

A Geospatial Exotic Plant Database for Saguaro National Park – Final Report

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Introduction

This project was designed to create a new spatial database for exotic plant species in Saguaro National Park. Cooperators were Dana Backer, Saguaro National Park (SNP), and Gary L. Christopherson, Director of the Center for Applied Spatial Analysis (CASA) at The University of Arizona. Michael T. Malone working through CASA was responsible for the hands-on development of the database and the migration of legacy data into the new system. He also created a series of macros that automate much of the processing necessary for management of the data and for producing information for reports. In addition, Michael wrote the manual for using the database. Essential feedback and suggested improvements for this project were supplied by – Becky MacEwen, Bethany Hontz, Adam Springer, and Matt Daniels of the National Park Service.

This report comes in two parts: first, an executive summary of the project containing a list of deliverables, a discussion of previous databases, a description of the new database; and second, the manual developed for the project which will provide a detailed description of the database, field collection, data management and reporting functions. Funding was provided through a grant from the Desert Southwest Cooperative Ecosystem Studies Unit.

Deliverables

This project had two objectives. 1) to develop a new SNP exotic species spatial database that retains the historic data and can accommodate collection of new field data collected by multiple handheld devices. 2) to develop data collection procedures that are simpler and more transparent for Park personnel. These objectives will provide the capacity to handle more complex data, perform more sophisticated analyses, and make data processing less complex.

Based on these objectives, the following deliverables were identified:

- The first deliverable was a **new geodatabase**. This would allow for the integration of new spatial data with historic data in an ESRI File Geodatabase. This geodatabase would contain feature classes, attribute tables, ModelBuilder macros, and metadata.
- The second deliverable was **the development and implementation of new data collection procedures** utilizing SNP's existing hardware and software. The data collection problems cited below would be eliminated by combining the new geodatabase with the latest version of ArcPad.
- The final deliverable was a **manual of procedures for collecting and managing data**. This manual includes descriptions of the geodatabase, ArcPad, the procedures for check-out of data from the geodatabase, the transfer of checked out data to the mobile GPS/data loggers, field collection of data, check-in of data, and the use of ModelBuilder macros to manage data and create reports.

The integration of these deliverables would create a system for collecting and managing exotic plant data that meets the objectives stated above.

Why a New Database?

A vital component for research, monitoring, and management of exotic species is a system that allows for the accurate collection and management of quality data. A good system will use the best available technology and procedures to provide efficient data entry, storage, management and extraction. Over time, both the available technology and the questions of interest change until the management activities and needs surpass the capabilities of the original system. This was the case with SNP's Exotic Plant Database. SNP had a functioning exotic plant database system but it had limitations. The rapidly expanding number, range, and treatments of exotic plants within the park stretched the capabilities of the data collection and management system. Over time, new systems were developed and a number of *fixes* were employed in an effort to improve the system. While these procedures were helpful, new software and technology are available which facilitate an improved system.

The following is a summary of previous exotic species databases.

The Access Database

A *Microsoft Access* database was used from 2000 to 2005. It kept track of such things as coordinates, species, patch size, density, treatment type, etc. Because Access lacks spatial capabilities, SNP personnel began using *ESRI shapefiles* to manage spatial data. Through a query and linkage, data could be viewed and manipulated in ArcView.

The inability of Access to store line or polygon data meant that all spatial data for exotic species were points. This severely limited the ability of the system to manage changing

patch size, to track species spread, to manage treatment, to determine total area, and to generate reports.

The ArcView 3.x Database

From 2005 through 2008 SNP used a custom ArcView 3.X database developed by the Advanced Resource Technology (ART) lab to store and manage exotic species data. Data were collected using ArcPad on handheld GPS units, on handheld computers equipped with GPS, and on paper datasheets. In 2007, features from the Access database were converted to point, line and polygon shapefiles and included in the new database.

A significant issue with this system was the creation and management of unique identifiers (ID). Data collected on the hand held computer units recorded a unique identifier. For data collected manually, a unique identifier had to be assigned manually. In addition, attribute data related to specific spatial features were collected and relating these attributes to their associated features required that a foreign key be posted to the attribute tables.

In order to manage these ID numbers as they cascaded through a variety of tables, a Python script was written. This script performed the following post-processing steps: feature geometry and attributes were reviewed; unique ID numbers were assigned and managed across related tables; spatial and attribute data were joined; and new features were merged with pre-existing feature classes.

This system was an improvement on the Access database but there were limitations in the data structure and in the application. This early version of ArcPad did not support one-to-many relationship; therefore if more than one species was present in the same space, the geometry had to be duplicated. This use of multiple features with duplicate geometry led to an overestimation of area. Further, this data structure could not track infestations through time; and data from multiple handheld units had to be merged prior to appending to pre-existing feature classes.

The New Database

The combination of improving technology and increasing capability of new GIS software, plus the limitations of the existing database and the breadth of the legacy data, lead SNP personnel to a decision to re-design the data management structure.

The goal for the new SNP exotic species database was the construction of a robust, user friendly data management and collection system. The new database was designed to be both simple and sophisticated. Simple in that it relies on out-of-the-box rather than programming solutions. At the same time it is sophisticated because it provides an integrated environment for collection, management and reporting of exotic species. This new database meets the challenges noted above, as well as providing additional functionality for the collection, management, and reporting of exotic species in Saguaro National Park. The following paragraphs describe the new database.

Database/Data Structure

The new exotic species database is an ESRI *file geodatabase*. This data structure provides a number of improvements over previous Exotic Plant Databases. It normalizes data structure along with projection and coordinates. It allows objects to be aware of themselves and their neighbors in ways that shapefiles are not. For example, features in a geodatabase are aware of geometric properties like length and area, automatically updating these properties as feature geometry changes. Also, spatial relationships between features in multiple themes can be managed by setting topological rules. This ensures that features that should not overlap do not overlap, or features that should be contiguous with other features will be contiguous. The use of a geodatabase also allows for better integration of spatial and tabular data. A variety of formal relationships established between tables has eliminated the need for duplicate geometries and all exotic species patches are now modeled as polygons. These relationships and the use of polygons allow for the tracking of patch growth and migration over time and makes for faster, more accurate reporting of spatial data such as total area and area change. Finally, the incorporation of linear referencing will allow the Park to better manage exotic species that are located along linear features, such as *tamarix*.

Federal Geographic Data Committee (FGDC) compliant metadata was developed for all spatial and tabular data in the geodatabase. These metadata will ensure that as the system grows, changes, and eventually becomes obsolete, that the source and processing history of each feature class will be known.

Data Collection

Improvements in data collection are tied to new features in ArcGIS and ArcPad, particularly the ability to do data check-out and check-in. This feature in ArcGIS allows the user to check-out data sets for multiple GPS collectors. Once data has been collected it can be checked-in. At check-in, ArcGIS manages unique ID numbers across all feature classes and related tables. New ArcPad data collection form includes attributes that enhance the knowledge about a particular exotic plant infestation and treatments. The geodatabase supports data collection from ArcPad, written data sheets, and on-screen digitizing (not sure if these are the correct choice of words)

Programming

The check-out and check-in process means that programming is no longer necessary to manage ID numbers. This provides greater stability for the database because it is not dependent on a particular set of programming skills. The loss of a GIS Specialist will still cause disruption, but it will not be critical to the health of the system.

Although code-based programming is not necessary, there are a number of processes in the new database that require multiple tools to run in a particular sequence. In order to aid the users, these have been combined in a series of macros using ESRI's ModelBuilder. ModelBuilder is an out-of-the-box tool that uses a graphical interface to string tools together, allowing the user to set parameters and define variables. The user

can then run the macro whenever they need to perform that particular processing sequence. Although these macros can break down, particularly if data is moved, the graphical interface makes it relatively easy for the user to fix.

Reporting

An important enhancement available with the new database is improved reporting capabilities. For example, because ArcGIS calculates and maintains area for all polygons, computing percent change in a species from year to year or finding out where the biggest change occurred is a simple task. There are ModelBuilder macros that are designed to produce report ready information about exotic species in SNP.

Manual

Finally, a detailed manual has been produced for this project. This manual provides an overview of the database plus step-by-step instructions for collecting and processing data, for adding processed data to the database, and for generating information for reports. The instructional tone of the manual should allow new SNP personnel to begin collecting data almost immediately.

Moving to the New Database

Moving from the previous database to the new geodatabase was completed by the following steps:

- The database was designed and the tables created
- *Dummy* data was used to determine if the geodatabase performed as designed, and corrections were made where necessary
- Legacy data was imported into the geodatabase, the database was tested again, and corrections made where necessary
- New data were collected using ArcPad, the database was tested again, and corrections made where necessary
- ModelBuilder macros were created to automate data processing, management and reporting
- The manual was written
- A training session for SNP personnel was held at CASA
- Final adjustments to the database were made
- A final edit of the manual was made

- Throughout this process, consultations between SNP and CASA personnel were held

Conclusion

This project was designed to replace the existing SNP exotic species database and data collection system with something that was easier to maintain and provided superior data collection, management, and reporting. By starting with and concentrating on data

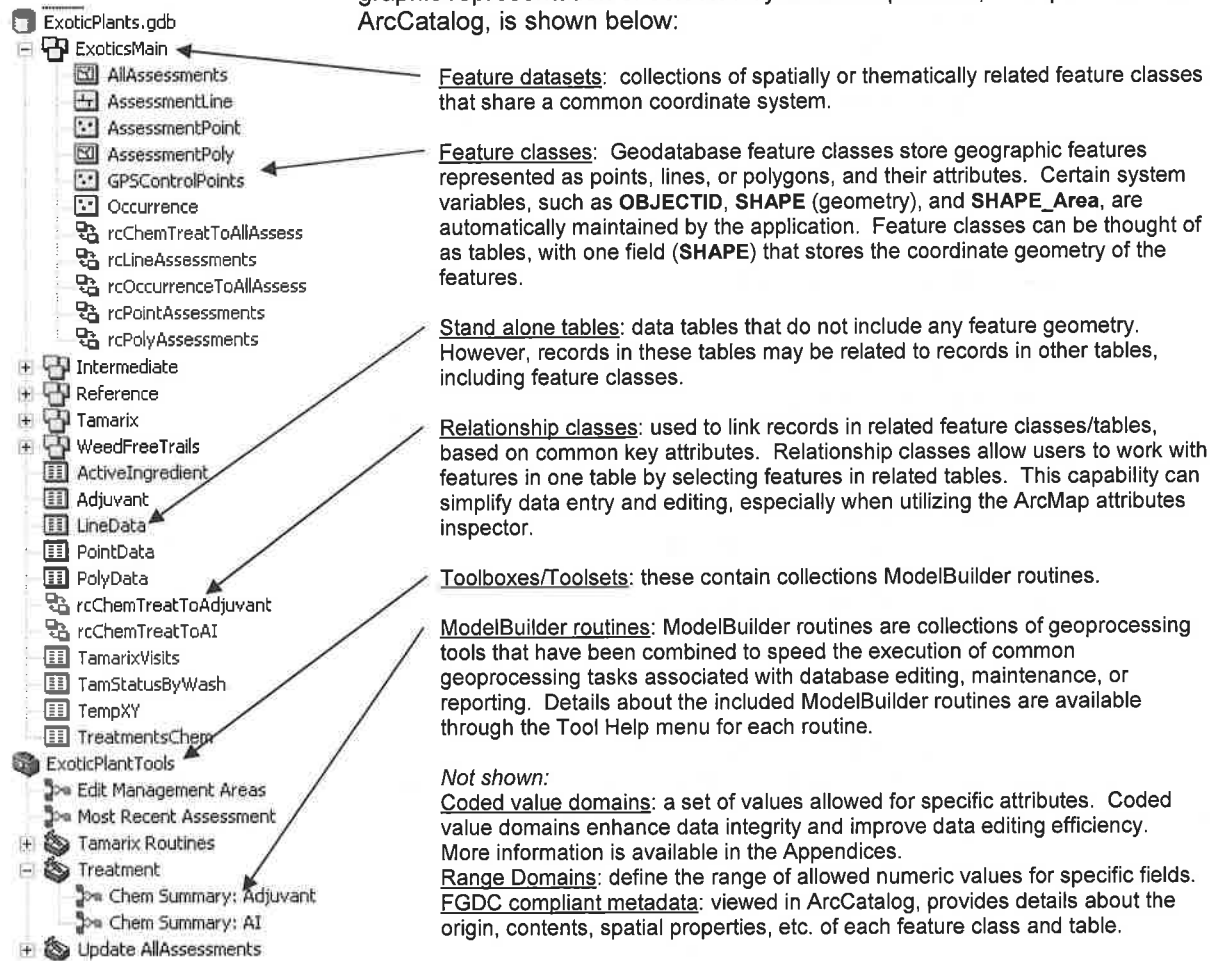
Introduction and Terminology

This document is intended to provide information about the design, structure, and function of the Exotic Plants geodatabase (ExoticPlantsGDB) and related tools developed by the Center for Applied Spatial Analysis (CASA) for Saguaro National Park.

The ExoticPlantsGDB and associated files support the following:

- Monitor change (cover, area, number of plants, etc) for specific exotic plant infestations over time
- Record information for multiple exotic species present at a given location
- Determine net area infested and/or treated by species, management unit, time period, or other criteria
- Field data collection using either ArcPad-equipped GPS receivers or paper data forms
- Collection of weed data using point, line, or polygon spatial representation
- Integrate previously collected data ("Merge" data and "Access" data) into the new geodatabase
- Incorporate all weed assessment data into a single (polygon) feature class, regardless of whether data were originally represented as points, lines, or polygons. This allows for simultaneous analysis of all exotics data
- Capture and support analysis and reporting of chemical treatment information

The exotic plants system utilizes the file geodatabase structure available beginning with ArcGIS 9.3. A graphic representation of selected system components, as represented in ArcCatalog, is shown below:



Data Model Overview

About related tables and relationship classes

The ExoticPlantsGDB is a relational database, meaning that it is composed of tables with records that can be linked or grouped, based on the values for key attributes present in each table. Maintenance of the related tables does require a certain amount of processing overhead, but the relational database approach enhances data integrity by minimizing data duplication and enforcing certain constraints during data editing.

The ExoticPlantsGDB utilizes geodatabase relationship classes to define a number of permanent relationships. The relationship classes improve data editing efficiency, and allow users to query and analyze records in related tables without the need to define additional relates or joins.

In most cases, the system generated **OBJECTID** serves as the key attribute in each relationship class. The **OBJECTID** value is recorded in the related table as the *foreign key* (the field used to reference the related table). Using the **OBJECTID** as the key variable means users do not need to manually maintain numbering schemes, since the system creates and maintains the **OBJECTID** values for new and existing records, ensuring that conflicts are avoided.

Properties for each relationship class may be examined in ArcCatalog by right clicking the relationship class name in the table of contents and selecting Properties... from the context menu. The example at right is for the *rcChemTreatToAssess* relationship class, which links records from the *AllAssessments* feature class to records in the *TreatmentsChem* table.

The relationship is defined as "Simple," meaning that when records are removed from one table, the related records are not affected.

(All ExoticPlantsGDB relationship classes are Simple, with the exception of the relationships between the *TreatmentsChem* and *ActiveIngredient* and *Adjuvant* tables, and between the *TamarixPoints* feature class and *TamarixVisits* table. Those are Composite relationships, meaning that if a record is deleted from the origin table, the related records in the destination table are also automatically deleted.)

The screenshot shows the 'Relationship Class Properties' dialog box with the 'General' tab selected. The 'Name' is 'rcChemTreatToAssess' and the 'Type' is 'Simple'. The 'Cardinality' is '1 - M' and 'Notification' is 'None (no messages propagated)'. Under 'Origin Table/Feature Class', the 'Name' is 'TreatmentsChem', 'Primary Key' is 'OBJECTID', and 'Foreign Key' is 'ChemTreatmentID'. Under 'Destination Table/Feature Class', the 'Name' is 'AllAssessments'. The 'Labels' section shows 'Forward' as 'AllAssessments' and 'Backward' as 'TreatmentsChem'. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Relationship Class Properties	
General Rules	
Name:	rcChemTreatToAssess
Type:	Simple
Cardinality:	1 - M
Notification:	None (no messages propagated)
Origin Table/Feature Class	
Name:	TreatmentsChem
Primary Key:	OBJECTID
Foreign Key:	ChemTreatmentID
Destination Table/Feature Class	
Name:	AllAssessments
Labels	
Forward:	AllAssessments
Backward:	TreatmentsChem
OK Cancel Apply	

The Cardinality is defined as one-to-many (1 – M), meaning that one treatment record may be related to multiple assessment records.

TreatmentsChem is the origin table, and, as mentioned above, uses the **OBJECTID** as the key attribute. The (foreign) key value in the related table *AllAssessments* is **ChemTreatmentID**.

The geodatabase relationship classes and their key attributes are summarized in the following table:

	Relationship Class	Origin feature class/table Primary key	Cardinality	Type	Destination feature class/table Foreign key	
Related data are available for field edit (in ArcPad)	rcPointAssessments	AssessmentPoint (fc) OBJECTID	1:M	Simple	PointData (table) ShapeID	
	rcLineAssessments	AssessmentLine (fc) OBJECTID	1:M	Simple	LineData (table) ShapeID	links one or more species-specific assessment records to assessment geometry records
	rcPolyAssessments	AssessmentPoly (fc) OBJECTID	1:M	Simple	PolyData (table) ShapeID	
	rcTamarix	TamarixPoints (fc) OBJECTID	1:M	Composite	TamarixVisits (table) TamarixID	
Related data are maintained or edited on the desktop	rcChemTreatToAllAssess	TreatmentsChem (table) OBJECTID	1:M	Simple	AllAssessments (fc) ChemTreatmentID	links assessment data with treatment records (for calculation of area treated, etc.)
	rcChemTreatToAI	TreatmentsChem (table) OBJECTID	1:M	Composite	ActiveIngredient (table) ChemTreatID	links one or more chemical-specific records with general information about the treatment, including gallons of mixture used
	rcChemTreatToAdjuvant	TreatmentsChem (table) OBJECTID	1:M	Composite	Adjuvant (table) ChemTreatID	
	rcOccurrenceToAllAssess	Occurrence (fc) OBJECTID	1:M	Simple	AllAssessments (fc) OccurrenceID	links one or more assessment records with an occurrence
	rcGridToAllAssess	Grid250m (fc) OBJECTID	1:M	Simple	AllAssessments (fc) GridID	links one or more assessment records with 250m grid reference
	rcMgmtAreaToAllAssess	ManagementAreas (fc) OBJECTID	1:M	Simple	AllAssessments (fc) ManagementArea	links one or more assessment records with management area

Occurrence, Assessment, and Treatment Data

Weed information is captured and maintained in a set of feature classes and related tables that contain Occurrence, Assessment, and Treatment data (*after* TNC Weed Information Management System (WIMS) - see <http://www.imapinvasives.org/GIST/WIMS/index.html>).

An occurrence identifies a specific infestation of a given species. All occurrences are represented as points in the *Occurrence* feature class. The two primary attributes for occurrences are **Species** and **Status**; **Status** indicates the most recent known activity for the infestation (for example: 'untreated exotics', 'undergoing treatment', 'treatment complete').

Associated with each occurrence record may be any number of assessments, which are date-specific evaluations of a given occurrence. Assessment records include the actual geometry of the infestation on a given date, as well as attributes such as percent cover, number of plants present, phenology, etc.

AssessmentPoint (feature class)					
OBJECTID	AssessDate	BufferRadius	DataDevice	MgmtArea	
523	2/23/2008	10 meters	Recon-Box	undefined	
524	2/26/2008	6 meters	Recon-Echo	undefined	
525	5/1/2008	8 meters	PDA - U1	Hope Hills Ce	
526	7/8/2008	20 meters	desktop	6A North	

PointData (table)					
OBJECTID	Species	PctCover	NumberOfPlants	ChemTreatID	
101	PENCIL	1-5%	6-10	28	
524	PENCIL	26-50%	26-50	78	
524	PENSET	11-25%	6-10	78	
184	BRORUB	51-75%	>500	102	

Assessments of two species represented by a single spatial data record

Assessment data may be captured as points, lines, or polygons; the geodatabase includes an assessment feature class for each geometry type. The assessment *feature classes* are used primarily to record spatial information.

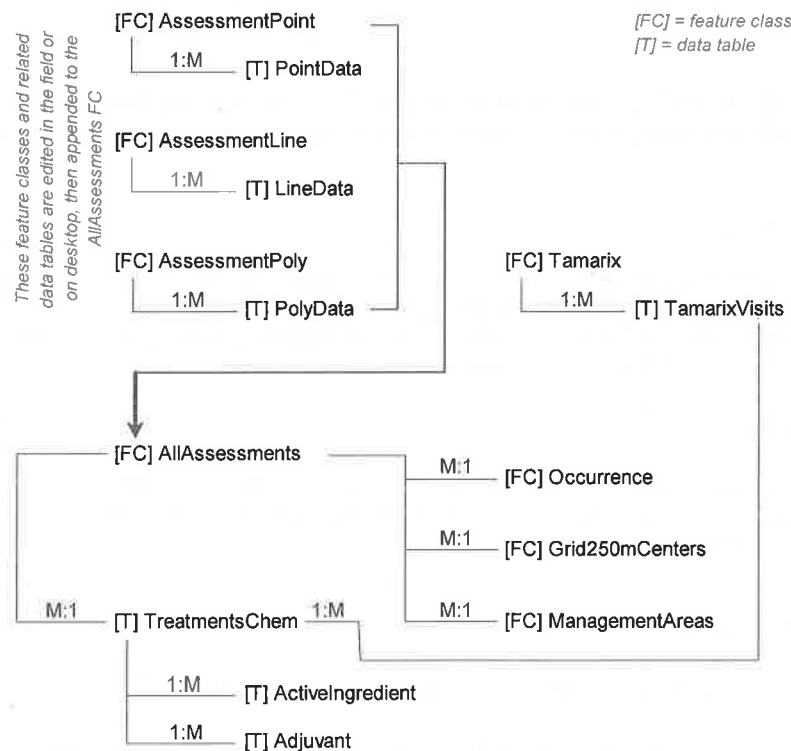
Related (via geodatabase relationship classes) to each point, line, or polygon assessment feature class are *data tables* where species-specific information is recorded. Each record in the data table represents a single species; there may be multiple records in the data table tied to the same feature class record.

A single *AssessmentPoint* record may be used to represent multiple species present at the location, each with its own values for percent cover, number of individuals, phenology, etc (see example, above).

Data from the three assessment feature classes (point, line, and polygon) and their related tables are combined into a single feature class, *AllAssessments*. For point and line features, this requires a buffer operation to create polygons. The derived polygons, as well as assessments captured as polygon features, are appended to *AllAssessments*. This feature class allows for analysis of all assessment data based on a single data source. Conversion of point, line, and poly assessment data into the *AllAssessments* feature class is done on the desktop using provided ModelBuilder routines.

The connection between occurrence and assessment data is specifically expressed between the *Occurrence* and *AllAssessments* feature classes (via the *rcOccurToAllAssess* relationship class).

Relationships between principal feature classes and tables



A ModelBuilder routine that selects and displays the most recent assessment for each occurrence is included in the system; it is intended that the resulting layer (*MostRecentAssessByOccur*) will be checked out to ArcPad for reference by field personnel. Although ArcPad users will be able to view occurrence and related assessment data, *Occurrence* and *AllAssessments* data are created and edited on the desktop. The relationship between occurrence data and actual (point, line, or polygon) assessment records collected in the field is only implied.

Also related to the *AllAssessments* feature class are tables that include chemical treatment data. Treatment data are generally recorded in the field on paper forms, and added to the geodatabase on the desktop. ModelBuilder routines are included that provide limited chemical treatment summary information. More information about treatment data is included in the section on Database Editing and Maintenance and in Appendix E.

Tamarix

Due to factors including distribution patterns and management practices, Tamarix infestations are treated separately from other exotic species in the geodatabase. Tamarix data are captured and maintained in the *TamarixPoints* feature class, along with the related *TamarixVisits* table. This arrangement is similar to the occurrence-assessment approach used for all other exotics. The feature class includes primarily spatial information about each Tamarix instance, and also includes a **Status** variable (similar to the **Status** variable in the *Occurrence* feature class). Data specific to each repeat visit to *TamarixPoints* instances are collected and maintained in the *TamarixVisits* table.

The system will also support capture and representation of systematic Tamarix survey data, should such surveys be undertaken.

Weed Free Trails

The system supports capture and representation of the periodic surveys of the Weed Free Trails route network. Survey start and end points are captured in the field and converted to linear representation on the desktop.

Reference data

The feature dataset Reference includes a number of feature classes representing park boundaries, the management areas (as defined by SNP staff), hydrologic features, and a reference grid on 250 meter centers covering the entire extent of the park. Assessment records also participate in relationships with the ManagementAreas and Grid250m feature classes.

Intermediate/temporary files

Files in the Intermediate feature dataset are generally created and/or accessed by the ModelBuilder routines as they process data. Data in these files are temporary, and are overwritten each time the various ModelBuilder tools are executed.

Data Entry and Post Processing

Data may be added to the ExoticPlantsGDB in one of two ways:

- Using ArcPad equipped GPS receivers and the ArcPad Data Manager check out/check in procedures
- Direct entry in ArcMap (on the desktop) of field data collected using paper data forms. Currently, this is the only method of capturing occurrence or treatment data.

Procedures for both methods are detailed in the following sections. Regardless of which method is used, a certain amount of desktop database maintenance and editing is required.

ESRI GIS dictionary

More information on terms used in this document may be found at:

<http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway>

Field Data Collection with ArcPad

Process Overview

This section introduces general concepts pertaining to exotic plant data collection using ArcPad equipped GPS receivers. Detailed instructions are included in the sections that follow.

In general, using ArcPad to collect data involves three steps:

1. Check out data to the GPS unit. This is done from an ArcMap document, using the ArcPad Data Manager
2. Capturing data in the field
3. Checking in collected data, again using the ArcPad Data Manager in ArcMap

Map layers are checked out to field GPS units either for display only ("Copy Out," or read-only) or editing ("Check Out," or read-write). Upon check in, the geodatabase will be updated with changes or additions to layers checked out for editing. Certain data layers (trails, hydrology, etc.) are copied out (read-only) for reference only and will not be available for editing.

For point, line, and polygon assessment data, the option to "Only check out schema of data to edit" will be selected. This means that the tables checked out for editing will not contain any records, and on check in, only new records will be added to the geodatabase. In the case of *Tamarix*, however, users need the ability to edit existing records, so the "Only check out schema" option will *not* be selected.

In the ArcMap document (APcheckout.mxd) used to check out data to the field units, certain feature class attributes are hidden, or turned off, so that they are not visible or editable by field staff. Feature class and table attributes have also been assigned *aliases*, or alternate names; it is the alias that is visible to the ArcPad user (for example, the attribute **NumberOfPlants** has been assigned the alias **#ofPlants**). Attribute names cannot be changed, but aliases can.

The check out process using ArcPad Data Manager creates a folder which is then copied to the GPS units via the ActiveSync connection. Geodatabase data checked out to the units for edit are stored in the folder as an .axf file; it is the .axf file that is edited in the field and will contain the geodatabase updates. The checkout folder also includes an .apm file (ArcPad map), which includes layer symbology, labels, etc., as displayed in the current ArcMap document. The checkout folder and .apm file are assigned names that reflect the date and GPS unit to be used.

In the field, collecting *assessment* records involves the following three steps; each of the three steps is completed on a separate ArcPad screen:

1. Recording assessment geometry (points, lines, or polygons)
2. Adding attribute data for the geometry (date, who collected data, GPS unit used, etc.)
3. Adding species specific attribute data (species name, percent cover, etc.)

Recording *Tamarix* data is slightly different, but may also be thought of as a three step process:

1. Collecting *Tamarix* geometry, or selecting an existing record (in the case of revisits)
2. Adding or updating attribute data for the geometry (status, length of infestation, etc.)
3. Adding visit specific attribute data (date, number of revisits needed, etc.)

It is critically important that the GPS units are set to the correct time and date. It is very likely that data collected using GPS units with incorrect time/date settings will not be able to be checked in to the GDB using ArcPad Data Manager; such data will have to be reviewed and manually entered on the desktop.

Collecting data from a control point on a daily basis, before you begin collecting data and after you have finished collecting data, provides an important system check. It allows you to identify problems with positional accuracy that can be caused by satellites, the atmosphere, or the receiving unit. Data collected on dates when there are problems with this system check should not be used.

Data check out using ArcPad Data Manger

1a. Start ArcMap, and open APcheckout.mxd.

This map document is located in the "mxds" folder in the "ExoticPlantsGDB" folder, and includes layers representing the following:

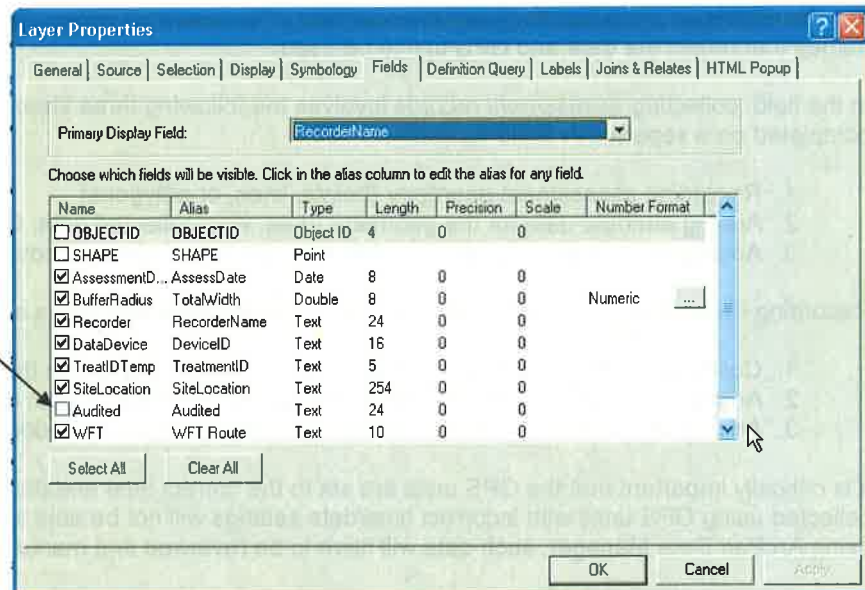
- Daily control points feature class
- Point, line, and polygon assessment feature classes and their related data tables
- Layers representing the most recent assessment for each occurrence and management area (selections from *AllAssessments*)
- Tamarix layers, including the *TamarixPoints* feature class and related table, a layer representing the most recent visit and status of each Tamarix instance, and a layer to record wash survey points
- Layer to record Weed Free Trail survey start and end points
- Various reference layers (trails, management areas, park boundaries, etc.)

SNP staff may develop other .mxd files, layers, etc. for use in the check-out process, depending on intended use, management objectives, and user preferences.

*Note: Certain fields have been (or should be) hidden, or turned off; hidden fields are not checked out to the units and so are not editable by field staff. In particular, the **Audited** field in the *AssessmentPoint*, *Line*, and *Poly* feature classes should be set as not visible. This is an important field during post processing, but is not intended to be edited in the field.*

1b. Turn off Audited in the assessment feature classes: double click the *AssessmentPoint* layer in the table of contents to open the Layer Properties dialog, and select the Fields tab. Uncheck the boxes as shown below to hide, or turn off, fields. Do the same for the *AssessmentLine* and *AssessmentPoly* feature classes:

Uncheck boxes to hide fields



2. **Enable the ArcPad Data Manager extension (Tools>Extensions), and add the ArcPad Data Manager toolbar to the map if it is not present (Tools>Customize>Toolbars tab).**

ArcPad Data Manager (This is *not* the same as the ArcPad toolbar.)

3. **Bring the desired extent to view in the map document:** use the pan and zoom controls in ArcMap to adjust the view.

ArcPad Data Manager includes the option to check out only those features in the current map extent, which helps limit the size of the file checked out to the GPS units; in many cases, this will be the appropriate option.

4. **Click the “Get Data for ArcPad” button** on the ArcPad Data Manager toolbar. Page one of the “Get Data for ArcPad” dialog opens.

5a. **Select layers for Check Out and Copy Out.**

Layers may be checked out for either display only $\Rightarrow$ (“Copy Out,” or read-only) or editing $\Rightarrow$ (“Check Out,” or read-write). Note that the scroll bar on the right may need to be used in order to view all map layers.

Note: NPS staff will decide on appropriate layers for check out. In this example, the standard set of Assessment data are checked out, along with accompanying reference layers.

Check Out: schema only

GPSControlPoints
AssessmentPoint (+ PointData 1:M)
AssessmentLine (+ LineData 1:M)
AssessmentPoly (+ PolyData 1:M)
WFTSurveyPoints (optional)

Copy Out

MostRecentAssessByOccur
MostRecentAssessByMA
HydroRoutesRMD
ManagementAreas
trails, roads, park boundaries, etc

Note: Tamarix data are checked out separately in step 6.

Make sure the option to “Only check out schema of data to edit” is checked. This means that the tables checked out for editing will not contain any records.

Once the desired layers have been selected and the schema option set, click the Next > button to go to the second page of the form.

The screenshot shows the 'Get Data For ArcPad' dialog box. It has a title bar with a question mark and a close button. The main text says: 'This wizard prepares data in your map for display or editing in ArcPad. Choose the layers you want to get from the map. Note: Only layers from one database can be selected for editing. Note: Only layers that have the map's spatial reference can be selected for editing.'

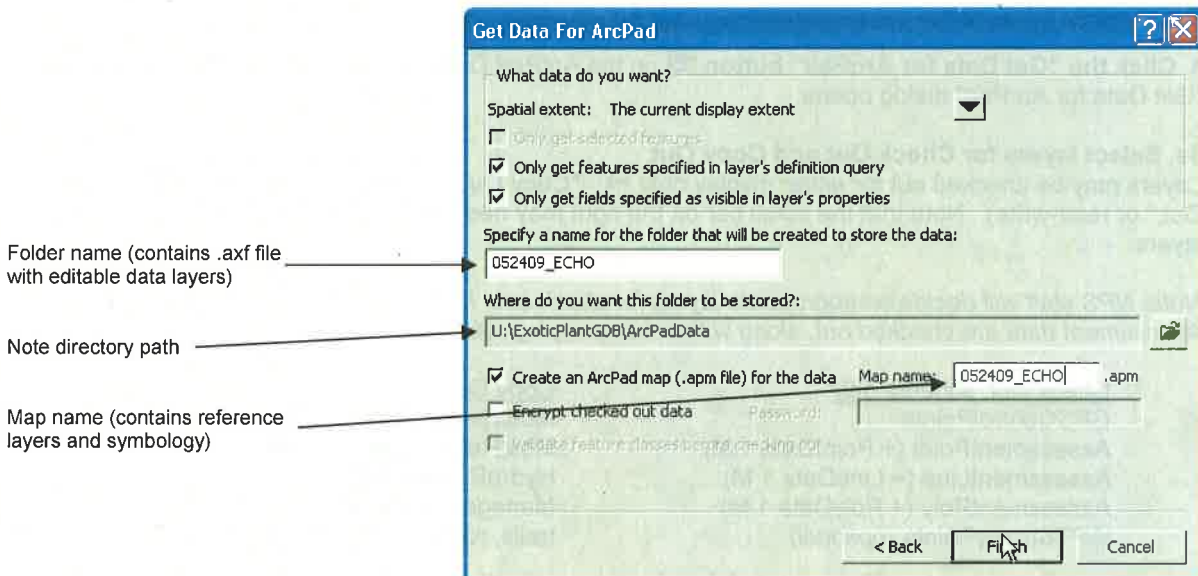
Below the text is a table with two columns: 'Layer' and 'Folder or Database'. The table lists several layers with checkboxes in the first column. The layers are: trails_tmd, HydroRoutesRMD, AssessmentLine (+ LineDa..., AssessmentPoint (+ Point..., AssessmentPoly (+ PolyDa..., ManagementAreas, BoundaryRMD, BoundaryTMD, and MostRecentAssessByMA. The checkboxes for AssessmentLine, AssessmentPoint, AssessmentPoly, ManagementAreas, and MostRecentAssessByMA are checked.

At the bottom of the dialog, there is a checkbox labeled 'Only check out schema of data to edit' which is checked. To its right is a dropdown menu for 'Image output' set to 'JPEG 2000'. On the right side of the dialog, there are three buttons: 'Select All for Check Out', 'Select All for Copy Out', and 'Clear All'. At the bottom right, there are three buttons: '< Back', 'Next >', and 'Cancel'. The 'Next >' button is highlighted.

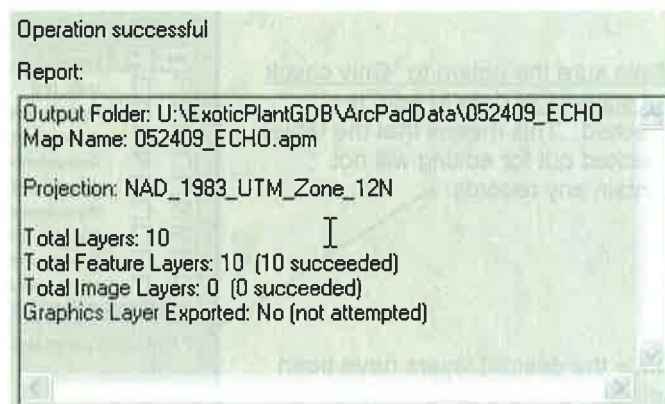
5b. **Complete page two of the check out dialog:** the second screen of the Get Data dialog allows users to make further specifications regarding the data to be checked out.

Generally, the check boxes should be left in the configuration shown (the default). If they are not, check the three boxes as indicated. It should not be necessary to encrypt checked out data.

Finally, enter appropriate file names for the folder containing the .axf file, along with the .apm file. The file names reference the check out date and GPS unit, and should follow the format "MMDDYY_UNIT NAME." Record the file name, etc. in the data check out log.



Clicking the Finish button will cause the ArcPad Data Manager to process the data, creating the specified folder containing the .axf file and .apm file. A report such as the example below will be generated, summarizing details about the checkout process.



6. Check out Tamarix data.

6a. Open the *TamarixPoints* properties dialog, and turn off the **Audited** and **PreviousID** attributes so that these are not checked out to the units. (See step 1b above.)

6b. Repeat steps 4 and 5, above, selecting layers as follows. Do not select the option to "Only check out schema of data to edit."

Check Out

TamarixPoints (+TamarixVisits 1:M)
WashSurveyPoints

Copy Out

TamarixMostRecent
HydroRoutesRMD
ManagementAreas
trails, roads, park boundaries, etc

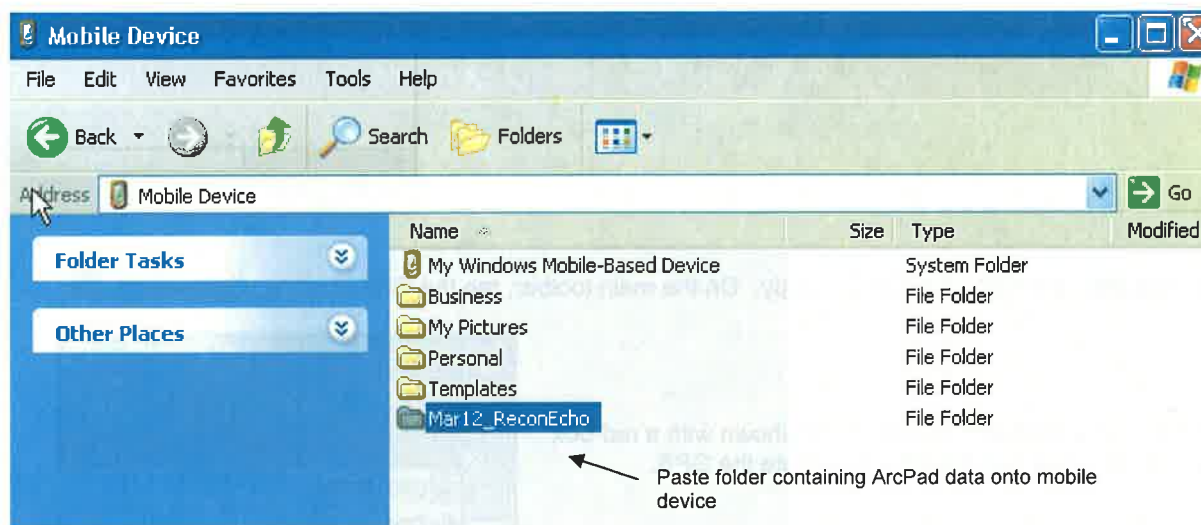
Make sure to enter appropriate folder/file names, following the format "MMDDYY_UNIT NAME_TAM."
Record the appropriate information in the data check out log.

7. **Confirm that the time and date on the GPS unit are correct.** If they are not, make the appropriate changes. For units running Windows CE, this can be done from the Start menu: Start>Settings>System tab>Clock.

8. **Copy the ArcPad data folder(s) to the GPS unit:**

8a. Attach the appropriate GPS unit to its base station and establish an ActiveSync connection (a Guest Partnership is adequate).

8b. Click the "Explore" button on the main ActiveSync screen (or go to "My Computer," etc.) and navigate to the ArcPadData folder in the ExoticPlantsGDB directory. Find the folder containing the check-out folder(s) you just created, then simply copy and paste the entire folder into the (top-level) "Mobile Device" directory. [This may not be the appropriate location for ArcPad data on units equipped with removable storage cards.]



The unit is now ready for data collection.

Using ArcPad to collect assessment data in the field

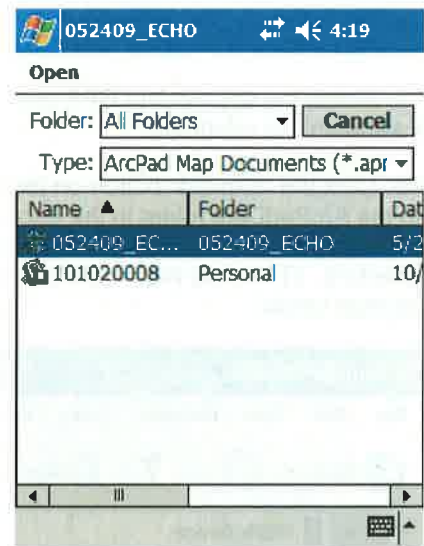
These instructions assume one or more folders containing data for ArcPad have been checked out to the GPS unit following the steps above.

1. **Before starting ArcPad, confirm that the time and date on the unit are correct.** If they are not, make the appropriate changes. For units running Windows CE, this can be done from the Start menu: Start>Settings>System tab>Clock.

2. **Start ArcPad**, either from the Programs menu (Start>Programs) or by tapping the ArcPad icon if it is present on the welcome screen .



3. **Open the appropriate .apm document:** from the "Start ArcPad with" screen, choose An existing map or data, then click the OK button on the Command bar (at the bottom of the screen). The Open dialog appears; select the appropriate ArcPad map document (.apm) from the list.



4. **Activate the GPS**, if it is not already. On the main toolbar, tap the GPS position window icon .

If active, the GPS Active icon will be shown with a red box around it. If not, tap the icon to activate the GPS.



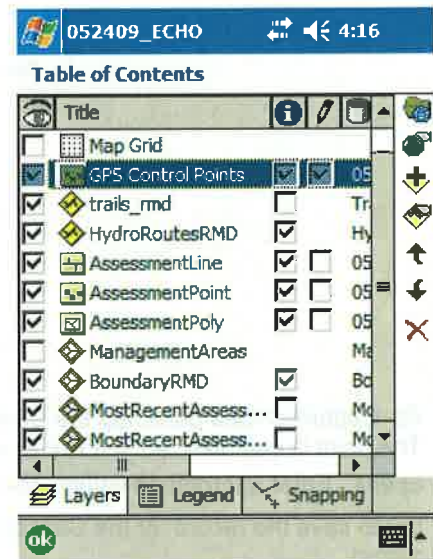
Note: GPS preferences may need to be configured for each unit. See the ArcPad User Guide for details on setting GPS preferences.

It is suggested that the option to Enable Averaging is selected: In GPS preferences, select the Capture tab and check the box to Enable Averaging. Set the desired number of positions to average for points. (This option results in more accurate data, but can slow data capture and so may not be appropriate in all situations.)

5. **Collect a GPS Control Point** at one of the established control locations (see Process Overview section, above, for comments on control points):

5a. Make the layer editable: open the table of contents by tapping its icon on the main toolbar . Check the box to make *GPS Control Points* editable, then click OK  on the command bar. (Alternatively, tap the Start/stop editing icon  on the browse toolbar, and select the desired layer from the list.)

The table of contents is used to turn layers on or off, to make them available for the Identify tool, and to make them editable.



5b. Capture a data point: tap the Capture Point Using GPS icon . The point is captured, and in a few moments the attributes table opens. Enter appropriate values, then tap OK  on the command bar to save the record, or the Cancel button  to discard the record.

Note: The column widths may be adjusted in order to facilitate data entry; drag the divider bars in the column headings. Also note the slider bar at bottom (only present if columns extend beyond the viewable screen width).

GPS Control Points attribute entry

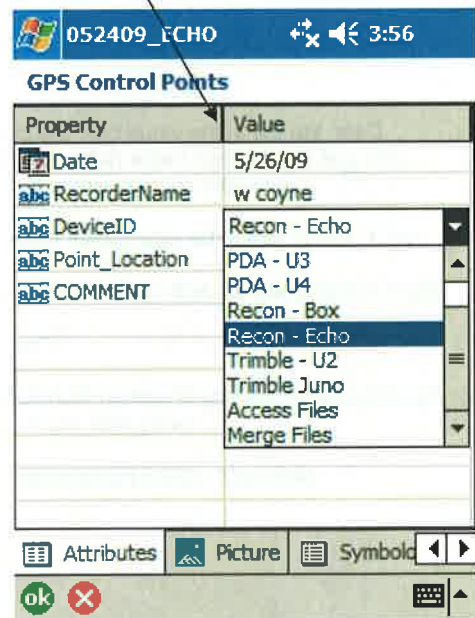
Date: tap the in the value box; the current date should appear. (tip: just tap the field name (left column), not the value box, then adjust the column widths by dragging the divider bars)

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

Point_Location: select the appropriate known location from the list, or "other: see comments" if appropriate.

Comment: optional text field. Describe your location if other than a standard control points.



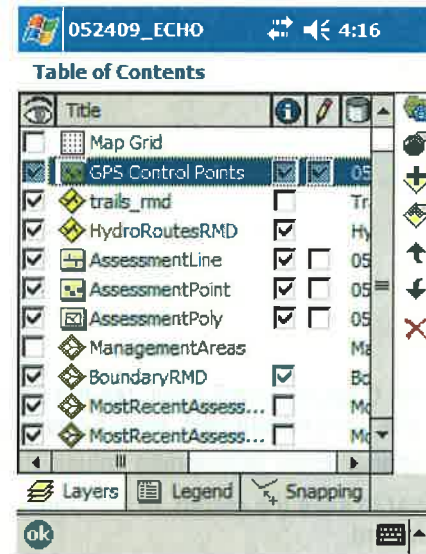
Property	Value
Date	5/26/09
RecorderName	w coyne
DeviceID	Recon - Echo
Point_Location	PDA - U3
COMMENT	PDA - U4

5c. Open the table of contents again and uncheck the box so that *GPS Control Points* is not editable.

6. Optional: **Collect a Weed Free Trails survey “Start” point.** If this is not part of a Weed Free Trails survey, proceed to step 7 or 8 to collect assessment point, line, or polygon records.

6a. Make the layer editable: open the table of contents by tapping its icon on the main toolbar . Check the box to make *WFTSurveyPoints* editable, then click OK  on the command bar. (Alternatively, tap the Start/stop editing icon  on the browse toolbar, and select the desired layer from the list.)

The table of contents is used to turn layers on or off, to make them available for the Identify tool, and to make them editable.



6b. Capture a data point: tap the Capture Point Using GPS icon . The point is captured, and in a few moments the attributes table opens. Enter appropriate values, then tap OK  on the command bar to save the record, or the Cancel button  to discard the record.

Note: The column widths may be adjusted in order to facilitate data entry; drag the divider bars in the column headings. Also note the slider bar at bottom (only present if columns extend beyond the viewable screen width).

WFTSurveyPoints attribute entry

Date: tap the in the value box; the current date should appear. (tip: just tap the field name (left column), not the value box, then adjust the column widths by dragging the divider bars)

WFT_route: select the appropriate route designation from the list.

StartOrStop: there are two options – (survey) Start or (survey) Stop.

Comments: optional text field.

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

Property	Value
Date	6/11/09
WFT_route	Route B
StartOrStop	
COMMENTS	optional
RecorderName	<Null>
DeviceID	<Null>

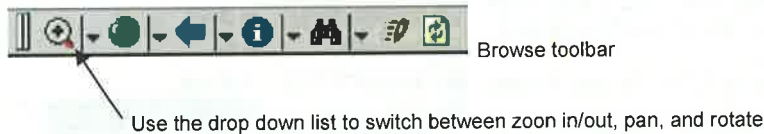
6c. Open the table of contents again and uncheck the box so that *WFTSurveyPoints* is not editable.

7. Collect (polygon) assessment data:

Step 7 describes the collection of polygon assessment data; description of the procedure to collect point or linear assessments appears in step 8.

7a. Open the table of contents, and check the appropriate box to make *AssessmentPoly* editable.

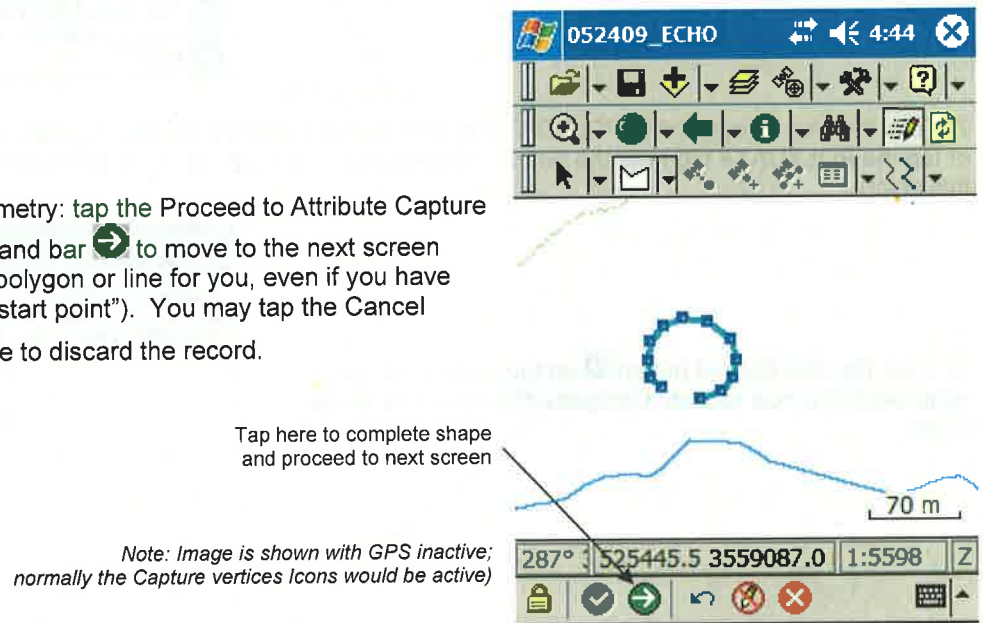
Note: You may wish to use the zoom or pan controls to make the display scale and position more suitable. Toggle between the zoom in, zoom out, and pan tools using the control on the browse toolbar:



7b. Add vertices to create the polygon: use either the Add GPS Vertex tool  to add vertices one at a time, or the Add GPS Vertices Continuously tool  to add points continuously. When collecting points continuously, you may pause collection by tapping the tool button, then tap again to resume collection.

Note: For smaller areas, it is recommended to add vertices manually (one at a time) using the Add GPS Vertex tool.

7c. Finalize the geometry: tap the Proceed to Attribute Capture button on the command bar  to move to the next screen (this completes the polygon or line for you, even if you have not returned to the "start point"). You may tap the Cancel button  at anytime to discard the record.



Note: multiple species may be represented by the same spatial feature. Some of the assessment attributes are specific to the spatial feature and so are captured only once for each assessment; the attributes specific to each species are captured separately, in a related table. In ArcPad, this relationship is maintained automatically.

7d. Enter the AssessmentPoly attributes.

Note: The column widths may be adjusted in order to facilitate data entry. Drag the divider bars in the column headings. Also note the slider bar at bottom (only present if columns extend beyond the viewable screen width).

AssessmentPoly attribute entry

AssessDate: tap in the value box; the current date should appear.
(tip: just tap the field name (left column), not the value box, then adjust the column widths by dragging the divider bars)

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

SiteLocation: optional text field.

WFT_route: select the route from the pick list, if appropriate, or accept the default (n/a) if not surveying a WFT route.

Property	Value
AssessDate	6/11/09
RecorderName	m davis
DeviceID	Echo
SITELOCATION	optional
WFT_route	n/a
POLYDATA	None

7e. Tap the blue arrow next to POLYDATA to view the related table containing species-specific records, or tap the POLYDATA tab near the bottom of the screen. This opens the related table (which is empty at this point):

SHAPEID	SPECIES	PERCE...	NUMBE...

7f. Click the Add Record button (+) on the command bar to begin editing a new record. Complete the record as shown below.

Note: it is possible to collect geometry and geometry attributes without entering species data in the Point/Line/PolyData table. If this happens, simply select the feature on the map, then click the Feature Properties button on the Editor toolbar and navigate back to this screen.

At least one record must be added to the PolyData table.

PolyData table attribute entry

Comment: optional text field.

SpeciesName: select the appropriate value from the list.

PctCover: select the appropriate value from the list.

#ofPlants: select the appropriate value from the list.

Life_Stage: select the appropriate value from the list.

TreatType: select the appropriate value from the list.

PctTreated: select the appropriate value from the list.

SHAPEID: this is the system-maintained foreign key linking PolyData records to the parent geometry in AssessmentPoly. Users should not attempt to edit this field.

052409_ECHO 5:01

AssessmentPoly

Property	Value
COMMENT	optional
SpeciesName	Pennisetum setaceum
PctCover	6-10%
#ofPlants	5
Life_Stage	mature
TreatType	No Treatment
PctTreated	No Treatment
SHAPEID	2
AssessmentP...	

Attributes POLYDATA 1/1

ok X ↩ +

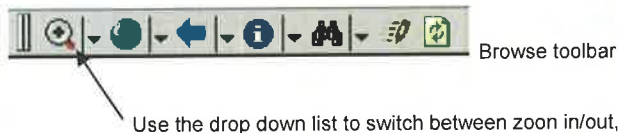
7g. Tap OK  to complete the record and return to the map, or the tap the Add Record button  to add another species entry. You may also add or edit records in the PolyData (species) table by selecting a feature, then clicking the Feature Properties button on the Editor toolbar  (assuming the layer is still available for editing).

8. Collect (point or line) assessment data:

Step 8 describes the collection of point assessment data; the procedure to collect linear assessment data is nearly identical with the exception of, of course, differences in the geometry. The primary difference between point or line and polygon assessments is that point and line records include the **TotalWidth** field used to create polygon representations (by buffering) during post processing.

8a. Open the table of contents, and check the appropriate box to make AssessmentPoint editable.

Note: You may wish to use the zoom or pan controls to make the display scale and position more suitable. Toggle between the zoom in, zoom out, and pan tools using the control on the browse toolbar:



8b. Add vertex/vertices to record the point/line: use the Add GPS Vertex tool  to add a vertex.

8c. For points, the *AssessmentPoint* attribute table opens automatically after a point has been recorded; For lines, it is necessary to tap the Proceed to Attribute Capture button  to complete the geometry and proceed to the *AssessmentLine* attribute screen (see 6c, above).

Note: multiple species may be represented by the same spatial feature. Some of the assessment attributes are specific to the spatial feature and so are captured only once for each assessment; the

attributes specific to each species are captured separately, in a related table. In ArcPad, this relationship is maintained automatically.

8d. Enter the *AssessmentPoly* attributes.

Note: The column widths may be adjusted in order to facilitate data entry. Drag the divider bars in the column headings. Also note the slider bar at bottom (only present if columns extend beyond the viewable screen width).

AssessmentPoint attribute entry

AssessDate: tap in the value box; the current date should appear.
(tip: just tap the field name (left column), not the value box, then adjust the column widths by dragging the divider bars)

TotalWidth: select the approximate width of the area from the list.

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

SiteLocation: optional text field

WFT_route: select the route from the pick list, if appropriate, or accept the default (n/a) if not surveying a WFT route.

8e. Tap the blue arrow next to POINT/LINEDATA to view the related table containing species-specific records, or tap the POINT/LINEDATA tab near the bottom of the screen. This opens the related table (which is empty at this point):

8f. Click the Add Record button  on the command bar to begin editing a new record. Complete the record as shown below.

Note: it is possible to collect geometry and geometry attributes without entering species data in the Point/Line/PolyData table. If this happens, simply select the feature on the map, then click the Feature Properties button on the Editor toolbar  and navigate back to this screen.

At least one record must be added to the Point/LineData table.

PointData table attribute entry

Comment: optional text field.

SpeciesName: select the appropriate value from the list.

PctCover: select the appropriate value from the list.

#ofPlants: select the appropriate value from the list.

Life_Stage: select the appropriate value from the list.

TreatType: select the appropriate value from the list.

PctTreated: select the appropriate value from the list.

Property	Value
COMMENT	optional
SpeciesName	Pennisetum ciliare
PctCover	6-10%
#ofPlants	5
Life_Stage	mature
TreatType	No Treatment
PctTreated	Mechanical
SHAPEID	No Treatment
AssessmentP...	n/a

8g. Tap OK to complete the record and return to the map, or tap the Add Record button to add another species entry. You may also add or edit records in the *Point/LineData* (species) table by selecting a feature, then clicking the Feature Properties button on the Editor toolbar (assuming the layer is still available for editing).

9. Optional: **Collect a Weed Free Trails survey “Stop” point.** Follow the procedure in step 6, above, and specify “Stop” for the *StartOrStop* attribute.

If this is not part of a Weed Free Trails survey, proceed to step 10, below.

10. **Exit ArcPad:** when you have finished collecting assessment data, tap the down arrow next to the folder icon on the Main toolbar, and select Exit from the drop down menu.

Note: it is not necessary to save the .apm (ArcPad map) document. Feature edits are saved to the .axf file as the records are successfully completed. The data that are checked back in to the geodatabase are contained in the .axf file, not the .apm document.

Using ArcPad to collect Tamarix data in the field

Notes: There are two basic scenarios under which Tamarix data are collected: 1) Revisiting a known plant or group of plants, and 2) collecting data for a previously unknown plant or group of plants. Both situations are considered in the procedures below.

*Tamarix infestations are generally represented as points. Several plants distributed over an area are represented by a single point feature; the attributes **PatchLength** and **#ofPlants** provide details about the infestation. Note that certain attributes, such as **Status**, **RevisitsNeeded**, and **PatchLength** are dynamic, and are updated at each revisit to known infestations.*

*The TamarixPoints and related TamarixVisits contain the associated fields **Status** and **Revisits**, respectively. Both have attribute values constrained by coded value domains, and are related as follows:*

TamarixPoints: MgmtStatus (Alias: Status)		TamarixVisits: Revisits (Alias:RevisitsNeeded)	
code and description		code	description
Untreated Exotics		4	untreated
Undergoing Treatment		3	needs 3 revisits
		2	needs 2 revisits
		1	needs 1 revisits
Treatment Complete		0	treatment complete
undefined		9	unknown

As with assessment data, Tamarix data are collected in a feature class and a related data table. Unlike assessment data, actual database records are checked out the the GPS units for editing (as opposed to empty tables, as is the case with assessment data). This allows existing records to be updated.

These instructions assume a folder containing Tamarix data for ArcPad has been checked out to the GPS unit, that the time and date on the unit are set correctly, that ArcPad is running with the GPS Active, and that a GPS control point has been collected. See steps 1 – 5 under "Using ArcPad to collect assessment data in the field," above; also see that section for more details on the procedures described below.

11. Open the ArcPad map containing Tamarix data: click the Open Map icon on the main toolbar  and browse to the appropriate .apm document.

12. Optional: Collect a WashSurveyPoint.

Note: WashSurveyPoints records are used to track which reaches of the hydrologic features in the park have/have not been surveyed for Tamarix. Steps 2, 3, and 5 apply when wash survey data are to be recorded. Tamarix data may be collected without recording WashSurveyPoints data.

Two WashSurveyPoints records are recorded for each wash, representing the beginning and end of the reach surveyed.

12a. Prior to collecting the survey start/stop points, determine the name of the wash, either from the label displayed on ArcPad, or by using the Identify tool  and clicking on the appropriate map feature. (The identify tool only operates on layers that have Identify turned on in the table of contents.)

12b. Make WashSurveyPoints editable: open the table of contents  and check the box in the Start/Stop Editing column to make WashSurveyPoints editable. Click OK on the command bar to close the table of contents. (See step 5 above.)

12c. **Capture a wash survey start point:** tap the Capture Point Using GPS icon . The point is captured, and in a few moments the attributes table opens. Enter appropriate values, then tap OK  on the command bar to save the record, or the Cancel button  to discard the record.

Note: The column widths may be adjusted in order to facilitate data entry. Drag the divider bars in the column headings. Also note the slider bar at bottom.

WashSurveyPoints attribute entry

Date: tap in the value box; the current date should appear.

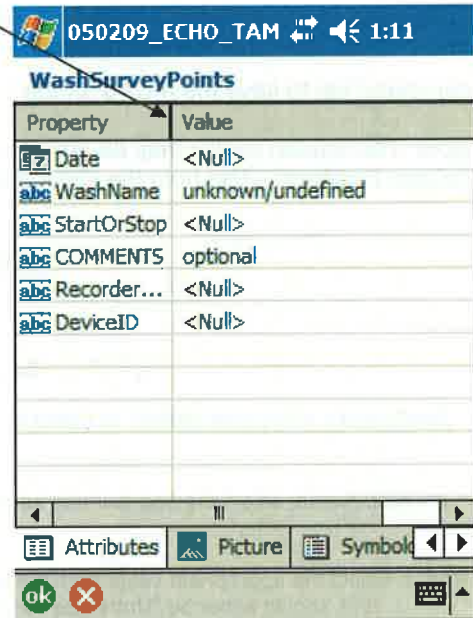
WashName: select the appropriate value from the list.

StartOrStop: select appropriate value – either survey start or end.

Comments: Optional text field.

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

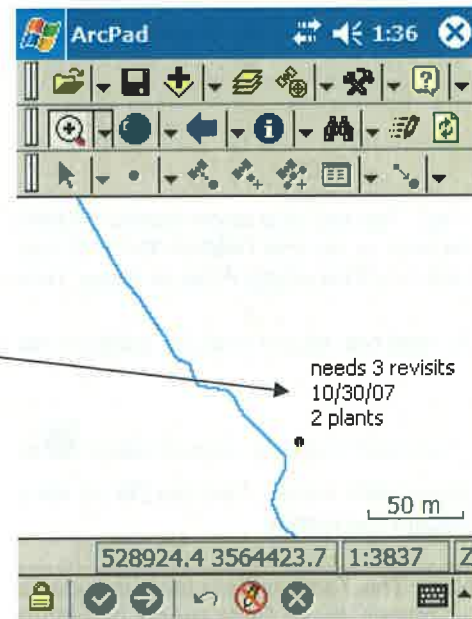


Property	Value
Date	<Null>
WashName	unknown/undefined
StartOrStop	<Null>
COMMENTS	optional
Recorder...	<Null>
DeviceID	<Null>

12d. Open the table of contents again and uncheck the box so that *WashSurveyPoints* is no longer editable.

13. **Collect Tamarix data:** Open the table of contents  and check the box in the Start/Stop Editing column to make *TamarixPoints* editable.

Note: You may also wish to turn the TamMostRecent layer on or off as appropriate – the label provides information about the most recent visit to an infestation.



Note: as mentioned above, there are two scenarios for recording Tamarix data: creating a new Tamarix location record, or collecting revisit data for a previously recorded Tamarix location. Similar to assessment data, Tamarix data are recorded in a feature class representing the location of the plant(s), and a related data table which contains information specific to each revisit.

13a. If a new Tamarix location is to be recorded: (Go to step 13b if this is a revisit to an existing infestation.)

13a1. Capture a TamarixPoints record: tap the Capture Point Using GPS icon . The point is captured, and in a few moments the attributes table opens. Enter appropriate values, then tap OK  on the command bar to save the record, or the Cancel button  to discard the record.

Note: The column widths may be adjusted in order to facilitate data entry. Drag the divider bars in the column headings. Also note the slider bar at bottom.

TamarixPoints attribute entry

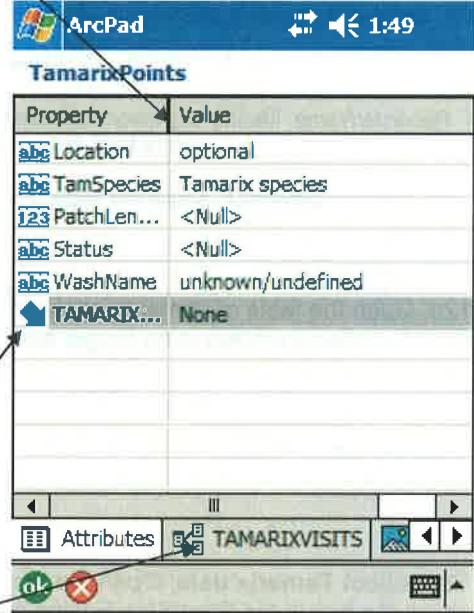
Location: optional text field.

TamSpecies: accept the default, or select the appropriate value from the list.

LengthInfested: select the approximate length over which plants are distributed.

Status: select the appropriate value from the list. For first encounters, this should either be "Untreated" or "Undergoing Treatment". For return visits, this field may be updated if necessary.

Wash Name: accept the default, or select the appropriate value from the list.



Property	Value
Location	optional
TamSpecies	Tamarix species
PatchLen...	<Null>
Status	<Null>
WashName	unknown/undefined
TAMARIX...	None

13a2. Tap the blue arrow next to TAMARIXVISITS to enter the related table containing visit-specific records, or tap the TAMARIXVISITS tab near the bottom of the screen. This opens the related table (which will be empty if this is a new Tamarix record).

At least one record must be added to the *TamarixVisits* table.

13a3. Click the Add Record button  on the command bar to begin editing a new record. Enter appropriate values, then tap OK on the command bar to save the record, or the Cancel button  to discard the record.

Note: The *TamarixVisits* table includes some fields not intended for edit by field staff. Due to ArcPad limitations, these fields cannot be hidden, or turned off. Users need to be aware that the fields should not be edited. The particular fields appear at the bottom of the table, and are: **TAMARIXID**, **TREATMENTID**, and **AUDITED**.

Note: The column widths may be adjusted in order to facilitate data entry. Drag the divider bars in the column headings. Also note the slider bar at bottom.

TamarixVisits attribute entry

Comments: Optional text field.

Date: tap in the value box; the current date should appear.

#ofPlants: select the appropriate value from the list.

AvgDiameter: select the appropriate value from the list.

Life_Stage: select the appropriate value from the list.

Treatment: select the appropriate value from the list.

RevisitsNeeded: enter the number of revisits that will be required following the current visit.

RecorderName: identity of person recording data. This is a free text entry field, but some data must be entered.

DeviceID: select the appropriate GPS unit from the list.

DO NOT EDIT TAMARIXID, TREATMENTID, OR AUDITED.

See note above.

13b. If revisit data is to be recorded for an existing Tamarix location

13b1. The existing Tamarix point should be visible on the map display. Note the label, which indicates the number of revisits necessary as of the last visit. (This is not the same as the label for the *TamMostRecent* label, mentioned above.)

13b2. Tap the Select tool button  on the Edit toolbar to activate it, then tap the Tamarix record to select it on the map. The dashed box around the point indicates the record is selected.

13b3. Tap the feature properties button  to open the attribute data. The screen will be similar to that shown in step 13a1, above.

Note: Simply double tapping the Tamarix record on the map with the select tool will also open the attribute record.

Note that the attributes table is already populated, and that there are one or more records indicated in the related TamarixVisits table. If necessary, edit the attributes table. Typically, this is limited to changing the **Status** value (for example, from "Undergoing Treatment" to "Treatment Complete").

13b4. Tap the blue arrow next to TAMARIXVISITS to enter the related table containing visit-specific records, or tap the TAMARIXVISITS tab near the bottom of the screen. This opens the related table. This table includes records for previous visits. (See 13a2, above.)

13b5. Click the Add Record button  on the command bar to begin editing a new visit record (see 13a3, TamarixVisits attribute entry, above). Enter appropriate values, then tap OK on the command bar to save the record, or the Cancel button  to discard the record.

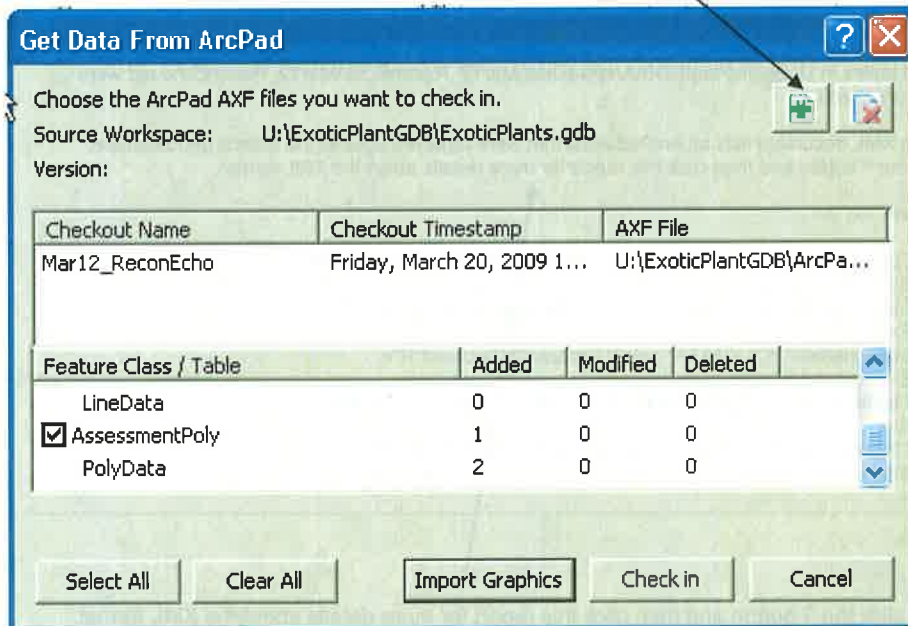
14. **Optional: Capture a wash survey stop point.** When the survey is complete, repeat step 12 above, entering appropriate attribute values.

15. **Exit ArcPad:** tap the down arrow next to the folder icon on the Main toolbar, and select Exit  from the drop down menu.

1. **Attach the GPS unit to its base station.** This should initiate an ActiveSync session. If prompted to Set Up a Partnership, do so. (A Guest partnership is adequate.)
2. **Copy the folder containing the data previously checked out to ArcPad, and paste it in the ArcPadData folder in the ExoticPlantsGDB directory:** use Windows Explorer (My Computer, etc.) and navigate to the Mobile Device. This is simply the reverse of step 8 in checking out ArcPad data. Since the folder already exists in that location, you will be prompted to "Confirm Folder Replace" – select "Yes to All" to complete the transfer.
3. **Start ArcMap, and open APcheckout.mxd.** The ArcPad Data Manager extension and the ArcPad Data Manager toolbars should still be active, but if not, activate the extension and/or toolbar (see step 2 of the check out process).
4. **Start an Edit session in ArcMap.** If the Editor toolbar is not present, add it to the map (Tools>Customize>Toolbars tab>check Editor, then click the Close button). Click the Editor button, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data.

Note: By conducting the check in process in an edit session, you will have a chance to review the potential changes to the ExoticPlantsGDB before they become permanent. You can check in data outside of an edit session, but a warning message will appear should you attempt to do so.

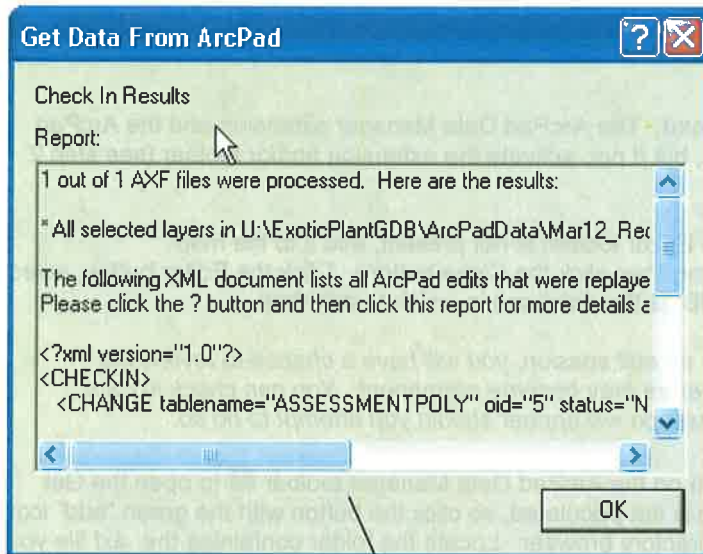
5a. **Click the Get Data from ArcPad button** on the ArcPad Data Manager toolbar  to open the Get Data From ArcPad dialog. Initially, the table is not populated, so click the button with the green "add" icon at the upper right of the dialog to launch a directory browser. Locate the folder containing the .axf file you wish to check in, and select it.



Scroll through entries in the lower pane to review the number and type of changes that are about to be applied to the geodatabase. In the example here, one new assessment polygon has been added, and two new records were added to the related table (i.e. one new polygon feature representing two separate species). One new point record was also added; it is not visible in the above screen capture.

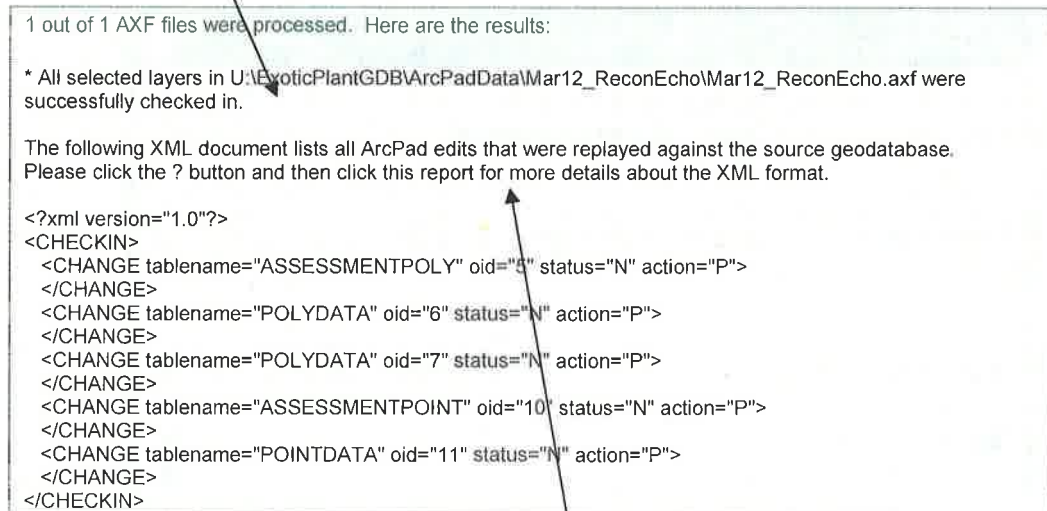
Note: If there appear to be problems, you may wish to cancel the check in pending further review. The .axf file will remain intact in the ArcPadData folder until it is deleted.

5b. Check the boxes to select feature classes/tables for check in, and then click the Check in button. Click Yes if prompted to confirm check in.



After processing the edits, a summary dialog is produced. Although cumbersome to review in this form (using the scroll bars), the text can simply be copied and pasted into a text editor (see below).

This results summary provides details of the check in process. The following is the complete text from the "Check In Results" dialog for the present example:



Note the comment "Please click the ? button and then click this report for more details about the XML format." Doing so produces a screen containing the following information, which can be used to interpret the codes in the result details above:

In Get Data For ArcPad:
Displays the location of the data you created for ArcPad, other details about the map, and a summary of the results of each layer copied out or checked out.

In Get Data From ArcPad:
Displays the results of the check in, including details about each ArcPad AXF file processed.
Following the list of ArcPad AXF files processed is an XML document that lists all the ArcPad edits that were replayed against the source geodatabase.
The XML document consists of a parent <CHECKIN> element, followed by a <CHANGE> element for each edit.

The <CHANGE> element has the following attributes:
The tablename attribute identifies the source geodatabase table.
The oid attribute identifies the source OID.
The status attribute identifies the type of edit:
N = New record
D = Deleted record
A = Attribute edit
G = Geometry edit
GA = Attribute and Geometry edit
The action attribute identifies the result of the edit:
P = Processed successfully
S = Skipped - the source OID does not exist (most likely was deleted)
F = Failed - in this case the message attribute contains additional information

In this simple example, the results summary confirm that one new *AssessmentPoly* record and two records from the related *PolyData* table were successfully processed, as well as the new point record.

5c. Click OK to close the Check In Results summary, then click Cancel or the close button to close the Get Data From ArcPad dialog.

6. Check in Tamarix data, if necessary. Repeat the procedure in step 5, selecting the .axf file containing the Tamarix data for check in.

7. Review records, then Save Edits and Stop Editing.

8. Update the data check out log.

Note: The next steps involve post processing, such as updating AllAssessments with these new point/line/poly records, reviewing Tamarix records for accuracy and consistency, and updating the MostRecentAssessments feature classes/layers.

Database Editing and Maintenance

Adding assessment records on the desktop

Notes: The procedures below assume that coordinates have been captured on devices using UTM Zone 12, NAD 83. Additional steps may be required if another coordinate system or datum is used.

*The following steps describe entry of assessments represented as polygons. Similar steps are used to add assessment records to the point and line feature classes and tables. The principal difference is that a **TotalWidth** (buffer radius) value is specified for points and lines (not necessary for polygons).*

It is possible to add features to the assessment feature classes without adding tabular coordinate data to the map, as described in step 2, below; however this method will produce the most accurate results. Alternate methods of adding coordinate data, such as uploading waypoints from GPS receivers, are also possible.

1. Start ArcMap and Open ProcessExoticsData.mxd.

2. Add X – Y data to the map.

Note: there are several methods for accomplishing this step. The procedure described here uses an existing table, TempXY, stored in the geodatabase, to capture coordinate data and export them to the map where they are referenced when digitizing features.

Note: you may wish to delete all existing records in the TempXY data table before you start adding new records; the best way to do this is using the "Delete Rows" tool in ArcToolbox. Open the tool from this location in ArcToolbox: Data Management Tools>Table>Delete Rows, then browse to find the TempXY table and run the tool. You should do this before beginning the editing session.

2a. Open the geodatabase table *TempXY* (you may need to switch to the "Source" tab in the table of contents to see the available tables), and start an editing session: click the Editor button on the Editor toolbar, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data. (If the Editor toolbar is not present, add it to the map (Tools>Customize>Toolbars tab>check Editor, then click the Close button).



The Editor toolbar in ArcMap

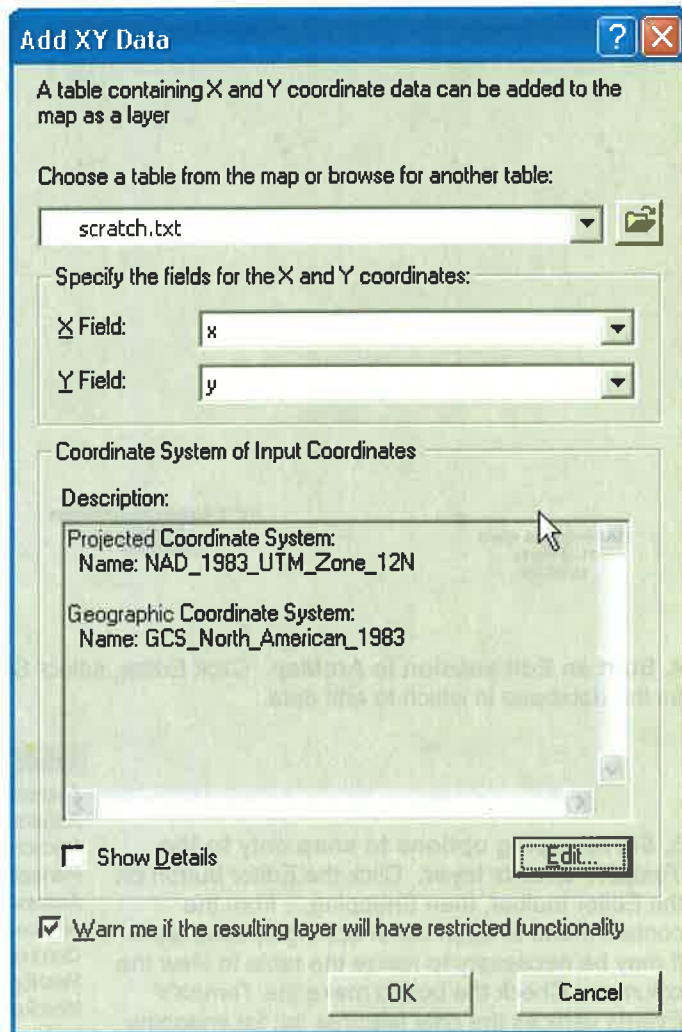
2b. Enter the X (Easting) and Y (Northing) data to the table for each point as recorded on the field data sheets. Note the ID field, which may be used to identify which feature each coordinate pair belongs to. Save your edits and stop editing (Editor button>Save Edits; Editor button>Stop Editing). The example below includes six points that will become the vertices of two polygons.

Attributes of TempXY			
OBJECTID *	Easting	Northing	ID
1	527670	3563459	a
2	527669	3563404	a
3	527736	3563404	a
4	527842	3563378	b
5	527827	3563351	b
6	527809	3563377	b

2c. Use the Add XY Data tool to add the table data to the map.

- 2c1. From the main menu in ArcMap, choose Tools>Add XY data... to open the Add XY Data dialog.
- 2c2. Browse to the *TempXY* file created above and select it;
- 2c3. Specify the X and Y coordinate fields;
- 2c4. Define the coordinate system: click the Edit... button, click Select to select a predefined coordinate system, and browse to the appropriate system: Projected Coordinate Systems>UTM>NAD 1983>NAD 1983 Zone 12N. Click the Add button to select the system, then click OK to return to the Add XY Data dialog.
- 2c5. Click OK to add the table to the map.

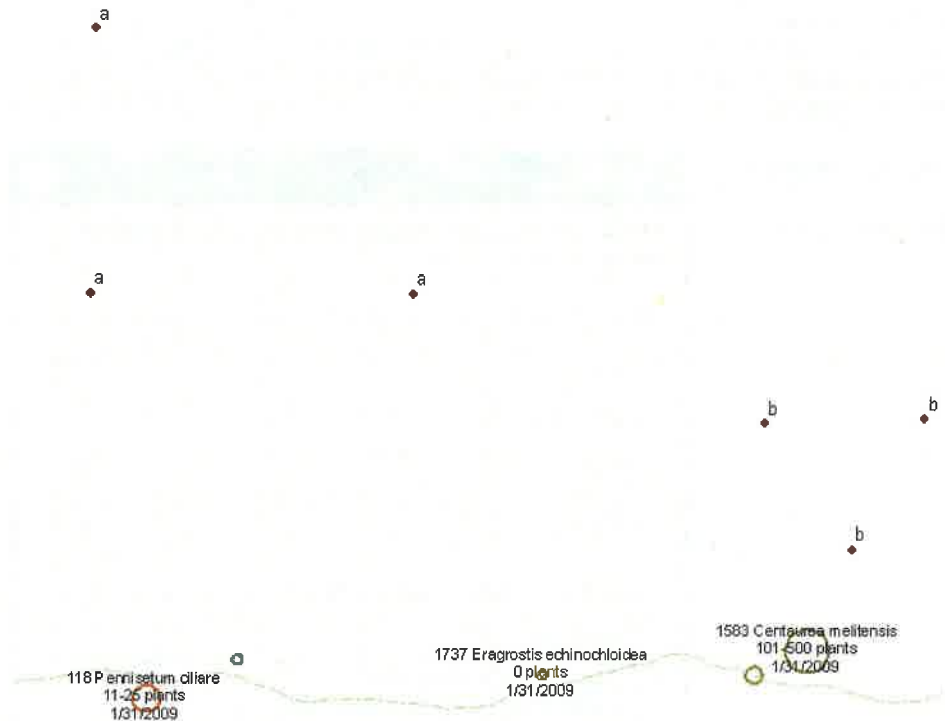
The completed dialog is shown at right.



Points are added to the map as shown below. The layer name is *TempXY Events*.
(If the points are not visible in the current map view, right click the *TempXY Events* layer in the table of contents, and select Zoom To Layer from the context menu.)

3. **Label the features with their feature identification values** – doing so will simplify determining which points belong to which polygon and attribute set. Open the layer properties dialog (double click the *TempXY Events* layer in the table of contents) and click the Labels tab, specify ID as the label field, check the box to label features, and click OK.

New points added to the map, with labels (along with existing records from AllAssessments)



4. **Start an Edit session in ArcMap.** Click Editor, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data.

5. **Set snapping options to snap only to the *TempXY Events* layer.** Click the Editor button on the Editor toolbar, then Snapping... from the context menu to open the snapping options table. It may be necessary to resize the table to view the columns. Check the box to make the *TempXY Events* vertices the only features set for snapping. All other boxes should be unchecked.

Layer	Vertex	Edge	End
AssessmentPoint	☐	☐	☐
AssessmentLine	☐	☐	☐
Districts	☐	☐	☐
ManagementAreas	☐	☐	☐
AssessmentPoly	☐	☐	☐
AllAssessments selection	☐	☐	☐
Occurrence	☐	☐	☐
MostRecentAssessByMA	☐	☐	☐
MostRecentAssessByOccur	☐	☐	☐
trails_rmd	☐	☐	☐
ProcessedPolysToAppend	☐	☐	☐
ProcessedPointsToAppend	☐	☐	☐
ProcessedLinesToAppend	☐	☐	☐
TempXY Events	☒	☐	☐

6. **Create a new feature in *AssessmentPoly*, and related record(s) in *PolyData*.**

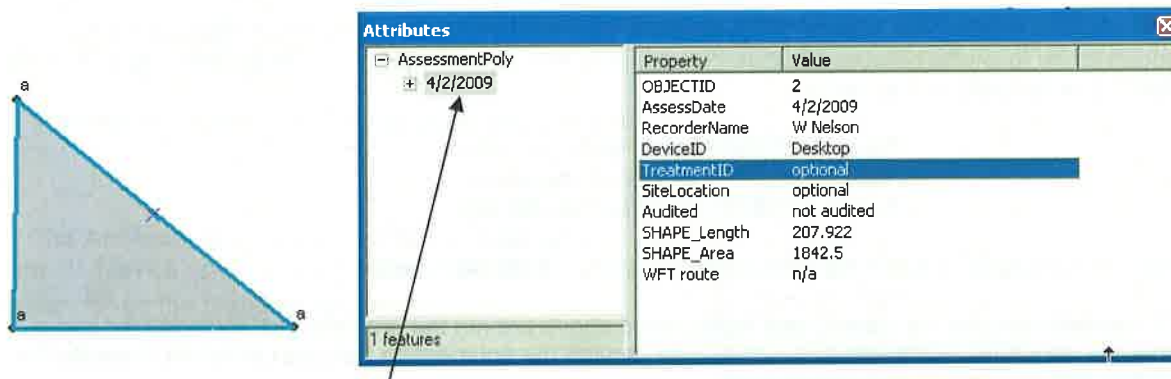
6a. On the Editor toolbar, select Create New Feature as the task, and make *AssessmentPoly* the target.



6b. Click the sketch tool  then digitize the shape, snapping to the appropriate points. When the sketch is completed, the feature should remain selected.

6c. With the feature selected, click the Attributes button on the Editor toolbar  to open the attributes dialog. In the right pane, edit the attributes.

Note: only selected features appear in the Attributes dialog.



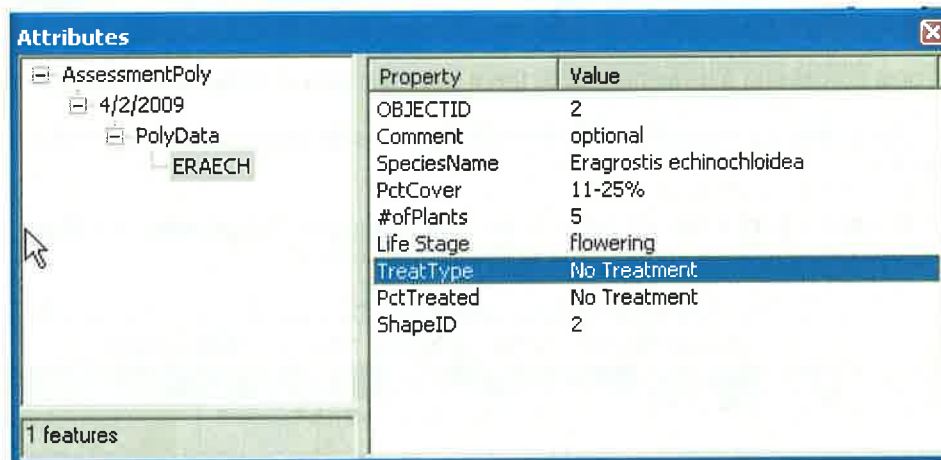
*Note: Features in the Attributes dialog are identified by the Primary Display Field for that layer; in this case, it is the **AssessDate** field. The Primary Display Field is specified on the Fields tab in the Layer Properties dialog (double click any layer in the table of contents to open the dialog for that layer).*

6d. Expand the tree in the left pane to view the related *PolyData* table.

6e. Right click *PolyData* and click Add New to create a new record of species specific assessment information.

6f. Click on the new record, and then edit its attributes in the right pane.

6g. Continue adding records to the *PolyData* table for all species associated with the polygon.



6h. Validate the new feature once data entry is complete: click the Editor button on the Editor toolbar, and select Validate Features from the context menu. Click OK to dismiss the "All features are valid" message. If the record is invalid, the problems will be indicated. Make the required corrections and Validate Features again.

Note: Validate Features operates only on selected records.

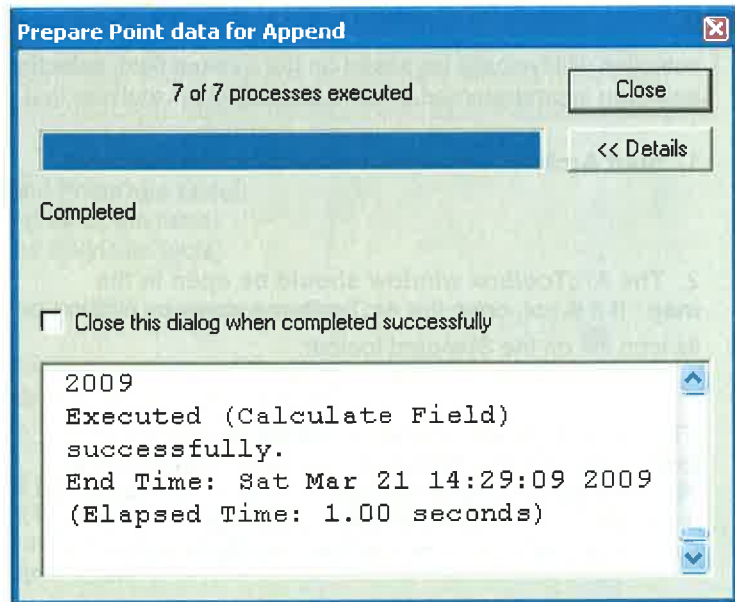
3b. Enter an operator name and date in the expression window by overwriting the existing text. Quotes are required or the tool will not run. Up to 24 characters may be entered. Enter data as "[first initial] [last name] MM/DD/YYYY" as shown in the example above.

3c. Click the OK button to run the model, or Cancel to close the model without running.

A model status dialog will appear as the model tools are processed. The status dialog should appear similar to the figure at right after the model has run successfully. If there are problems are encountered, review the status information.

3d. Click the "Close" button to dismiss the dialog.

3e. Open the *ProcessedPointsToAppend* attribute table, and review the records. Confirm that the expected records are present, etc. You may also wish to pan and zoom to the map features, confirming the buffer operation completed successfully.



4. **Make note of the largest OBJECTID value in the *AllAssessments* attribute table:** open the table, right click on the **OBJECTID** column heading, and select "Sort Descending." Make note of the largest **OBJECTID** value (the value for the first record in the table, in this example 5521) and close the table. You will need this value in step 7.

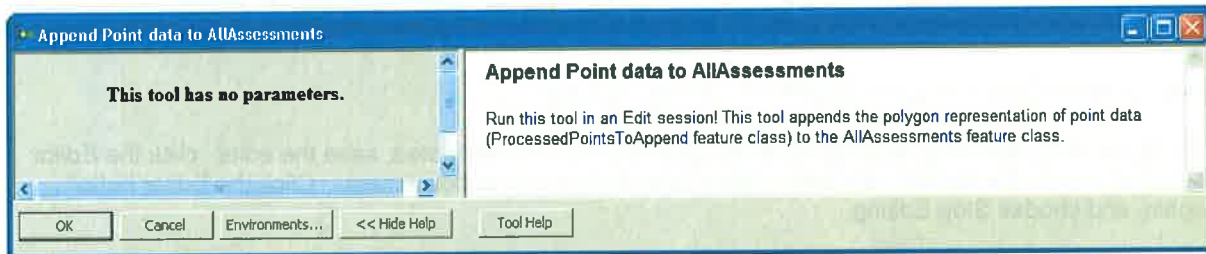
Attributes of AllAssessments						
	OBJECTID *	SHAPE *	MergeID	GridID *	District	ManagementArea *
	5521	Polygon	300444	2729	RMD	RMD Admin
	5520	Polygon	300443	2153	RMD	Javelina Pull
	5519	Polygon	300442	1858	RMD	OST South

Make note of the largest value!

5. **Start an Edit session in ArcMap.** Click Editor, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data. . If the Editor toolbar is not present, add it to the map (Tools>Customize>Toolbars tab>check Editor, then click the Close button).

By updating the database inside an edit session, you will have a chance to review changes before they become permanent.

6. Run the “Append Point Data to AllAssessments” model: right click the icon, then select “Open” from the context menu (or just double click the icon). This opens the model dialog:



There are no parameters for this model – just click the OK button to run the tool.

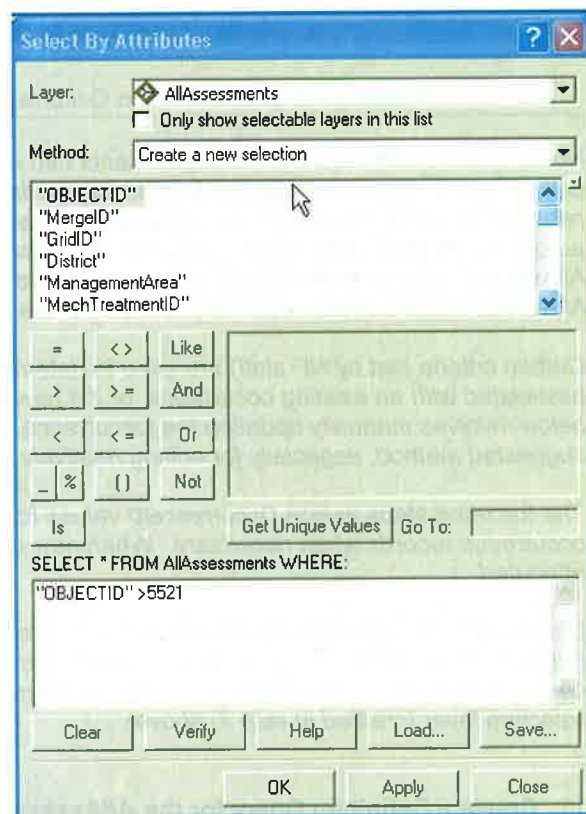
Review the model status dialog as above (step 3c), and click the “Close” button to dismiss the dialog when the model completes successfully (the model includes only 1 process).

7. Create a new layer that includes only the new records added to AllAssessments:

7a. After adding point, line, and polygon assessment records to AllAssessments, open the Select by Attributes dialog from the main menu (Select>Select by Attributes...). Complete the dialog as shown: set the layer as AllAssessments, the method as Create a new selection, and enter the selection statement as shown, using the value you recorded in step 4 as the “greater than” value. Click the Verify button to evaluate the selection expression, then click OK to select the records.

7b. Once records have been selected, right-click on AllAssessments in the table of contents, then click Selection in the context menu, then Create Layer From Selected Features. This layer is added to the table of contents as “AllAssessments selection.”

7c. Click the Clear Selected Features button  to remove all selections.



8. **Open the *AllAssessments* selection attribute table, and select all records.** Open the table, click the Options button, and click Select All from the context menu.

9. **Validate the new records:** click the Editor button on the Editor toolbar, and select Validate Features from the context menu. Click OK to dismiss the "All features are valid" message. If invalid records exist, the problems will be indicated. Make the required corrections and Validate Features again.

Note: Validate Features operates only on selected records.

10. **Save edits and stop editing:** once all records have been validated, save the edits: click the Editor button on the Editor toolbar, and select Save Edits from the drop down menu. Click the Editor button again, and choose Stop Editing.

The remaining post processing steps involve adding occurrence and/or treatment records to the geodatabase, and populating the **OccurrenceID** and **ChemTreatmentID** fields in the *AllAssessments* feature class. If these fields are not accurately edited, the relationships between the feature classes and tables will not function as expected.

Relating *AllAssessments* to *Occurrences*, and adding new occurrence records

*Notes: Each (new) record in AllAssessments can be associated with a record in the Occurrence feature class. Relationships between tables use key fields to match objects in related tables. For example, the relationship class between Occurrence and AllAssessments uses the Occurrence **OBJECTID** (which is an automatically generated system variable) as the primary key; the foreign key (the matching variable) in AllAssessments is **OccurrenceID**. The Occurrence **OBJECTID** value must be recorded in the AllAssessments **OccurrenceID** field in order for the objects to be related via the relationship class.*

Certain criteria (set by NP staff) are used to determine whether a given assessment record will be associated with an existing occurrence, or if a new occurrence will be established. The method described below involves manually updating the Occurrence and AllAssessments feature classes. This is the suggested method, especially for editing relatively small numbers of records.

*The following steps assign **OccurrenceID** values to the AllAssessments records, and create new occurrence records when necessary. When new occurrence records are created, they also must be attributed.*

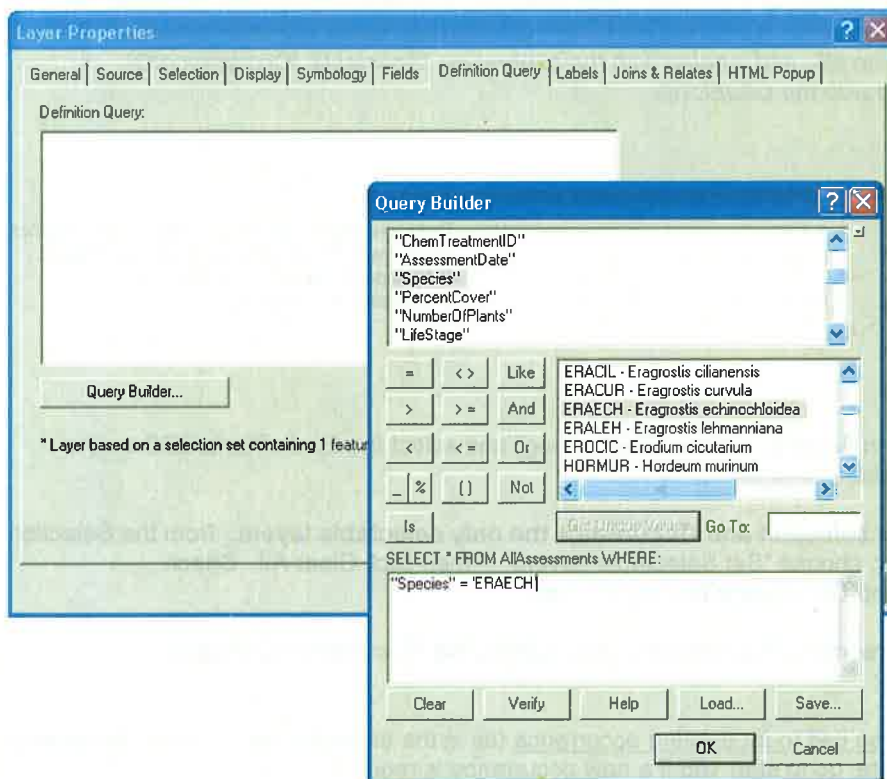
Occurrence and assessment records are, of course, species specific. Because the database contains a relatively large number of occurrence records, it is simplest to update Occurrence and AllAssessments one species at time. The following steps can be repeated for each species present in the AllAssessments selection layer (created in step 7, above).

11. **Create a Definition Query for the *AllAssessments* selection layer to include only ONE of the species present in that layer:**

11a. Right-click on the *AllAssessments* selection layer (created in step 7), then choose Properties... and click on the Definition Query tab in the Layer Properties dialog.

11b. Click the Query Builder button. In the Query Builder window, scroll to Species in the attributes list, and double-click it to add it to the query. Click the "=" (equals) button, then Get Unique Values to

generate a list of species. Scroll to the desired value and double-click it to complete the query, as shown below:



11c. Verify the expression (click the Verify button), then click OK to apply the query, then click OK to apply changes to the layer and dismiss the dialog.

You may wish to open the layer attribute table to confirm that the definition has been applied.

12. Follow the instructions in step 11 to create a Definition Query for Occurrences, selecting the same species that was selected for the AllAssessments selection layer. The selection expression should be modified to include occurrence records with null values for species (the new occurrence records that will be added during the edit session, before they have been attributed).

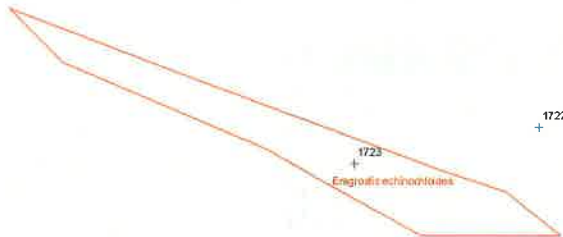
The expression is "Species" = 'ERAECH' OR "Species" IS NULL.

This will remove all occurrence records from the map display other than potential matches for the new AllAssessments records.

Note: the selection expression is stated as "Species" IS NULL. This is not the same as "Species" = NULL. Generally speaking, the = (equals) operator will not work in an expression evaluating for NULL values.

13. **Adjust the map display:** in the table of contents, turn off all layers except Occurrence and the "AllAssessments selection" layers.

Note: These should both be displaying the same single species. You may wish to turn on reference layers (trails, park boundaries, etc.). It is suggested that the AllAssessments selection layer be symbolized as outline only (no fill), and labeled with the expression [Species]& [OccurrenceID]. Occurrences can be labeled with the OBJECTID.



Three previously recorded ERAECH occurrences, labeled with **OBJECTID**, and a new ERAECH assessment that has not yet had an **OccurrenceID** assigned.

14. **Start an Edit session in ArcMap** (Editor>Start Editing) and select the ExoticPlantsGDB as the database in which to edit data.

15. **Make AllAssessments selection and Occurrence the only selectable layers:** from the Selection menu on the main menu bar, choose "Set Selectable Layers..." then click Clear All. Check AllAssessments selection and Occurrence then click Close.

16. **Add new occurrence records, if necessary, and update the OccurrenceID field in AllAssessments selection:**

16a. If an assessment is to be tied to an existing occurrence (as in the example above, where occurrence 1723 is the obvious candidate; go to step 16b if a new occurrence is required):

16a1. make sure no records are selected (click the Clear Selected Features button )

16a2. Click the Select Features tool , then click and drag across both the assessment and appropriate occurrence to select them.

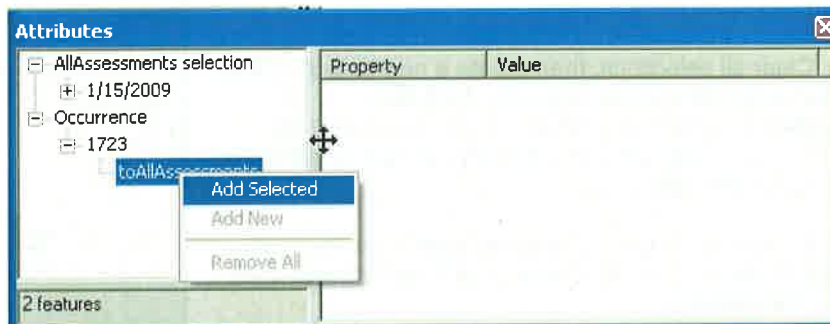


16a3. Click the Attributes button  on the Editor toolbar to open the attributes editor dialog. The left pane includes a hierarchical display including the table name, records, and relationship classes for all selected features. The attributes for the highlighted record are shown in the right pane (caution: fields can be edited!).

Attributes		
AllAssessments selection 1/15/2009 Occurrence 1723 toAllAssessments		
	Property	Value
	OBJECTID	1723
	Species	Eragrostis echinoclodea
	Status	undefined
	Recorder	CASA
	DataDevice	Desktop
	Audited	CASA-requires NP review
2 features		

16a4. If they are not already, click the “plus” boxes to expand the *Occurrence* entry. Both the occurrence record and its relationship to the *AllAssessments* should be visible:

16a5. Right-click “toAllAssessments,” then pick “Add Selected”. This adds the occurrence **OBJECTID** value to the **OccurrenceID** field in *AllAssessments*, creating a relationship between the two features.



16a6. Clear selected features ☒ and refresh the map. Note that the **OccurrenceID** (the *Occurrence* **OBJECTID**) is now included in the assessment label.



16a7. Save your edits (Editor>Save Edits).

16b. If a new occurrence record is needed: set the editor task to Create New Feature, and make the target *Occurrence*. Then click the sketch tool button (the “pencil” icon), and click the map where you wish to place the feature.



Note: The new Occurrence record may be attributed at this time, using either the attributes editor  described above, or directly in the Occurrence attribute table. However, if many occurrence records are being added, it may be more efficient to use the field calculator to assign values to all the new occurrence records simultaneously. This method is described below in step 17.

Follow the procedures in step 16a, above, to relate the new occurrence record to the appropriate record(s) in the *AllAssessments* selection.

Repeat this process until you have created the necessary new occurrence records and assigned **OccurrenceID** values to all records in the “AllAssessments selection layer” (except those in certain management areas as specified by NPS staff).

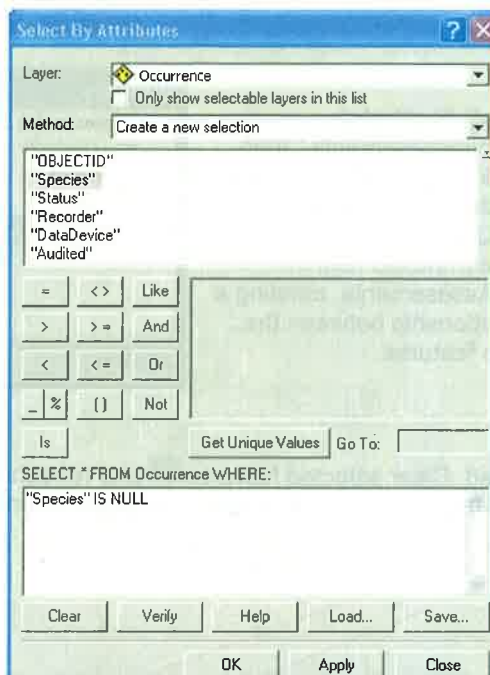
17. Optional: **Use the field calculator to attribute new Occurrence records:**

17a. Clear all selections, then create a new selection from Occurrences: Selection>Select By Attributes. Complete the dialog as shown at right, then verify the selection and click OK. (This selects the new, unattributed occurrence records).

17b. Right click on the Occurrence layer in the table of contents, then select "Selection" and "Create Layer from Selected Features."

A new layer named *Occurrences selection* will be added to the table of contents. This layer should include only the new *Occurrence* records (for the single species).

17c. Clear all selections .

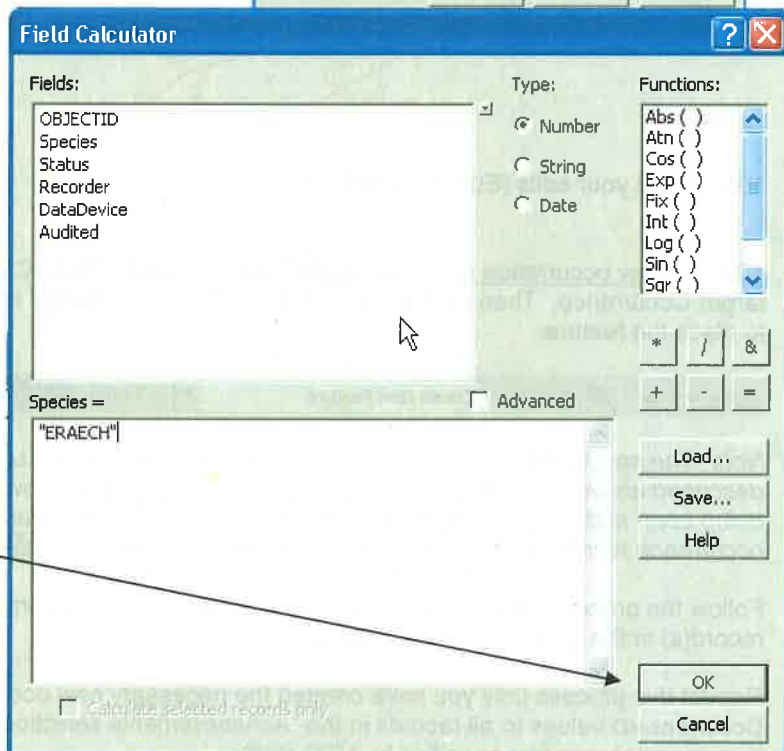


17d. Open the attribute table of the *Occurrences selection* layer. Right click on the column heading for **Species**, and choose "Field Calculator..." from the context menu. Enter the correct Species value using quotes as shown.

Note: Since Species has a coded values domain, the value entered must match exactly one of the values in the domain, or the records will not validate.

17e. Click OK to populate all records with the species code.

17f. Continue using the field calculator to populate the **Status**, **Recorder**, **DataDevice**, and **Audited** fields.



18. **Validate the new occurrence features.**

18a. Open the *Occurrence* attribute table, click the Options button at the bottom of the window, and click Select All from the context menu.

18b. Click the Editor button on the Editor toolbar, and click Validate Features.

18c. Click OK to dismiss the "All features are valid" message. If invalid records exist, the problems will be indicated. Make the required corrections and Validate Features again.

18d. Once all records have been validated, save the edits and end the edit session (Editor button>Save Edits; Editor button again>Stop Editing).

18e. If you created an *Occurrences selection* layer in the optional step 17, remove the layer from the map (right click the layer name in the table of contents, and click Remove in the context menu).

19. **Remove the definition queries from Occurrence and AllAssessments selection:** open the layer properties dialog, and delete the expressions from the Definition Query tab.

Note: Treatment records, if any, can now be added to the geodatabase. This may be an appropriate time to do so, since the "new" assessment records are isolated in the selection layer created in step 7. See section(s) on Adding chemical treatment data to the geodatabase, below. Otherwise you may wish to remove the selection layers from the map as described in step 20.

20. Optional: **Remove Assessments selection layer from the map.**

Skip this step if you intend to add treatment data related to the new *AllAssessments* records. If you do not wish to add treatment data to the "new" *AllAssessments* records (as represented in the *AllAssessments selection*), you may remove the *AllAssessments selection* layer from the map.

21. **Save the map.**

22. **Run the "Most Recent Assessment" ModelBuilder routine.** This updates the *MostRecentAssessByOccur* and *MostRecentAssessByMA* feature classes.

22a. The model is located in the ExoticPlantsTools toolbox. Right click the icon, then select "Open" from the context menu (or just double click the icon). This opens the tool dialog.

Note: Details about the tool can be viewed by clicking the Tool Help button.

22b. There are no parameters for this model – just click the OK button to run the tool.

22c. Review the model status dialog, and click the "Close" button to dismiss the dialog when the model completes successfully.

23. **Save the map.**

Treatment data overview

Note: Chemical treatment data are recorded on paper forms in the field, then entered into the geodatabase on the desktop. The following instructions assume that the assessment data associated with the treatment data to be entered has been appended to AllAssessments (see Appending new point, line, or polygon assessment data to AllAssessments). It is advisable to complete the following procedures as soon as possible following addition of new assessment records to the geodatabase.

The geodatabase stores chemical treatment information in three related tables: TreatmentsChem, ActiveIngredient, and Adjuvant. Geodatabase relationship classes link records in the ActiveIngredient and Adjuvants tables to their "parent" records in the TreatmentsChem table. There may be multiple active ingredient and/or adjuvant records associated with a given treatment:

OBJECTID	TreatmentDate	Method	GallonsMix	PctBrown
77	2/23/2008	Backpack	16	<25%
78	2/28/2008	Backpack	20	<25%
79	5/1/2008	Backpack	12	<25%
80	7/8/2008	Backpack	6	26-50%

OBJECTID	BrandName	OuncesAI	ChemTreatID
101	Rodeo	24	124
67	Garion 4	12	78
68	KleenUp Pro	12	78
184	Rodeo	10	199

OBJECTID	Adjuvant	OzAdjuvant	ChemTreatID
12	Choice	30	14
198	LI-700	20	220
80	Choice	24	78
188	MSO	24	198

OBJECTID	Species	PctCover	ShapeArea	ChemTreatID
101	PENCIL	1-5%	1045.6	28
67	PENCIL	26-50%	101.3	78
68	PENSET	11-25%	210.6	78
184	BRORUB	51-75%	10045	102

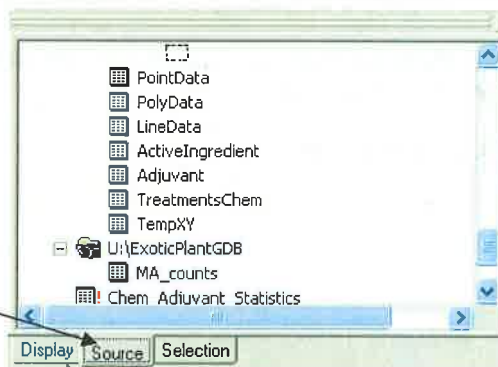
A critical step in this process is relating the treatment records to the appropriate related records in the AllAssessments feature class. A single chemical treatment may be associated with multiple assessment records.

The procedure involves entry of data directly into tables, as well as utilizing the attributes editor dialog.

Adding chemical treatment data to the geodatabase

- 1. Start ArcMap, and open ProcessExoticsData.mxd.** Click the Source tab in the table of contents, and make sure the ActiveIngredient, Adjuvant, and TreatmentsChem tables are present.

Tables are not visible from the Display tab – click the Source tab to view the treatment data tables.



- 2. Create a selection layer of AllAssessments records.** These are the records for which treatment data are to be entered.

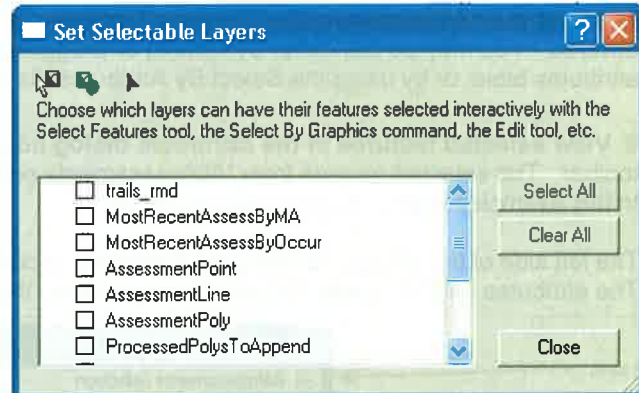
Note: A selection layer, "AllAssessments selection," may already be present in the map; this layer is created during the procedure to add assessment data to AllAssessments. The AllAssessments records to be associated with treatment data may already included in this layer. See step 7 in Post processing assessment data, above.

If necessary, use the Select By Attributes dialog (Select>Select By Attributes) to obtain records from AllAssessments based on one or more attributes. For example, selecting records where TreatmentType=Chemical and AssessmentDate equals the date recorded on the treatment data form should return an appropriate set of records.

3. Prepare the map for editing:

3a. Turn on "AllAssessments selection" (or the appropriate selection layer, created in step 2), and turn all other layers off

3b. Make "AllAssessments selection" (or the appropriate selection layer, created in step 2) the only selectable layer. Right click the layer name in the table of contents, then choose Selection>Make This the Only Selectable Layer from the context menus. Alternately, from the main menu, choose Selection>Set Selectable Layers... to open the dialog shown at right.



4. **Start an Edit session in ArcMap.** Click Editor, select Start Editing, and select the ExoticPlantsGDB as the database to edit.

5. **Enter a record in the TreatmentsChem table:** open the table, and enter the values from the field data form. It is very important to accurately enter the gallons of mixture used (*GallonsUsed*). Note that data specific to active ingredients and/or adjuvants are *not* entered at this time.



Enter the treatment record data on a new line in the table. Enter the date first using the format shown. It may then be necessary to hit the "down arrow" key on the keyboard to make the system acknowledge the new record.

6. **Select the new treatment record:** when you have completed the record, clear all previous selections , then select the record by clicking the box to the left of the row. The record should be highlighted as shown below:



Click this box to select the record.

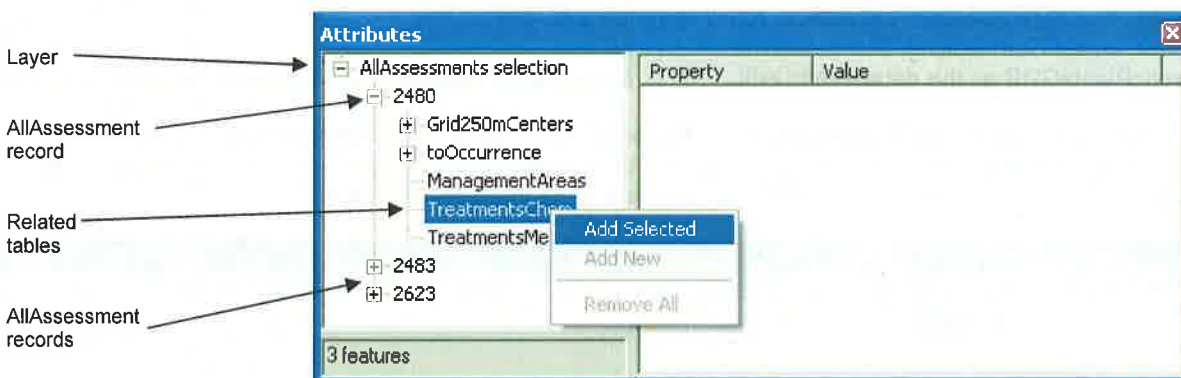
Note: the system generated OBJECTID is the primary key for this table, and will be used to link these records to records in ActiveIngredient, Adjuvant, and AllAssessments based on the key fields (ChemTreatmentID) in those tables.

Note: the Attributes dialog box allows you to view and edit attributes of selected map features, including related table records. However, in order to use the Attributes dialog box, at least one map feature must be selected (i.e. the attributes editor will not work for stand alone table records where no related features have been selected).

7. Select the “AllAssessments selection” record(s) related to the treatment record you just entered. You may do this either by clicking or dragging on the map, selecting the records in the attributes table, or by using the Select By Attributes dialog (Selection>Select By Attributes).

8. View selected features in the attributes dialog box: click the attributes button  on the editor toolbar. The selected records from “AllAssessments selection” will be listed in the left side of the dialog. In this example, three records have been selected.

The left side of the dialog displays the table name, records, and related tables for the selected features. The attributes for the highlighted record are shown in the right pane (caution: fields can be edited!).



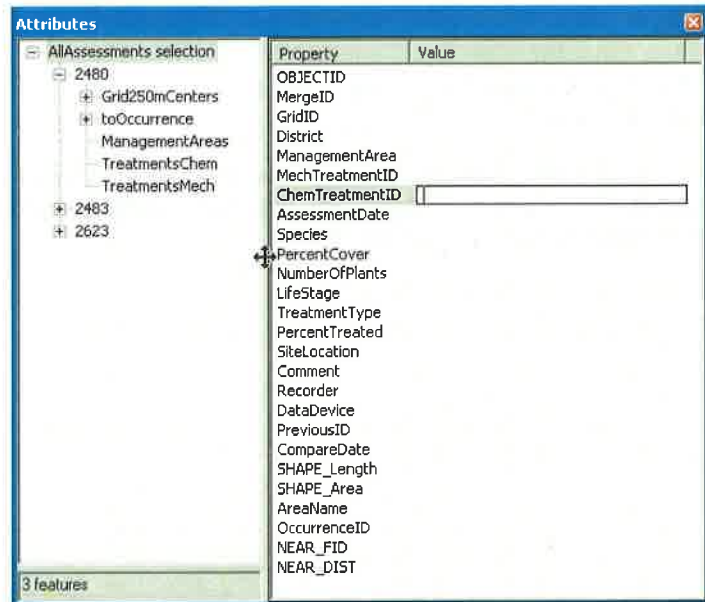
9. Add the selected chemical treatment record to the selected AllAssessments record(s):

9a. Click the “plus” boxes to expand the first AllAssessments selection entry. The related table TreatmentsChem should be visible.

9b. Right-click TreatmentsChem, then pick “Add Selected”. You have now added the chemical treatment record OBJECTID value to the ChemTreatmentID field in AllAssessments, creating a relationship between the two records. Repeat this process for the other selected assessment records.

Alternatively, add the ChemTreatID (the OBJECTID for the appropriate TreatmentsChem record) to all selected assessment records at once by clicking the table name "AllAssessments selection" in the left pane, then manually entering the OBJECTID for the chemical treatment record in the ChemTreatID field in the right pane.

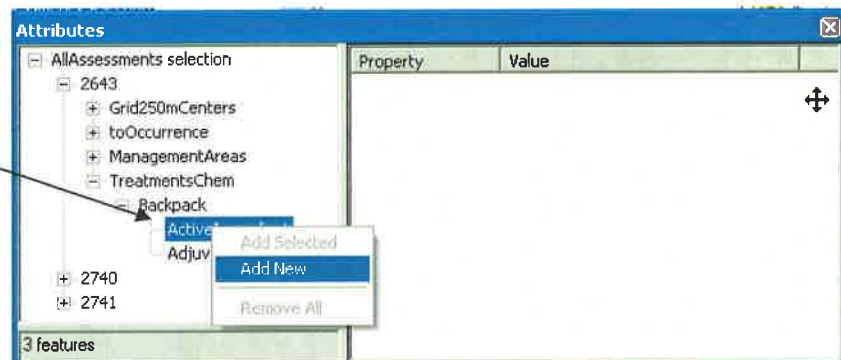
This method introduces the possibility of error, as it relies on manual data entry.



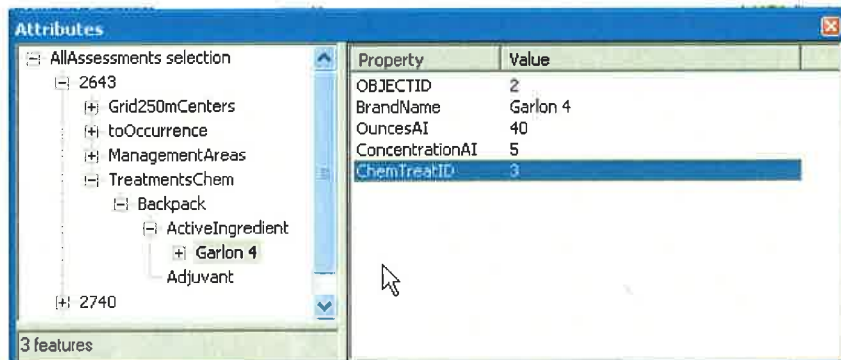
10. Add ActiveIngredient and Adjuvant table data for the selected records:

10a. In the left pane of the attributes dialog, expand the TreatmentsChem table to view the record you just added; note the related ActiveIngredient and Adjuvant tables.

-10b. Right click ActiveIngredient, and select Add New.



10c. In the right pane, enter the active ingredient data as recorded on the field data form.



10d. Repeat the process for each active ingredient: right click the ActiveIngredient table, and select Add New.

10e. Enter adjuvant data, if any, in the same manner: right click the Adjuvant table, select Add New, and enter the data.

11. **Save edits, and stop editing.** Continue entering data as above for each new chemical treatment record. When complete, save edits and stop editing. You may remove the "AllAssessments selection" layer from the map table of contents.

Tamarix data: Overview

Procedures for Tamarix (and associated wash survey) data capture using ArcPad equipped GPS receivers are described above (see sections on [Data check out](#) and [Using ArcPad to collect Tamarix data in the field](#)). In many instances, however, Tamarix data are collected on paper forms in the field, and then added to the geodatabase on the desktop. The sections below describe procedures for doing so, and provide guidance for post processing and summarizing Tamarix records.

Tamarix infestations are recorded as points, regardless of the number of individual plants encountered at a given location. Similar to the approach used to collect other assessment data, a feature class (*TamarixPoints*) is used to capture spatial information about the infestation, while date specific attributes are recorded and maintained in a related table (*TamarixVisits*). However, in contrast to the assessment feature classes and related tables, which are checked out as empty tables to ArcPad units, the actual geodatabase Tamarix records are checked out to ArcPad units and are available for field edit. This accommodates updates to the **Revisits** and **Status** fields, in particular.

In general, post processing tasks for Tamarix involve some or all of the following steps:

- Adding new *TamarixPoint* and/or *TamarixVisit* data from paper forms to the geodatabase
- Reviewing new Tamarix records for logical consistency (this primarily involves comparing the **Status** and **Revisits** fields)
- Establishing relationships between *TamarixVisits* records and the appropriate chemical treatment records
- Updating the *TamRecent* feature class, which is a derived feature class depicting the most recent visit data for active Tamarix infestations
- Running the ModelBuilder routine that updates the derived *LinearTamarix* feature class
- Adding *WashSurveyPoint* data to the geodatabase
- Updating the *WashSurveys* (linear) feature class

Each visit to a Tamarix location should result in a new record in the *TamarixVisits* table, regardless of whether it is a newly recorded or previously existing location. Only newly encountered Tamarix plants will result in new records added to the *TamarixPoints* feature class. Field staff that do not have access to existing data (because they do not have an ArcPad unit, or a map showing recent Tamarix data) will not, in most cases, know whether they are at a new or previously known Tamarix location, so desktop users will need to discern between new and previously recorded infestations during post processing. Similarly, field staff conducting systematic wash surveys without the benefit of historical Tamarix data will not necessarily know when they are at a previously successfully treated Tamarix location; users completing post processing will need to be aware that "revisits" should be added to the *TamarixVisits* table in these situations (this situation is considered in the example below).

Typically, relatively few new Tamarix records will be added to the geodatabase at any given time, and so some of the post processing steps described below are noted as "optional;" they were designed to facilitate the processing of numerous new records.

The *TamarixPoints* and related *TamarixVisits* contain the related fields **Status** and **Revisits**, respectively. Both have attribute values constrained by coded value domains, and are related as follows:

TamarixPoints: MgmtStatus (Alias: Status)		TamarixVisits: Revisits (Alias:RevisitsNeeded)	
code and description		code	description
Untreated Exotics		4	untreated
Undergoing Treatment		3	needs 3 revisits
		2	needs 2 revisits
		1	needs 1 revisits
Treatment Complete		0	treatment complete
undefined		9	unknown

Adding Tamarix records on the desktop

Notes: The procedures below assume that coordinates have been captured on devices using UTM Zone 12, NAD 83. Additional steps may be required if another coordinate system or datum is used.

It is possible to add features to the Tamarix feature classes without adding tabular coordinate data to the map, as described in step 2, below; however this method will produce accurate results. Alternate methods of adding coordinate data, such as uploading waypoints from GPS receivers, are also possible.

1. Start ArcMap and Open ProcessExoticsData.mxd.

2. Add X – Y data to the map.

Note: there are several methods for accomplishing this step. The procedure described here uses an existing table, TempXY, stored in the geodatabase, to capture coordinate data and export them to the map where they are referenced when digitizing features.

Note: you may wish to delete all existing records in the TempXY data table before you start adding new records; the best way to do this is using the "Delete Rows" tool in ArcToolbox. Open the tool from this location in ArcToolbox: Data Management Tools>Table>Delete Rows, then browse to find the TempXY table and run the tool. You should do this before beginning the editing session.

2a. Open the geodatabase table *TempXY* (you may need to switch to the "Source" tab in the table of contents to see the available tables), and start an editing session: click the Editor button on the Editor toolbar, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data. (If the Editor toolbar is not present, add it to the map (Tools>Customize>Toolbars tab>check Editor, then click the Close button).



The Editor toolbar in ArcMap

2b. Enter the **X (Easting)** and **Y (Northing)** data to the table for each point as recorded on the field data sheets. Note the ID field, which may be used to identify which feature each coordinate pair belongs to (by referring to the paper data form, etc.).

Save your edits and stop editing (Editor button>Save Edits; Editor button>Stop Editing). The example below includes one new point.

OBJECTID *	Easting	Northing	ID
7	530074	3564849	Tam1

2c. Use the Add XY Data tool to add the table data to the map.

2c1. From the main menu in ArcMap, choose Tools>Add XY data... to open the Add XY Data dialog.

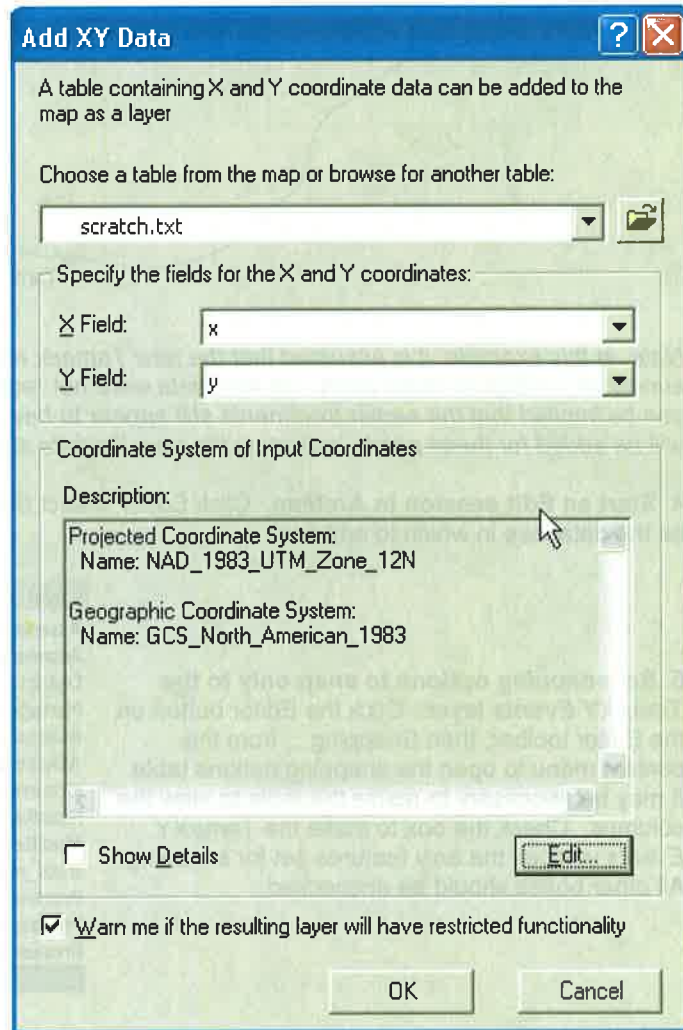
2c2. Browse to the *TempXY* file created above and select it;

2c3. Specify the X and Y coordinate fields;

2c4. Define the coordinate system: click the Edit... button, click Select to select a predefined coordinate system, and browse to the appropriate system: Projected Coordinate Systems>UTM>NAD 1983>NAD 1983 Zone 12N. Click the Add button to select the system, then click OK to return to the Add XY Data dialog.

2c5. Click OK to add the table to the map.

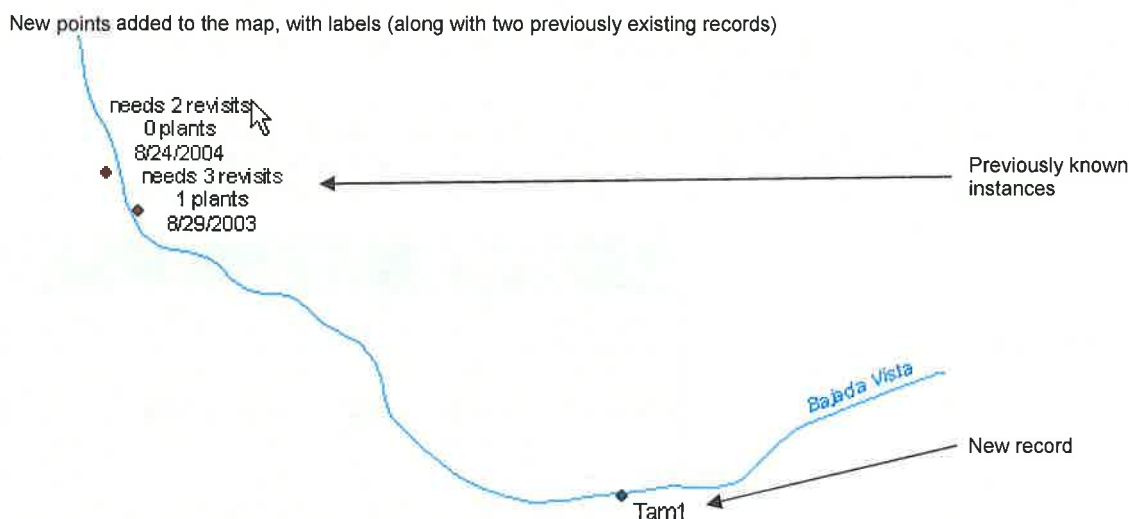
The completed dialog is shown at right.



Points are added to the map as shown below. The layer name is *TempXY Events*.

(If the points are not visible in the current map view, right click the *TempXY Events* layer in the table of contents, and select Zoom To Layer from the context menu.)

3. Label the features with their feature identification values – doing so will simplify determining which points belong to which polygon and attribute set. Open the layer properties dialog (double click the *TempXY Events* layer in the table of contents) and click the Labels tab, specify *ID* as the label field, check the box to label features, and click OK.



Note: in this example, it is assumed that the new Tamarix record was recorded during a systematic survey of the Bajada Vista wash. As new data were not recorded at the previously known locations, it can be implied that the earlier treatments still appear to have been effective. New TamarixVisits records will be added for these points, reflecting the new Revisits status (see Overview note, above).

4. Start an Edit session in ArcMap. Click Editor, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data.

5. Set snapping options to snap only to the TempXY Events layer. Click the Editor button on the Editor toolbar, then Snapping... from the context menu to open the snapping options table. It may be necessary to resize the table to view the columns. Check the box to make the TempXY Events vertices the only features set for snapping. All other boxes should be unchecked.

Layer	Vertex	Edge	End
AssessmentPoint	☐	☐	☐
AssessmentLine	☐	☐	☐
Districts	☐	☐	☐
ManagementAreas	☐	☐	☐
AssessmentPoly	☐	☐	☐
AllAssessments selection	☐	☐	☐
Occurrence	☐	☐	☐
MostRecentAssessByMA	☐	☐	☐
MostRecentAssessByOccur	☐	☐	☐
trails_rmd	☐	☐	☐
ProcessedPolysToAppend	☐	☐	☐
ProcessedPointsToAppend	☐	☐	☐
ProcessedLinesToAppend	☐	☐	☐
TempXY Events	☒	☐	☐

6. Create a new feature in TamarixPoints and related record in TamarixVisits.

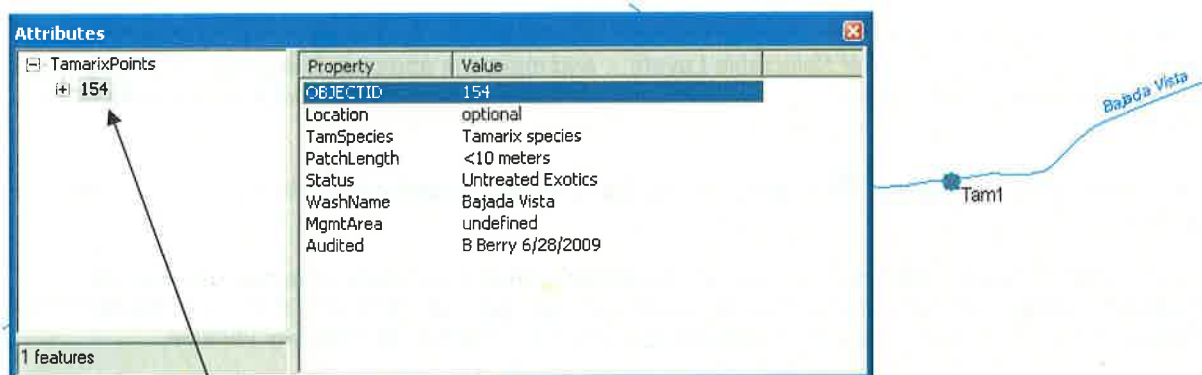
6a. On the Editor toolbar, select Create New Feature as the task, and make TamarixPoint the target.



6b. Click the sketch tool  then digitize the shape, snapping to the appropriate point. When the sketch is completed, the feature should remain selected.

6c. With the feature selected, click the Attributes button on the Editor toolbar  to open the attributes dialog. In the right pane, edit the attributes.

Note: only selected features appear in the Attributes dialog.

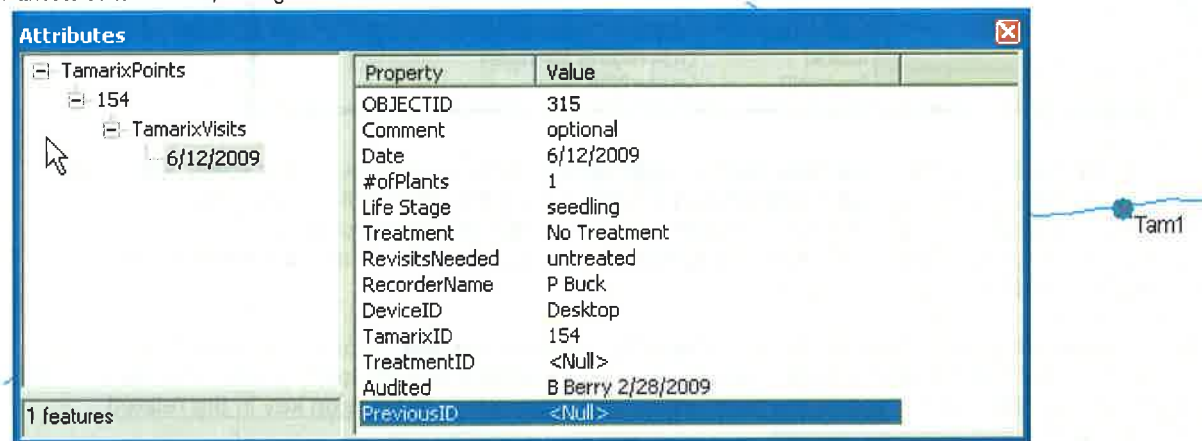


Note: Features in the Attributes dialog are identified by the Primary Display Field for that layer; in this case, it is the field. The Primary Display Field is specified on the Fields tab in the Layer Properties dialog (double click any layer in the table of contents to open the dialog for that layer).

6d. Expand the tree in the left pane to view the related *TamarixVisits* table.

6e. Right click *TamarixVisits* and click Add New to create a new record of date specific information.

Attribute editor window, adding a new *TamarixVisits* record



6f. Click on the new record, and then edit its attributes in the right pane.

6h. Validate the new feature once data entry is complete: click the Editor button on the Editor toolbar, and select Validate Features from the context menu. Click OK to dismiss the "All features are valid" message. If the record is invalid, the problems will be indicated. Make the required corrections and Validate Features again.

Note: Validate Features operates only on selected records.

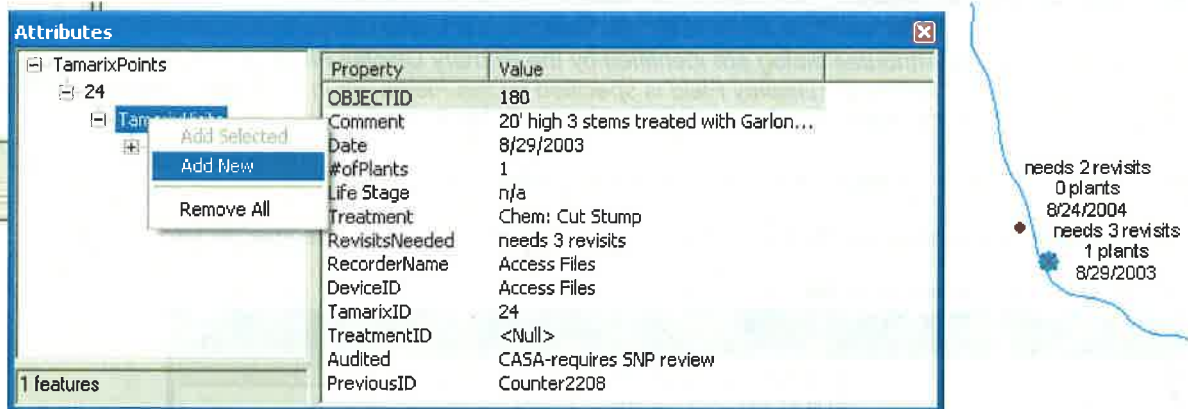
7. Add new **TamarixVisits** data for **Tamarix revisits**, if necessary. In this example, the systematic wash survey passed two previously encountered points, but no Tamarix were present. New records should be added to the *TamarixVisits* table, indicating the new **Revisits** status.

7a. Clear selected records, , then use the selection tool  to select one of the *TamarixPoints* features from the map.

Note: it may be necessary to make TamarixPoints a selectable layer (or the only selectable layer): From the Selection menu, choose Set Selectable Layers... and make the appropriate adjustments, or right click the TamarixPoints layer in the table of contents, and choose Selection>Make This the Only Selectable Layer.

7b. Open the Attributes editor , and add a new *TamarixVisits* record to the selected *TamarixPoint* record.

Note that the previous visit record (shown below) indicated three (3) revisits were required; the new record should be coded to indicate that two revisits are now required. Note also that the Status field in the TamarixPoints may need to be edited, depending on changes made to the Revisits variable.



Property	Value
OBJECTID	180
Comment	20' high 3 stems treated with Garlon...
Date	8/29/2003
#ofPlants	1
Life Stage	n/a
Treatment	Chem: Cut Stump
RevisitsNeeded	needs 3 revisits
RecorderName	Access Files
DeviceID	Access Files
TamarixID	24
TreatmentID	<Null>
Audited	CASA-requires SNP review
PreviousID	Counter2208

8. Optional: **Add chemical treatment data, if appropriate.** This involves two basic steps: adding the appropriate data to the chemical treatment tables, then adding the **OBJECTID** for the new *TreatmentsChem* record to the **TreatmentID** field in the *TamarixVisits* record(s). See the section [Adding chemical treatment data to the geodatabase](#) for details; In summary, the procedure is as follows:

8a. Open the *TreatmentsChem* table, and enter values to create a new record. Then open the *ActiveIngredient* and *Adjuvant* tables and enter data as necessary to complete the treatment data record. Insure that the OBJECTID value from *TreatmentsChem* is posted as the foreign key in the related *ActiveIngredient* and *Adjuvant* records.

8b. Post the foreign key from *TreatmentsChem* to the appropriate *TamarixVisits* record(s): enter the *TreatmentsChem* **OBJECTID** as the value for **TreatmentID** in *TamarixVisits*. This relates the records.

9. **Save edits and stop editing:** once all records have been validated, save the edits: click the Editor button on the Editor toolbar, and select Save Edits from the drop down menu. Click the Editor button again, and choose Stop Editing.

10. **Remove the TempXY Events layer (not the TempXY table) from the map:** right click the layer in the table of contents, and select Remove from the context menu.

Note: at this point, records should be fully attributed and have valid geometry. Proceed to post processing step 20, below.

Post processing Tamarix data

Note: it may be useful to review the information in the Overview section. For records entered on the desktop, as described above, much of the post processing described below should be unnecessary; for those records, the remaining tasks include updating the TamRecent feature class, and running the ModelBuilder routine that updates the derived LinearTamarix feature class.

Steps 11 – 19 below are intended to assist with post processing of a relatively large quantity of Tamarix data, such as would be checked in from extensive ArcPad data collection. For smaller (and more typical) data volumes, it may be more efficient to simply review and edit the new records, using the procedures (outlined above) for desktop data entry as guidance.

In steps 11-19, a number of temporary layers and tables are generated and added to the map. These layers and tables contain the new or modified records from TamarixPoints and TamarixVisits. They are reviewed, edited if necessary, and then removed from the map document and/or deleted.

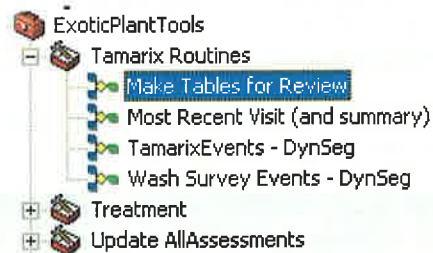
11. Start ArcMap, and open ProcessExoticsData.mxd. The ExoticPlantsTools toolbox should appear in the toolbox list.

12. Add temporary selection layers and tables to the map. These layers will include the records to be reviewed during post processing.

12a. Run the Make Tables for Review model:

If necessary, expand the toolbox list to view the "Tamarix Routines" toolset, then double click on the "Make Tables for Review" model to open the tool dialog (or right click on the model icon and select Open from the context menu).

The tool requires no user input. Click OK to run the model, or Cancel to abort. Details about the model can be viewed by clicking the Tool Help button.



Click close to dismiss the status dialog after the tool executes.

Note: Running the model should result in the addition of two (2) layers and one (1) table to the map table of contents. Click the Source tab, and confirm that New TamarixPoints, Status & Revisit Query, and New TamarixVisits (table) are present.

12b. Create a new map layer containing selected records from TamarixPoints:

12b1. Open the New TamarixVisits table (created in step 12a). Note of the number of records in the table.

12b2. Click the Options button at the bottom of the table, then click Select All from the context menu.

12b3. Click the Options button again, then select Related Tables, and then rcTamarix : TamarixPoints relationship class. This selects related records in the TamarixPoints feature class, and may cause one or more attribute tables to open.

12b4. Close or minimize the New TamarixPoints attribute table, if it is open. View the TamarixPoints attribute table (not the New TamarixPoints table), and note the number of records selected (indicated at

the bottom of the table). This should match the number of records in the *New TamarixVisits* table. Data entry errors are probable if the number of records do not match. Typically, the error involves adding a new point, but failing to add a related record to *TamarixVisits*.

12b5. Right click the *TamarixPoints* layer in the table of contents, then choose Selection>Create Layer From Selected Features from the context menus. The *TamarixPoints selection* layer is added to the map.

Note: TamarixPoints selection may include both previously existing records (previously recorded locations that have been revisited), as well as new records (first visits; Audited="not audited").

12b6. Close any open tables, and clear all selections . Save the map.

13. Prepare the map for editing.

13a. If there are no records in *New TamarixPoints*, this indicates that all new data represent revisits to previously recorded locations. If this is the case, remove the layer from the map, and go to step 16.

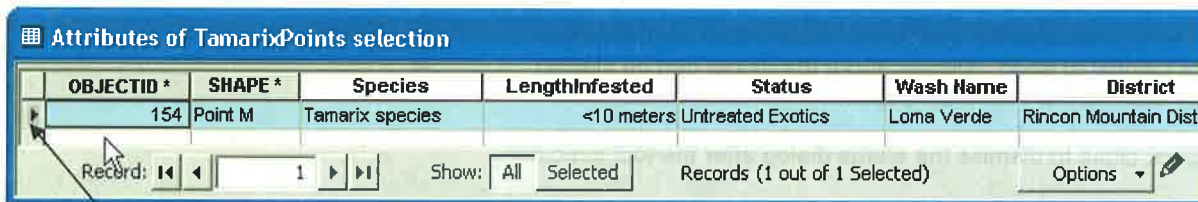
13b. Label *New TamarixPoints* with the wash name: right click the layer name and select Properties. Click the Labels tab, check the box to label features, and select **WashName** as the label field from the pick list. Click OK to close the dialog.

13c. Make *New TamarixPoints* the only selectable layer: right click the layer, then select Selection>Make This the Only Selectable Layer.

13d. In the table of contents, make *New TamarixPoints* the only visible Tamarix point layer, and make sure *HydroRoutesRMD* is checked as visible.

14. Review and edit the Wash Name values for the new TamarixPoints records.

14a. Start an Edit session in ArcMap: click Editor, select Start Editing, and select the ExoticPlantsGDB as the database in which to edit data.

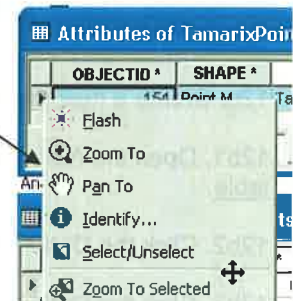


OBJECTID *	SHAPE *	Species	LengthInfested	Status	Wash Name	District
154	Point M	Tamarix species	<10 meters	Untreated Exotics	Loma Verde	Rincon Mountain Dist

Click this box to select the record; right-click to view context menu

14b. Pan and/or zoom to various records in the map, insuring that **WashName** values (labels) are accurate. To pan to the Tamarix feature, right-click the row heading box, and choose Pan To (Zoom To, etc.)

Note: If necessary, use the Identify tool  (on the standard toolbar) and click a feature from the HydroRoutesRMD layer to confirm the wash name.



14c. Correct the **WashName** values in *New TamarixPoints* if necessary: use the Edit Tool  on the Editor toolbar to select the feature on the map, and edit the value directly in the table, or use the attributes dialog .

15. **Validate features and save edits** when all records have been reviewed.

15a. With the *New TamarixPoints* attribute table open, click the Options button at the bottom of the table, and click Select All from the context menu. All records should be highlighted.

15b. Click the Editor button on the Editor toolbar, then click Validate Features.

15c. Click OK to dismiss the "All features are valid" message. If invalid records exist, the problems will be indicated. Make the required corrections and Validate Features again.

15d. Once all records have been validated, save the edits (Editor button>Save Edits).

15e. Turn off the *New TamarixPoints* layer in the map table of contents: un-check the box next to the layer name.

16. **Review and edit the fields Status (from *TamarixPoints*) and Revisits (from *TamarixVisits*) for logical inconsistencies.** The query table *Status & Revisit Query*, created in step 12a, includes records with probable conflicts between the two fields.

Note: Each record in the query table Status & Revisit Query is created by combining each new record in TamarixVisits (table) with the related record from TamarixPoints (feature class). Records are included in the table if they meet the following conditions: they are "new" records (Audited in either table = "not audited"), and if inconsistencies exist between the fields Status (from TamarixPoints) and Revisits (from TamarixVisits) – for example, Status="Untreated Exotics" and Revisits="Needs 2 revisits."

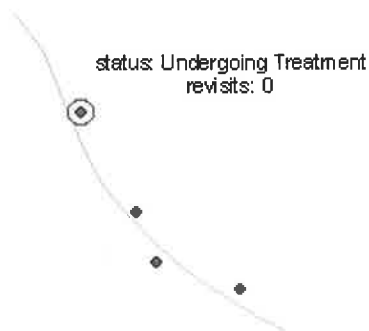
16a. Open the *Status & Revisit Query* table. If it contains no records, conflicts are not indicated. Go to step 17.

16b. If the *Status & Revisit Query* table contains records, label the features: open the layer properties dialog, click the Labels tab, click the Expression button, click the Load button, and browse to "TamStatus&Revisits.lxp" in the Expressions folder.

16c. In the table of contents, make both *TamarixPoints selection* and *Status & Revisit Query* visible.

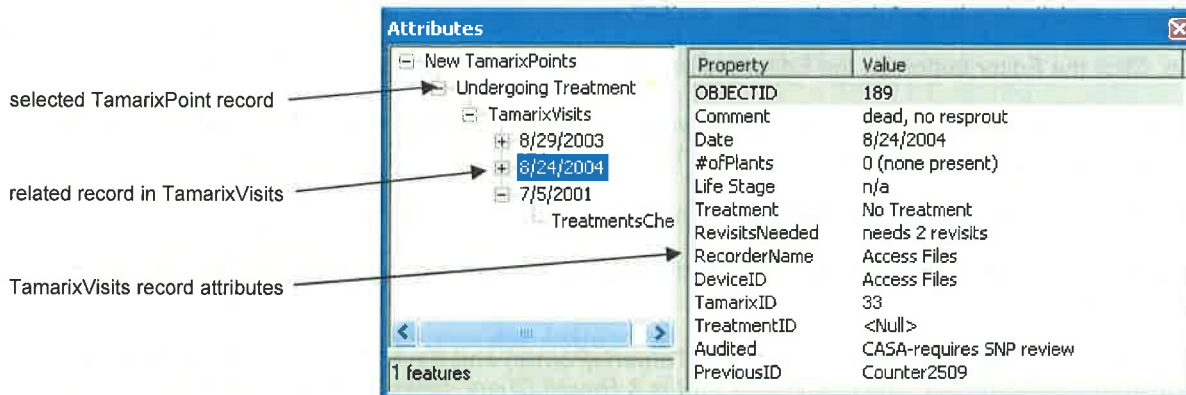
16d. Make *TamarixPoints selection* the only selectable layer: right click the layer, then select Selection>Make This the Only Selectable Layer.

16e. Pan and/or zoom to the query table records. The label added in 16b, above, should help indicate the conflict.

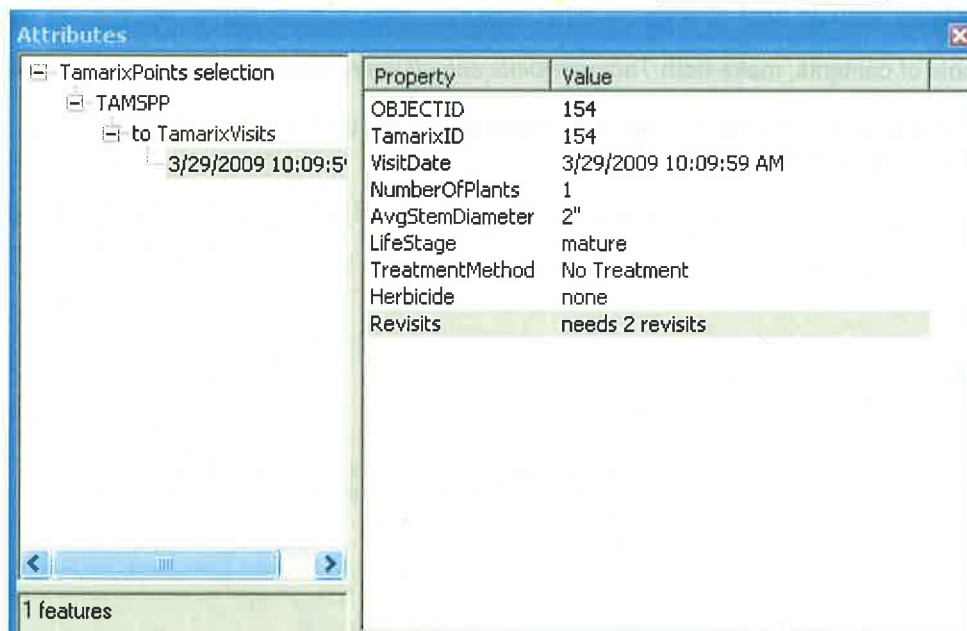
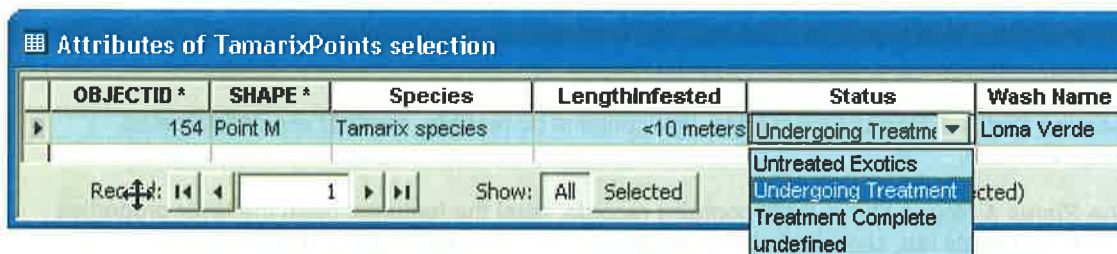


Four Tamarix points, one with an apparent conflict between Status and Revisits (Indicated by the labeled query table record, symbolized with the red circle).

16f. Correct the conflict in *TamarixPoints* and/or *TamarixVisits*: use the Edit tool to select the *TamarixPoint* selection record on the map (start an Edit session if necessary), then use the Attributes dialog to view the selected record and its attributes, along with the attributes from the related records in *TamarixVisits*. Edit the **Status** and/or **Revisits** field as necessary.



Another view -- editing Tamarix data: A record in the *TamarixPoints* selection is selected and the attributes editor is open. The attribute values of the related record in the *TamarixVisits* table are shown. Note that the **Status** value ("Undergoing Treatment") is appropriate, given the **Revisits** value in the related record ("needs 2 revisits")



16g. Once all conflicts have been reviewed and resolved, save the edits (Editor button>Save Edits). Remove the *Status & Revist Query* layer from the map (right click the layer name>Remove).

17. **Recode Audited values In *TamarixPoints selection* and *New TamarixVisits*:** once all *TamarixPoints selection* records and the related records in *TamarixVisits* have been reviewed, complete the following:

17a. With the *TamarixPoints selection* table open, click the Options button at the bottom of the table, and click Select All from the context menu. All records should be highlighted.

17b. Right-click the **Audited** field column heading and click Field Calculator... to open the field calculator dialog.

*Note: The **Audited** field may be hidden. Click the Options button at the bottom of the table, then Turn All Fields On.*

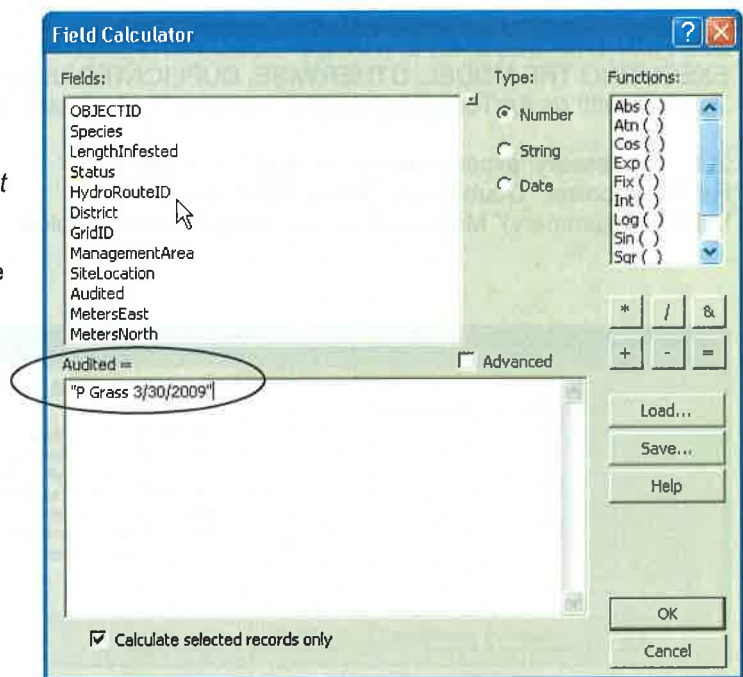
17c. Complete the dialog to update the **Audited** field for the selected records.

Note: This step overwrites the default "not audited" value for the field.

The identity of the post processor and the date are recorded. Quotation marks are required or an error will be returned.

Click OK to update the records.

17d. Repeat the process to update the **Status** attribute in the *New TamarixVisits* table.



18. **Validate features and save edits.**

18a. Make sure all records in *TamarixPoints selection* are still selected, then click the Editor button on the Editor toolbar, and pick Validate Features.

18b. Click OK to dismiss the "All features are valid" message. If invalid records exist, the problems will be indicated. Make the required corrections and Validate Features again.

18c. Once all records have been validated, save the edits, then stop editing (Editor button>Save Edits; Editor button again>Stop Editing).

18d. Remove the *TamarixPoints selection* layer from the map: right-click on the layer name in the table of contents and select Remove from the context menu.

19. Confirm that records in New TamarixPoints are valid.

Note: Each record in the New TamarixPoints layer should be related to one and only one related record in the TamarixVisits table. Any other condition indicates probable incomplete or inaccurate data capture.

Note: This layer may have been removed in step 13, if no new points were added to the geodatabase.

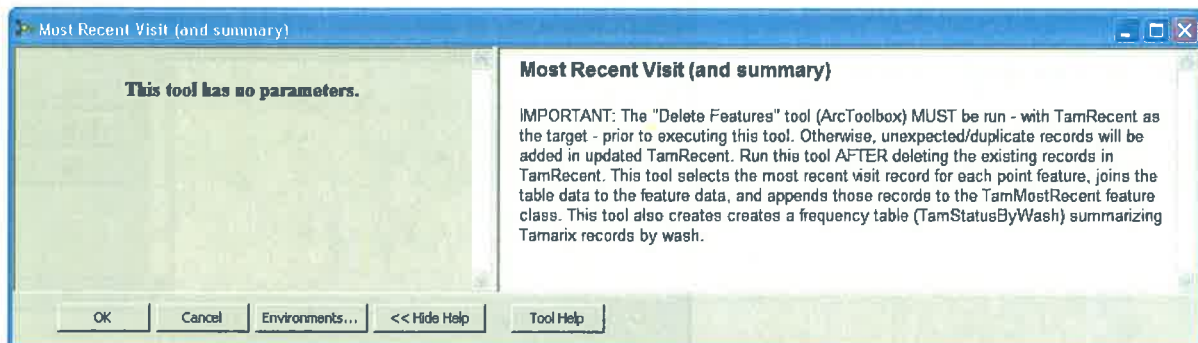
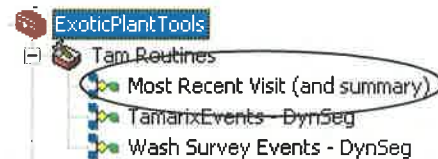
19a. Open the *New TamarixPoints* attribute table, and view the **Audited** field. All of the records should have the new audit value added in step 17; none of the records should now be coded "not audited" or "(blank)". Records still coded "not audited" or "(blank)" result from entering a *TamarixPoints* feature class record, but failing to enter the related record in *TamarixVisits*.

19b. Once conflicts have been resolved, remove *New TamarixPoints* from the map and save the document.

20. Update the *TamRecent* layer and produce the summary table.

20a. RUN THE "DELETE FEATURES" TOOL WITH *TamRecent* AS THE TARGET BEFORE EXECUTING THE MODEL. OTHERWISE, DUPLICATED/UNEXPECTED RECORDS WILL APPEAR IN *TamRecent*!!! (in ArcToolbox>Data Management Tools>Features>Delete Features)

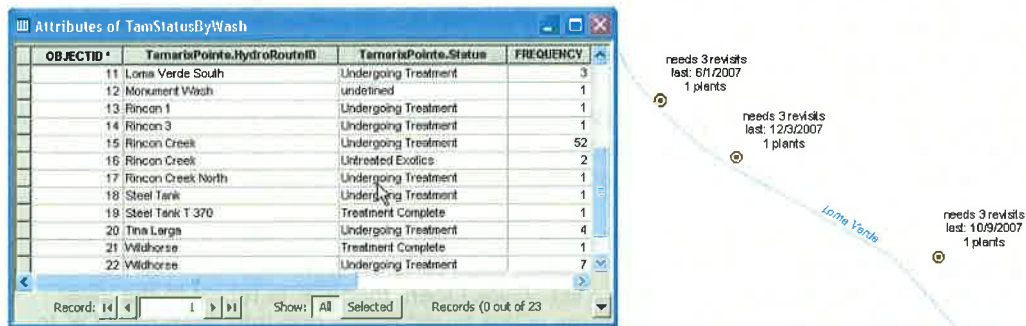
20b. If necessary, expand the ExoticPlantsTools and Tam Routines toolset. Double-click on the "Most Recent Visit (and summary)" ModelBuilder icon to open the tool dialog.



20c. Click OK to run the tool, or Cancel to abandon the process. Details about the routine can be viewed by clicking the Tool Help button.

20d. A status dialog will appear as the model tools are processed. If there are problems encountered, review the status information. Click the Close button to dismiss the dialog once the tool completes successfully.

The tool produces a summary table indicating the number Tamarix instances in each of the Status categories in each wash segment (below left), and updates the *TamRecent* feature class, which displays data from the most recent visit to each *TamarixPoint* (below right).



21. Run the tool to update the *LinearTamarix* feature class.

21a. If necessary, expand the ExoticPlantsTools and "Tam Routines" toolset. Double-click on the "Tamarix Events – Dyn Seg" ModelBuilder icon to open the tool dialog.

21b. Click OK to run the tool, or Cancel to abandon the process. Details about the routine can be viewed by clicking the Tool Help button.

21c. A status dialog will appear as the model tools are processed. If there are problems are encountered, review the status information. Click the Close button to dismiss the dialog once the tool completes successfully.

Note: a valid and updated TamRecent feature class is necessary for this tool to produce the expected results.

Post processing wash survey data

Note: Where systematic wash surveys are undertaken, survey data are collected as "start" and "end" points in the field, either using ArcPad equipped GPS receivers, or by recording information on paper forms which is later added to the geodatabase. In either case, the survey point data are converted to linear representations of survey events on the desktop. The following section outlines the procedure for making this conversion. The product of the procedure is the WashSurveys (linear) feature class, which, when combined with the LinearTamarix feature class, can be used to visualize and evaluate Tamarix infestations within the park.

Note: The process described below is essentially the same as that used to enter and process Weed Free Trails survey data.

1. Optional: **Add new survey point data to WashSurveyPoints.** Skip this step if survey data were collected in ArcPad.

If survey data recorded on paper forms are to be added to *WashSurveyPoints*, follow the procedure outlined in step 2 above (*Adding Tamarix records*), to add X-Y (coordinate data) map, then digitize and attribute the new *WashSurveyPoints* features.

2. Prepare the map for editing *WashSurveys*.

2a. In ArcMap, open ProcessExoticsData.mxd (if it is not already), and turn off all layers other than *HydroRoutesRMD*, *WashSurveyPoints*, and *WashSurveys*.

2b. Create a selection layer that includes the survey points to be converted to new linear representations. This can be done using the "Select by Attributes" tool (Selection>Select by Attributes) and selecting by **Date**, **Audit** code (i.e. "unaudited"), etc., or by simply opening the *WashSurveyPoints* attribute table and selecting the desired records (generally, these should be coded "unaudited" for the **Audit** field).

2c. With the desired records selected, right click the *WashSurveyPoints* layer name in the table of contents, then select Selection>Make Layer From Selected Records from the context menu. The new layer *WashSurveyPoints Selection* is added to the map. Turn *WashSurveyPoints* off.

2d. Label the features in *WashSurveyPoints Selection*: open the layer properties dialog, click the Labels tab, click the Expression button, then click the Load... button. Browse to the Expressions folder, and select the label expression "SurveyPoints.lxp" from the list. Click Open, then OK to return to the layer properties dialog. Make sure to check the "Label features in this layer" option (top left), then click OK to close the dialog. Wow.

3. **Edit the records in *WashSurveyPoints Selection***, if necessary. Open the attribute table and make sure the records are correctly attributed. Correct any obvious errors or omissions. Be sure to update the **Audited** field with your name and date.

Note: Recorder (Alias: RecorderName) refers to the individual collecting field data. Audited refers to the individual (and date) conducting post processing.

4. Add features to the *WashSurveys* feature class:

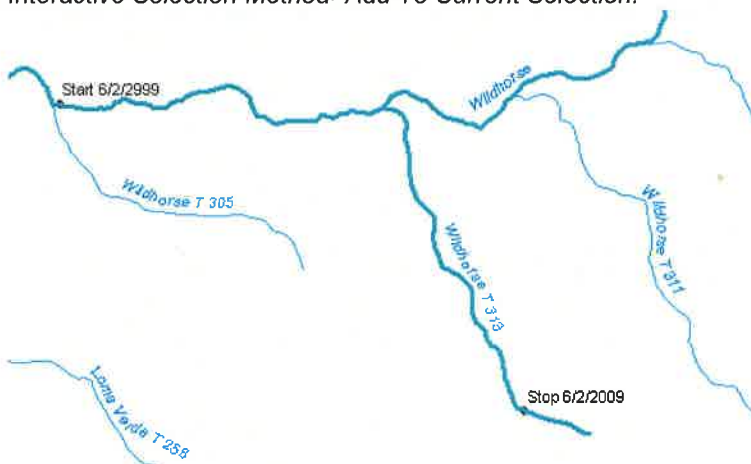
4a. Start an Edit session in ArcMap: click Editor, select Start Editing, and select the *ExoticPlantsGDB* as the database in which to edit data.

4b. Set snapping options to snap only to the *HydroRoutesRMD* selection layer. (See step 5 above for details). Check all three boxes: Vertex, Edge, and End.

4c. Make *HydroRoutesRMD* the only selectable layer: right click on the layer name, then select Selection>Make This the Only Selectable Layer.

4d. Identify the survey to be represented by the new *WashSurvey* line feature, based on the *WashSurveyPoints* selection, and use the select tool  to select all the *HydroRoutesRMD* features between the two points.

Note: you may need to adjust the selection method setting: from the main menu, choose Selection>Set Interactive Selection Method>Add To Current Selection.



A pair of survey start and stop points, with connecting features from *HydroRoutesRMD* selected.

4e. Make sure the Editor task is set to "Create New Feature," and that the target is "WashSurveys."



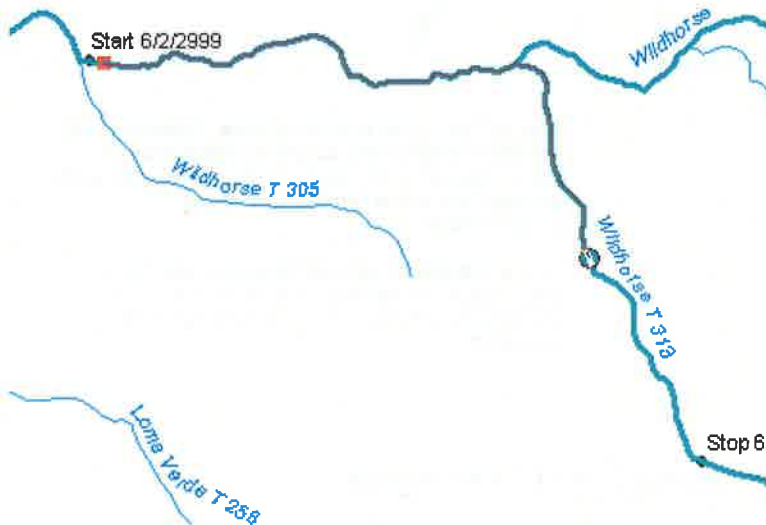
4f. Click the sketch tool, and create the first vertex by snapping to the *HydroRoutesRMD* feature at a point near as possible to the "start" point. The cursor should snap to the line if the snapping options are set correctly.

4g. Trace the line: from the Toolbar, change from the Sketch tool to the Trace tool.

Then click the selected line near where your initial vertex was placed, and slowly move the cursor along the line, insuring that the line is being traced. This is indicated by the black line following the cursor.



Note: the Trace tool only works on selected features.

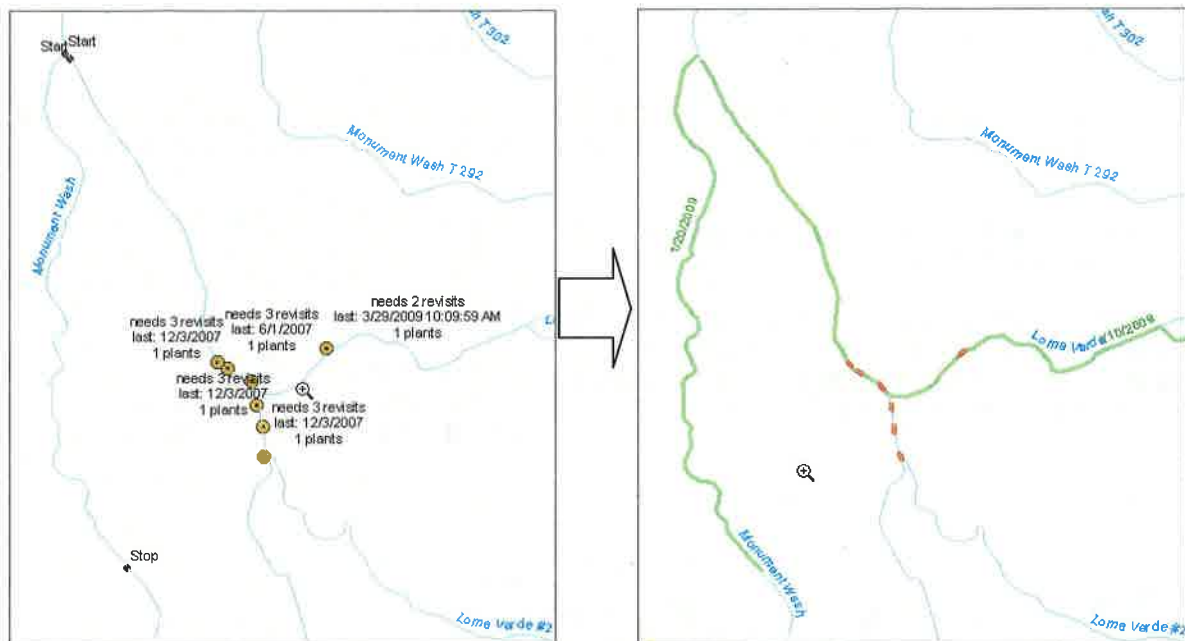


Creating a new WashSurvey feature by tracing the *HydroRouteRMD* features between survey start and stop points.

4h. Finish the line: when the survey stop point is reached, click the line to insert a final vertex, then press the **F2** key to finish the sketch. This will unselect the *HydroRoutesRMD* features, and leave the new *WashSurvey* feature selected.

4i. Attribute the new feature: click the Attributes button on the Editor toolbar  to open the attributes dialog, and code the record. The only attribute is **SurveyDate**.

4j. Save your edits (Editor>Save Edits). When you have completed creating new features in *WashSurveys*, save your edits and stop editing (Editor>Stop Editing).



Survey start/stop points, and TamRecent data.

Point data converted to linear features. Green reaches indicated surveyed wash segments (*WashSurveys*); blue reaches are unsurveyed. Red lines indicated wash segments with active Tamarix infestations (*LinearTamarix*).

Survey data may be displayed based on selections by date, for example, and summary measures may be easily produced to summarize distance surveyed, infested, etc.

Post processing Weed Free Trails survey data

The process for converting WFT survey start and stop points to linear representations is essentially identical to that for processing wash survey points. See preceding section, Post processing wash survey data.

The principal differences between the processes are, of course, the feature classes involved. For WFT surveys:

- Survey start and stop points are maintained in the WFTSurveyPoints feature class (instead of WashSurveyPoints)
- Linear representations of the surveys are created in the WFTsurveys feature class (instead of WashSurveys)
- Reference data traced to create the linear survey representations come from the Trails_RMD and Trails_TMD feature classes (instead of HydroRoutesRMD).

Appendix A: Revising Geodatabase Coded Value Domains

Coded value domains contain the sets of allowable values for certain specified fields, and are a property of the geodatabase. For example, the coded value domain *SpeciesCodes* contains the codes and descriptions for the field *Species* in the Point, Line, and PolyData tables. It is the coded value domains that supply the values present in the "pick lists" that appear to users editing feature class or data table records in ArcPad or ArcMap.

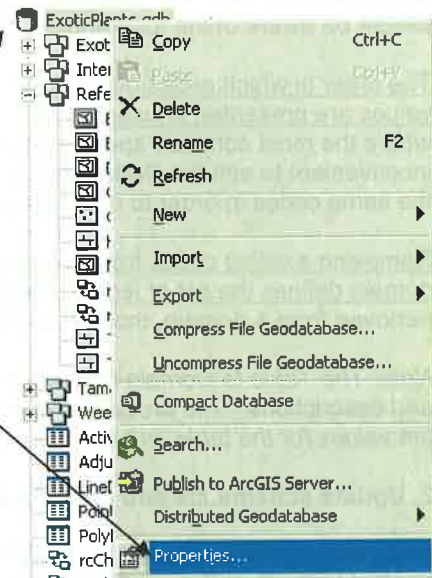
Coded value domains may be viewed and edited in ArcCatalog.

To view the list of domains and their codes and descriptions, do the following:

1a. In ArcCatalog, right-click the ExoticPlants.gdb icon, and select Properties from the context menu.

This opens the Database Properties dialog.

1b. Click the Domains tab to view the list of domains.

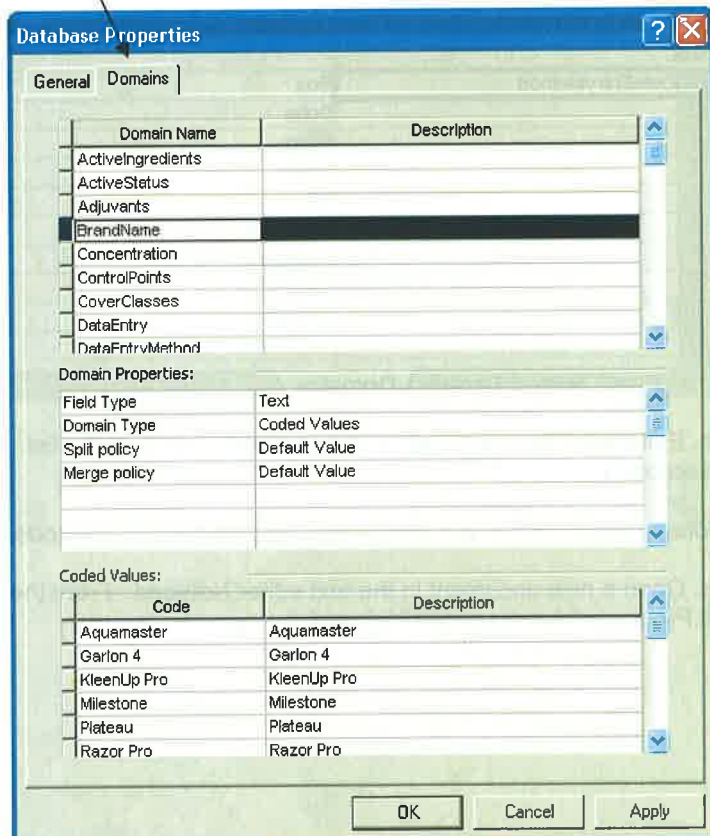


The top pane lists all GDB domains.

The middle pane includes properties for the selected domain (in this example, BrandName).

The bottom pane includes the actual Codes (the actual data values stored in the feature classes/tables) and Descriptions (values users see when editing data.)

Note: domain codes and descriptions are listed in the Excel spreadsheet schema.xls.



In general, there are two options for modifying coded value domains:

- Editing directly in the Coded Values pane in the Database Properties dialog, shown above
- Using the *Table to Domain* tool available in ArcToolbox to append to or overwrite the list of codes and descriptions for a specified domain.

In most cases, using the *Table to Domain* tool should be used to modify domains. Before doing so, please be aware of the following:

The order in which codes/descriptions are entered into the Coded Values table will be the order that the values are presented to users in pick lists. This is particularly important in the case of Species Codes, where the most common species have been placed at the top of the table. This is one reason it is usually inconvenient to edit the Coded Values table directly, as it will likely be necessary to delete, then re-enter the same codes in order to maintain the desired order.

Removing existing codes from a domain can cause feature class records to become invalid, since the domain defines the set of legal values for specified fields. If codes that exist in database records are removed from a domain, those records will need to be recoded; otherwise they will not validate.

Note: The Table to Domain tool reads values from a table that must contain at least two columns: codes and descriptions. The procedure described here uses the Excel spreadsheet schema.xls as the source of the values for the table, but there are numerous other methods for creating the table.

2. Update schema.xls and create a text file table containing the revised domain values:

Note: this example updates the DataEntryMethod domain, which contains the codes and descriptions applied to the DataDevice fields (alias: DeviceID) in a number of the feature classes.

2a. Open schema.xls, click on the Domains worksheet tab, and scroll to the DataEntryMethod rows:

51	DataEntryMethod	Box	Box
52		Dobe	Dobe
53		Echo	Echo
54		King	King
55		U2	U2
56		Vacant01	Vacant01
57		Vacant02	Vacant02
58		Vacant03	Vacant03
59		Desktop	Desktop
60			

2b. Edit the table as desired to add new instruments to the list. Make sure to add both a code and a description.

Note: in this example, the descriptions are identical to the codes, but this is not always the case.

2b. Open a new document in the text editor Notepad. From the Start menu in Windows, select All Programs>Accessories> Notepad.

2c. Select the appropriate cells from the Excel spreadsheet, copy them, and paste them in to the Notepad document. (They should be automatically be added as tab-delimited text.)

Box	Box
Dobe	Dobe
Echo	Echo
King	King
U2	U2
Vacant01	Vacant01
Vacant02	Vacant02
Vacant03	Vacant03
Desktop	Desktop



Untitled - Notepad		
File Edit Format View Help		
Box	Box	
Dobe	Dobe	
Echo	Echo	
King	King	
U2	U2	
Vacant01		Vacant01
Vacant02		Vacant02
Vacant03		Vacant03
Desktop	Desktop	

Copy cells from Excel (two columns) and paste into the Notepad document. Confirm that resulting data in the Notepad document are tab-delimited.

2d. Add a new row to the top of the Notepad document that will contain column headings. Complete the row as shown, adding "Code" and "Descrip." Make sure to insert a tab between the two headings.

"Tab" here – not "spaces"

Untitled - Notepad		
File Edit Format View Help		
Code	Descrip	
Box	Box	
Dobe	Dobe	
Echo	Echo	
King	King	
U2	U2	
Vacant01		Vacant01
Vacant02		Vacant02
Vacant03		Vacant03
Desktop	Desktop	

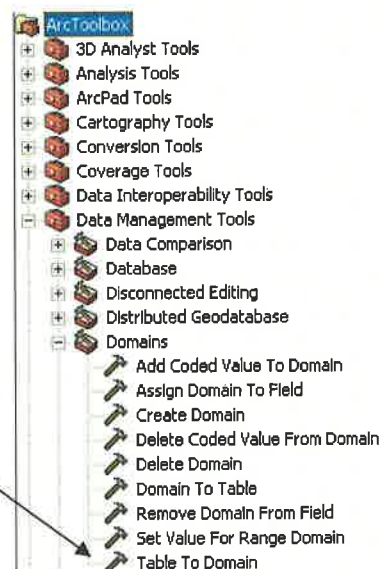
2e. Save the Notepad document: from the File menus, select Save As, then specify the name as "DataEntryMethod," and make the folder "DomainLists" the destination (in the ExoticPlantsGDB folder).

2f. Close Excel, and close Notepad.

3. Use the Table to Domain tool to update a coded values domain:

3a. If it is not already, open ArcCatalog, and open ArcToolbox by clicking the show/hide toolbox icon .

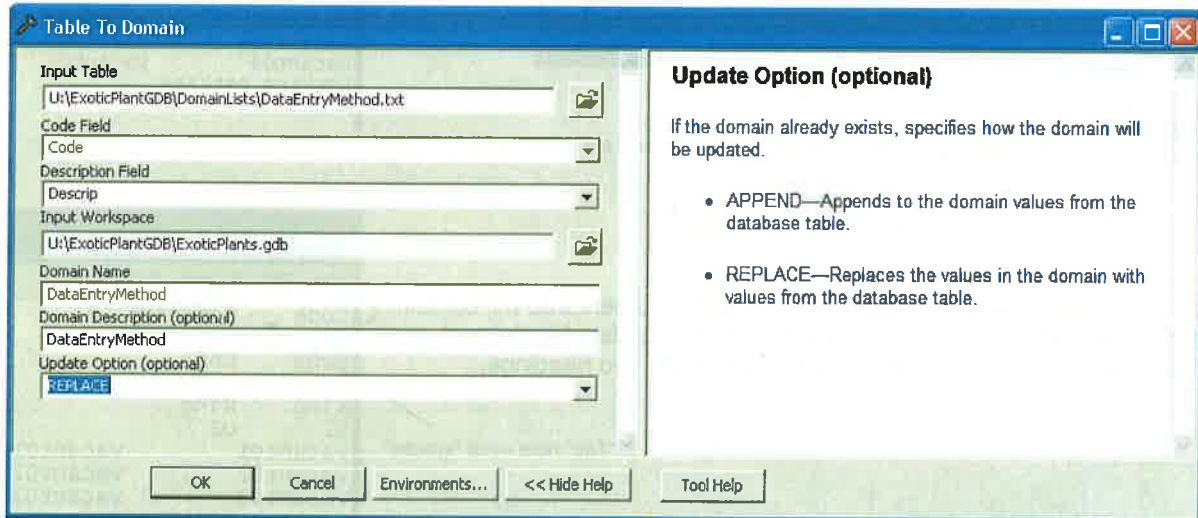
3b. Open the Table To Domain tool dialog: Data Management Tools>Domains>Table To Domain



3c. Complete the tool dialog as shown below, using the text file created in step 2, above, as the input table.

Note: the domain name and description must be typed in by the user (it is not a pick list), so be sure to duplicate precisely the existing domain name.

Note: the option to "Replace" existing codes is selected. This overwrites existing domain values.



3d. Click the OK button to run the tool. If the tool runs successfully, no messages will generate. Confirm that the domain has been modified by reviewing the values in the Database Properties dialog (see step 1, above).

Note: A tool error is often the result of the table being out of order in some manner. For example, duplicate values in the codes list will cause the tool to fail. Insure that the input text table is correctly formatted (tab-delimited) and contains no extraneous data or duplicate records.

Appendix B: Adding "Access" and "Merge" data to the ExoticPlant Geodatabase

Existing exotic plant data from six (6) shapefiles have been added to the AllAssessments feature class. This involved standardizing the attribute data to conform to the coded value domains present in the geodatabase, and also buffering the point and line records based on patch width and length values (sometimes) present in the original datasets.

Essentially all of the Access (Point/Line/and Polygon) records have been added to AllAssessments (except Tamarix spp. records – pending). Merge data present in the Point/Line/Polygon_Merge files as of February 11, 2009 have also been added to AllAssessments, excepting those records noted below.

Original Data	Buffer output files (loaded to AllAssessments)
Access_Exotic_Points n=2925 (approx 1000 had Radius=0) TAM=58	AccessPointsSelectionBuffer n=2867
access_exotic_lines n=587 TAM=1	AccessLinesSelectionBuffer n=586
Access_Exotic_Poly n=225	Access_Exotic_Poly n=225 (all records loaded)
exotic_point_merge* n=1328 TAM=94 bad data=13**	MergePointSelectionBuffer n=1221
exotic_line_merge* n=184 TAM=5 bad data=7**	MergeLineSelectionBuffer n=177
exotic_polygon_merge n=447	exotic_polygon_merge n=447 (all records loaded)
* through Feb 11, 2009	
**see FLAGTMP field and/or list below	

Merge data added to the existing shapefiles after February 11, 2009 can be appended to AllAssessments following the guidelines below.

Note: AllAssessments contains two fields indicating origin of a given data record: PreviousID, which pertains only to Access or Merge records and contains the key field value from the original data source, and MergeID, which is assigned to all records during post-post processing, and was also assigned to the previous Access and Merge records according to the following scheme:

source	value range	derivation
Access Point	10,000-19,999	10,000+OBJECTID
Access Line	20,000-29,999	20,000+OBJECTID
AccessPoly	30,000-39,999	30,000+OBJECTID
PointMerge	100,000-199,999	100,000+OBJECTID
LineMerge	200,000-299,999	200,000+OBJECTID
PolyMerge	300,000-399,999	300,000+OBJECTID
AssessmentPoint+PointData	1,000,000-1,999,999	1,000,000+OBJECTID
AssessmentLine+LineData	2,000,000-2,999,999	2,000,000+OBJECTID
AssessmentPoly+PolyData	3,000,000-3,999,999	3,000,000+OBJECTID

In adding the remaining Merge data records to AllAssessments, care should be taken that this convention is enforced and that MergeID data are not inadvertently duplicated.

Standardizing attribute data - notes:

A number of temporary fields (corresponding to those in the target AllAssessments) were created in the exotic_point/line/polygon_merge files, then populated manually or using the field calculator.

Some of the fields, such as the (nullable) text entry fields such as *Comments*, *SiteLocation (Route)*, *Recorder*, etc. are computed for the new temporary fields more or less directly from the old data with little or no manipulation.

However, a certain amount of interpretation and/or revision was required when assigning values to fields that are non-nullable and/or have coded value domains. This is because some existing records were missing values for some attributes altogether, and because values in the existing datasets do not necessarily conform to the coded value domains present in the new ExoticPlantsGDB.

For fields with coded value domains (percent cover, number of plants, patch width), it may be useful to create a summary table for the records to be imported. This will inform the development of the expressions used in the field calculator to populate the new temporary fields. For example, the table below (left) is a *partial* list of the values for *COVER* found in the existing exotic_point_merge dataset. Below right are the legal values in the new AllAssessments feature class. In order for the existing data to be loaded into the new geodatabase and result in valid values, the original data must be recoded.

exotic_point_merge COVER	
value	# records
(blank)	86
0	1
0%	12
1%	9
1-5	40
1-5%	236
1-5% incomplete	1
10%	11
10-20%	10
10-25%	58
100%	12
11-25%	52
16-25%	2
16-30	1
16-30%	39
2	1
20%	41
20-30%	3
25%	7
25-35%	1
25-50%	42
25-50%a	1
26-50%	78
30%	22
30-40	1
30-40%	3
30-50%	8
31-50%	35

Coded value domain CoverClasses (Assessments)	
Code	Description
0	0
0.03	1-5%
0.08	6-10%
0.18	11-25%
0.38	26-50%
0.68	51-75%
0.88	76-99%
1	1

Refer to the document *schema.xls* for descriptions of the legal domain values and the attributes to which they apply.

Creating polygon representations of the point and line merge data – notes:

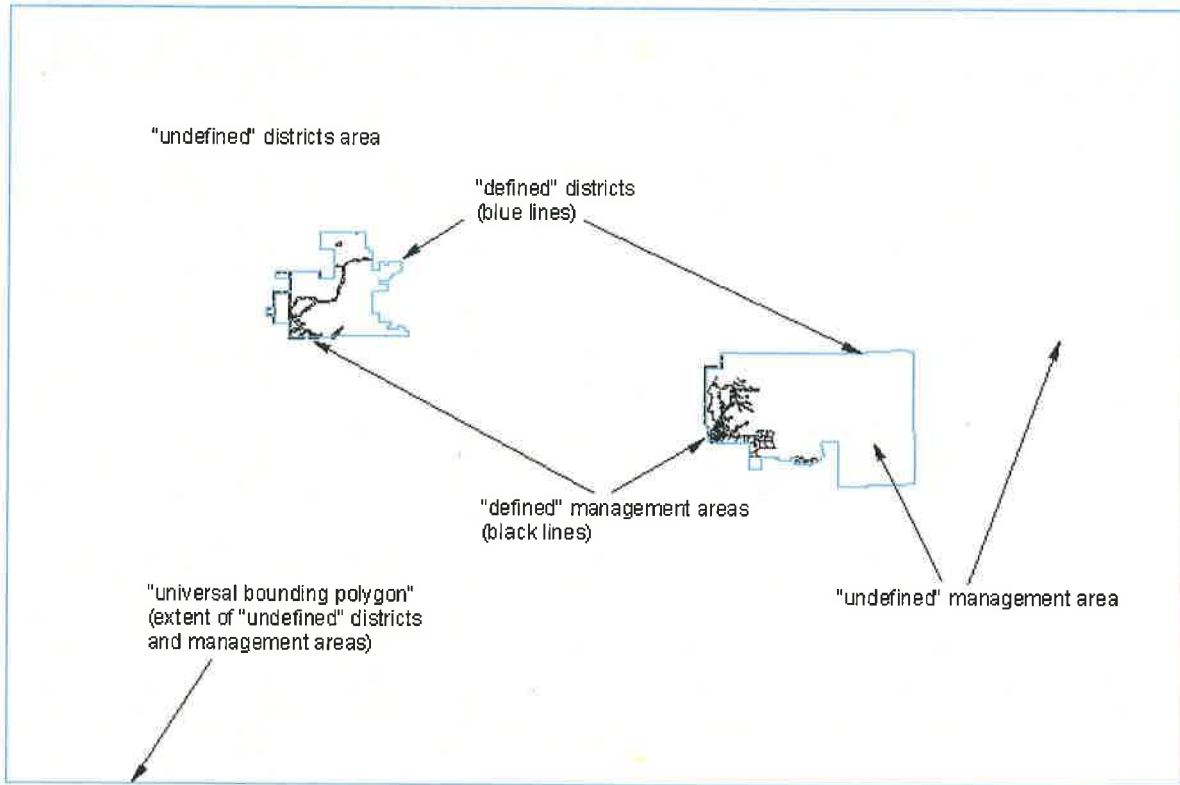
The point and line assessments feature classes in the ExoticPlantsGDB use a single value, *BufferRadius* (alias: *TotalWidth*) to compute the buffer when converting these features to polygons. However, the exotic_point_merge data has two such fields, *PATCH_LENGTH* and *PATCH_WIDTH*; these fields are

used to calculate the *PATCH_SIZE* field. The *RADIUS* field is then derived. Before executing the buffer function used to create the MergePointSelectionBuffer shapefile (which is then loaded into AllAssessments), the *RADTMP* field was computed in the same manner and compared to the values in *RADIUS*.

Loading data into AllAssessments

Once the temporary attribute fields are populated and the polygon representations have been created, records may be appended to AllAssessments. Probably the safest method of accomplishing this is inside an edit session in ArcMap, using the Append tool in ArcToolbox. This method allows database updates to be reviewed and validated before being made permanent.

The *ManagementAreas* and *Districts* feature class includes one record – the “undefined” area – that can be thought of as the “universal bounding polygon” for the feature class. It encompasses all areas outside the other defined management areas, such that (assessment) features falling outside any other defined management area are assigned to the “undefined” management area:



The *Districts* feature class contains three records (“RMD,” “TMD,” and “undefined”), while the *ManagementAreas* feature class currently contains over 100 records (including “undefined”). Note that the “undefined” features in the two feature classes are *not* coincident, because an area inside, for example, the “RMD” district might also be “undefined” in terms of management area.

Features in *ManagementAreas* may be edited, and new areas may be added. However, when doing so, it is then necessary to update the “undefined” feature. If this is not done, overlaps and/or voids will occur between the revised “defined” management areas and the “undefined” area. The following summarizes the procedure for doing so.

1. In an edit session, delete the existing “undefined” area from *ManagementAreas*. Save the edit, then make the desired revisions and/or additions to the “defined” features. Save edits and stop editing.
2. Run the “Erase” tool found in Arc Toolbox: erase *ManagementAreas* from *Districts*; the output should be named *newMAtemp* and placed in the “Intermediate” feature dataset.
3. Run the “Dissolve” tool on the *newMAtemp* feature class: set of accept the options so that there are no dissolve fields and no multipart features. The output should be named *newMA dissolve*, and again written to the “Intermediate” feature dataset. Open the attribute table for *newMA dissolve* and insure that there is only one feature and review the geometry on the map to insure sure it is as expected.

4. Start a new edit session, and use the "Append" tool to add the feature in *newMA* dissolve to *ManagementAreas*. The input is *newMA* dissolve, the target is *ManagementAreas*, and the schema type option should be set to NO_TEST.

5. Clear selected features, if any. Open the *ManagementAreas* attribute table, locate the new record, and select it. Insure the corresponding geometry in the map is as expected. Edit the **AreaName** field ("undefined").

Note: "undefined" is an element of the coded values domain for ManagementAreas, so the text entry must be as specified, or the feature will not validate.

The feature class has now been updated. Validate the new *ManagementAreas* features: select all features, then choose "Validate Features" from the Editor menu. Save edits and stop editing. Clear all selections.

At this point the management area values in *AllAssessments* may no longer be accurate. Use the "Near" tool and/or manual editing to make the revisions:

6. Run the "Near" tool with *AllAssessments* as the input and *ManagementAreas* as the near feature. Do not specify a search radius. This creates or updates two fields in *AllAssessments*, **NEAR_FID** and **NEAR_DIST**. **NEAR_FID** is the **OBJECTID** for the nearest feature in *ManagementAreas*.

7. Use the "Join Field" tool to add the **AreaName** field from *ManagementAreas* to *AllAssessments*: The input dataset is *AllAssessments*, the input join field is **NEAR_FID**, the join table is *ManagementAreas*, and the output join field is **OBJECTID**. Make the join field **AreaName**.

8. After the tool runs, use the field calculator to recode the *AllAssessment* field **ManagementArea**. Make **ManagementArea = AreaName**. The field is now updated with values reflecting the revised *ManagementAreas* features (additional manual edits may be necessary where assessments overlap two or more management area features).

The fields **NEAR_DIST**, **NEAR_FID** and **AreaName** can be deleted from *AllAssessments*.

Appendix D: Data Dictionary

Feature Classes, Tables, and their Attributes

AllAssessments <i>Polygon Feature Class</i>	Updated on the desktop during post processing. Derived polygon representation of records from AssessmentPoint/Line/Poly and their related data tables, Point/Line/PolyData (see below). This feature class is specifically related to the chemical treatment data tables, and provides values used to calculate (net) area treated. Also related to occurrence records. Includes records derived from the previously existing Merge and Access data. Source of records in "Most Recent Assessment" layers. Coded value domains are indicated, where applicable; see source feature class/table descriptions for additional details.		
OBJECTID system variable	System generated Primary Key for this Table. (This is the foreign key <i>OccurrenceID</i> in the assessment feature classes/tables.)		
SHAPE system variable	system generated coordinate geometry for the record		
MergeID long	Computed by ModelBuilder tool during post processing. Indicates the data source and OBJECTID from that source.		
	<i>source</i>	<i>value range</i>	<i>derivation</i>
	Access Point	10,000-19,999	10,000+OBJECTID
	Access Line	20,000-29,999	20,000+OBJECTID
	AccessPoly	30,000-39,999	30,000+OBJECTID
	PointMerge	100,000-199,999	100,000+OBJECTID
	LineMerge	200,000-299,999	200,000+OBJECTID
	PolyMerge	300,000-399,999	300,000+OBJECTID
	AssessmentPoint+PointData	1,000,000-1,999,999	1,000,000+OBJECTID
	AssessmentLine+LineData	2,000,000-2,999,999	2,000,000+OBJECTID
	AssessmentPoly+PolyData	3,000,000-3,999,999	3,000,000+OBJECTID
GridID text 4	Foreign key, references the <i>GRIDID</i> in the Grid250mCenters feature class. Computed by ModelBuilder tool during post processing.		
District text 5	Park district. Computed by ModelBuilder tool during post processing. - coded values domain [DistrictCodes]		
ManagementArea text 36	Identity of management area as represented in ManagementAreas feature class. Computed by ModelBuilder tool during post processing. coded values domain [MgmtAreas] REMOVED to allow for continuous editing of the MA feature class		
ChemTreatmentID long	Foreign key, OBJECTID in the TreatmentsChem table.		
AssessmentDate date	Assessment date.		
Species text 12	Genus and specific epithet. - coded values domain [SpeciesCodes]		
PercentCover double	Estimated cover, per species. - coded values domain [CoverClasses]		
NofPlants text 7	Estimated or actual number of plants, per species. - coded values domain [NofPlants]		
LifeStage text 12	Phenology or growth form. - coded values domain [Phenology]		
TreatmentType text 2	General treatment method, if any. - coded values domain [TreatmentCode]		
PercentTreated double	Fraction of infestation treated. Included in calculation of net area treated. - coded values domain [FractionTreated]		
SiteLocation text 254	Optional text entry field for details regarding site location or navigation.		
Comment text 254	Optional entry, including flags for post-processor.		
Recorder text 24	Identity of individual(s) recording observation data.		
DataDevice text 16	Identifies GPS unit, or desktop (paper form) data entry.		
PreviousID text 12	Key ID value from source data for records derived from previously existing datasets (Access or Merge).		
CompareDate date	Scratch field for post processing; system generated values used in determination of the most recent AllAssessment records.		
SHAPE_Length	System generated perimeter length in meters.		

double	
SHAPE_Area double	System generated feature area in square meters; used in area treated calculations.
OccurrenceID long	Foreign key, references OBJECTID in the Occurrence feature class.
WFT text 10	Weed Free Trail route, if applicable - coded values domain [WFTroutes]

Occurrence Point Feature Class

Identifies a specific infestation, by species. In some cases, this may be a complex of infestations/patches.

OBJECTID system variable	System generated Primary Key for this Table. (This is the foreign key <i>OccurrenceID</i> in the assessment feature classes/tables.)
SHAPE system variable	System generated coordinate geometry for the record.
Species text 12	Genus and specific epithet. - coded values domain [SpeciesCodes] - not nullable
Status text 24	Describes management activity status. - coded values domain [ActiveStatus] - not nullable - default value: undefined
Recorder text 24	First initial and last name of person capturing data - Alias: Recorder - not nullable

AssessmentPoint Point Feature Class

This feature class and its related table PointData are edited in the field by ArcPad users. Location and geometry of one or more assessment (point representation). A given feature may be related to multiple species specific PointData records.

OBJECTID system variable	System generated Primary Key for this Table. (This is the foreign key ShapeID in the related PointData table.)
SHAPE system variable	System generated coordinate geometry for the record.
AssessmentDate Alias: AssessDate date	Assessment date - ArcPad: users are prompted with the current date - tap to accept - Desktop: must be keyed in manually - but this accomodates entering data from field forms collected on earlier dates - desktop format: mm/dd/yyyy (ex: 4/1/2008 or 12/30/2007) - not nullable
BufferRadius Alias: TotalWidth double	Half-width of area to be represented by point. Users identify total width, via discriptions (labels) present in the CVD. - coded value domain [RadiusValues] - not nullable
Recorder Alias: RecorderName text 24	Identity of individual(s) recording observation data. - not nullable
DataDevice Alias: DeviceID text 16	identifies GPS unit, or desktop (paper form) data entry - coded values domain [DataEntryMethod] - not nullable
SiteLocation text 254	Optional text entry field for details regarding site location or navigation. - default value: optional
WFT Alias: WFT route text 10	Weed Free Trail route, if applicable - coded values domain [WFTroutes] - not nullable - default value: n/a
Audited text 24	Audit status for CheckIn QA/QC; identity of post processor - not nullable - default value: "not audited"

AssessmentLine Line Feature Class

This feature class and its related table LineData are edited in the field by ArcPad users. Location and geometry of one or more assessment (linear representation). A given feature may be related to multiple species specific LineData records. Attribute set like AssessmentPoint, above, but also includes *SHAPE_Length*, a system generated field representing the feature length in meters.

AssessmentPoly Polygon Feature Class

This feature class and its related table PolyData are edited in the field by ArcPad users. Location and geometry of one or more assessment (polygon representation).

A given feature may be related to multiple species specific PolyData records. Attribute set like AssessmentPoint, above, but also includes *SHAPE_Length*, a system generated field representing the feature length in meters, and *SHAPE_Area*, a system generated field representing the feature area in square meters.

PointData
Table

Species specific assessment data other than geometry and location. Related to AssessmentPoint records (via a Geodatabase relationship class). Field editable: ArcPad users access the table after creating a new geometry record (AssessmentPoint), or by selecting an existing shape and adding a new table record related to that shape.

OBJECTID system variable	system generated Primary Key for this Table.
Comment text 254	Optional entry, including flags for post-processor. - default value: optional
Species <i>Alias: SpeciesName</i> text 12	Genus and specific epithet. - coded values domain [SpeciesCodes] - not nullable
PercentCover <i>Alias: PctCover</i> double	Estimated cover, per species. - coded values domain [CoverClasses] - not nullable
NumberOfPlants <i>Alias: #ofPlants</i> text 7	Estimated or actual number of plants, per species. - coded values domain [NumberOfPlants] - not nullable
LifeStage <i>Alias: Life_Stage</i> text 12	Phenology or growth form. - coded values domain [Phenology] - not nullable
TreatmentType <i>Alias: TreatType</i> text 2	General treatment method, if any. - coded values domain [TreatmentCode] - not nullable - default value: NT (No Treatment)
PercentTreated <i>Alias: PctTreated</i> double	Fraction of infestation treated. Included in calculation of net area treated. - coded values domain [FractionTreated] - not nullable - default value: 0 (No Treatment)
ShapeID double	This is the foreign key to the assessment geometry. Will automatically populate for ArcPad users. - not nullable

LineData
Table

Species specific assessment data other than geometry and location. Related to AssessmentLine records (via a Geodatabase relationship class). Field editable: ArcPad users access the table after creating a new geometry record (AssessmentLine), or by selecting an existing shape and adding a new table record related to that shape. Attribute set like PointData, above.

PolyData
Table

Species specific assessment data other than geometry and location. Related to AssessmentPoly records (via a Geodatabase relationship class). Field editable: ArcPad users access the table after creating a new geometry record (AssessmentPoly), or by selecting an existing shape and adding a new table record related to that shape. Attribute set like PointData, above.

TreatmentsChem
Table

Data based on information recorded on hard copy forms by field staff and added to the database on the desktop. General information about treatment events; chemical specific data are recorded in separate, related tables. Also related to AllAssessments (provides area and cover measures).

OBJECTID	system generated Primary Key for this Table. (This is the foreign key <i>ChemTreatmentID</i> in the ActiveIngredient, Adjuvant, and AllAssessments)
TreatmentDate date	Date of treatment event. - desktop format: mm/dd/yyyy (ex: 4/1/2008 or 12/30/2007) - not nullable
Method text 16	Application method. - coded values domain [MethodChemical] - not nullable - default value ?
PercentBrown text 8	Estimated percent of treated vegetation appearing dead or dormant. - coded values domain [PctBrown] - not nullable
GallonsUsed double	Gallons of mixed formula used. Accurate data entry is essential, otherwise ModelBuilder tools that summarize chemical treatment data will produce inaccurate results.
TransHours double	Combined crew transportation hours. - range domain [Hours]

HikeHours double	Combined crew hiking hours. - range domain [Hours]
PrepHours double	Combined crew preparation hours. - range domain [Hours]
SprayHours double	Combined crew chemical application hours. - range domain [Hours]
HoursTTL double	Total person-hours for treatment - sum of all four 'Hours' fields. - range domain [Hours]
CrewLeader text 25	Identity of crew leader.
NumberInCrew short	Number of NP staff involved in treatment. - range domain [PersonCount]
Comment text 254	optional

ActiveIngredient Table

Active ingredient data for chemical treatment events. These records are related to records in the TreatmentsChem table and provide information about the mixture.
Data based on information recorded on hard copy forms by field staff and added to the database on the desktop.
There can be multiple records in this table related to a given TreatmentsChem record.

OBJECTID	System generated Primary Key for this Table.
BrandName text 24	Trade name of active ingredient. - coded values domain [BrandName]
OuncesAI double	Ounces AI <i>used</i> in treatment.
ConcentrationAI double	Fractional concentration of AI in mixture (examples: "5" "10" "1" (e.g. 5%, 10%, 1%)) - range domain [Concentration]; values allowed from 0 to 100
ChemTreatID long	Foreign key to TreatmentsChem table; references TreatmentsChem <i>OBJECTID</i> . This field may be populated by using the attributes editor to enter treatment data, as described in the documentation (i.e. manual data entry is not necessary). - not nullable

Adjuvant Table

Adjuvant data for chemical treatment events. These records are related to records in the TreatmentsChem table and provide information about the mixture.
Data based on information recorded on hard copy forms by field staff and added to the database on the desktop.
There can be multiple records in this table related to a given TreatmentsChem record (or no records).

OBJECTID	System generated Primary Key for this Table.
Adjuvant text 24	Generic compound name for active ingredient. - coded values domain [Adjuvants] - not nullable
OuncesAdjuvant double	Ounces adjuvant <i>used</i> in treatment. - not nullable
ChemTreatID long	Foreign key to TreatmentsChem table; references TreatmentsChem <i>OBJECTID</i> . This field may be populated by using the attributes editor to enter treatment data, as described in the documentation (i.e. manual data entry is not necessary). - not nullable

GPSControlPoints Point Feature Class

Control point data collected to confirm the proper functioning of various GPS receivers.
These records are collected at known control locations to evaluate locational accuracy of GPS data.

OBJECTID system variable	System generated Primary Key for this Table.
SHAPE system variable	System generated coordinate geometry for the record.
DataDate <i>Alias: Date</i> date	Assessment date - ArcPad: users are prompted with the current date - tap to accept - not nullable
Recorder <i>Alias: RecorderName</i> text 24	Identity of individual(s) recording observation data. - not nullable
DataDevice <i>Alias: DeviceID</i> text 16	identifies GPS unit, or desktop (paper form) data entry - coded values domain [DataEntryMethod] - not nullable
ControlLocation <i>Alias: Point Location</i>	Identification of control point (known location) - coded values domain [ControlPoints]

	text 36	- not nullable - CVD includes "other: see comments" option
	Comment text 100	Optional comments field.
WFTSurveyPoints <i>Point Feature Class</i>	OBJECTID system variable	System generated Primary Key for this Table.
	SHAPE system variable	System generated coordinate geometry for the record.
	SurveyDate <i>Alias: Date</i> date	Survey date - ArcPad: users are prompted with the current date - tap to accept - not nullable
	Route <i>Alias: WFT Route</i> text 10	WFT route designation - coded values domain [WFTRoutes] - not nullable
	StartStop <i>Alias: StartOrStop</i> text 5	Indicates survey beginning and end points - coded values domain [LineSurveyEnds] - not nullable
	Comments text 254	Optional comments field.
	Recorder <i>Alias: RecorderName</i> text 24	Identity of individual(s) recording observation data. - not nullable
	DataDevice <i>Alias: DeviceID</i> text 16	identifies GPS unit, or desktop (paper form) data entry - coded values domain [DataEntryMethod] - not nullable
	Audited text 24	Audit status for CheckIn QA/QC; identity of post processor - not nullable - default value: "not audited"
WashSurveyPoints <i>Point Feature Class</i>	OBJECTID system variable	System generated Primary Key for this Table.
	SHAPE system variable	System generated coordinate geometry for the record.
	SurveyDate <i>Alias: Date</i> date	Survey date - ArcPad: users are prompted with the current date - tap to accept - not nullable
	DrainageName <i>Alias: WashName</i> text 30	Wash or drainage name per HydroRoutesRMD - coded values domain [HydroRouteList] - not nullable - default value: "unknown/undefined"
	StartStop <i>Alias: StartOrStop</i> text 5	Indicates survey beginning and end points - coded values domain [LineSurveyEnds] - not nullable
	Comments text 100	Optional comments field. - default value: "optional"
	Recorder <i>Alias: RecorderName</i> text 24	Identity of individual(s) recording observation data. - not nullable
	DataDevice <i>Alias: DeviceID</i> text 16	identifies GPS unit, or desktop (paper form) data entry - coded values domain [DataEntryMethod] - not nullable
	Audited text 24	Audit status for CheckIn QA/QC; identity of post processor - not nullable - default value: "not audited"
ManagementAreas <i>Polygon Feature Class</i>	OBJECTID system variable	System generated Primary Key for this Table.
	SHAPE system variable	System generated coordinate geometry for the record.
	AreaName text 36	Management area name - not nullable See notes in documentation regarding editing this feature class.
06/30/09	SHAPE_Length	System generated perimeter length in meters.

double	
SHAPE_Area double	System generated feature area in square meters; used in area treated calculations.

WashSurveys
Line Feature Class

Linear representation of wash surveys; converted from WashSurveyPoints data.

OBJECTID system variable	System generated Primary Key for this Table.
SHAPE system variable	System generated coordinate geometry for the record.
SurveyDate date	Survey date - not nullable
SHAPE_Length double	System generated perimeter length in meters.

WFTsurveys
Line Feature Class

Linear representation of WFT surveys; converted from WFTSurveyPoints data.

OBJECTID system variable	
SHAPE system variable	
SurveyDate date	Survey date - not nullable
Route text 10	WFT route designation
SHAPE_Length double	

TamarixPoints
Point Feature Class

Location and identity of a plant or cluster of plants

OBJECTID system variable	system generated Primary Key for this Table. (This is the foreign key TamarixID in the related 'TamarixVisitis' table.)
SHAPE system variable	system generated coordinate geometry for the record
SiteLocation Alias: Location text 254	Optional text entry field for details regarding site location or navigation. - default value: "optional"
Species Alias: TAM Species text 12	Genus (and specific epithet, if specified) - coded values domain [TamSppCodes] - not nullable - default: "TAMSPP"
LengthInfested Alias: PatchLength short	Estimate of wash length containing Tamarix plant(s) - coded values domain [InfestLength] - not nullable
MgmtStatus Alias: Status text 24	Activity status based on observations, treatments, etc - used to select and symbolize records - for example, this would be the primary display field. This is dependent on the "RevisitsNeeded" field in the related table, below. - coded values domain [TamActiveStatus] - not nullable
HydroRouteID Alias: WashName text 36	This identifies the stream, wash or route; basis of summary table (number/status of plants per stream, etc) - coded values domain [WashNames] - not nullable - default value: "unknown/undefined"
ManagementArea Alias: MgmtArea text 36	Management area. Populated on the desktop, not visible to field staff. - coded values domain [MgmtAreas] - not nullable - default value: "undefined"
Audited text 24	Audit status for CheckIn QA/QC; identity of post processor - not nullable - default value: "not audited"
PreviousID text 12	

TamarixVisits
Table

Date specific visit/revisit information related to TamarixPoint data

OBJECTID system variable	system generated Primary Key for this Table.
Comment text 254	Optional entry, including flags for post-processor. - default value: "optional"
VisitDate <i>Alias: Date</i> date	Date of visit. ArcPad users tap to accept default value. - not nullable
NumberOfPlants <i>Alias: #ofPlants</i> short	Estimated or actual number of plants, per species. - coded values domain [TamarixCount] - not nullable
LifeStage <i>Alias: Life_Stage</i> text 12	Phenology or growth form. - coded values domain [Phenology] - not nullable
TamTreatment <i>Alias: Treatment</i> text 16	General treatment method, if any. - coded values domain [TamTreatment] - not nullable
Revisits <i>Alias: RevisitsNeeded</i> short	Used to determine value of "Status" in the feature class. - coded values domain [TamRevisit] - not nullable
Recorder <i>Alias: RecorderName</i> text 24	Identity of individual(s) recording observation data. - not nullable
DataDevice <i>Alias: DeviceID</i> text 16	Identifies GPS unit, or desktop (paper form) data entry. - coded values domain [DataEntryMethod] - not nullable
TamarixID long	Foreign key to the Tamarix and Treatment tables; on ArcPad, this is automatically populated. - not nullable
TreatmentID long	Foreign key to the Tamarix and Treatment tables. Edited on desktop only.
Audited text 24	Audit status for CheckIn QA/QC; identity of post processor. - not nullable - default value: "not audited"
PreviousID text 12	

TamRecent
Point Feature Class

Derived feature class. Includes the most recent TamarixVisits data for each "active" TamarixPoint record (Status not equal to "Treatment Complete")
Intended for check out to units for reference only.

OBJECTID system variable	system generated Primary Key for this Table. (This is the foreign key TamarixID in the related 'TamarixVisits' table.)
SHAPE system variable	system generated coordinate geometry for the record
Revisits short	Used to determine value of "Status" in the feature class.
NoPlants short	Estimated or actual number of plants, per species.
VisitDate date	Date of visit. ArcPad users tap to accept default value.
Status text 24	Activity status based on observations, treatments, etc - used to select and symbolize records - for example, this would be the primary display field. This is dependent on the "RevisitsNeeded" field in the related table, below.
Treatment text 16	General treatment method, if any.
TamarixID long	OBJECTID for the point in the source TamarixPoints feature class.
HydroRouteID text 16	This identifies the stream, wash or route; basis of summary table (number/status of plants per stream, etc)

LinearTamarix
Line Feature Class

Derived feature class for active Tamarix locatins, based on "length infested" in TamarixPoints.
 (includes record where Status not equal to "Treatment Complete")
 Created by ModelBuilder routine "TamarixEvents - DynSeg"

OBJECTID system variable	system generated Primary Key for this Table. (This is the foreign key TamarixID in the related 'TamarixVisitis' table.)
SHAPE system variable	system generated coordinate geometry for the record
Revisits short	Used to determine value of "Status" in the feature class.
NoPlants short	Estimated or actual number of plants, per species.
VisitDate date	Date of visit. ArcPad users tap to accept default value.
Status text 24	Activity status based on observations, treatments, etc - used to select and symbolize records - for example, this would be the primary display field. This is dependent on the "RevisitsNeeded" field in the related table, below.
Treatment text 16	General treatment method, if any.
TamarixID long	OBJECTID for the point in the source TamarixPoints feature class.
HydroRouteID text 16	This identifies the stream, wash or route; basis of summary table (number/status of plants per stream, etc)

PctBrown	<25% 25-50% 51-75% 76-100%	<25% 25-50% 51-75% 76-100%
PersonCount (Range domain)	minimum legal: 0 (zero)	maximum legal: 1000 (one-thousand)
RadiusValues	0.25 0.5 1 2 3 4 5 6 7 8 9 10	1/2 meter 1 meter 2 meters 4 meters 6 meters 8 meters 10 meters 12 meters 14 meters 16 meters 18 meters 20 meters
SpeciesCodes	PENCIL PENSET ERAECH MELREP ENNCEN CENMEL AGRSTO ASPFIS AVEFAT BRATOU BRORUB BROTEC CAEGIL CENLON CONARV CORSEL CYNDAC DICANN DIMSIN ECHSPP ERACIL ERACUR ERALEH EROCIC HORMUR LACSER LAMAMP MALPAR MARVUL MELSPP NEROLE NICGLA	Pennisetum ciliare Pennisetum setaceum Eragrostis echinochloidea Melinus repens Enneapogon cenchroides Centaurea melitensis Agrostis stolonifera var. palustris Asphodelus fistulosus Avena fatua Brassica tournefortii Bromus rubens Bromus tectorum Caesalpinia gilliesii Cenchrus longispinus Convolvulus arvensis Cortaderia selloana Cynodon dactylon Dichanthium annulatum Dimorphotheca sinuata Echinochloa species Eragrostis cilianensis Eragrostis curvula Eragrostis lehmanniana Erodium cicutarium Hordeum murinum Lactuca serriola Lamium amplexicaule Malva parviflora Marrubium vulgare Melilotus species Nerium oleander Nicotiana glauca

