receivers that can deliver location data in National Marine and Electronics Association (NMEA; <http://www.nmea.org>) format via COM (serial) and virtual COM ports. Although survey form development within DNRSurvey requires an intermediate level of ArcMap skills, data capture requires only basic ArcMap and computer skills.

## Hardware and Software Requirements

The minimum requirements for using DNRSurvey in the field include the following:

- Laptop computer (tablet or convertible tablet preferred) with:
  - Processor (e.g.,  $\geq 2.2\text{GHz}$ ) and RAM (e.g.,  $\geq 2\text{GB}$ ) specifications that meet minimum requirements to run ArcGIS.
  - COM (serial) or virtual COM ports.
  - Input device (e.g., touch-screen, touch-screen stylus, touch-pad, mouse).
- For audio recording, a microphone or microphone/speaker combination.
- GPS that connects via COM or virtual COM port and delivers coordinate data in NMEA mode. This includes most Bluetooth receivers. COM port emulation software is required for Universal Serial Bus (USB) connections.
- Microsoft Windows 7 operating system. DNRSurvey has not been tested with Windows 8 or higher.
- ArcGIS 10.0 – 10.2 software. DNRSurvey has not been tested with ArcGIS 10.3 and is not compatible with ArcGIS Pro.

## Installation

To install DNRSurvey:

1. Download DNRSurvey\_Install.zip from the MNDNR [DNRSurvey web site](#) and extract all content (e.g., *ReferenceChimes*, *SampleForms*, *SampleSurveys*, *SampleToolGraphics*, *DNRSurvey.esri AddIn*, *DNRSurvey\_UserGuide.pdf*) to your computer hard drive at *D:\DNRSurvey* or *C:\DNRSurvey*.
2. Define the path to DNRSurvey.esriAddIn and activate the toolbar:
  - a. Open ArcMap and select Customize | Add-In Manager | Options | Add Folder.
  - b. Navigate to and select the DNRSurvey folder utilized in step 1. Select OK to exit the dialog.
  - c. Confirm the path to the Add-In folder is displayed and close the dialog.

- d. Select Customize | Toolbars and choose DNRSurvey from the list of toolbars.
3. Update the AddIn and User Guide files as needed:
  - a. With ArcMap open, select About DNRSurvey from the DNRSurvey drop-down menu. Note the installed version of the AddIn file and close the dialog.
  - b. Select Help from the DNRSurvey drop-down menu. Note the installed version of the User Guide and close the dialog.
  - c. Revisit the [DNRSurvey web site](#) and check for updates.
  - d. Download new versions and overwrite installed versions, as needed. **Note: Retain file names and locations. Functionality issues may occur if multiple versions of DNRSurvey.esriAddIn are imbedded within the DNRSurvey directory structure. Keep only the current version of the AddIn.**

## Sample Surveys, Forms, Tool Graphics, and Reference Chimes

To assist the user in understanding survey file structure, layout, and form development, 3 sample surveys are provided as part of the installation procedure:

- Point, line, and polygon data forms from a hypothetical survey (*D:\DNRSurvey\SampleSurveys\PointLinePolygonSurvey\PointLinePolygonExample.mxd*).
- Audio (voice recording) form from a crane survey (*D:\DNRSurvey\SampleSurveys\VoiceRecordingSurvey\VoiceExample\_CraneSurvey.mxd*).
- Point form from a deer survey (*D:\DNRSurvey\SampleSurveys\PointSurvey\PointExample\_DeerSurvey.mxd*). This sample survey is subsequently referenced throughout Section 3 of the User Guide to demonstrate survey development from start to finish.

Additional sample forms from existing surveys (e.g., beaver, crane, deer, elk, moose, swan, wild rice) are provided as screen captures (*SampleForms\_Info.pdf*) and import files (\*.xml) at *D:\DNRSurvey\SampleForms*.

Also, a variety of tool button graphics are included at *D:\DNRSurvey\SampleToolGraphics*. Copyright acknowledgements include the following:

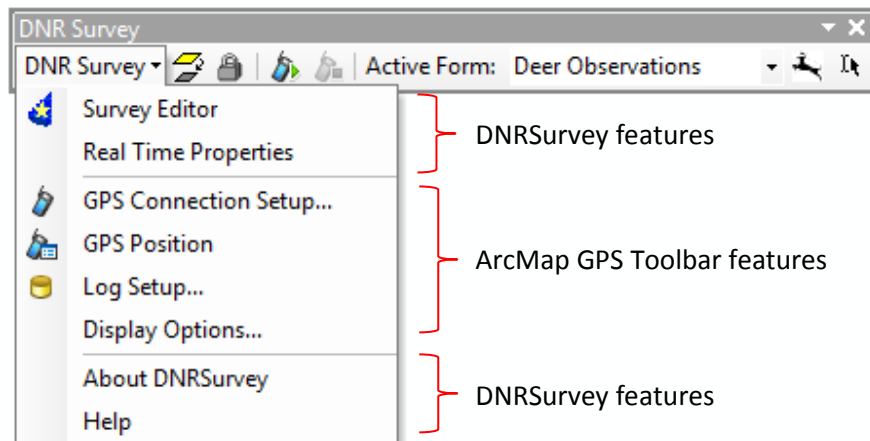
- The airplane, helicopter, deer, and moose graphics were created by various authors at <http://www.openclipart.org> and downloaded from <http://all-free-download.com>.
- The duck, goose, and dog track graphics were created by various authors at <http://www.flaticon.com/authors/freepik> and downloaded from <http://www.flaticon.com>.
- All remaining graphics were created by the DNRSurvey authors.

Finally, the audio tones used to signal changes in GPS connection status and voice recording status are included at *D:\DNRSurvey\ReferenceChimes*.

## 2

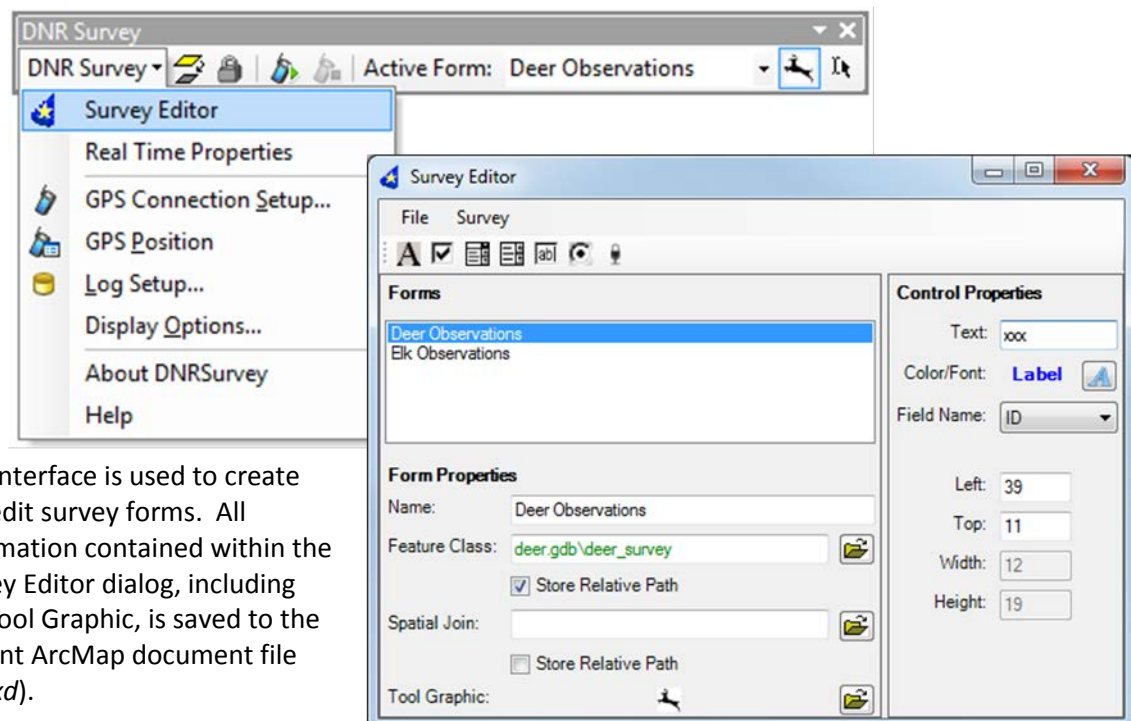
## DNRSurvey Toolbar

## Menu Functionality



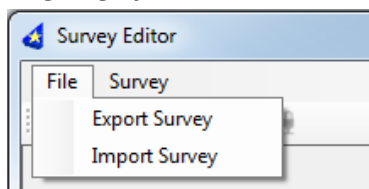
The DNRSurvey drop-down menu includes both survey form development and operational setup tools. The top section contains custom DNRSurvey functionality. The middle section incorporates ArcGIS functionality derived directly from the ArcMap GPS toolbar. The bottom section contains general information about DNRSurvey and the User Guide. Menu functionality is described below.

## 1. Survey Editor



This interface is used to create and edit survey forms. All information contained within the Survey Editor dialog, including the Tool Graphic, is saved to the current ArcMap document file (\*.mxd).

- **File Menu**

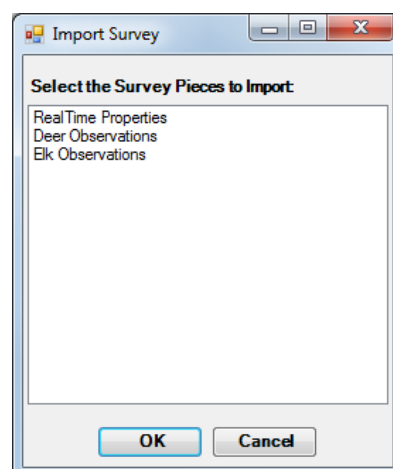


- **Export Survey** – Survey information can be exported to an XML file at a user-defined location and subsequently used as a “template” for new surveys. Exported items include [real-time property](#) values (e.g., pan window and log file metrics) and form layout values (e.g., [form property](#) and [control property](#) metrics) for all forms.

Sample export file (XML format):

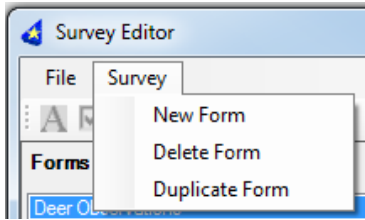
```
<?xml version="1.0" encoding="UTF-8"?>
<dnrSurvey name="New Survey">
  <realTime>
    <showCurrentPosition>True</showCurrentPosition>
    <showEstimatedPosition>False</showEstimatedPosition>
    <panZoneWidth>3</panZoneWidth>
    <panZonePct>90</panZonePct>
    <panZoneColor>-32768</panZoneColor>
    <autoStartLog>True</autoStartLog>
  </realTime>
  <forms>
    <form name="Deer Observations">
      toolGraphic="iVBORw0KGgoAAAANSUhEUgAAAB4AAAAeCAMAAM7I6QAAAAAXNSR0IArs4c6QAAAAARnQU1BAACxjwv8YQUAAAMAEExURQAAAAEBAQICAgMDAwQEBAUFBQYGB
      relativePathSpatialJoin="False" featureClassPathSpatialJoin="True" relativePath="True" featureClassPath="deer.gdb\deer_survey" collectionType="PEN">
        <label fieldName="ID" font="Microsoft Sans Serif, 9pt, style=Bold" color="Blue" height="19" width="12" top="11" left="39" text="1"/>
        <button font="Microsoft Sans Serif, 10.2pt, style=Bold" color="ControlText" height="30" width="100" top="300" left="55" text="OK"/>
        <button font="Microsoft Sans Serif, 10.2pt, style=Bold" color="ControlText" height="30" width="100" top="370" left="55" text="Delete"/>
        <button font="Microsoft Sans Serif, 10.2pt, style=Bold" color="ControlText" height="30" width="100" top="335" left="55" text="Cancel"/>
        <listbox fieldName="COUNT" font="Microsoft Sans Serif, 9pt, style=Bold" color="Red" height="379" width="75" top="35" left="200" defaultValue="2"/>
        <label fieldName="" font="Mistral, 11.25pt, style=Bold" color="Green" height="24" width="46" top="10" left="175" text="COUNT:"/>
        <listbox fieldName="SPECIES" font="Microsoft Sans Serif, 9pt, style=Bold" color="Purple" height="79" width="80" top="70" left="30" defaultValue="Deer"/>
        <label fieldName="" font="Mistral, 11.25pt, style=Bold" color="Green" height="24" width="21" top="10" left="5" text="ID:"/>
        <label fieldName="" font="Mistral, 11.25pt, style=Bold" color="Green" height="24" width="53" top="45" left="5" text="SPECIES:"/>
        <label fieldName="" font="Mistral, 11.25pt, style=Bold" color="Green" height="24" width="68" top="171" left="5" text="DIRECTION:"/>
        <label fieldName="DIRECTION" font="Mistral, 11.25pt, style=Bold" color="Green" height="24" width="21" top="170" left="5" text="NE"/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="200" left="120" text="NE" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="250" left="120" text="SE" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="225" left="120" text="E" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="250" left="75" text="S" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="200" left="75" text="N" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="250" left="15" text="SW" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="225" left="15" text="W" defaultValue=""/>
        <radiobutton fieldName="DIRECTION" font="Microsoft Sans Serif, 9pt, style=Bold" color="Olive" top="200" left="15" text="NW" defaultValue=""/>
      </form>
    <form name="Elk Observations">
      toolGraphic="iVBORw0KGgoAAAANSUhEUgAAAB4AAAAeCAIAAAC0Ujn1AAAAAXNSR0IArs4c6QAAAAARnQU1BAACxjwv8YQUAAAMAEExURQAAAAEBAQICAgMDAwQEBAUFBQYGB
      relativePathSpatialJoin="True" featureClassPathSpatialJoin="d:\elk_surveys\2015\grygla\map_layers\grygla_plots.shp" relativePath="True" featureClassPath="deer.gdb\elk_survey"
    </form>
  </forms>
</dnrSurvey>
```

- **Import Survey** – Survey information can be imported from an existing XML file. The user is prompted to select among real-time properties and available forms. Multiple items can be selected. A variety of sample data forms are available for viewing or importing at *D:\DNRSurvey\SampleForms*.

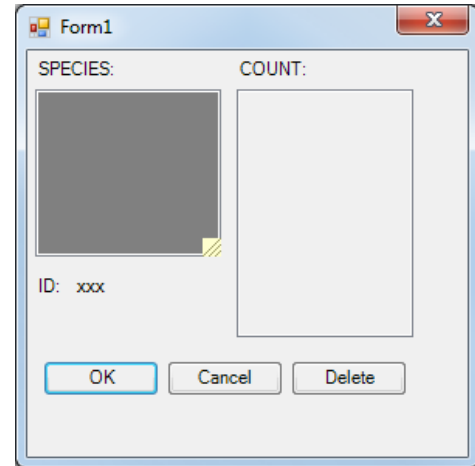




- **Survey Menu** – The user can add, delete, or duplicate survey forms within this dialog.



- **New Form** – Add a new form. By default, the form name is auto-generated (e.g., FormX, where X = 1 to n) and each new form includes 3 labeled [controls](#). Controls can be added or deleted as needed.
  - **Delete Form** – Delete the active form.
  - **Duplicate Form** – Duplicate the active form. As before, form name is auto-generated (e.g., Form1\_1, Form1\_2, Deer Observations\_1, etc.).
- **Control Types** – Seven controls are available to create custom data-entry forms (Table 1). Controls represent unique feature class fields and are added to the survey form when selected within the Survey Editor dialog.






**Table 1.** Functionality of controls used within data entry forms.

Control Type	Icon	Description	Data Type	Domain Allowed	
				Coded	Range
Label		Generally used as a text label for other controls, but can also be used independently to record observation data (e.g., ID, Date, Time, etc.).	Text	No	No
Checkbox		Used to record Boolean values (true, false) to an attribute table.	Text	No	No
Combobox		Used to display a single value. A drop-down arrow within the control expands the value list to display all values.	Text or Numeric	Yes <sup>a</sup>	No
Listbox		Used to display multiple values simultaneously. The size of the control (W x H) determines the number of values displayed. In addition, the position of the slide bar within the control determines the range of values displayed.	Text or Numeric	Yes <sup>a</sup>	No
Textbox		Allows direct user input from a keyboard.	Text or Numeric	No	Yes <sup>b</sup>
Radio Button		Used to display all values simultaneously by assigning multiple radio buttons to the same field. The text/numeric value displayed on each radio button is saved to the attribute table.	Text or Numeric	No	No
Voice Recorder		Used to record an audio track to a Windows WAV file and link it to an observation.	Text	No	No

<sup>a</sup> A coded domain is required to populate field values within a combobox or listbox control.

<sup>b</sup> A range domain is optional to populate field values within a textbox control.

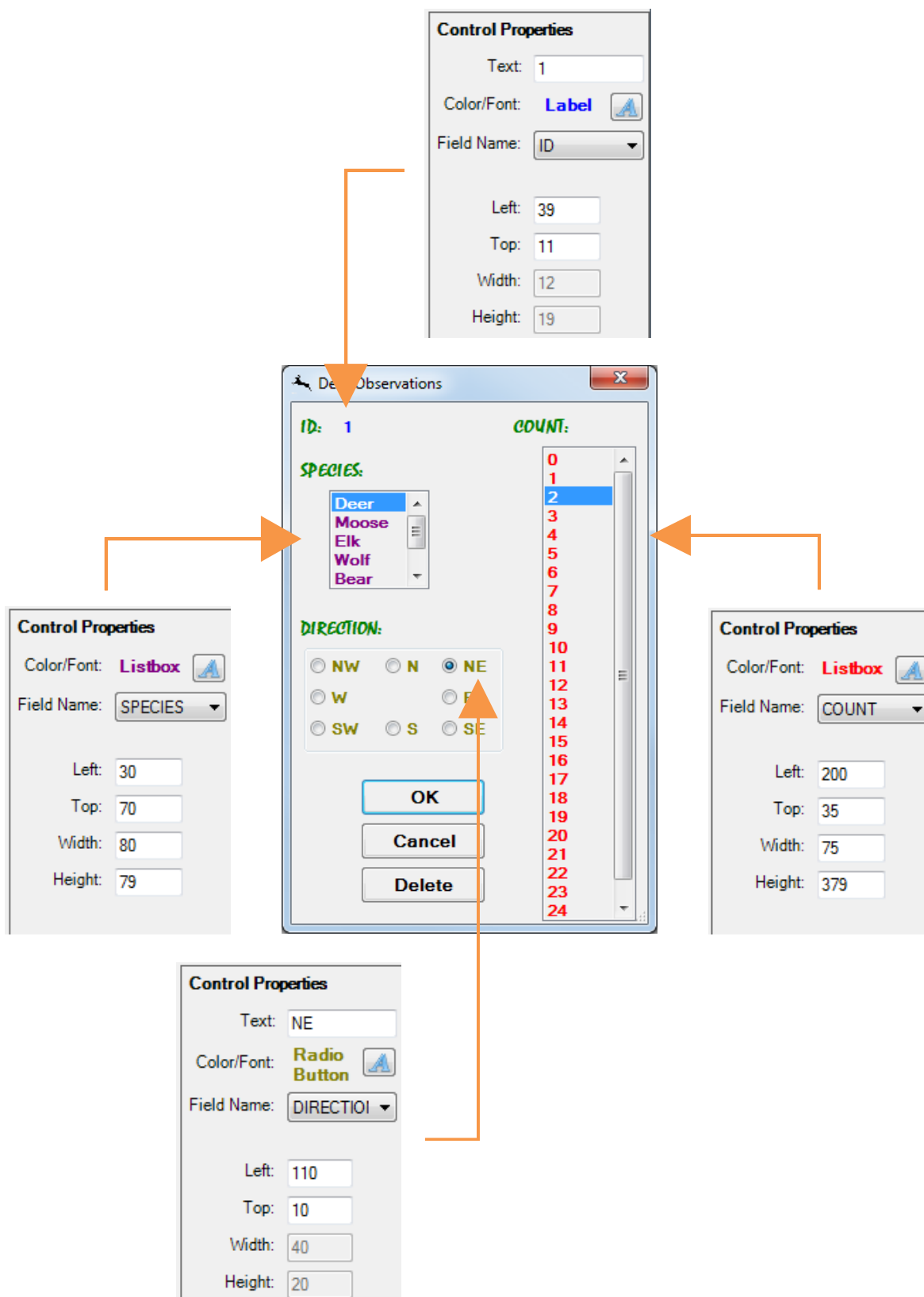
- **Forms** – Each user-defined form is cataloged within the Forms section of the Survey Editor dialog. Select a form to display its associated properties. The number of forms utilized within each survey is user-defined and varies with each survey application.
- **Form Properties** – Multiple properties can be assigned to each custom data-entry form:
  - **Name** – Edit the name of the active form. This value also displays on the form dialog header and DNRSurvey toolbar.
  - **Feature Class** – Define the directory path to the feature class associated with the active form.
  - **Spatial Join** – Define the directory path to an optional spatial join layer (feature class or shapefile format) associated with the active form. Data from matching fields (e.g., Plot\_ID, Strata) within both the spatial join layer and the form feature class will be copied over to the feature class attribute table.
  - **Store Relative Path** – If selected, the directory path to the feature class and spatial join layer is stored, relative to the location of the ArcMap document file (\*.mxd). This feature allows the user to port a folder of data to different locations and is especially useful for voice-recorded surveys where the path to the WAV file is stored as a text attribute.
  - **Tool Graphic** – Assign a graphic icon (bmp, gif, jpg, png format) to the active form and corresponding toolbar button. Tool graphics can be obtained from 3 sources: (1) accept the default graphic for point (  ), line (  ), or polygon (  ) feature classes; (2) select an existing graphic from D:\DNRSurvey\SampleToolGraphics; or (3) create a custom tool graphic. Image appearance is improved if the tool graphic is small (approximately 30 x 30 pixels).
- **Control Properties** – The user assigns display and formatting properties to each control within this dialog (Table 2, Fig. 1, Fig. 2). **Note: Changes do not take effect until the user selects another field.**
  - **Text** – Define the text value of a label, checkbox, or radio button control. This feature is unavailable in the other controls.
  - **Color/Font** – Assign display color, font, style, and size metrics to the values of a control. Control type (e.g., Label, Listbox, Radio Button) is displayed within the Color/Font field using the selected formatting attributes.
  - **Field Name** – Assign the corresponding feature class field name (e.g., Species, Count, ID) to a control. Select the drop-down arrow to display a list of available field names.
  - **Left** – Define the control position from the left side of the form. Control placement can also be modified by dragging the control to a new location.
  - **Top** – Define the control position from the top of the form. Control placement can also be modified by dragging the control to a new location.
  - **Width** – Define width of the control. Control size can also be modified by selecting and dragging the control corner.
  - **Height** – Define height of the control. Control size can also be modified by selecting and dragging the control corner.

*Note: Radio Buttons are positioned within their own “graphics box”, which is independent of positioning values for other controls within the form (Fig. 1).*

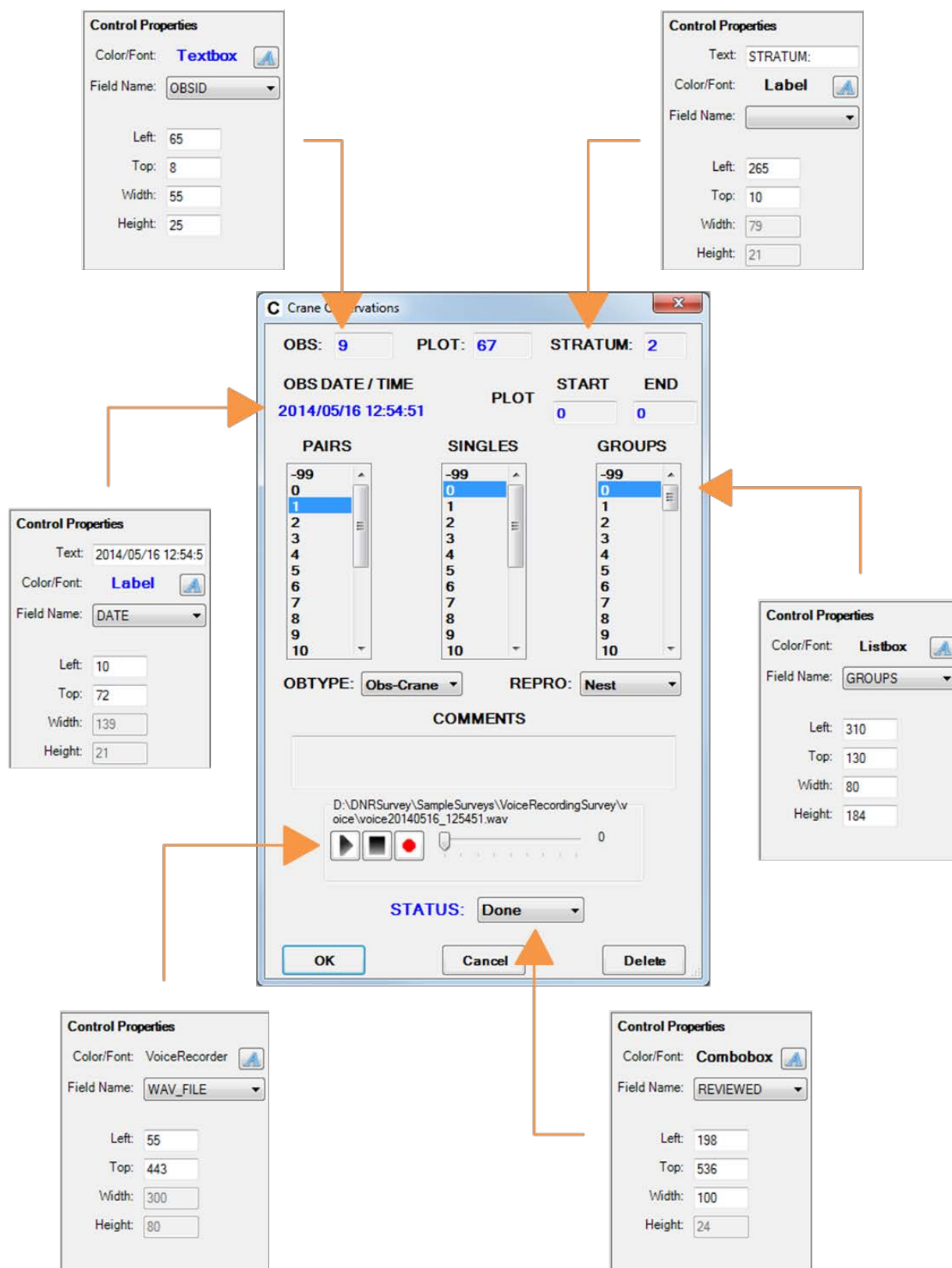
**Table 2.** Display and formatting properties available for each control.

Control Type	Control Property						
	Text	Color / Font	Field Name	Left	Top	Width	Height
Label	x	x	x <sup>a</sup>	x	x		
Checkbox	x	x	x	x	x		
Combobox		x	x	x	x	x	
Listbox		x	x	x	x	x	x
Textbox		x	x	x	x	x	x
Radio Button	x	x	x	x	x		
Voice Recorder		x	x	x	x		

<sup>a</sup> The assignment of a field name to a label control is optional.



**Figure 1.** Control properties for a subset of controls used within a deer survey form.

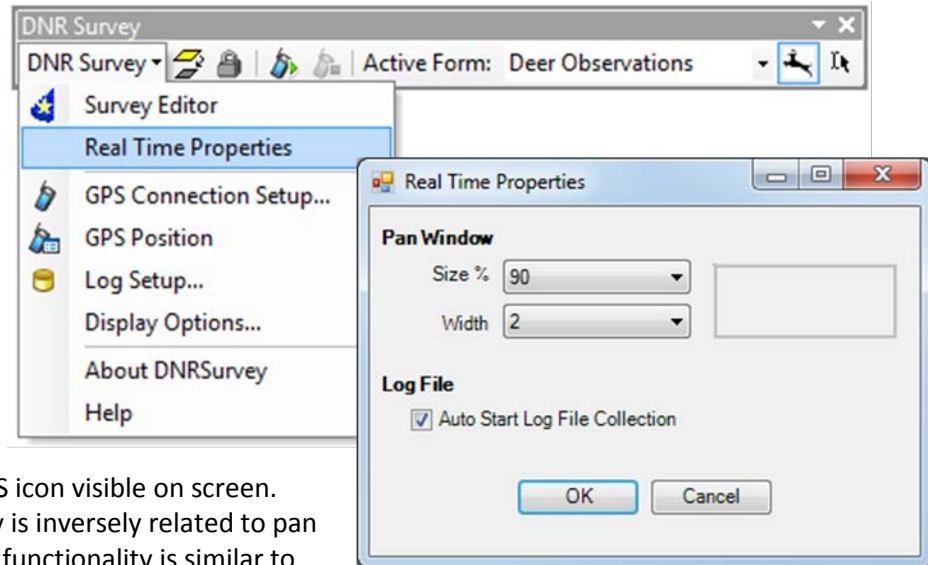


**Figure 2.** Control properties for a subset of controls used within a crane survey form.

## 2. Real Time Properties

Pan Window and Log File properties are custom, real-time functionality not found in ArcMap's GPS toolbar.

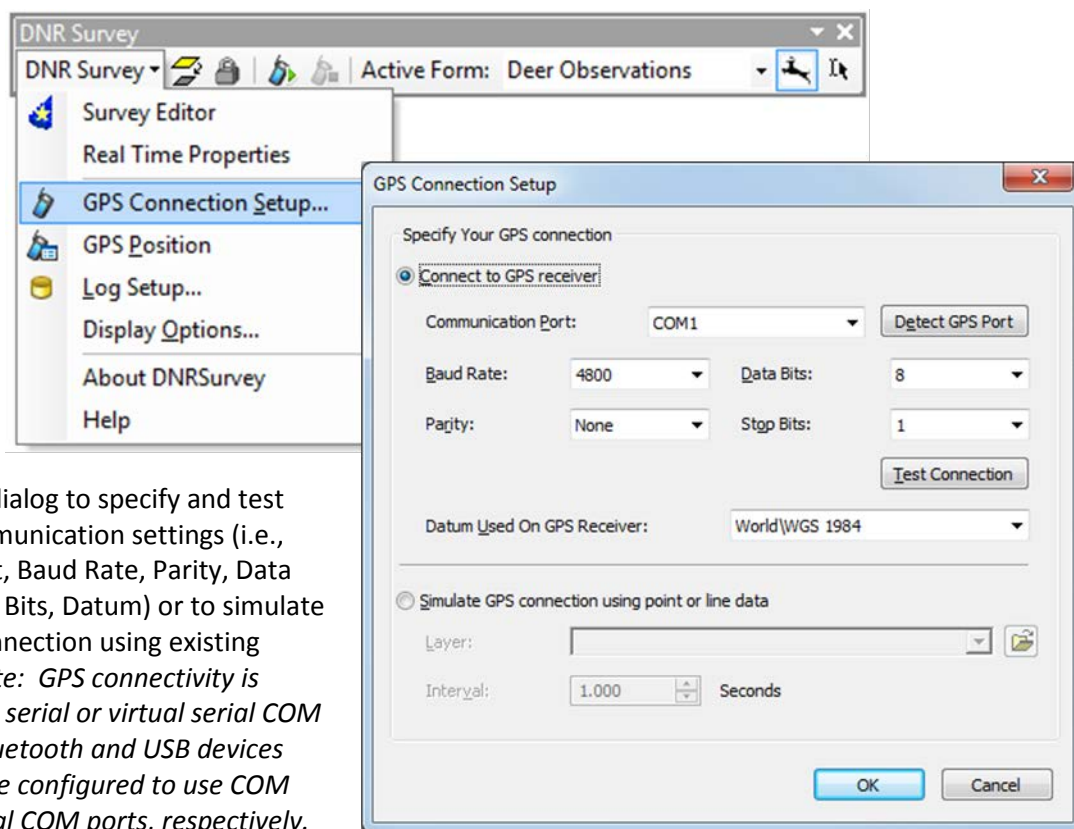
- Pan Window** – The map display pans automatically to keep the current location of the GPS icon visible on screen. Panning frequency is inversely related to pan window size. This functionality is similar to *Auto Pan* in the ArcMap GPS toolbar. However, pan window size, line width, and color options can be customized in DNRSurvey. To hide the pan window within the map display, but retain auto-pan functionality, define Width = 0. Select the pan window graphic within the Real Time Properties dialog to change pan window color.



**TIP:** There is no automated screen-rotation functionality programmed within DNRSurvey. The top of the screen corresponds to true north, regardless of travel direction. However, ArcMap's *Rotate Data Frame* tool can be used to modify data frame rotation angle at each corresponding turn of the survey vehicle and maintain a uniform direction of travel of the GPS icon across the screen (e.g., always bottom to top). *Note: Pan Window size may need to be adjusted after rotating the data frame.*

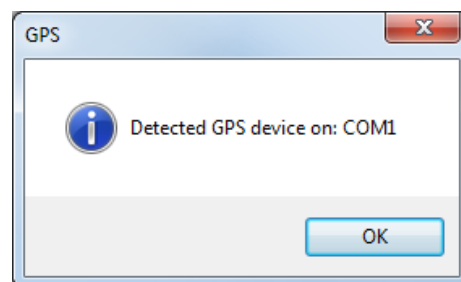
- Log File** – If checked (*default*), GPS coordinates are automatically streamed to a user-defined log file (See [Log Setup](#)) when the GPS connection is established. Data streaming stops when the GPS connection is closed. This functionality eliminates the need to manually start/stop data streaming and replaces the *Start Streaming To Log* and *Stop Streaming To Log* tools on the ArcMap GPS toolbar.

### 3. GPS Connection Setup

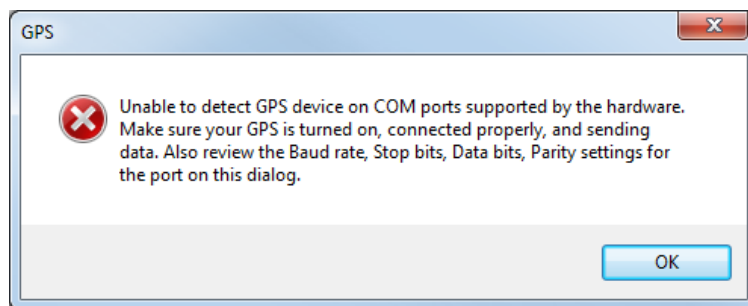


Use this dialog to specify and test GPS communication settings (i.e., COM port, Baud Rate, Parity, Data Bits, Stop Bits, Datum) or to simulate a GPS connection using existing data. *Note: GPS connectivity is limited to serial or virtual serial COM ports. Bluetooth and USB devices need to be configured to use COM and virtual COM ports, respectively.*

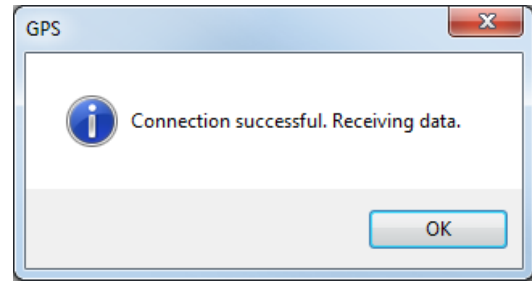
- **Connect to GPS Receiver** – Modify the communication settings, as needed. In most cases, only the COM Port value needs to be updated.
  - **Detect GPS Port** – If the port setting is unknown, select *Detect GPS Port* to search for a GPS device on all available COM ports. If a device is found, the port setting is updated and a confirmation message is generated (COM1 in this example).



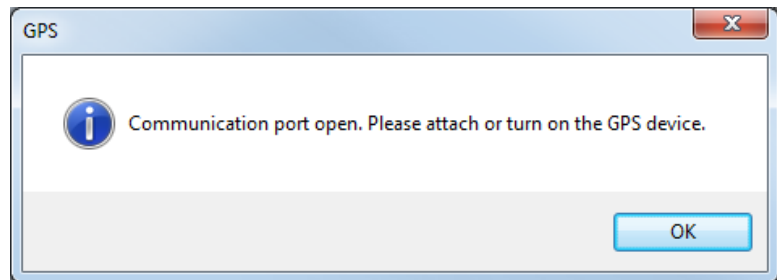
However, if no device is detected, an error message is generated with suggested fixes.



- **Test Connection** – After a GPS device is detected, confirm data are being received by selecting the *Test Connection* button. A successful connection generates a confirmation message.



Conversely, a failed connection generates a message with suggested fixes.

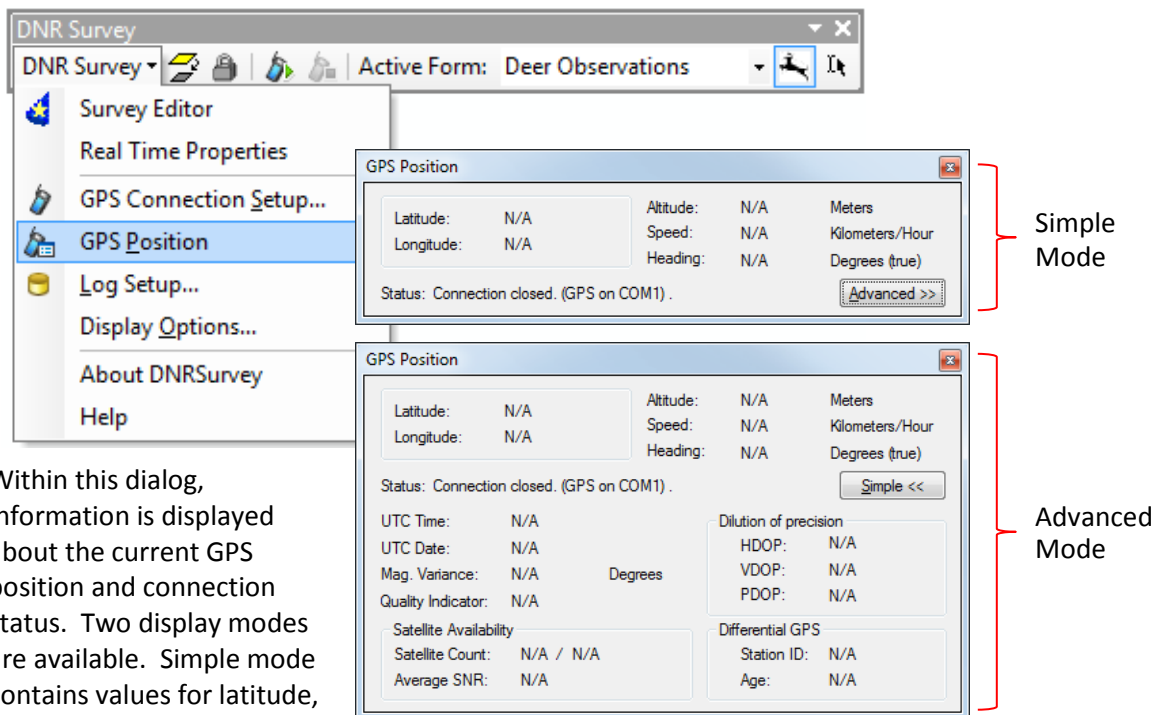


- **Simulate GPS Connection** – In addition to connecting to a GPS device, the user can also simulate a GPS connection using existing point or line feature data (shapefile or feature class format).

For further information, see [GPS Connectivity and Troubleshooting](#) or search within ArcGIS Desktop Help for "GPS Connection Setup."



## 4. GPS Position



Within this dialog, information is displayed about the current GPS position and connection status. Two display modes are available. Simple mode contains values for latitude, longitude, altitude, speed, heading, and GPS connection status. Advanced mode adds values for time, date, magnetic variance, satellite availability, and satellite distribution. Measurement units for *Altitude* and *Speed* are set within [Display Options](#) under the [General](#) tab.

GPS connection status messages include:

- Port is open but not receiving any data. (GPS on COMx).
- Connection open. Receiving data. (GPS on COMx).
- Connection closed. (GPS on COMx).
- Poor signal, not receiving positions. (GPS on COMx).
- GPS signal lost. Satellites not available. (GPS on COMx).

**TIP:** Consider displaying the Simple Mode dialog during real-time surveys to monitor flight protocol (e.g., altitude, speed) and connection status. Identifying GPS connection status is the first step in diagnosing connection issues.

## 5. Log Setup

GPS position and attribute data can be saved to a log file as points or lines in either shapefile or feature class format. Streaming options are available to control the number of saved positions. The measurement unit for *Minimum*

*Sampling Distance Between Points* is set within [Display Options](#) under the [General](#) tab.

**Note:** A software bug impacts the frequency at which GPS data are written to the log file and displayed on screen. See [Known Issues – ArcMap Bug#1](#).

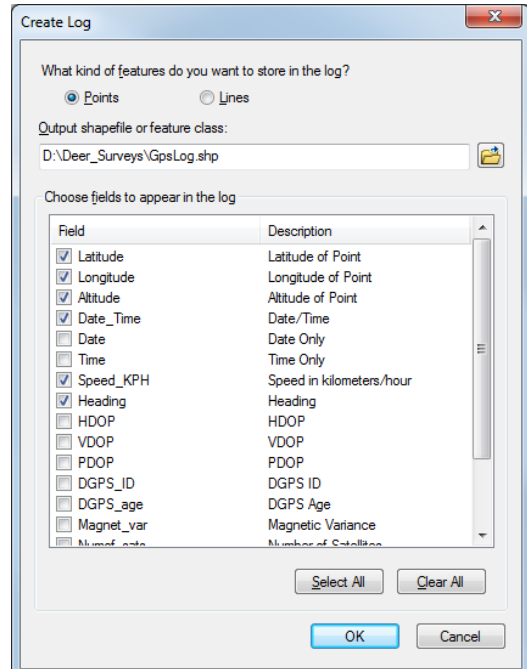
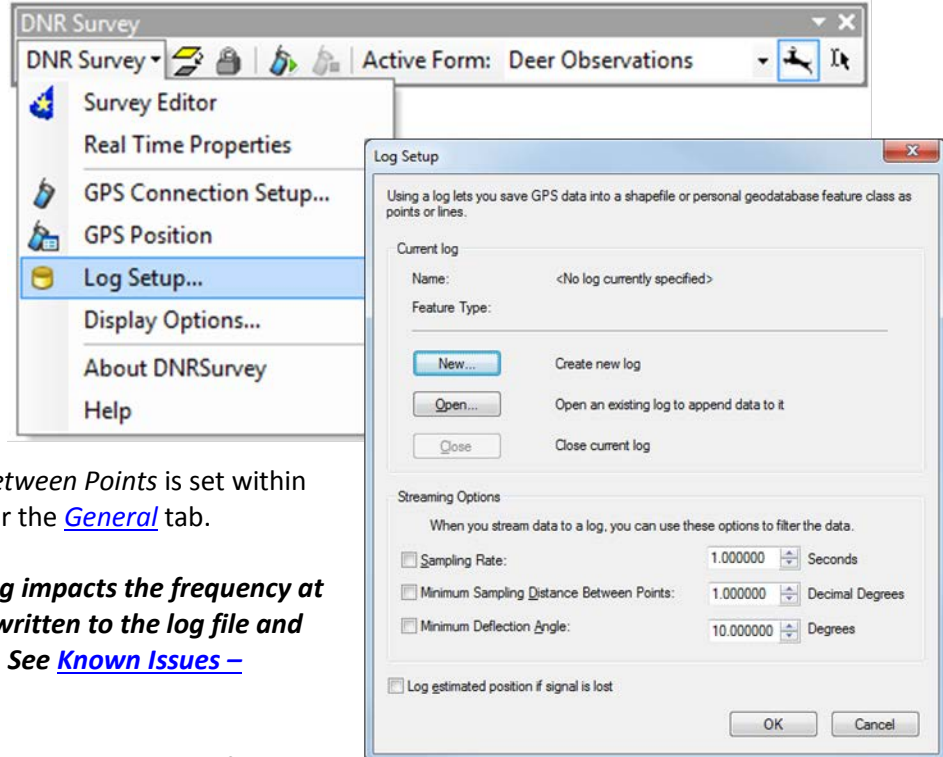
When creating a new log, the user specifies which fields to save to the attribute table. *Note: Date and time attribute data are erroneously saved within the Time field.*

Additional log functionality within DNRSurvey:

- If the log file is located by the MXD, then a relative path is saved for the file.
- When a GPS connection is initially established each day, a new date-stamped log file (e.g., *GpsLog20150408.shp*) is created and added to the data frame if the [Log File checkbox](#) is activated within Real Time Properties. GPS data are appended to this log file throughout the day and new date-stamped files are generated on subsequent days.

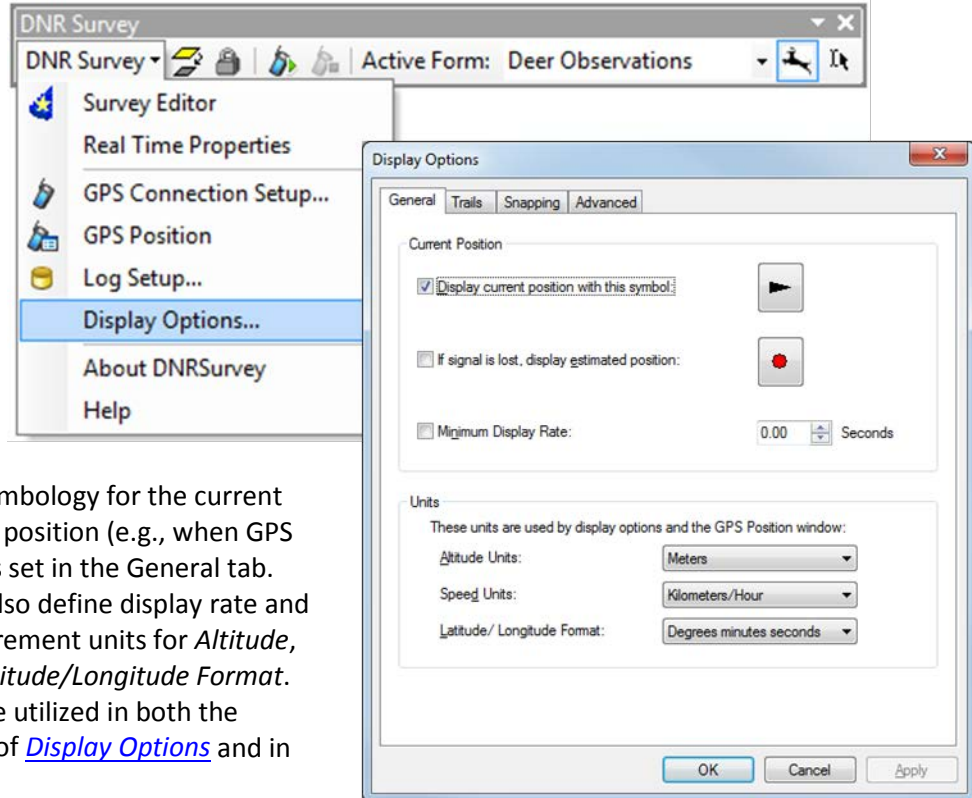
For further information, search within ArcGIS Desktop Help for:

“Log Setup”  
 “Filtering Data When Streaming”  
 “GPS Information In Logs”



## 6. Display Options

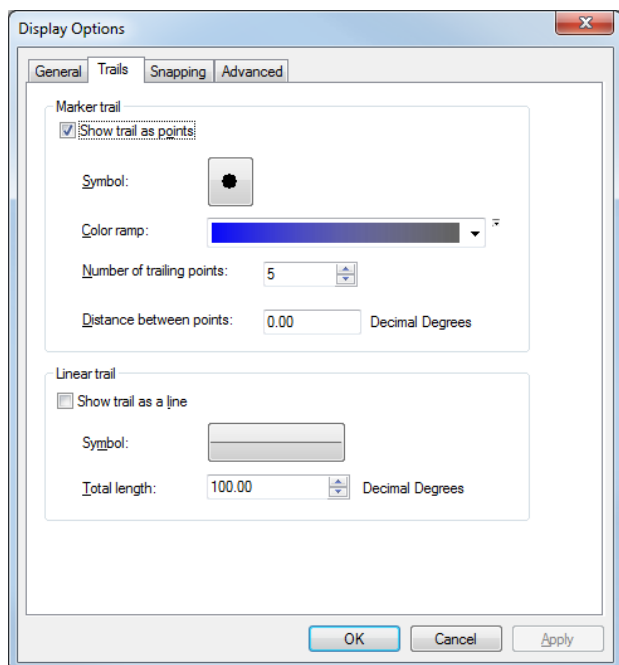
Display properties of GPS positions are customized within 4 dialog boxes.



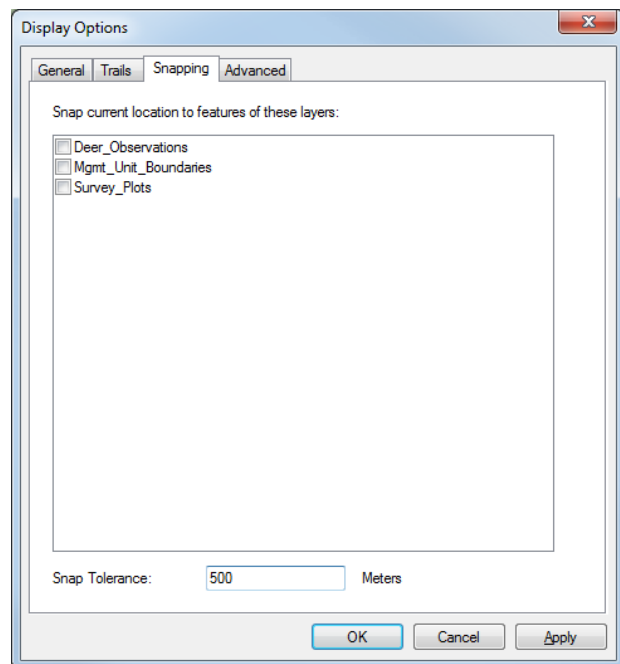
- **General** – Symbology for the current and estimated position (e.g., when GPS signal is lost) is set in the General tab. The user can also define display rate and set the measurement units for *Altitude*, *Speed*, and *Latitude/Longitude Format*. These units are utilized in both the [Advanced](#) tab of [Display Options](#) and in [GPS Position](#).

- **Trails** – Within this tab, symbology and streaming options are defined for a temporary “bread crumb” trail of previous GPS positions. **Note: When streaming options exceed some unknown threshold, software instability may occur. See [Known Issues – ArcMap Bug#2](#).**

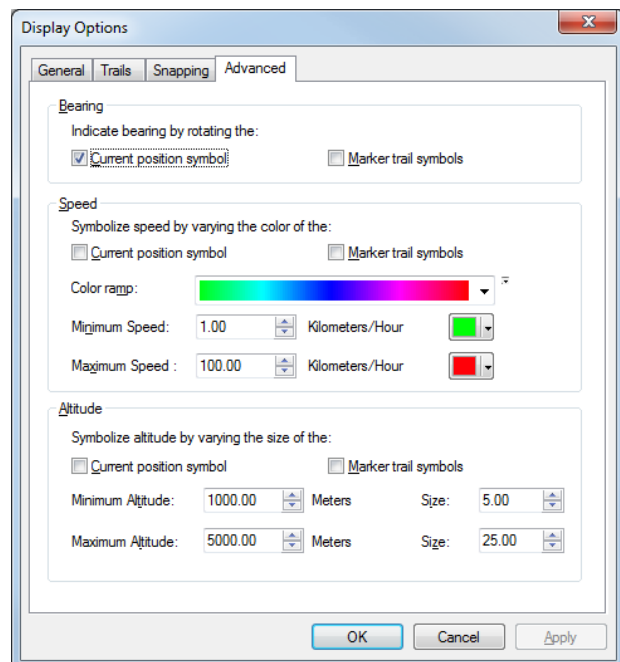
The measurement unit for *Distance between points* and *Total length* references the data frame *Display* unit.



- **Snapping** – The current GPS position can be snapped to data layer features within the data frame Table of Contents. The measurement unit for *Snap Tolerance* references the data frame *Display* unit.

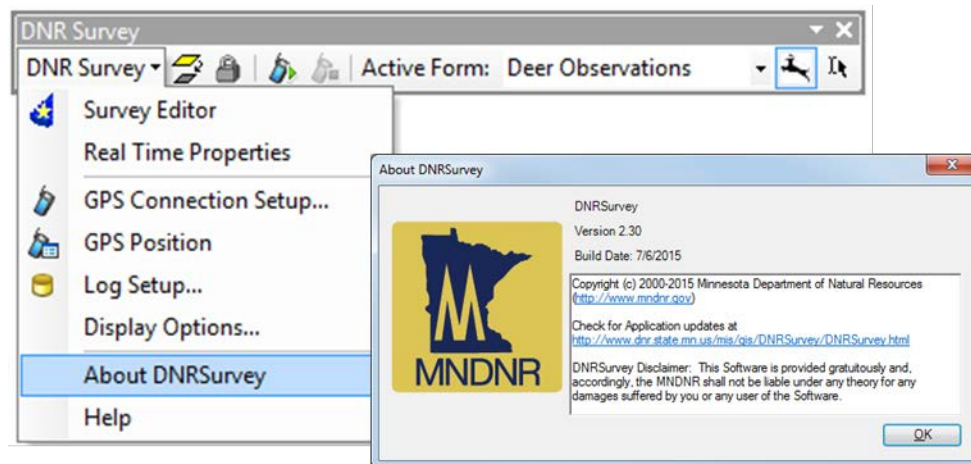


- **Advanced** – The user can set position and “bread crumb” trail symbology to vary with changes in bearing, speed, and altitude. *Note: The current position symbol does not rotate with change in directional bearing when the GPS is in simulation mode.*



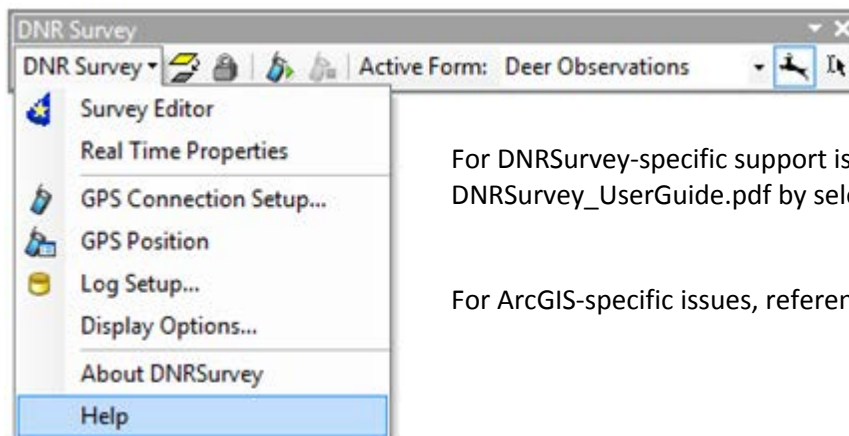
For further information, search within ArcGIS Desktop Help for “GPS Display Options.”

## 7. About DNRSurvey



This dialog contains information about the software version, date, and licensing disclaimer. A link to the [DNRSurvey web site](http://www.dnr.state.mn.us/mis/gis/DNRSurvey/DNRSurvey.html) is provided where the user can download installation files and check for updates (e.g., DNRSurvey.esriAddIn, DNRSurvey\_UserGuide.pdf).

## 8. Help

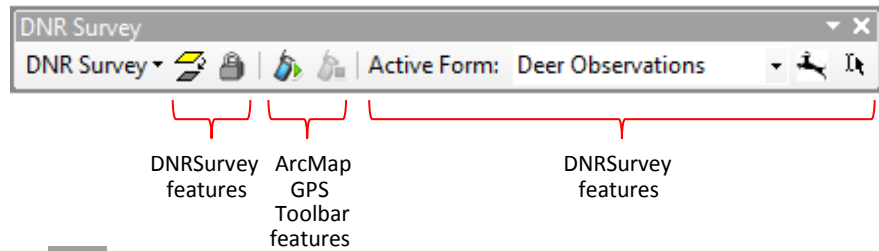


For DNRSurvey-specific support issues, reference DNRSurvey\_UserGuide.pdf by selecting the Help menu.

For ArcGIS-specific issues, reference ArcGIS Desktop

# Tool Button Functionality

The DNRSurvey toolbar contains both custom tool button functionality and ArcGIS functionality derived from the ArcMap GPS toolbar.



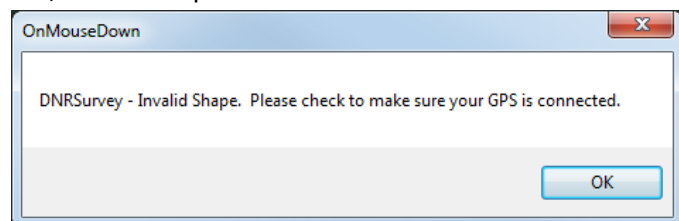
## 1. Backup Survey Data

Use this tool to create a backup copy of both the active geodatabase and *Voice* folder (present if recording information to WAV files). Each copy includes a date-time stamp for identification (e.g., *DeerSurvey2015\_20150221\_155007.gdb, voice\_20150221\_155003*) and is saved as a subfolder within the existing file structure.

## 2. Lock Cursor to Map

Use this tool to restrict cursor movement to the confines of the map display, thereby preventing inadvertent selection of other tools, data layers, etc. When this tool is selected, the [Collect Features](#) tool is automatically activated to expedite data entry.

In addition, when the user marks a **point** feature location on the map display, the coordinates of the “current” GPS position are captured, instead of the user-defined location. This can be useful, for example, when hovering over a nest or den site, where the position of the GPS device is desired. An error message is generated when attempting to georeference a **point** feature prior to connecting to the GPS device. Contrary to **point** features, **line** and **polygon** features are georeferenced to the selected map location.



*Note: The cursor restriction applies to all feature types (point, line, polygon). Press the Alt-Tab key combination to unlock the cursor.*

## 3. Open GPS Connection

Select this tool to open a connection between the computer and GPS device. This connection must first be configured through the [GPS Connection Setup](#) dialog.

Additional connection functionality within DNRSurvey:

- When opening a connection, the map display is forced to *Data View*.
- Diverse audio tones alert the user to changes in GPS connection status.
- Display of the pan window, current position icon, scroll bars, and status bar varies with connection status (Table 3).

**Table 3.** GPS connection status, reference chime, and display status of select map display elements.

GPS Connection Status	Reference Chime	Map Display Status			
		Pan Window	Current Position Icon	Scroll Bars	Status Bar
Connection open. Receiving data.	<a href="#">GPS Connection Open</a>	On	On	Off	Off
Connection closed.	<a href="#">GPS Connection Closed</a>	Off	Off	On	On
Port is open but not receiving any data. –OR– Poor signal, not receiving positions. –OR– GPS signal lost. Satellites not available.	<a href="#">GPS Connection Error</a>	Off	Off	Off <sup>a</sup>	Off <sup>a</sup>

<sup>a</sup> Scroll bars and Status bar remain off if the GPS signal degrades from “Connection open. Receiving data.” Otherwise, they will turn on.

*Note: When initially connecting to a GPS device, the “GPS Connection Error” and “GPS Connection Open” chimes may activate in rapid succession as the connection transitions from “Port is open but not receiving any data” to “Connection open. Receiving data.”*

For further information, search within ArcGIS Desktop Help for “Open GPS Connection.”

#### 4. Close GPS Connection



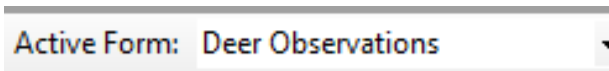
Select this tool to close a connection between the computer and GPS device. *Note: This tool is not available until a GPS connection is open.*

Additional connection functionality within DNRSurvey:

- A “disconnect” audio chime alerts the user to a change in GPS status.
- The pan window graphic and current position icon are removed from the map display.
- The data frame *Scroll Bars* and *Status Bar* are restored on the map display.

For further information, search within ArcGIS Desktop Help for “Close GPS Connection.”

#### 5. Active Form



Specify the active form by selecting it from the dropdown list. This selection will be reflected in the [Collect Features](#) tool graphic.

#### 6. Collect Features



Select this tool to activate data entry functionality within the active form. The tool graphic for the active form is displayed on this tool button. Auto-panning functionality of the map display is paused when the user is collecting a feature.

#### 7. Edit Features



Use this tool to activate editing functionality within the active form.



# 3 Survey Development

Several steps must be completed to develop the various survey components. Most of these steps incorporate ArcMap functionality. Recognizing there are multiple ways to complete each step, we offer one possible method using a deer survey example from the *SampleSurveys* folder. For ArcMap-specific functionality, search within ArcGIS Desktop Help for additional information.

## Customize the ArcMap Interface

Establish standardized customizations within each survey map document, including relative pathname, coordinate system, display units, toolbars, and tools.

1. Start ArcMap and set the map document's "relative pathnames" (maximizes portability) by selecting File | Map Document Properties and checking the box titled "Store relative pathnames to data sources."
2. Define the coordinate system of the data frame as **WGS 1984** by selecting View | Data Frame Properties | Coordinate System | Geographic Coordinate Systems | World | WGS 1984 | OK.  
**Note: The data frame must be set to WGS 1984 to avoid alignment or accuracy problems with the GPS data stream. Data layers, however, can be set to any standard or user-defined coordinate system (e.g., NAD 1983 UTM Zone15N), although drawing delays can occur if ArcMap needs to project data on the fly.**
3. Define the display units of the data frame by selecting View | Data Frame Properties | General | Display = Meters | OK.
4. Enable "hardware acceleration" to improve drawing performance of basemap layers and accelerated raster layers on computers with compatible hardware by selecting Customize | ArcMap Options | Data View and selecting the checkbox titled "Enable hardware acceleration for supported layers."
5. Customize toolbars and tools:
  - a. Create a new toolbar.
    - i. Select Customize | Customize Mode | Toolbars from the main drop-down menu.
    - ii. Within the Customize window, select New and define Toolbar name = Custom 1.
    - iii. Select OK | Close to close the window. Note the empty toolbar visible at the top of the screen.
  - b. Add commands (e.g., Zoom In, Pan, etc.) to the toolbar.
    - i. With the new toolbar visible, select Customize | Customize Mode | Commands from the main drop-down menu.
    - ii. Select the category (e.g., Pan/Zoom, Tools, Page Layout, etc.) that contains the command you wish to add.
    - iii. Select the command (e.g., Zoom In) you wish to add.
    - iv. Drag the command to the custom toolbar.
    - v. Repeat steps ii-iv until all desired commands (e.g., Zoom Out, Pan, Full Extent, Fixed Zoom In, Fixed Zoom Out, Go Back To Previous Extent, Go To Next Extent) are added.





- vi. Within the Customize window, select the Toolbars tab and Standard toolbar. From the map display, drag the Map Scale tool from the Standard toolbar to the custom toolbar. **Note: Because the Map Scale tool can only be added once in the user interface, this command must be moved from the Standard toolbar instead of copied from the Commands tab.**
- c. Turn off extraneous toolbars.
  - i. With the Toolbars tab displayed, unselect all toolbars except Custom 1, DNR Survey, and Main Menu.
  - ii. Select Close to close the Customize window.
- d. Customize the Map Scale drop-down list.
  - i. Open the Map Scale drop-down list and select “Customize This List.”
  - ii. Within the Scale Settings window, select the Standard Scales tab.
  - iii. Modify (i.e., add/delete) the existing scales to derive appropriate scale options (e.g., 5k, 15k, 30k, 50k, 100k, 500k, 1000k).
  - iv. Select OK to close the window.
6. Save customizations to the map document.
  - a. Select Customize | Customize Mode from the main drop-down menu.
  - b. Within the Customize window, select the Options tab.
  - c. Select the checkbox titled “Save all customizations to the document.”
  - d. Select OK to close the window.
  - e. Select File | Save As from the main drop-down menus and choose a file name and location (e.g., *D:\DNRSurvey\survey\_template.mxd*).

---

**TIP:** Consider saving the map document as a template file to retain ArcMap interface customizations for subsequent surveys.

---

## Create a File Geodatabase

Create a new file geodatabase from the Catalog window.

1. Start ArcMap and open the Catalog window by selecting Windows | Catalog.
2. Right-click the file folder in the directory tree where you want to create the file geodatabase and select New | File Geodatabase.
3. Rename the file geodatabase (e.g., *D:\DNRSurvey\SampleSurveys\PointSurvey\DeerSurvey.gdb*).

## Create a Feature Class for Each Survey File

Create a new feature class for each survey (output) file using the *Create Feature Class* wizard. Define field name, data type, and field properties for each variable.

1. With the Catalog window open, right-click on the geodatabase created in the previous step and select New | Feature Class.
2. Within the New Feature Class window, define the following:
  - a. Name = Deer\_Obs
  - b. Alias = leave blank <default>
  - c. Type = Point Features (or Line, Polygon)
  - d. Select Next to advance.

- e. Coordinate System = Geographic Coordinate Systems | World | WGS 1984.
  - f. Select Next to advance.
  - g. XY tolerance = 0.00000008983153 Degree <default>
  - h. Select Next to advance.
  - i. Configuration Keyword = Default <default>
  - j. Select Next to advance.
3. Within the feature class data tables, define Field Name, Data Type, and Field Properties (Alias, Length) for each variable (Table 4). Repeat until all desired fields are added. **Note: For voice recording, an associated text field (e.g., WAV\_FILE) is required which has sufficient field length to contain the path and field name of the WAV file (e.g., voice\voice20140506\_011841.wav).**
  4. Select Finish to exit the wizard.

The screenshot shows the 'New Feature Class' dialog box. It contains a table with the following fields:

Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
ID	Short Integer
SPECIES	Text
COUNT	Short Integer
DIRECTION	Text
DATE	Text
X_PROJ	Double
Y_PROJ	Double
PLOT_ID	Text

Below the table, the 'Field Properties' for 'PLOT\_ID' are shown:

Alias	PLOT_ID
Allow NULL values	Yes
Default Value	
Domain	
Length	5

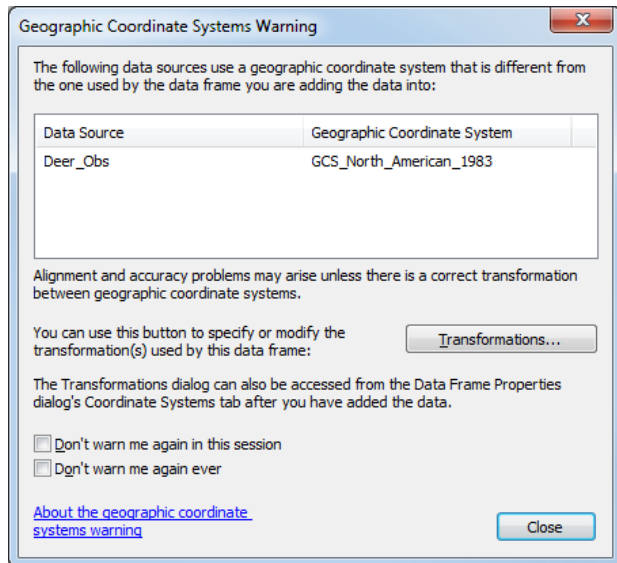
At the bottom, there are buttons for '< Back', 'Finish', and 'Cancel'. The 'Finish' button is highlighted in blue.

**Table 4.** Feature class data values for a deer survey example.

Field Name	Data Type	Field Properties				
		Alias	Allow NULL Values	Default Value	Domain	Length
ID	Short Integer		Yes			n/a
SPECIES	Text		Yes			10
COUNT	Short Integer		Yes			n/a
DIRECTION	Text		Yes			5
DATE	Text		Yes			25
X_PROJ	Double		Yes		n/a	n/a
Y_PROJ	Double		Yes		n/a	n/a
PLOT_ID	Text		Yes			5

5. If the geographic coordinate system (GCS) of the feature class is different from the one used by the data frame (i.e., WGS 1984), a warning message may be generated. Depending upon GCS selected, a geographic/datum transformation may be required to prevent alignment and accuracy problems. Alternatively, convert the feature class to WGS 1984.
6. Repeat steps 1-5, as needed, for each additional feature class.

All feature classes include a set of required fields, which are auto-generated with the feature class, and cannot be deleted. Required fields (and corresponding feature class types) include: **OBJECTID** (point, line, polygon); **SHAPE** (point, line, polygon); **SHAPE\_Length** (line, polygon); and **SHAPE\_Area** (polygon).



In addition, DNRSurvey auto-populates the following fields when an observation is collected:

- **ID, OBSID** – If either field is present within a point, line, or polygon feature class and data type is *short integer* or *text*, the field is populated with an incrementing record value (e.g., 1, 2, 3 ... n). If both fields are present, only ID is populated.
- **DATE, OBSDATE** – If either field is present within a point, line, or polygon feature class and data type is *date* or *text*, the field is populated with the current date/time value (e.g., 10/19/2015 2:27:13 PM [*date format*]; 2015/10/19 14:27:13 [*text format*]). *Note: Date format is variable and set by Windows (select Control Panel | Clock, Language, and Region | Region and Language to edit); time format is fixed and defined in code.* If both fields are present, only DATE is populated.
- **X\_PROJ, Y\_PROJ** – If a point feature class contains either field and data type is *double* or *long integer*, the field is populated with X and Y coordinate values in the feature class coordinate system.

## Create Domains and Domain Values within the File Geodatabase

Domains are analogous to look-up tables. When a domain is associated with an attribute field, only the values within that domain are valid for the field. Domains are required when using combobox and listbox controls, optional when using textbox controls, and prohibited when using remaining controls (Table 1). Coded domains can apply to any attribute type (e.g., text, numeric, date), whereas range domains must be numeric.

1. Open the Catalog window by selecting Windows | Catalog.
2. Right-click on the geodatabase name created previously (i.e., *D:\DNRSurvey\SampleSurveys\PointSurvey\DeerSurvey.gdb*) and select Properties | Domains tab.
3. Within the Database Properties dialog box, define Domain Name, Description, Domain Properties (Field Type, Domain Type, Min/Max Value, Split/Merge Policy), and Coded Values (Code, Description), as needed, for each domain (Fig. 3, Table 5).

- Select OK to close dialog box.

**CODED DOMAIN:**

Database Properties

General Domains

Domain Name	Description
Count	Count of animals observed.
Species	Species list.

Domain Properties:

Field Type	Short Integer
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
0	0
1	1
2	2
3	3
4	4

OK Cancel Apply

**RANGE DOMAIN:**

Database Properties

General Domains

Domain Name	Description
Count	Count of animals observed.
Species	Species list.

Domain Properties:

Field Type	Short Integer
Domain Type	Range
Minimum value	0
Maximum value	100
Split policy	Default Value
Merge policy	Default Value

Coded Values:

Code	Description
------	-------------

OK Cancel Apply

**Figure 3.** User-defined “Count” values ( $n = 0-100$ ) for coded domain and range domain options within a deer survey example.

**Table 5.** Domain data values for a deer survey example.

Domain Name	Description	Domain Properties						Coded Values	
		Field Type	Domain Type	Min. Value <sup>a</sup>	Max. Value <sup>a</sup>	Split Policy	Merge Policy	Code	Description
Count	Count of animals observed.	Short Integer	Coded	n/a	n/a	<default>	<default>	0 – 100	0 – 100
Species	Species list.	Text	Coded	n/a	n/a	<default>	<default>	Deer	WT Deer
								Moose	Moose
								Elk	Elk
								Wolf	Gray Wolf
								Bear	Black Bear

<sup>a</sup> Valid fields for Range domains only.

Coded domains contain both a *Code* (text, numeric) that is saved to the attribute table and a *Description* (text) of what that code represents.

**Note:** *Description values are displayed on the survey form.*

**Deer Observations**

ID: 1      COUNT: 0

SPECIES:

- WT Deer
- Moose
- Elk
- Gray Wolf
- Black Bear

DIRECTION:

☐ NW   ☐ N   ☒ NE

☐ W     ☐ E

☐ SW   ☐ S   ☐ SE

OK   Cancel   Delete

**Database Properties**

General   Domains

Domain Name	Description
Count	Count of animals observed.
Species	Species list.

Domain Properties:

Field Type	Text
Domain Type	Coded Values
Split policy	Default Value
Merge policy	Default Value

Coded Values:

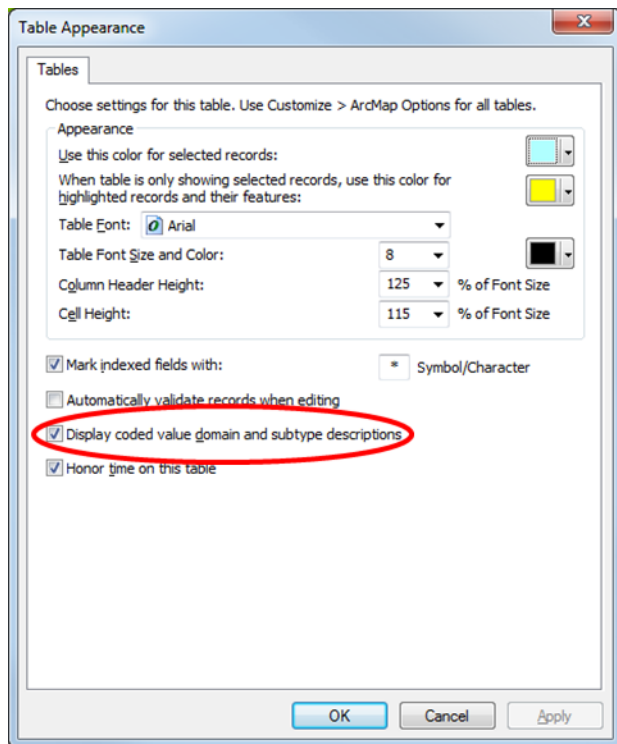
Code	Description
Deer	WT Deer
Moose	Moose
Elk	Elk
Wolf	Gray Wolf
Bear	Black Bear

OK   Cancel   Apply

**TIP:** By default, *Description* values are displayed within the associated attribute table within ArcGIS. To switch between *Description* values and *Code* values, proceed as follows:

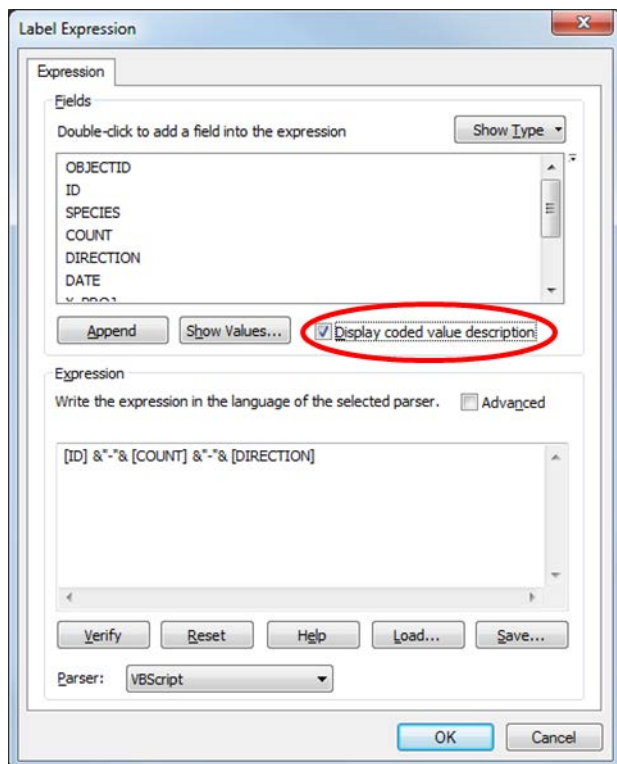
- Right-click on the associated feature class in the data frame Table of Contents and select *Open Attribute Table*.
- With the attribute table open, select Table Options | Appearance.
- Within the Table Appearance dialog, find the checkbox titled “Display coded value domain and subtype descriptions.”
- When this box is checked, *Description* values are displayed. When unchecked, *Code* values are displayed.

**Note:** Regardless of “display” setting, the *Code* values are saved to the attribute table.



**TIP:** In a similar manner, the user can switch between *Description* values and *Code* values for on-screen labels by selecting/unselecting the “Display coded value description” checkbox in the Label expression dialog:

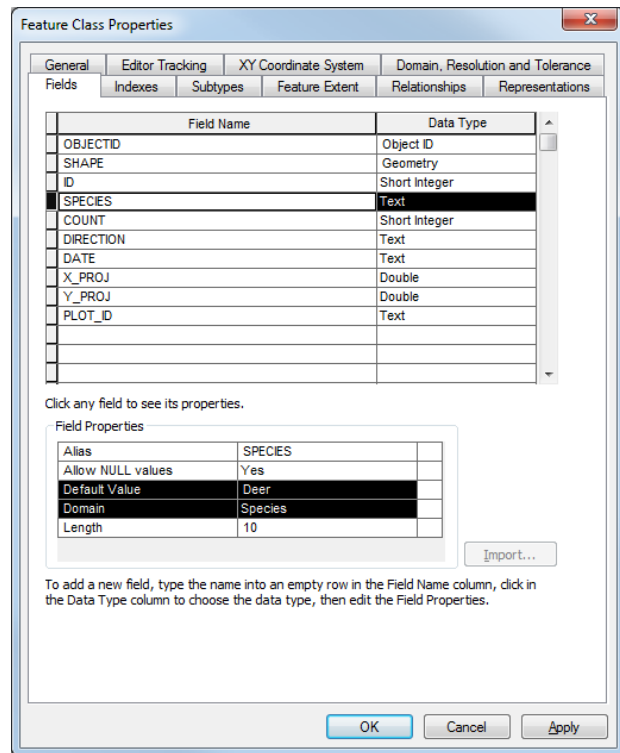
- Right-click on the associated feature class in the Table of Contents and select Properties.
- Within the Layer Properties dialog, select Labels | Expression.
- Within the Label Expression dialog, find the checkbox titled “Display coded value description.”
- When this box is checked, *Description* values are displayed as labels. When unchecked, *Code* values are displayed.



# Assign Domains to Feature Class Fields and Define Default Values

Assign domains and default values to associated feature class fields.

1. Open the Catalog window by selecting Windows | Catalog.
2. Right-click on the feature class name (e.g., *D:\DNRSurvey\SampleSurveys\PointSurvey\DeerSurvey.gdb\Deer\_Obs*) and select Properties | Fields tab.
3. Within the Feature Class Properties dialog box, sequentially select each field name associated with a domain (i.e., SPECIES, COUNT) and define the corresponding Default Value and Domain in the Field Properties table (Table 6).
4. Repeat steps 2-3, as needed, for each additional feature class.
5. Select OK to close dialog box.



**Table 6.** Default values and domains for a deer survey example.

Field Name	Data Type	Field Properties				
		Alias	Allow NULL Values	Default Value	Domain	Length
ID	Short Integer		Yes			n/a
<b>SPECIES</b>	Text		Yes	<b>Deer</b>	<b>Species</b>	10
<b>COUNT</b>	Short Integer		Yes	<b>2</b>	<b>Count</b>	n/a
DIRECTION	Text		Yes			5
DATE	Text		Yes			25
X_PROJ	Double		Yes		n/a	n/a
Y_PROJ	Double		Yes		n/a	n/a
PLOT_ID	Text		Yes			5

## Define Feature Class Symbology and Labels

Define symbology and labels for each feature class (output) file located within the data frame Table of Contents.

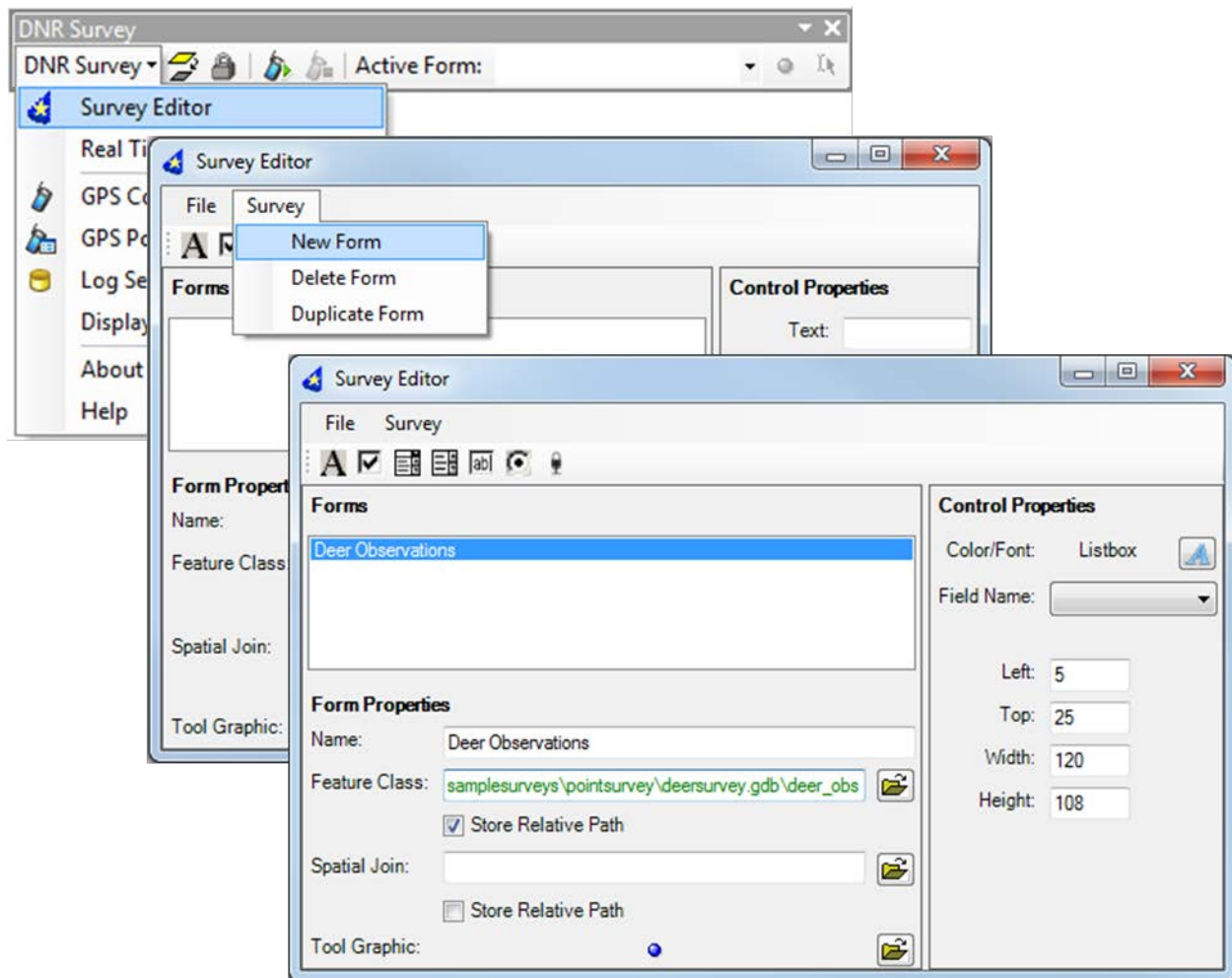
1. Right-click on the feature class layer name (e.g., *D:\DNRSurvey\SampleSurveys\PointSurvey\DeerSurvey.gdb\Deer\_Obs*) and select Properties.
2. Using standard ArcMap protocol, symbolize and label the point feature using the formatting options within the Symbology and Labels tabs, respectively.
3. Select OK to close dialog box.



# Create Survey Forms

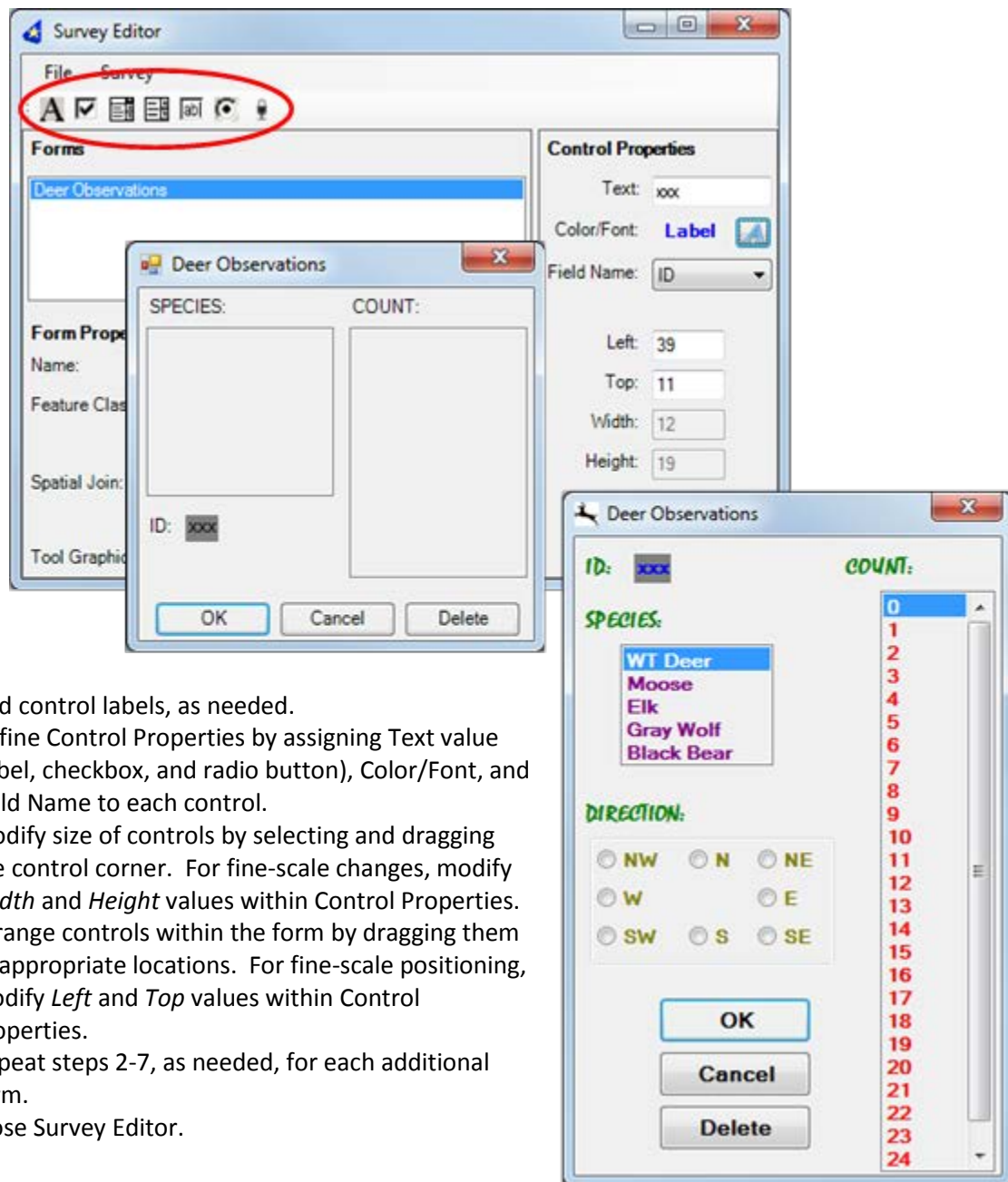
Create custom data entry forms, as needed. *Note: The user can also import or duplicate existing forms instead of using the New Form template described below.*

1. Select DNRSurvey | Survey Editor from the DNRSurvey toolbar drop-down menu.
2. Within Survey Editor dialog box, select Survey | New Form and define Form Properties:
  - a. Name = Deer Observations
  - b. Feature Class = D:\DNRSurvey\SampleSurveys\PointSurvey\DeerSurvey.gdb\Deer\_Obs
  - c. Select the checkbox titled "Store Relative Path"
  - d. Spatial Join = Leave blank – A value will be assigned during one of the final Survey Development steps.
  - e. Store Relative Path = Leave unchecked – The checkbox will be selected after the [spatial join value is assigned](#).
  - f. Tool Graphic = Choose from 3 sources: (1) accept the default graphic for point (●), line (↗), or polygon (□) feature classes; (2) select an existing graphic from D:\DNRSurvey\SampleToolGraphics; or (3) create a custom tool graphic.





- Using the Control Toolbar, add controls (e.g., label, listbox, radio button, etc.) to the form, as needed, to represent the corresponding feature class fields. To delete a control, select it on the form and hit the Delete key on the keyboard.

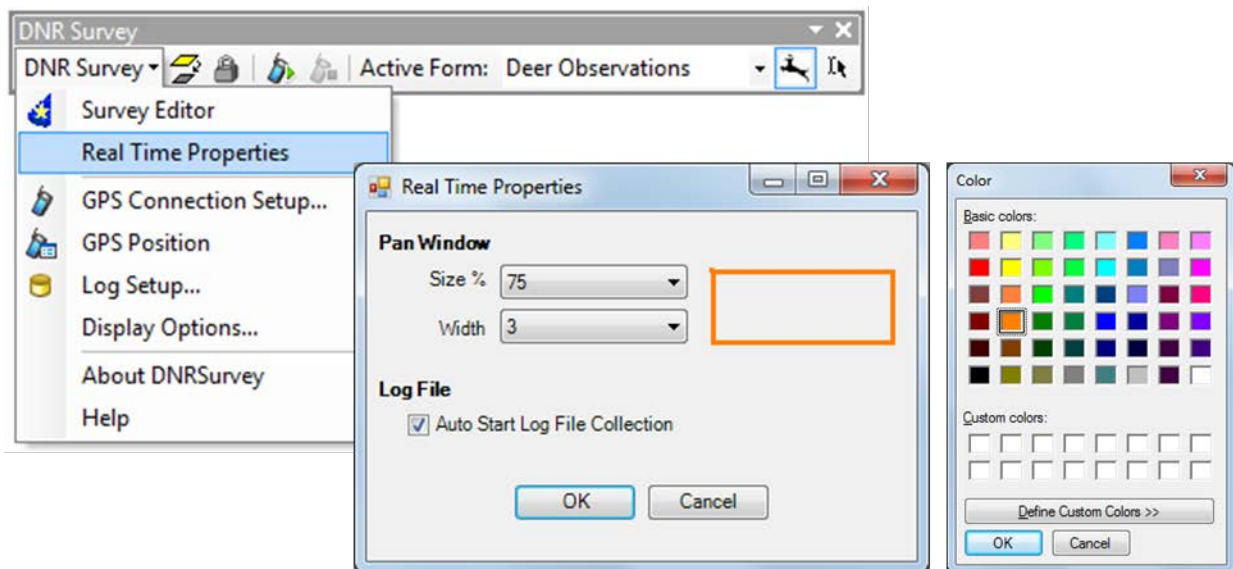


- Add control labels, as needed.
- Define Control Properties by assigning Text value (label, checkbox, and radio button), Color/Font, and Field Name to each control.
- Modify size of controls by selecting and dragging the control corner. For fine-scale changes, modify *Width* and *Height* values within Control Properties.
- Arrange controls within the form by dragging them to appropriate locations. For fine-scale positioning, modify *Left* and *Top* values within Control Properties.
- Repeat steps 2-7, as needed, for each additional form.
- Close Survey Editor.

## Define Pan Window and Log File Properties

Define the pan window display properties and activate the auto-start feature for the GPS track log file.

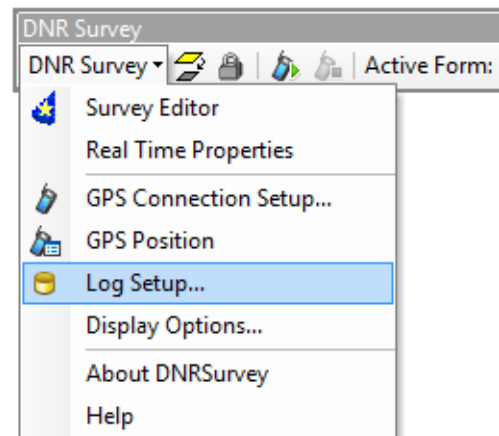
1. Select DNRSurvey | Real Time Properties from the DNRSurvey toolbar drop-down menu.
2. Within the Real Time Properties dialog box:
  - a. Define pan window size and line width. *Note: To hide the pan window within the map display but retain auto-pan functionality, define Width = 0.*
  - b. Select the pan window graphic.
    - i. Within the Color dialog box, select a color option.
    - ii. Select OK to close the Color dialog box.
  - c. Select the Log File checkbox titled "Auto Start Log File Collection."
  - d. Select OK to exit Real Time Properties.



## Define GPS Log File and Streaming Options

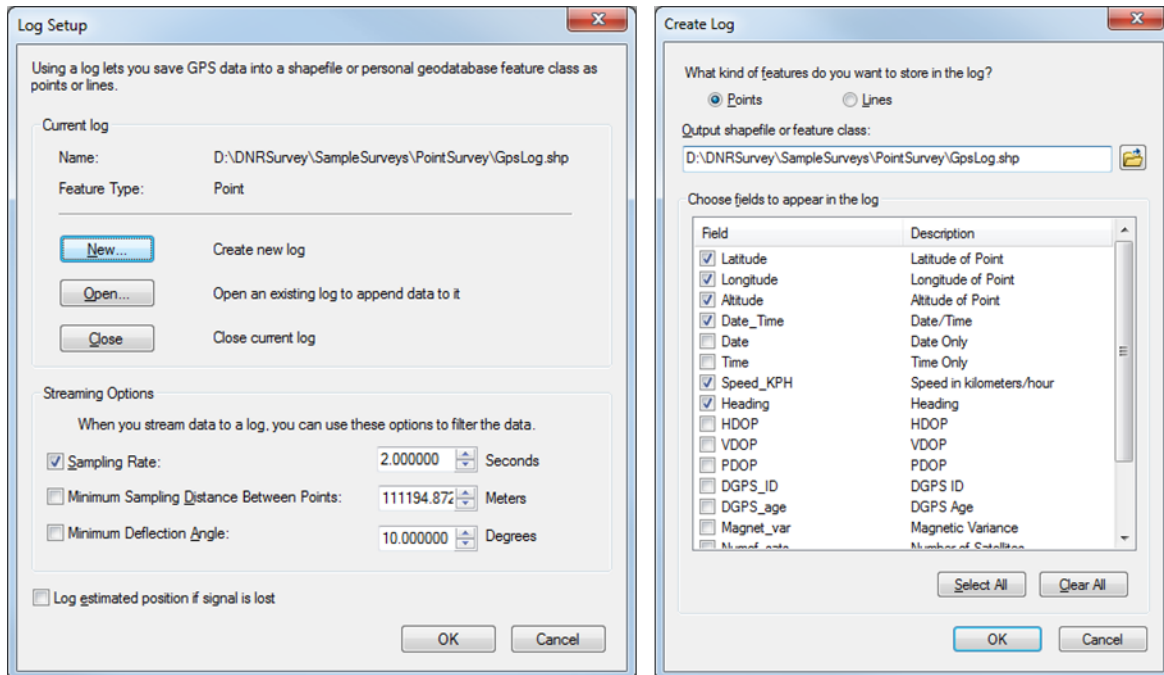
Create a GPS track log file (feature class or shapefile format) and select applicable data fields (e.g., Latitude, Longitude, Altitude) and data streaming options.

1. Select DNRSurvey | Log Setup from the DNRSurvey toolbar drop-down menu.
2. Within the Log Setup dialog box:
  - a. Select the New button to create a new log file.
  - b. Within the Create Log dialog box, define the following:
    - i. Select the Points (or Lines) radio button.
    - ii. Output shapefile or feature class = D:\DNRSurvey\SampleSurveys\PointSurvey\GpsLog.shp



**Note: A software bug impacts the frequency at which GPS data are written to the log file and displayed on screen. See [Known Issues – ArcMap Bug#1](#).**

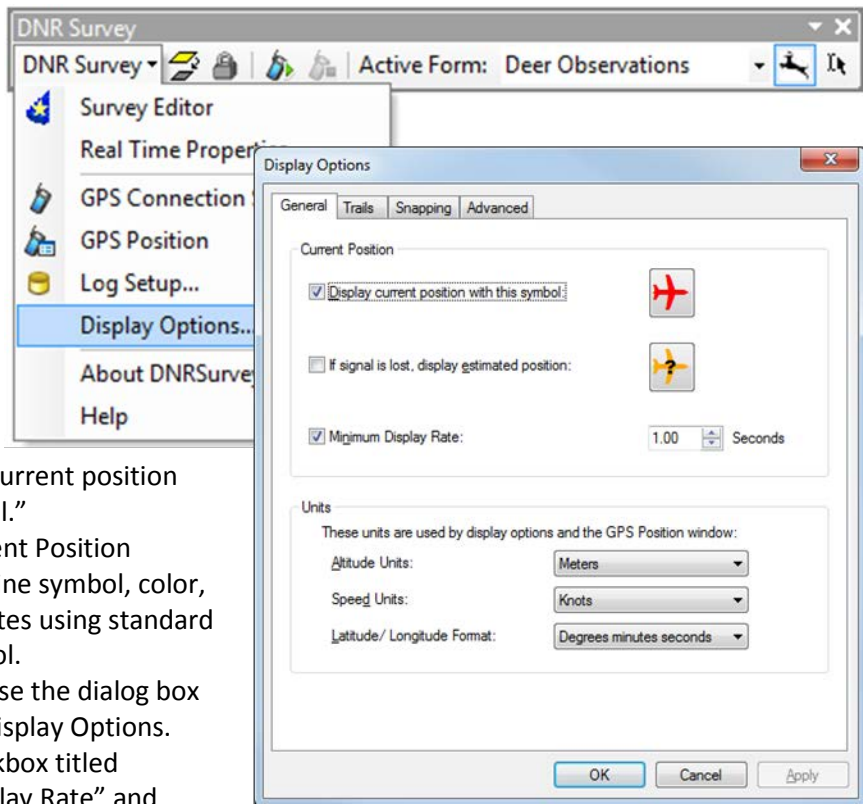
- iii. Select the field attributes to appear in the log (e.g., Latitude, Longitude, Altitude, Date\_Time, Speed\_KPH, Heading).
- iv. Select OK to close the dialog box and return to Log Setup.
- c. Select the Sampling Rate checkbox and define the streaming rate (e.g., 2.0 Seconds).
- d. Select OK to exit Log Setup.



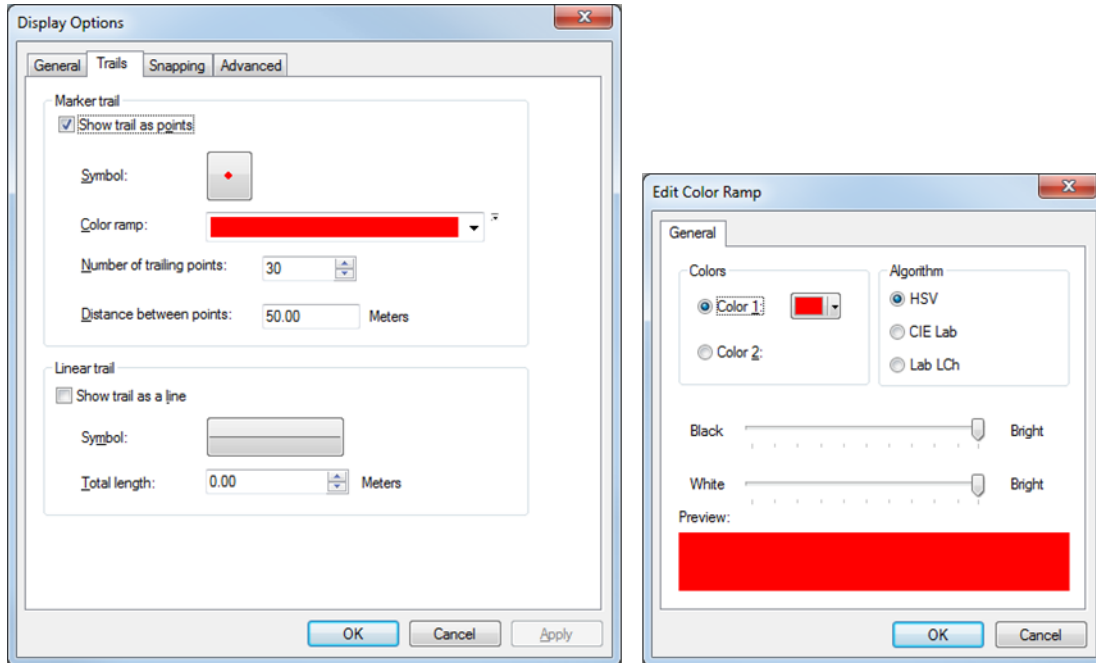
# Define Display Options

Define symbology for the real-time GPS icon (current GPS position) and temporary “bread crumb” trail (previous GPS positions).

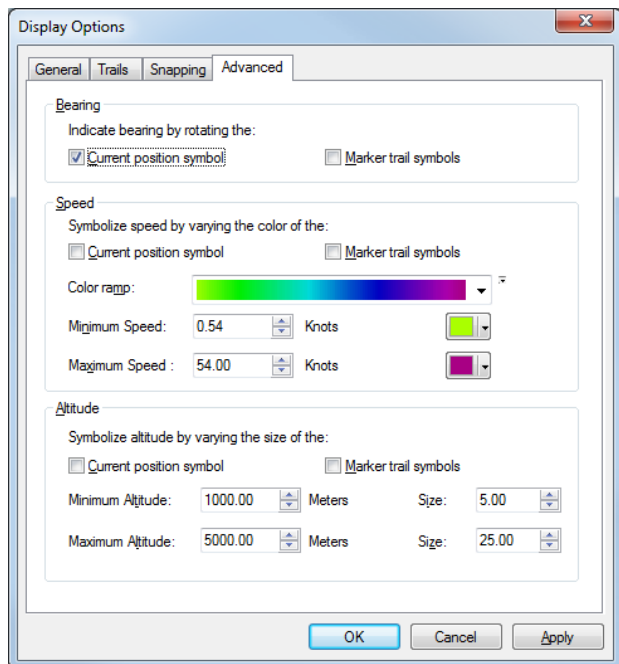
1. Select DNRSurvey | Display Options from the DNRSurvey toolbar drop-down menu.
2. Within the Display Options dialog box, select the **General** tab and define the following:
  - a. Select the checkbox titled “Display current position with this symbol.”
  - b. Select the Current Position symbol and define symbol, color, and size attributes using standard ArcMap protocol.
  - c. Select OK to close the dialog box and return to Display Options.
  - d. Select the checkbox titled “Minimum Display Rate” and define streaming rate (e.g., 1.00 Seconds).
  - e. Define Altitude Units (e.g., Meters).
  - f. Define Speed Units (e.g., Knots)
  - g. Define Latitude/Longitude Format (e.g., Degrees minutes seconds)
3. Within the Display Options dialog box, select the **Trails** tab and define the following:
  - a. Select the Marker Trail checkbox titled “Show trail as points.”
  - b. Select the Marker Trail symbol and define symbol, color, and size attributes using standard ArcMap protocol.
  - c. Select OK to close the dialog box and return to Display Options.
  - d. Select the button adjacent to the Color Ramp drop-down list and select Properties to set the color ramp to a single color.
    - i. Within the Edit Color Ramp dialog box, define the following:
      1. Select Color 1 radio-button
      2. Color = Mars Red
    - ii. To change back to a color ramp, select Color 2 and update the 2 colors.
    - iii. Select OK to close the dialog box.
  - e. Number of trailing points = 30
  - f. Distance between points = 50.00 Meters



**Note:** When streaming options exceed some unknown threshold, software instability may occur. See [Known Issues – ArcMap Bug#2](#).



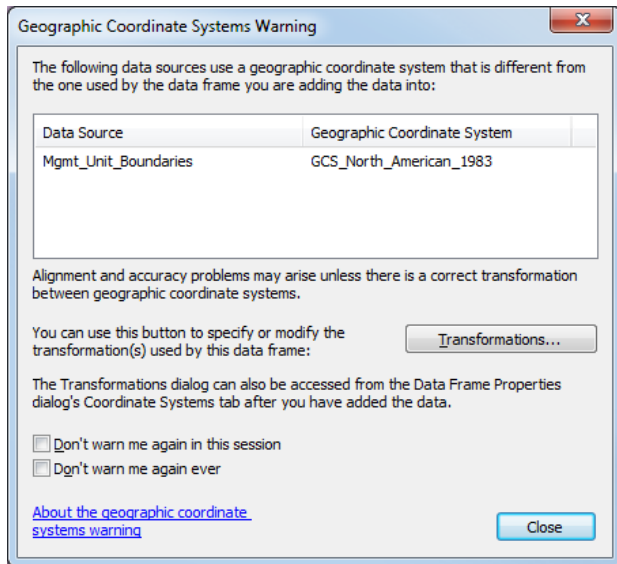
4. Within the Display Options dialog box, select the **Advanced** tab and define the following:
  - a. Select the Bearing checkbox titled “Current position symbol.”
  - b. Select OK to exit Display Options.



## Add Background Data Layers and Define Symbology

Add background layers (e.g., management unit boundaries, aerial photos, etc.), as needed, to the data frame Table of Contents and define symbology.

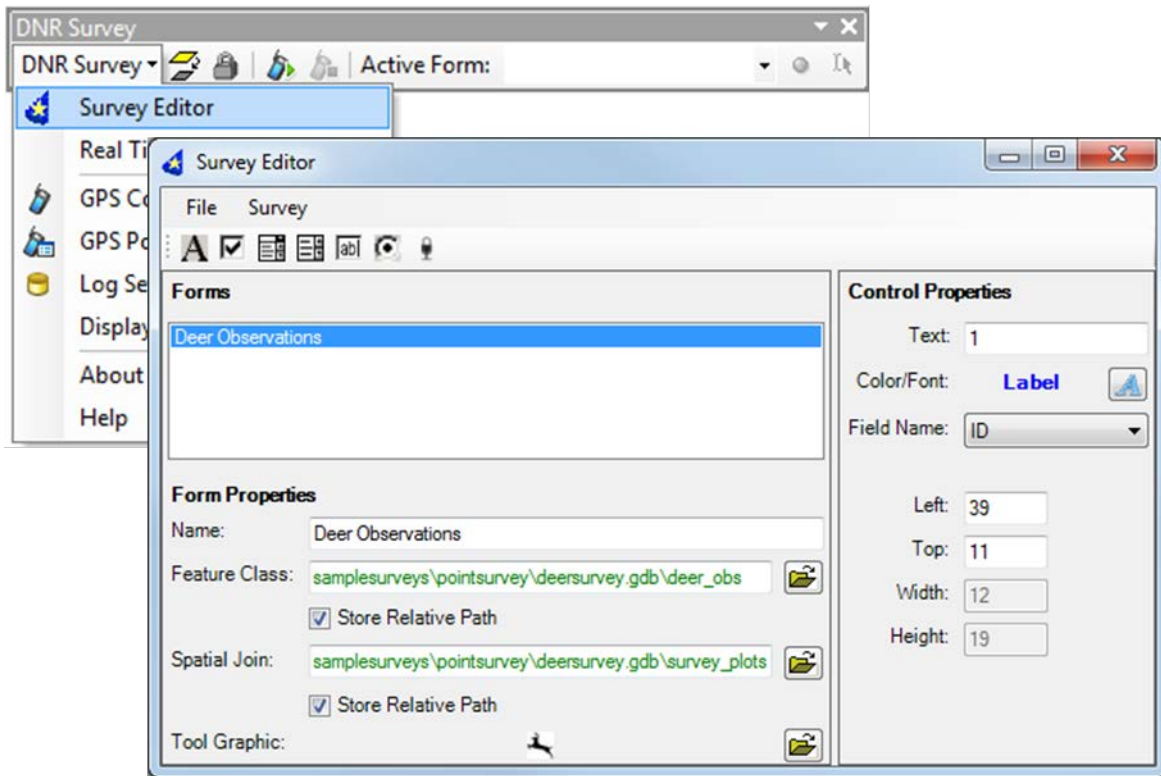
1. Add appropriate background data layers.
2. If the GCS of a background layer is different from the one used by the data frame (i.e., WGS 1984), a warning message may be generated. Depending upon GCS selected, a geographic/datum transformation may be required to prevent alignment and accuracy problems. Alternatively, convert the background layer to WGS 1984.
3. Right-click on each layer name and select Properties | Symbology tab.
4. Symbolize each layer using standard ArcMap protocol.



## Update Spatial Join Features and Save the Map Document

Update [Spatial Join](#) and [Store Relative Path](#) features, as needed and save the map document.

1. Select DNRSurvey | Survey Editor from the DNRSurvey toolbar drop-down menu.
2. Within the Survey Editor dialog, define the path to the spatial join file located within the data frame Table of Contents (e.g., *D:\DNRSurvey\SampleSurveys\PointSurvey\Deer\_Survey.gdb\Survey\_Plots*) and check the “Store Relative Path” box associated with it.
3. Close Survey Editor and save the map document as a new file (e.g., *D:\DNRSurvey\SampleSurveys\PointSurvey\PointExample\_DeerSurvey.mxd*).



## Create Backup Copies – Optional

When survey development is complete, consider saving backup copies of the survey map document and geodatabase folder to a separate data folder (e.g., *D:\Deer\_Surveys\_BUP*). This will allow the user to continue collecting data in a timely manner, independent of the original survey, should problems occur during data collection. Ensure the paths to all feature class files, survey forms, and log files are updated to the backup location.



## 4 GPS Connectivity and Troubleshooting

The GPS device must have an input/output (I/O) interface and be NMEA compliant. In addition, ArcMap limits GPS connectivity to COM (serial) or virtual COM ports. Bluetooth GPS receivers can be assigned to a COM port using the computer's Bluetooth configuration setup. USB connections are possible only via virtual COM ports, which require additional software.

**TIP:** Third-party software programs can be used to create virtual serial COM ports for use with USB-connected GPS receivers. Examples include, but are not limited to, the following:

- GpsGate Splitter ([http://gpsgate.com/products/gpsgate\\_client](http://gpsgate.com/products/gpsgate_client))
- Xport (<http://www.curious-tech.net/xport.html>)

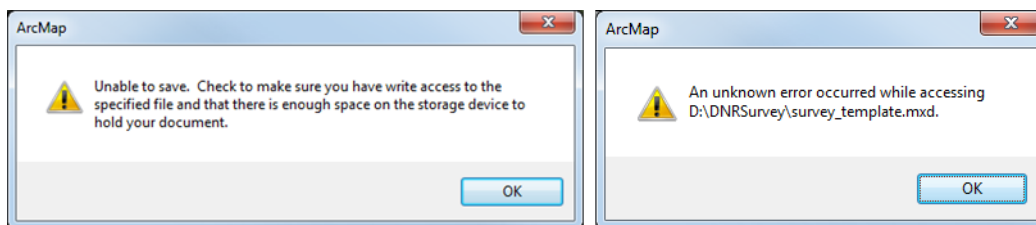
**Table 7.** GPS troubleshooting solutions.

GPS Problem	Possible Solution
The pan window and current position icon are not displaying.	<p>Identify <a href="#">GPS Connection Status</a>:</p> <ol style="list-style-type: none"> <li>(1) If status message = "Connection closed," the GPS connection has been inadvertently closed. The <a href="#">GPS Connection Closed</a> chime will sound to signal the change to closed status. Select the "Open GPS Connection" tool button to reconnect to the GPS.</li> <li>(2) If status message = "Port is open, but not receiving any data," the GPS device has either (a) lost power [e.g., dead batteries], (b) become disconnected from the computer [e.g., serial or USB cable is unplugged, Bluetooth connection has failed], or (c) malfunctioned [e.g., device failure]. The <a href="#">GPS Connection Error</a> chime will sound <b>after approximately 25 seconds</b> to signal the change in connection status. Replace batteries, reconnect the serial/USB cable, reestablish the Bluetooth link, or use a backup GPS device, as necessary.</li> <li>(3) If status message = "Poor signal, not receiving positions" –OR– "GPS signal lost. Satellites not available," satellite reception has been lost. The <a href="#">GPS Connection Error</a> chime will sound <b>after approximately 25 seconds</b> to signal the change in connection status. Reposition the GPS device to improve satellite reception. <i>Note: Atmospheric conditions can also temporarily degrade or disrupt satellite communication and the GPS data stream.</i></li> </ol>
The current position icon and map display are not updating.	<p>Identify <a href="#">GPS Connection Status</a>. If status message = "Connection open. Receiving data," GPS communication has been lost for <b>&lt; 25 seconds</b>. The GPS device has either lost power, become disconnected from the computer, or malfunctioned (see #2 above). Replace batteries, reconnect the serial/USB cable, reestablish the Bluetooth link, or use a backup GPS device, as necessary. <i>Note: <b>After approximately 25 seconds</b>, the <a href="#">GPS Connection Error</a> chime will sound, the status message will update to "Port is open, but not receiving any data," and the pan window and current position icon will no longer display.</i></p>



# 5 Collecting Data

**TIP:** Make sure only one copy of ArcMap is open at any one time. Although multiple copies of the same map document can be open simultaneously, only one is active. Errors occur when trying to save the inactive document after changes have been saved to the active document. Exit the inactive document without saving it.



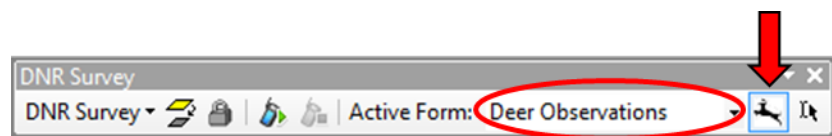
Observation data (e.g., animal locations, counts, etc.) can be collected by either direct entry to customized survey forms (i.e., standard observations) or voice recording to audio files.

## Standard Observations

Observations entered directly to customized forms can be collected and displayed as points, lines, or polygons. Although multiple data types are permissible, each type must be saved to a separate feature class.

To initiate an observation, select the form of interest (e.g., Deer Observations) and the *Collect Feature* tool.

Recall that an active tool is bounded by a blue line.



Mark the location of the observation directly on the map display using the computer touch pad, stylus, or mouse and release the input device to open the data entry form.

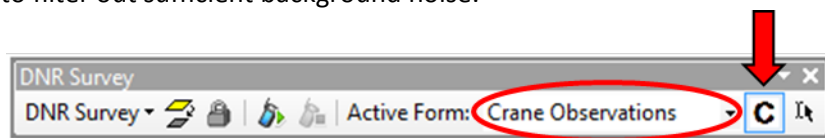
- Point – Touch the map display at a single location. **Note: To capture the coordinates of the “current” GPS position instead of the user-defined location, select the Lock Cursor to Map tool prior to touching the map display. This functionality only applies to point features.**
- Line – Touch and drag a line on the map display.
- Polygon – Draw a polygon to capture the area of interest. Start and end points are automatically connected.

Default values, if applicable, are auto-selected within the form. Reposition the form, as needed, by dragging it to the desired location. Complete data entry within the form. Select *OK* to exit the form and save inputs to the feature class. Select *Cancel* to exit the form without saving inputs.

## Voice Recorded Observations

In contrast to standard observations, only point features can be collected as voice recordings. Depending upon computer hardware configuration and survey environment, a high-quality microphone (e.g., speech microphone) will likely be required to comprehend audio recordings to WAV files. Low-end microphones are generally unable to filter out sufficient background noise.

To initiate an observation, select the form of interest (e.g., Crane Observations) and the *Collect Feature* tool.



Using the computer input device, **press and hold** a “left mouse click” directly on the map display to mark the location of the observation, create/open a WAV file, and open the data form. **Note: To capture the coordinates of the “current” GPS position instead of the user-defined location, select the Lock Cursor to Map tool prior to touching the map display.**

Dictate observation data into the microphone. When finished, release the “left mouse click” to save the recording, close the WAV file, and close the form. **Note: A date-time stamped WAV file is created for each observation and saved to an auto-generated “Voice” folder within the same root directory as the survey map document and geodatabase folder (e.g., D:\Crane\_Surveys\voice\ voice20150506\_160202.wav).** Additional audio can be added to the WAV file by selecting the observation in [Edit mode](#) and clicking the *Record* button. Minimum and maximum recording length per observation is 1 second and 60 seconds, respectively. To replay the most recent recording, depress the right mouse button on the input device. Audio tones alert the user to voice recording status (Table 8).

**Table 8.** Voice recording status and associated reference chime for voice recorded observations.

Voice Recording Status	Reference Chime
Initiate new recording. –OR– Play back most recent recording.	<a href="#">Begin Voice Recording</a>
Save current recording.	<a href="#">End Voice Recording</a>
Recording error (insufficient length).	<a href="#">Voice Recording Error</a>

Populate the data form as time allows (e.g., post-survey) by editing each observation, replaying each recording, and transcribing observation data to the form. See [Editing Data –Voice Recorded Observations](#) for further information.

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**TIP:** If an observation is initiated using touch screen functionality (e.g., touch pad, stylus, mouse), it can be difficult maintaining the “left-mouse click” throughout the recording due to aircraft motion and accompanying turbulence. Consider using a high-quality speech microphone, with integrated trackball and mouse controls, to minimize input problems and overcome background noise. See [Appendix](#) for additional information.

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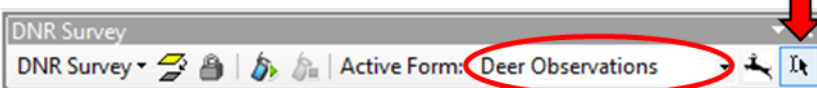
**TIP:** In some survey applications, the goal is to revisit existing features (e.g., wild rice bed photo points) on multiple occasions and document changes to feature attributes (e.g., rice bed size). In these situations, consider using ArcGIS Editor Tracking functionality to document feature changes and dates during each replicated survey. For further information, search within ArcGIS Desktop Help for “Editor Tracking.”

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## 6 Editing Data

### Standard Observations

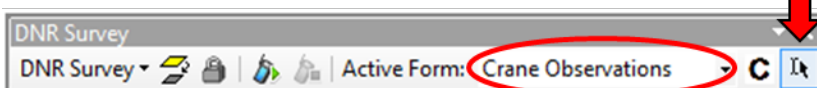
To edit a standard, non-voice recorded observation, begin by selecting the form of interest (e.g., Deer Observations) and the *Edit Feature* tool.



Select the observation of interest on the map display to open the data form. Modify field metrics, as needed. Select *OK* to exit the form and save edits to the feature class. Select *Delete* to remove an observation.

### Voice Recorded Observations

To transcribe voice recorded observations to the data form, begin by selecting the form of interest (e.g., Crane Observations) and the *Edit Feature* tool.



Select an observation on the map display to open its data entry form. Default values, if applicable, are auto-selected. Reposition the form, as needed, by dragging it to the desired location. Click the *Play* and *Stop* buttons, as needed, and populate the data form during audio playback. Click the *Record* button to add additional audio to the WAV file. Select *OK* to exit the form and save inputs to the feature class.

Repeat data transcription for each observation.

**TIP:** The user may wish to incorporate a “transcription status” field (e.g., STATUS) to document and symbolize data transcription for each observation.

# 7 Known Issues

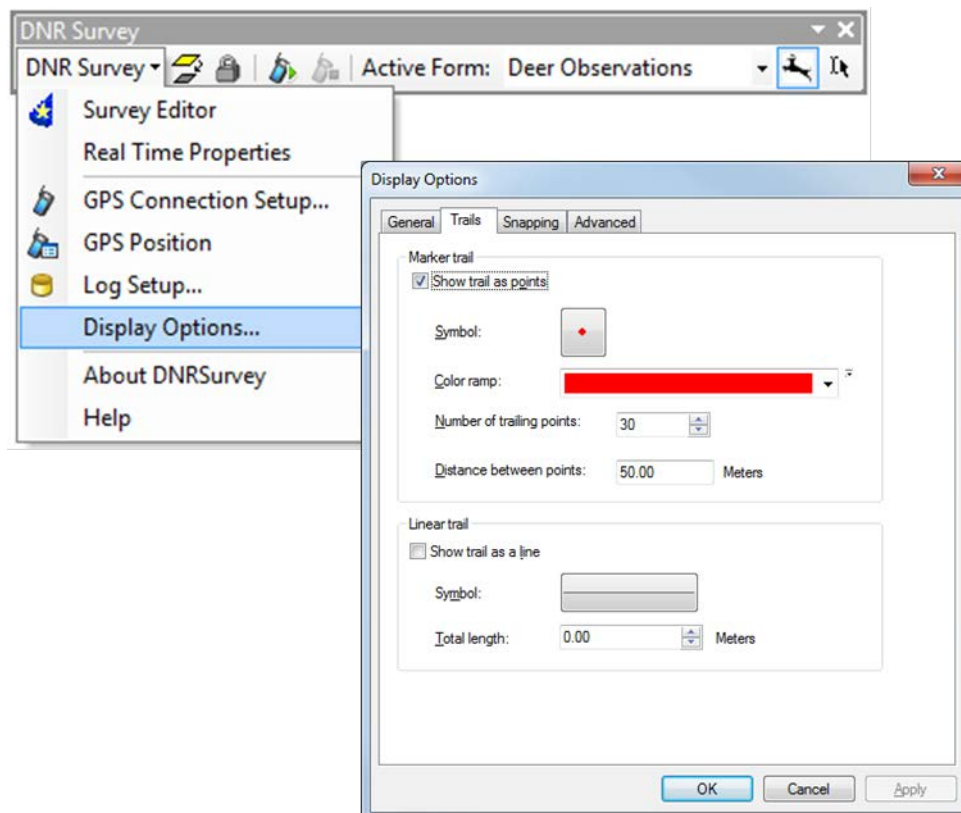
## ArcMap Bugs

### 1. Failure to Write/Display GPS Log File Data

When streaming GPS point data to a [log file](#) in **feature class** format, position data are not written to the file or displayed until the GPS connection is closed. When streaming to a log file in **shapefile** format, position data are not written to the file or displayed until the screen is refreshed (e.g., via pan, zoom, etc.). To overcome these issues, we recommend using the shapefile format in combination with a temporary “bread crumb” trail configured under [Display Options](#).

### 2. ArcMap Instability and GPS Log File Corruption

When using a temporary “bread crumb” trail (point or line) configured under [Display Options](#), if the streaming options exceed some unknown threshold, ArcMap becomes unstable and closes unexpectedly after approximately 1-2 hours of run-time. When this occurs, the GPS Log file (shapefile format) may be corrupted and the link to the template log file may be broken (i.e., reset to “No Current Log Specified”). We have found software instability and file corruption do not occur when using a *Marker trail* with *Number of trailing points*  $\leq 30$  and *Distance between points*  $\leq 50\text{m}$ . Currently, we recommend against using the *Linear Trail* option.



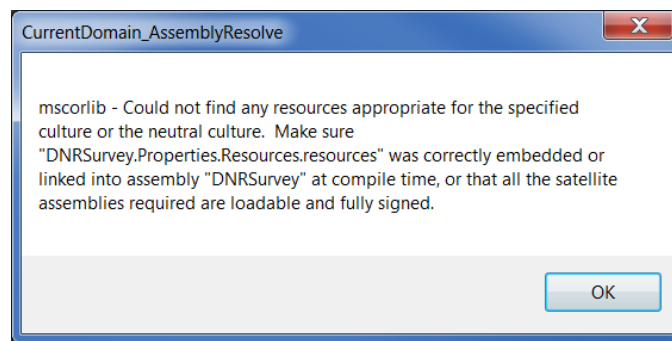
## DNRSurvey Bugs

### 1. Instability of Real-time Pan Window

Periodically, the [pan window](#) graphic does not resize correctly after the user changes the scale of the map window. When this occurs, the map window reverts to the previous scale after the display pans. To reset the pan window, close the GPS connection, close and reopen the ArcMap survey document, then open the GPS connection. This process takes < 1 minute to complete.

### 2. CurrentDomain\_AssemblyResolve Error

Because this error message occurs infrequently and inconsistently, the root cause is unknown. It does not appear to cause any adverse effects. We believe the bug is confined to ArcMap 10.1, but this is not guaranteed. Select OK to close the message.



# 8

## Appendix

### Voice Recording Input Device

When choosing an audio input device, the most important requirement is that the recorded survey information is discernable over any background noise during playback. For low-noise environments, a basic computer microphone may be adequate. For high-noise environments (e.g., aircraft cockpit), a high-quality microphone is essential to overcome background noise. We have found the Philips SpeechMike ([http://www.dictation.philips.com/us/products/category/stationary\\_dictation](http://www.dictation.philips.com/us/products/category/stationary_dictation)) performs adequately during aerial surveys in high-noise environments. Likely, there are comparable devices available from other manufacturers as well.

The Philips SpeechMike is a USB-connected, medical-dictation device that integrates both a microphone and speaker with numerous button controls. We suggest the following setup for conducting aerial surveys:

1. Install the Philips Device Control Center software **before** connecting the SpeechMike to the computer.
2. Connect the SpeechMike to the computer and allow the device drivers to be installed. The serial ball driver can cause cursor-control issues and should be disabled via the Windows Device Manager. Disabling the driver prevents reinstallation when the device is subsequently connected to the computer.
3. Update the device firmware as needed.
4. Use the Control Center software to disable all button functionality except for the track-ball and left/right mouse click buttons. Upload all new settings to the device.
5. Note that audio playback is directed back to the SpeechMike and not to the audio output jack on the computer.