



United States Department of Agriculture



Digital Mobile Sketch Mapping (DMSM)

DMSM Desktop Tools User's Manual



Forest Service

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DMSM Desktop Tools Introduction

The DMSM Desktop Tools is part of a suite of tools designed to collect, quality check, and edit Forest Health data. Each tool was designed to address the needs of a specific part of this workflow. While there may be some crossover in use/function of each, their strengths are highlighted below.

- DMSM Tablet application:
 - ✓ Data collection/creation
 - *Limited editing capability*
- Data Reviewer for DMSM:
 - ✓ Data quality checking
 - *Used in conjunction with DMSM Desktop Tools for editing.*
- **DMSM Desktop Tools:**
 - ✓ Data editing
 - ✓ Data extraction
 - *Limited data collection/creation capability*

Please explore the following links for more information and documentation related to other parts of this workflow. These links require an ArcGIS Online (AGOL) login and membership to the DMSM user group.

[DMSM Tablet application and documentation](#)

[DMSM Tablet application online training](#)

[Data Reviewer for DMSM batch files and documentation](#)



ArcGIS License and Version Level

The DMSM Desktop Tools require the Standard or Advanced license level of ArcGIS Desktop. The version of ArcGIS Desktop must be 10.5.1 or higher.

Toolbar

The DMSM Desktop Tools user interface consists of a custom toolbar in ArcMap, and various dialogs accessed from the toolbar. The toolbar can be toggled on and off via the ArcMap Customize | Toolbars menu.

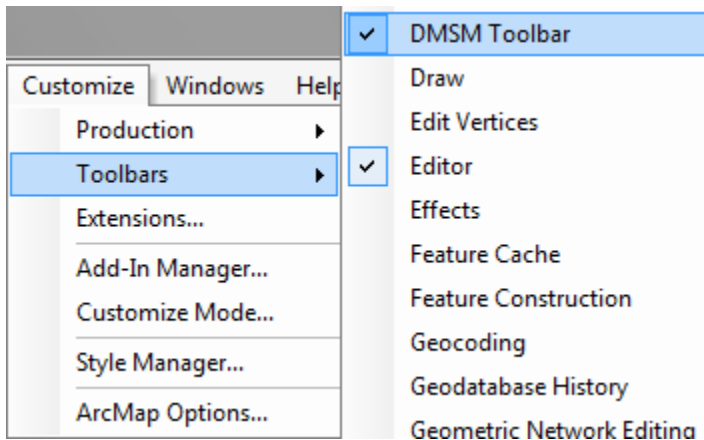


Figure 1 - Accessing the DMSM Desktop Tools toolbar

As with other standard ArcMap toolbars, the DMSM Desktop Tools toolbar can be free floating, or docked on any edge of the ArcMap window.



Figure 2 - DMSM Desktop Tools toolbar in ArcMap, displayed free-floating

Settings



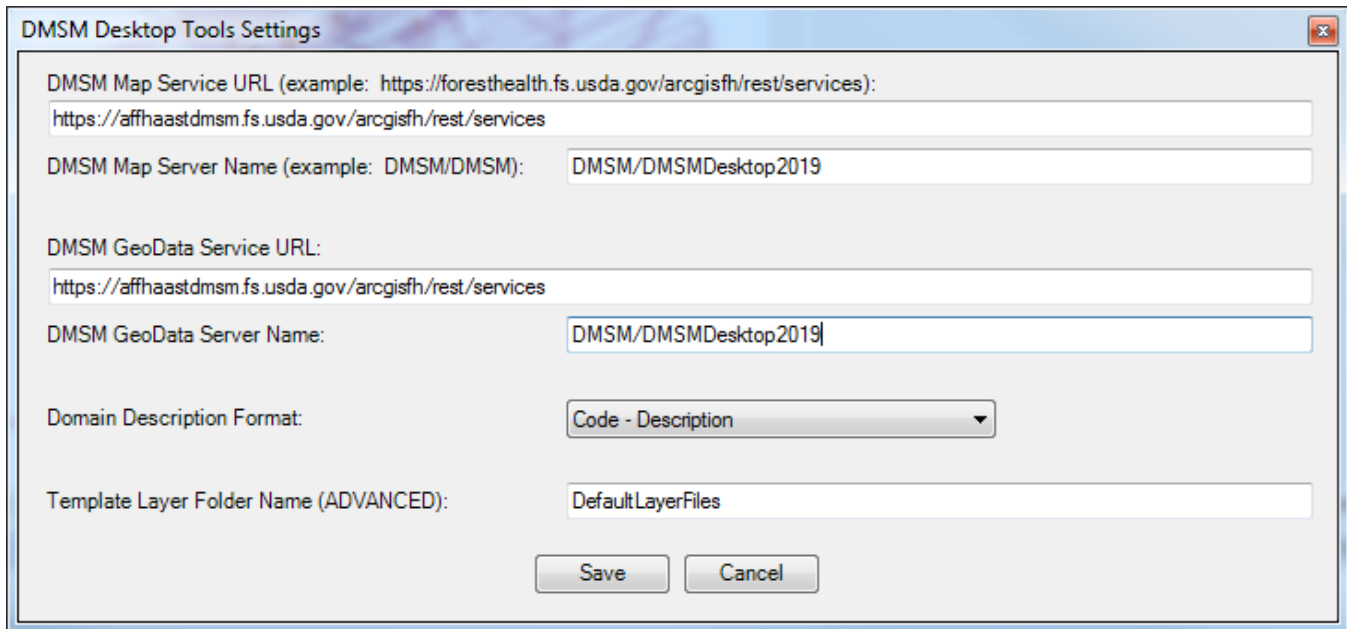
Settings – The Settings button opens the Settings Dialog, which is used to define user-specific settings.

Available settings include:

1. The DMSM Map Service URL and service name.
2. The DMSM GeoData Service URL and service name.



3. The format for displaying certain database domain descriptions.
4. Template Layer Folder Name.




The image shows a Windows-style dialog box titled "DMSM Desktop Tools Settings". It contains several input fields and a dropdown menu. The fields are: "DMSM Map Service URL (example: https://foresthealth.fs.usda.gov/arcgisfh/rest/services):" with the value "https://affhaastdmsm.fs.usda.gov/arcgisfh/rest/services"; "DMSM Map Server Name (example: DMSM/DMSM):" with the value "DMSM/DMSMDesktop2019"; "DMSM GeoData Service URL:" with the value "https://affhaastdmsm.fs.usda.gov/arcgisfh/rest/services"; "DMSM GeoData Server Name:" with the value "DMSM/DMSMDesktop2019"; "Domain Description Format:" with a dropdown menu showing "Code - Description"; and "Template Layer Folder Name (ADVANCED):" with the value "DefaultLayerFiles". At the bottom are "Save" and "Cancel" buttons.

Figure 3. Settings dialog

The service locations are stored as user settings so that, in the event that a service URL or name changes, the user can update the location without FHAASST having to deploy a new version of the software.

To update a service path or name, simply change the value or values as desired and click "Save". If changes to these values are required, users will be notified with the new values.

Tip: For the most current map and geodata server URLs and names, log on to www.arcgis.com and go to the Digital Mobile Sketch Mapping (DMSM) Group (you must be a member of this group). Within the DMSM group, open the DMSM Desktop Tools Install Package content to view current server information:



★ Remove from Favorites

[DMSM Desktop Tools Install Package v1.0.8](#)

DTT no longer supports ArcMap versions older than 10.5.1 and an ESRI patch for ArcMap 10.5.1, 10.6.x is also required.

Important: The protocol for the server URLs is https:// (note the "s" in https). Be sure to include the "s" in https, or the connection to the servers will fail.

The domain description format controls how domain descriptions involving damage agent and host codes are created. This determines how the descriptions are shown in the ArcMap dropdowns when editing.

To change a format, select the desired format from the dropdown list and click "Save". A change to this setting must be set prior to running the data [Check-Out](#) or [Extract tool](#). The available choices include:

1. **Code Only.** Only the DCA or Host Code will be displayed in the domain description, not actual names of damage agents or hosts. For example, "11006".
2. **Code – Description.** The code and common name will be combined, code first and separated by a dash. For example, "11006 – Mountain Pine Beetle".
3. **Description Only.** Only the common name of the damage agent or host will be displayed, not the corresponding codes. For example, "Mountain Pine Beetle".
4. **Description – Code.** The code and common name will be combined, name first and separated by a dash. For example, "Mountain Pine Beetle – 11006".

The template layer folder name is an advanced setting and should usually be set to "DefaultLayerFiles".

Authentication

The tools on the toolbar that involve accessing the master DMSM geodatabase (e.g. Check-In, Check-Out, etc.) require authentication. Users must be signed-in to ArcGIS Online (AGOL), and must be a member of the Forest Service "Digital Mobile Sketch Mapping" group in AGOL.

If necessary, contact FHAAS for the procedures for acquiring an AGOL account and inclusion in the DMSM group in AGOL.

Note that users are not required to be in the Forest Service to obtain an AGOL account and be added to the DMSM group.

If the user clicks a button such as Check-Out, and is not currently signed-in, the out-of-the-box ArcMap AGOL sign-in dialog will be presented:

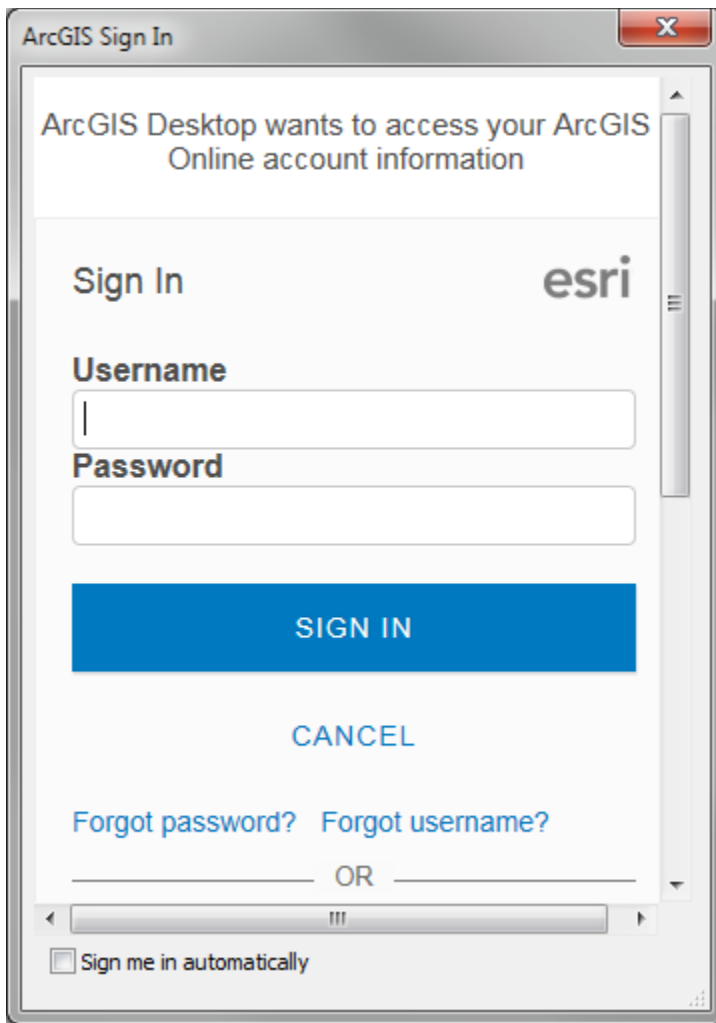


Figure 4. Out-of-the-box ArcGIS Online sign-in dialog

After successful authentication, the desired tool dialog will be displayed. If the authentication fails or if the user is not a member of the DMSM group in AGOL, the following dialog is displayed:

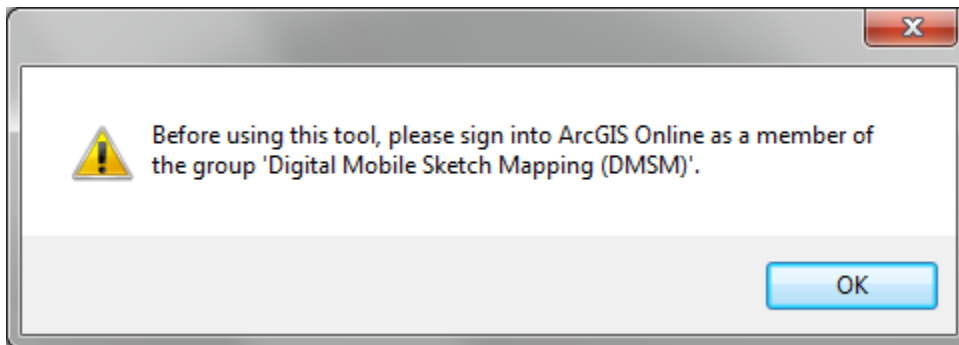


Figure 5. Failed authentication dialog



Adding a Basemap

Including a basemap or other reference data in your map is optional, but may be very useful when working with the DMSM Desktop Tools. This may be especially useful with the [Check-Out](#) and [Extract](#) tools, as the data to be pulled down from the server is filtered by the current map extent. A basemap might also be useful as reference while editing.

To add a basemap with the out-of-the-box ArcGIS tools, use the ArcMap "Add Data" command dropdown and the "Add Basemap" option.

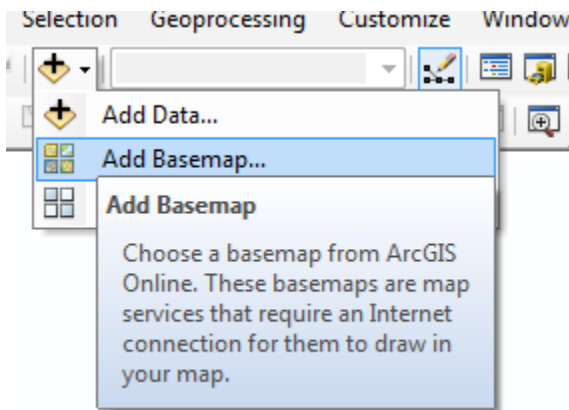


Figure 6. Out-of-the-box Add Basemap command.

In the "Add Basemap" dialog, click on the desired basemap, and then click the "Add" button.

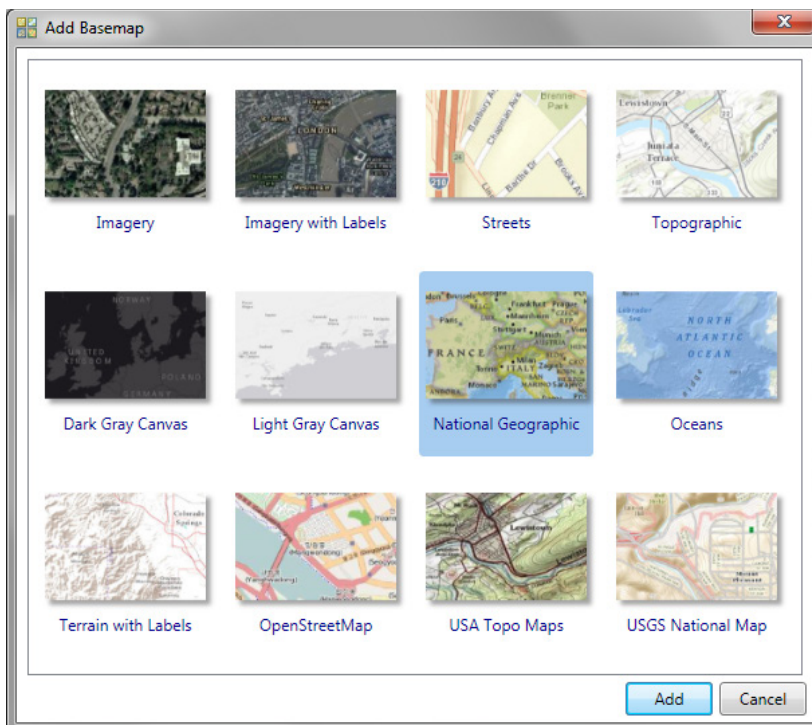


Figure 7. Out-of-the-box Add Basemap dialog

Spatial Reference of the Map

You may use any projected spatial reference you wish when using the DMSM Desktop Tools.

If you start the [editing workflow](#) with a new, blank map document and the map spatial reference is undefined, then the initial spatial reference will be set to Web Mercator by the tools.

If you add other reference data (such as a basemap) before doing anything else in a new, blank map document, then ArcMap will set the map spatial reference to that of the first layer added. Out-of-the-box basemaps will be Web Mercator by default.

In any case, you can change the spatial reference of the data frame as usual with the ArcMap Data Frame Properties dialog at any time, and then continue using the tools.

Editing Workflow

The workflow for editing DMSM data with the DMSM Desktop Tools is “Check-out / Edit / Check-in”.

The check-out step is accomplished via the [Check-Out tool](#), which downloads a specific set of features from the master DMSM geodatabase to a local file geodatabase stored on the user's computer. In this step, the local data is prepared for editing by the Check-Out tool, which creates database relationships and domains, adds the layers to the map with consistent symbology, creates map joins, and numerous other details.

During the editing step, the ArcMap editing environment is utilized to make any necessary edits to the checked-out, local file geodatabase. The DMSM Desktop Tools aid in the editing process by automatically performing numerous checks and constraints as edits occur, such as enforcing required database relationship key field values, disallowing edits to certain fields, and disallowing invalid attribute values.

When edits are complete, the check-in step is accomplished via the [Check-In tool](#), which uploads the edits back to the master DMSM geodatabase.

Important: The three steps of the “Check-out / Edit / Check-in” workflow must be completed in that order, and is complete after the check-in step. This means that once the check-in is complete, editing is complete for that cycle. To implement further edits, the “Check-out / Edit / Check-in” workflow is repeated. The editing step may be completed in multiple ArcMap sessions, for example over several hours or days, by saving the map document and re-opening it each time for more editing.

Tip: FHAAS recommends that you keep the “Check-out / Edit / Check-in” workflow relatively brief. Although possible, it would not be a good idea to do a check-out and then spend many days or weeks editing before doing the check-in step.

Repeating the workflow more often will keep corrected data flowing into the master DMSM geodatabase, and perhaps more importantly will lessen the chance of data loss if you were



to experience hardware or system issues prior to doing a check-in. Additionally, with each check-out you may see the most recent edits implemented by other users, and reduce the chance of editing conflicts with other users. A good schedule for completing a single "Check-out / Edit / Check-in" cycle would be a day or two at the most.

Check-Out



Check-Out Tool – The Check-Out tool is the first step in the [editing workflow](#). This tool presents a wizard dialog where the user selects the data to be checked out for editing. In step 1, the desired data is filtered by Forest Service Region, the user(s) who created the data, and by a date range:

Check Out DMSM Data for Editing

Step 1 - Filter By Attributes

Set the following attribute filters to limit what data is checked out.

Limiting the number of features to check out may greatly improve processing speed.

Forest Service Region: Region 3

User(s):

- ☒ All Users
- ☒ andrew owen
- ☒ andrewowen_AZSF
- ☒ cgtischler_usfs

Creation Date Range: 3/26/2016 - 9/26/2016

Next Close

Figure 8. Check-Out tool, step one

Each damage feature in the master DMSM geodatabase is tagged with the user that originally collected the data (for example, in the plane with the DMSM tablet application). The list of users presented in this step of the Check-Out tool is obtained from the master DMSM geodatabase, so it will only contain user names that actually exist in the data for the selected Region.

Check the user names whose data you want to include to be checked out for editing.



Important: By default, DMSM Desktop Tools users may only edit their own data. Therefore you may potentially only see your own user name in the Users(s) list. FHAAS maintains a user permissions administration tool that allows for detailed assignment of permissions, on a per-user basis.

Users who need to edit other users' data will need to contact and coordinate with FHAAS in order to set the required permissions.

In step 2, the user is asked to set the Check Out Type (damage features or flight lines) and Map Extent of the desired data. This further filters the data, as only data within the current map extent will be checked out. The spatial select parameters change from 'IS CONTAINED WITHIN' to 'INTERSECTS' depending on which feature types are selected for checkout. The user may add the master DMSM geodatabase data to the map for reference by clicking the "Display DMSM Map Service (Optional)" button, and pan and zoom using the buttons on the dialog. The first button on the left will zoom to the features selected by the attribute filters in step 1. The second button from the left will zoom to the desired Forest Service Region.

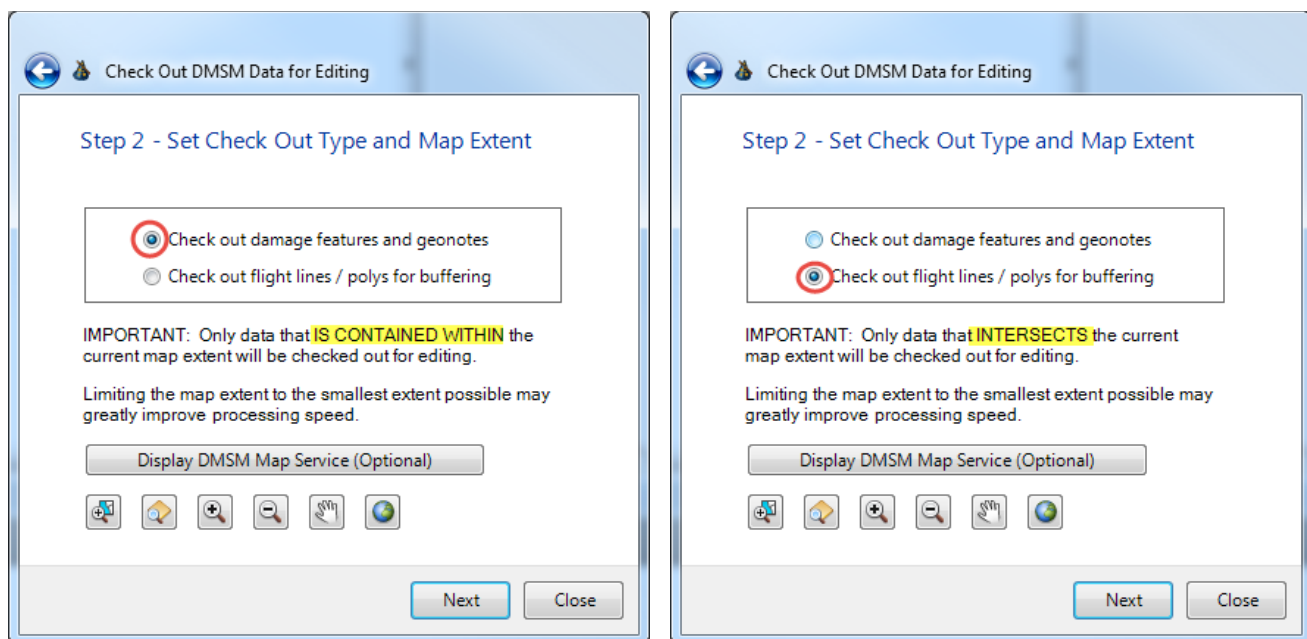


Figure 9. Check-Out tool, step two

Important: Limiting the amount of data checked out via the attribute and spatial filters will enhance the processing speed of the check-out process, since less data will be sent over the network.

Tip: Depending on your network bandwidth, the quickest method for defining the map extent may be to [add a basemap](#), zoom to the approximate location of your desired data, then display the DMSM map service, and then further refine the map extent. This will limit the amount of data displayed in the DMSM map service layers and result in faster map drawing.

In step 3, the user is provided with a summary of the data that will be checked out for editing.

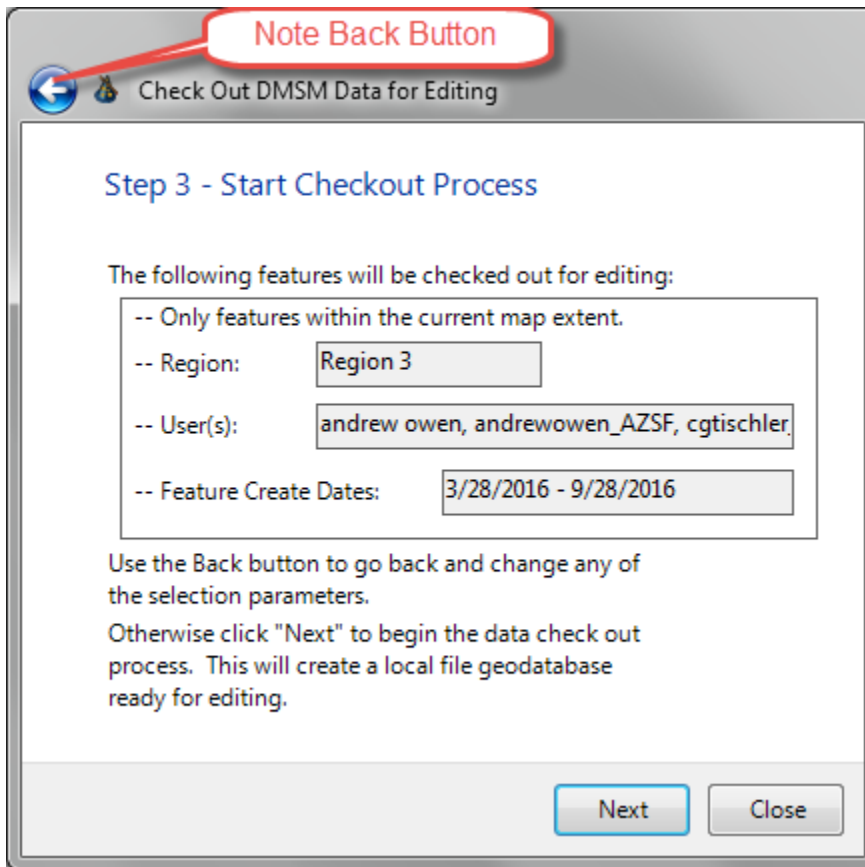


Figure 10. Check-Out tool, Step three

The "Back" button in the wizard can be used to go back to previous steps to change the attribute and spatial filters, if necessary. (The "Back" button is the left-pointing arrow in the upper left corner of the wizard dialog).

Clicking "Next" at step 3 begins the check-out processing.



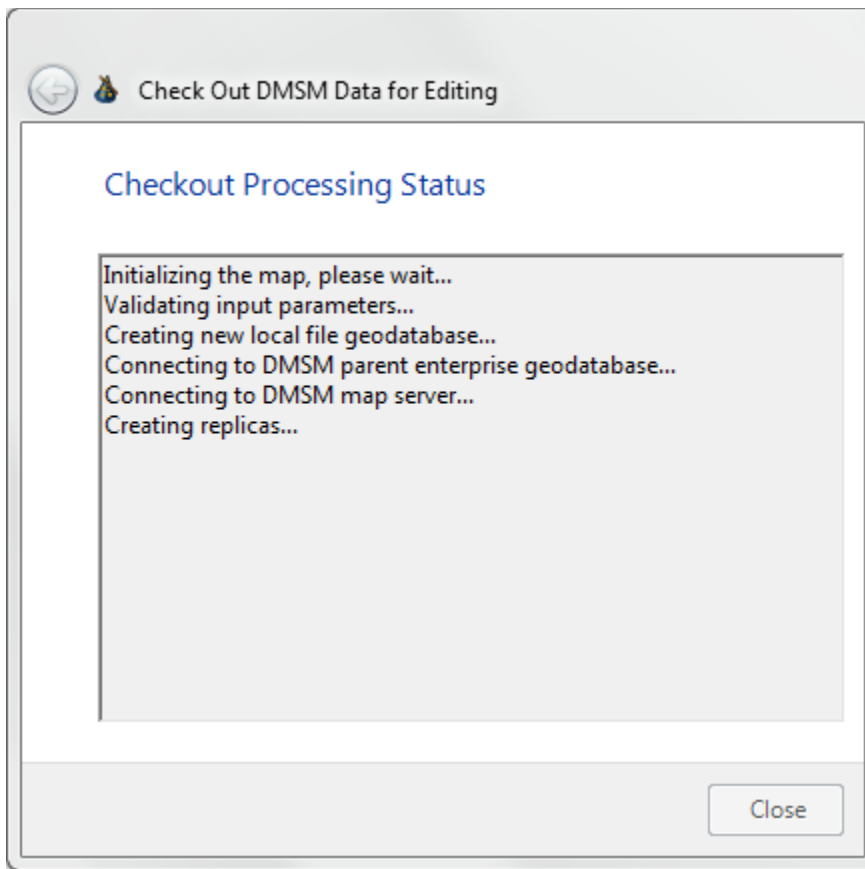


Figure 11. Check-Out tool running the check-out process

The check-out process automates multiple steps that would be quite time consuming and complicated for a user to do with the out-of-the-box ArcMap tools. Specifically, it does the following:

1. Creates a local file geodatabase on the client computer. This is placed in a special location under the user's My Documents folder.
2. Creates a replica and extracts the desired data from the master DMSM geodatabase into the new, local file geodatabase. The replica information in both the "parent" and "child" geodatabases allows the system to keep track of the fact that edits will be made in the child and checked back into the parent.
3. Extracts lookup tables from the master DMSM geodatabase into the local file geodatabase. These tables contain information such as the available damage agent and host codes, but cannot be edited by the user.
4. Creates database domains in the local file geodatabase, based on the lookup tables.
5. Assigns domains to individual fields in specific tables. For example, the DCA domain is assigned to the DCA_CODE field in the Observations table. Domains



are very useful during editing, as they allow the user to choose only valid values from a dropdown list. Note also that some domains are customized by Region, so that users only see values that make sense for their Region. The [Settings](#) dialog can control the format of the descriptions displayed in some of the domains.

6. Creates database relationships in the local file geodatabase. These relationships define how certain tables are related to other tables, for example damage area features to Observations.
7. Implements the [object class extensions](#). This step registers the custom object class extensions to the appropriate tables and feature classes. Without this step, the custom code in the class extensions would not run.
8. Adds the checked out datasets to the map as layers and standalone tables.
9. Removes the master DMSM geodatabase layers from the map, if they were loaded. Steps 8 and 9 basically “replace” the master DMSM geodatabase layers with the local layers in the map.
10. Adds map joins, which append fields from one table to the fields in a related table. For example, this allows the user to see the Observation attributes as fields in the Damage Areas featureclass table.
11. Applies standardized map symbology to the layers in the map. The symbology is stored in template layer files that are installed with the application. The user will always see a consistent set of symbols each time the Check-Out tool is run. Additionally, this step standardizes other layer properties, such as which fields are visible, the order of the fields, field alias names, etc.
12. Applies standardized properties to the standalone tables in the map.

When the check-out process finishes, a message is displayed in the status messages area of the wizard, and the Close button becomes enabled. Click “Close” to close the wizard and begin editing the checked-out data.

Important: It is a very good idea to save the map document immediately after the Check-Out tool completes processing and the dialog has been closed. **You must save the map document if you plan to close ArcMap and return later to finish editing the data, and then do the check-in process.**

Important: Never change the names of the group layers, or of the individual map layers, created by the DMSM Desktop Tools in the ArcMap table of contents. Do not add any fields to the featureclasses or tables. Altering the name of any layer or the structure of the underlying tables in the replica will result in failures during editing and/or a failure on check-in.



Check-In



Check-In Tool – After editing of the checked out data has been completed, the edits are loaded back into the master DMSM geodatabase by the Check-In tool.

When the user clicks the “Check In” button on the dialog window a series of simple data validation checks look for missing values in core attributes. If the checks find null values in the following attributes a warning message will display, but the check-in will proceed.

- PERCENT_AFFECTED (polygon features only)
- NUMBER_OF_TREES and TREE_COUNT (point features only)

If the checks find null values in the following attributes, an error message will display and the user will need to correct the null values before completing the check-in.

- DCA_CODE
- DAMAGE_TYPE_CODE
- HOST_CODE and HOST_GROUP_CODE.

Tip: Use codes for “unknown” values in place of nulls to pass the validation checks. See pages 24 – 30 for more information on attribute editing.

DCA general unknown code = **90000**

DAMAGE_TYPE unknown damage code = **19**

HOST_CODE unknown conifer = **299** or unknown hardwood = **998**

Once all validation checks complete successfully, data edits are loaded back up to the master DMSM geodatabase, the replica information is removed, and the local file geodatabase map layers are removed from the map.

Additionally, the master DMSM geodatabase layers are added back into the map. That data streams from the FHAAS server and is not resident on your local computer.



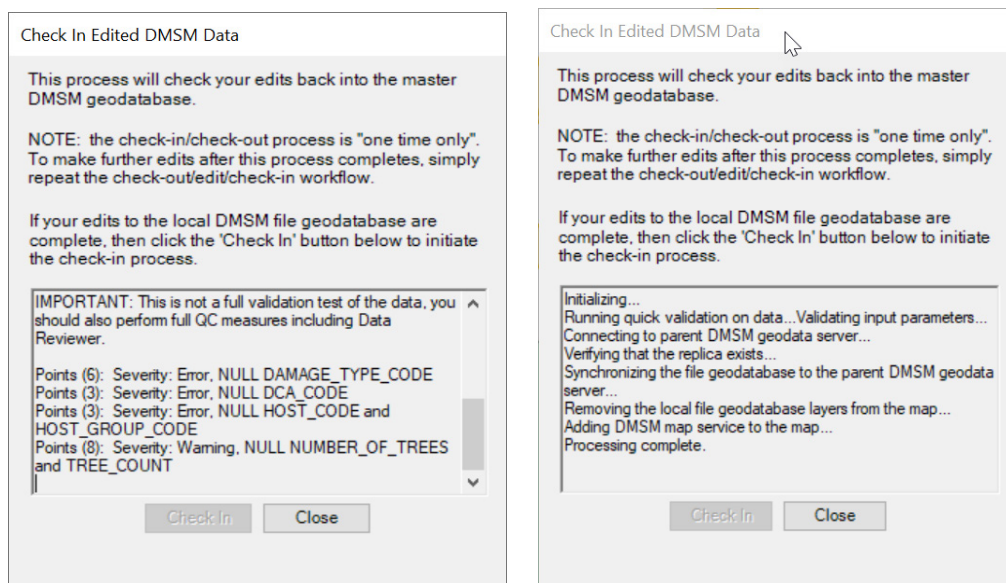


Figure 12. Check-In tool dialog with validation warning and after successful check-in

The Map Document and the Editing Workflow

As previously mentioned, the [Check-Out](#) tool adds the checked out, local data as layers to the map. These map layers are always added to a group layer with a special name, “DMSM Local Edit Layers”, and the layers inside the group layer are named by DMSM Desktop Tools as depicted in the following figure.

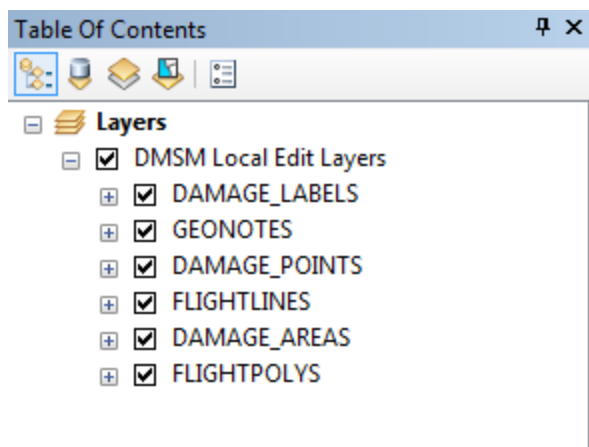


Figure 13. ArcMap Table of Contents (List by Drawing Order tab) showing checked out map layers for editing

The [Check-Out](#) tool also adds two “standalone” tables to the map. The Observations table holds the observation attributes for both point and polygon damage features, and is related to and joined to those tables. The Quick_Keys table is included for reference, but no

relationships or joins are created for this table. (Do not attempt to edit the Quick_Keys table, as any edits will not be checked in to the master DMSM geodatabase).

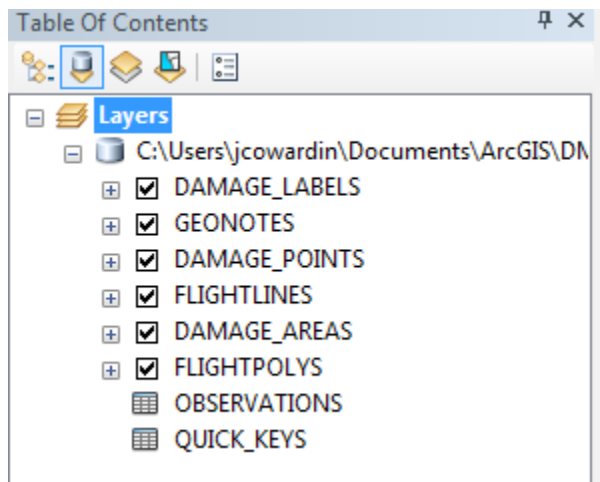


Figure 14. ArcMap Table of Contents (List by Source tab) showing checked out map layer and standalone tables for editing

Important: In order for the tools to work correctly, the layer and group layer names created by DMSM Desktop Tools must not be altered. Also, the layers must not be removed or moved outside of the group layer.

You may add additional map layers such as base maps, but do not place them inside the "DMSM Local Edit Layers" group layer, as the group layer will be automatically removed during the check-in process.

The DMSM database structure stores labels as point features in the DAMAGE_LABELS map layer, and stores the label information in the LABEL field. The DMSM Desktop Tools manage the LABEL attribute automatically, updating it as necessary when attribute edits are done. There is no need to manually edit the DAMAGE_LABELS layer.

FHAAS suggests the following steps when managing the editing workflow and associated map documents:

1. Create a "base mxd" file that contains your favorite reference data and basemap, bookmarks, etc.
2. Use this base mxd as a starting place when doing an initial check-out.
3. When the check-out process is complete, immediately do a "Save As" of the map document to a different mxd, with specifics about the date, and/or user id and/or geography for that specific check-out included in the new mxd file name. Make sure to leave the "base mxd" unchanged and without the DMSM checked out map layers in its table of contents.
4. After completing edits and the check-in step, delete the mxd from disk as the map layers are no longer useful or editable.



Extract



Extract Tool – The Extract tool is designed to extract data from the master DMSM geodatabase without the intention of editing the data. Instead, the extracted data could be used for whatever purposes the DMSM user might need, such as mapping and reporting.

Technically the process is very similar to the check-out data process, in that data is extracted to a local folder location, layers are added to the map in a consistent fashion, etc. The main differences are that no replica is created and so the data cannot be checked back in, and also the [object class extensions](#) are not implemented, since editing will not be done.

Steps 1 and 2 of the Extract dialog are similar to the Check-Out dialog, where the user defines the Region, user(s), date range and map extent of the data to be extracted. One difference is that the user permissions are not enforced for extracts, as they are during check-outs. In step 3, the user specifies an output location for the extracted data and optionally whether to create a “flattened” version of the database. Step 3 is slightly different when the option to extract flight lines and polys is selected in Step 2.

Extract DMSM Data to Local File Geodatabase

Step 3 - Define Output Location

Output folder location:

Normalized File Geodatabase Name:

☒ Flattened File Geodatabase Name:

☐ Do Not Calculate ACRES (Web Mercator)

☒ Calculate ACRES (USA Contiguous Albers Equal Area Conic USGS)

Next Close

Figure 15. Extract Tool dialog, step 3

Under “Output folder location”, enter the path on disk to the folder where the extracted data is to be created.



Under "Normalized File Geodatabase Name", enter the name of the normalized file geodatabase to be created. The normalized geodatabase is similar in structure to the master DMSM geodatabase, where the observations attributes are stored in a separate table from the point and polygon damage featureclasses, and database relationships and map joins are created.

Optionally check the "Flattened File Geodatabase" checkbox and provide a name to create a "flattened" version of the database. The flattened file geodatabase flattens the database structure into one point damage featureclass and one polygon damage featureclass, whose attribute tables include all of the observation attributes. In this case, no database relationships or map joins are created.

If you choose to create the flattened file geodatabase, you must also optionally choose whether to calculate an Acres field in the output damage areas featureclass. If you do not choose to calculate acres, then the flattened output datasets will remain in the Web Mercator map projection. If you do choose to calculate acres, then the output datasets will be automatically projected to an appropriate Albers Equal Area map projection.

Tip: The flattening process may take several minutes; the more features being extracted, the slower the process will be.

Tip: When extracting data from Region 5 and creating the flattened file geodatabase, and calculating acres, you will be presented with an additional pair of option buttons that will specify the correct output map projection. The correct option, for either Hawaii or California, should usually be correctly pre-selected by the application, but the option is included so that the user can verify that the correct map projection will be used. For obvious reasons, because of the automatic map projection process, it is not recommended to extract Hawaii and California data together when calculating acres.

Tip: The normalized version of the extracted data is always created by this tool. If you only need the flattened version, then you can safely remove the normalized layers and standalone tables from the map, and delete the normalized file geodatabase from disk, using the out-of-the-box ArcGIS tools.

Important: In the flattening process, features that have multiple observations will be extracted as duplicate, "pancake" features for each observation. These features will have the same DAMAGE_AREA_ID and geometries, but different OBSERVATION_IDs. Care must be taken to avoid double counting when attempting to summarize flattened data.

Add and Remove DMSM Map Service



Add and Remove Tools – These two buttons simply add or remove the DMSM map service layers from the map. Remember that the DMSM map service displays the map



layers from the master DMSM geodatabase stored on the FHAAS server. This data can be useful for browsing and map navigation. Depending on the initial map extent, it may take a minute for the data to load when displaying the DMSM map service.

Cleanup Local Workspace



Cleanup Tool – The Cleanup Local Workspace command deletes the local file geodatabases created by the check-out process, and also removes the related replica information in the master DMSM geodatabase.

After a check-in process completes, the local file geodatabase remains on disk. This tool will attempt to delete those geodatabases, as well as any file geodatabases created by the check-out process that have not been checked in.

Important: This tool must not be run if there are any outstanding edits that still need to be checked in, otherwise your edits will be lost.

Important: This tool should be run immediately after starting ArcMap with a new, blank document. Otherwise existing ArcGIS file locks may cause the process to fail.

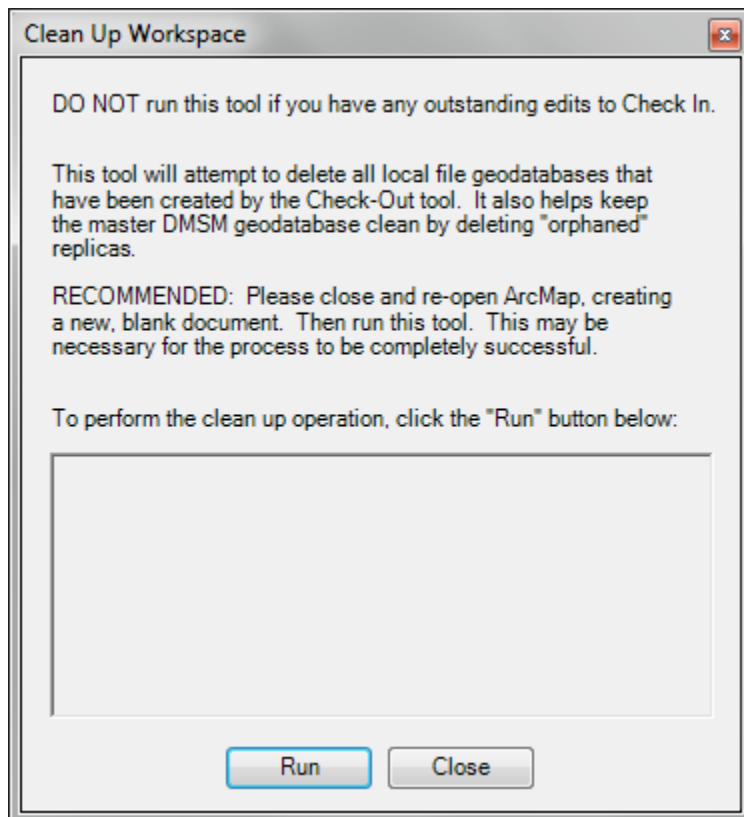


Figure 16. Cleanup Local Workspace tool dialog



To clean up the local file geodatabase workspace:

1. Close and re-open ArcMap with a new, blank document.
2. Click the Cleanup Local Workspace button on the toolbar.
3. Click "Run".

Please note that this tool may fail to successfully delete the local file geodatabases. This can be caused by a number of issues, but typically this happens if ArcGIS is maintaining any locks on the files. There are a number of potential error messages or warnings that may appear in the dialog.

Tip: None of the warning and informational messages displayed by this tool are critical; in the worst case you may have old file geodatabases from the check-out process remaining on disk.

If the Cleanup tool does fail with any error or warning messages, you may try closing and re-opening ArcMap and re-running the tool. If it still fails, the following steps can be used to manually clean up the local file geodatabases.

Important: Do NOT follow these steps if you have any remaining edits in progress that have not been checked in yet.

1. Open Windows Explorer.
2. Navigate to C:\Users\<your_user_name>\My Documents\ArcGIS\DMSMLocalEdits (note on some systems this folder may be on a drive other than "C:").
3. Delete all folders whose names start with your user name and end with a string of numbers and letters. Be careful not to delete the usersettings.config file.

Performing Geometry Edits on the Damage Areas

The DMSM Desktop Tools toolbar includes several tools that aid in performing geometry edits on the polygons in the DAMAGE_AREAS layer. In some cases these tools essentially just run the corresponding out-of-the-box ArcMap tool, and are included on the toolbar for convenience. In other cases, you should always use the custom tool and not the corresponding out-of-the-box tool found on the ArcMap Editor toolbar.

You will notice that these tools are generally disabled (grayed out) until an editing session is started via the ArcMap Editing toolbar.

Important: The following custom tools should be used in place of the corresponding out-of-the-box tools, as the out-of-the-box tools do not maintain the DMSM database integrity.



1. [Cut DMSM Damage Areas Tool](#)
2. [Explode DMSM Damage Area Tool](#)
3. [Custom Merge Polygons Tool](#)
4. [Custom Union Tool](#)

The following tools on the DMSM toolbar are provided for convenience and are technically copies of the corresponding out-of-the-box tools:

1. [Clip Polygons Tool](#)
2. [Merge Polygons Tool](#)

The following out-of-the-box ArcMap Editor tools will create a new feature and leave the existing features intact. The newly created feature will need to be properly attributed, as the new Observation record will contain <null> values for the DCA, HOST_CODE, etc., and the original features may need to be deleted if so desired.

1. Buffer
2. Union

Note that FHAAS does not consider the out-of-the-box Union tool to be useful, as it does not actually do a union; it does more what appears to be merge. Instead use the [Custom Merge Polygons Tool](#).

Additionally, the out-of-the-box Reshape and Vertex editing tools may be used on DMSM damage area polygons normally without affecting the database integrity.

Tip: Note that generally speaking, the geometry editing tools will set the CREATED_DATE to the current date for the output damage area features. The Observations related to the output features, however, will maintain the CREATED_DATE of the input feature Observations.

Clip Polygons Tool



Clip Polygons Tool – The Clip tool clips one damage area polygon by another overlapping polygon feature during editing. Technically, this runs the out-of-the-box ArcMap Clip command and is provided on the toolbar as a convenience.

1. To use, in an ArcMap editing session:
2. Select a polygon that overlaps another polygon to be clipped.



3. Click the "Clip Damage Area" button on the toolbar.
4. On the subsequent dialog, optionally enter a distance by which to buffer the clip.
5. Also make the appropriate choice to preserve the intersecting area or discard the intersecting area.
6. Click "Ok".

Merge Polygons Tool



Merge Polygons Tool – The Merge tool merges multiple, selected damage areas into a single polygon feature during editing. Technically, this runs the out-of-the-box ArcMap Merge command and is provided on the toolbar as a convenience.

To use, in an ArcMap editing session:

1. Select two or more polygons to be merged.
2. Click the "Merge Polygons" button on the toolbar.
3. On the subsequent dialog, choose the polygon whose attributes will be applied to the new, merged polygon. (Clicking in this dialog flashes the chosen polygon on the map).
4. Click "Ok".

Custom Merge Polygons Tool



Custom Merge Tool – The Custom Merge tool merges two, selected damage areas into a single polygon feature and maintains all of the input Observations on the output features during editing.

To use, in an ArcMap editing session:

1. Select exactly two, overlapping damage area polygons to be merged.
2. Click the "Custom Merge Polygons" button on the toolbar.



Cut DMSM Damage Areas Tool



Cut Damage Areas Tool – This custom editing tool cuts a damage area polygon into two separate features. The new features inherit the attributes of the original. In a normal workflow, after cutting a polygon, the user would probably normally change the attributes on one side of the cut.

Note that, unlike the out-of-the-box Cut tool, the custom tool does not require selection of the polygon(s) to be cut. The user may simply enable the cut tool and start sketching the cutting geometry, regardless of whether the polygon(s) to be cut are currently selected.

To use, in an ArcMap editing session:

1. Click the “Cut” button on the toolbar.
2. Draw an edit sketch to define the cutting line through one or more polygons.

Important: Never use the out-of-the-box ArcMap Cut tool on DMSM data. Use this custom tool instead.

Explode DMSM Damage Area Tool



Explode Damage Area Tool – This custom Explode tool turns a multi-part damage area polygon feature into separate features, one for each part in the input multi-part. It operates immediately on the selected multi-part feature. The original Observation attributes are maintained on the new, individual features.

To use, in an ArcMap editing session:

1. Select a multi-part damage area feature.
2. Click the “Explode” button on the toolbar.

Important: Never use the out-of-the-box ArcMap Explode tool on DMSM data. Use this custom tool instead.

Union Damage Areas Tool



Union Damage Area Tool – This custom Union tool creates a new damage area from the overlapping area of two input damage area features. The new feature is assigned all of the Observations from the two input features. Note that this tool will work when the input




features partially overlap each other, as well as in the case where one feature completely overlaps (or envelopes) another feature.

To use, in an ArcMap editing session:

1. Select two overlapping damage area features.
2. Click the "Union" button on the toolbar.

DMSM Attribute Editor

 **Attribute Editor** – The attribute editor was developed mainly as a supplement to the out-of-the-box ArcMap Field Calculator. It is also a convenient method for editing the attributes of any individual feature.

The button for this tool toggles the visibility of a custom, dockable window, meaning it can be free floating or docked to any edge of the ArcMap window:

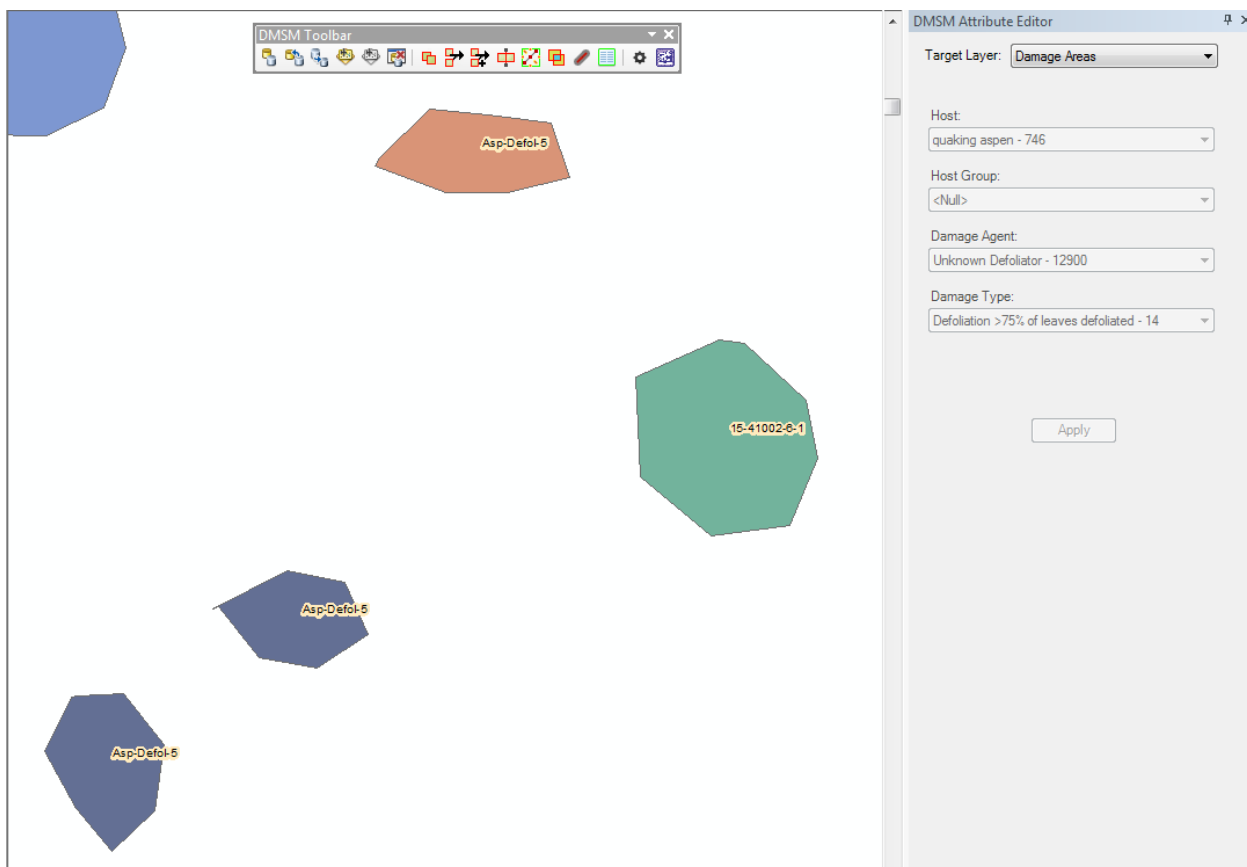


Figure 17. DMSM Attribute Editor, docked to the right side of the ArcMap window



During an editing session, the attribute editor responds to changes in the feature selection of the selected Target Layer. If all of the selected features contain an identical combination of host, DCA and damage type, then the attribute editor becomes enabled.

Important: All of the selected features in the Target Layer must have the same combination of host (or host group), damage agent, and damage type in order for the dropdowns and Apply button to become enabled.

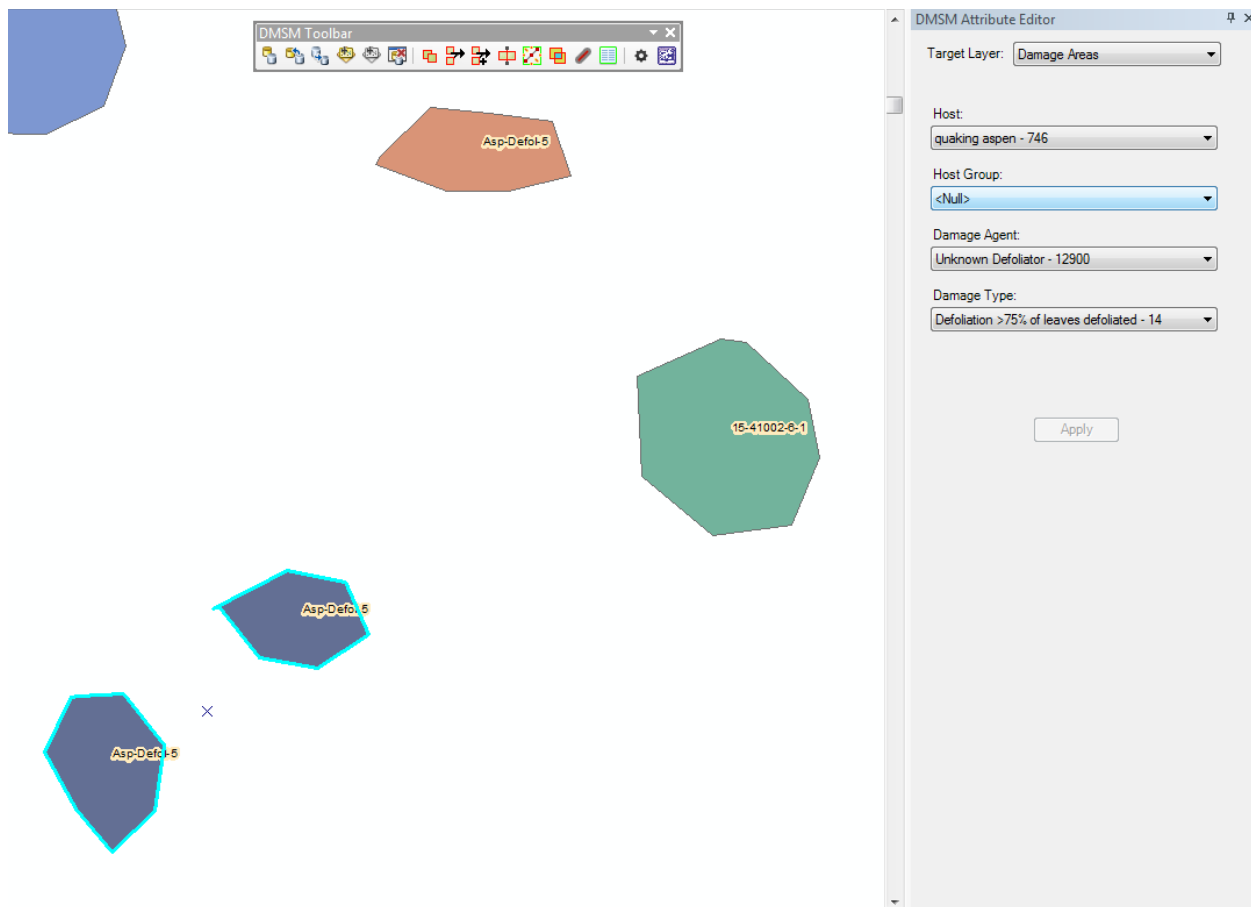


Figure 18. DMSM Attribute Editor in an enabled state

At this point the user simply selects the desired value(s) from the dropdown lists and clicks "Apply".

Note that the Host or the Host Group, but not both, must be attributed, and the attribute editor enforces that rule.

The feature selection may take place either on the map or in the attribute table for the selected Target Layer. This is convenient for changing the attributes of multiple features in a single operation.

In the special case where a single damage feature is selected, the attribute editor will display an additional input for editing either the Percent Affected field (for damage areas) or the Number of Trees field (for damage points).

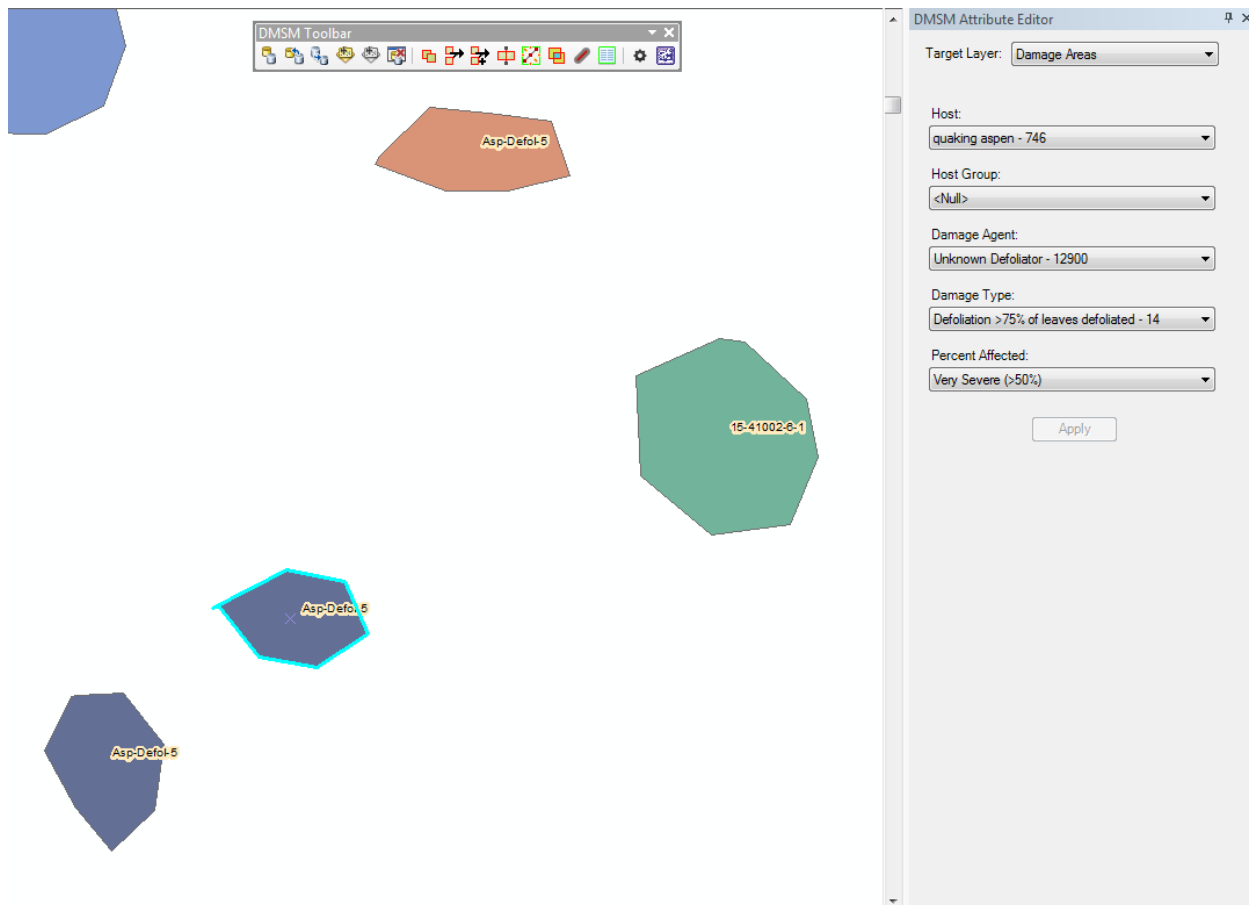


Figure 19. DMSM Attribute Editor displaying the additional dropdown for Percent Affected. This input is only available when a single damage feature is selected

ArcMap Field Calculator

Although there are a couple of issues to be aware of, the out-of-the-box ArcMap Field Calculator tool may be used to edit the attributes of multiple selected features.

First, the observation attributes such as the host, damage agent, etc. are stored in the related Observations table, and some of those fields are displayed for convenience as joined fields in the damage areas and points featureclasses. Those joined fields cannot be edited directly in the featureclass attribute table with the Field Calculator.

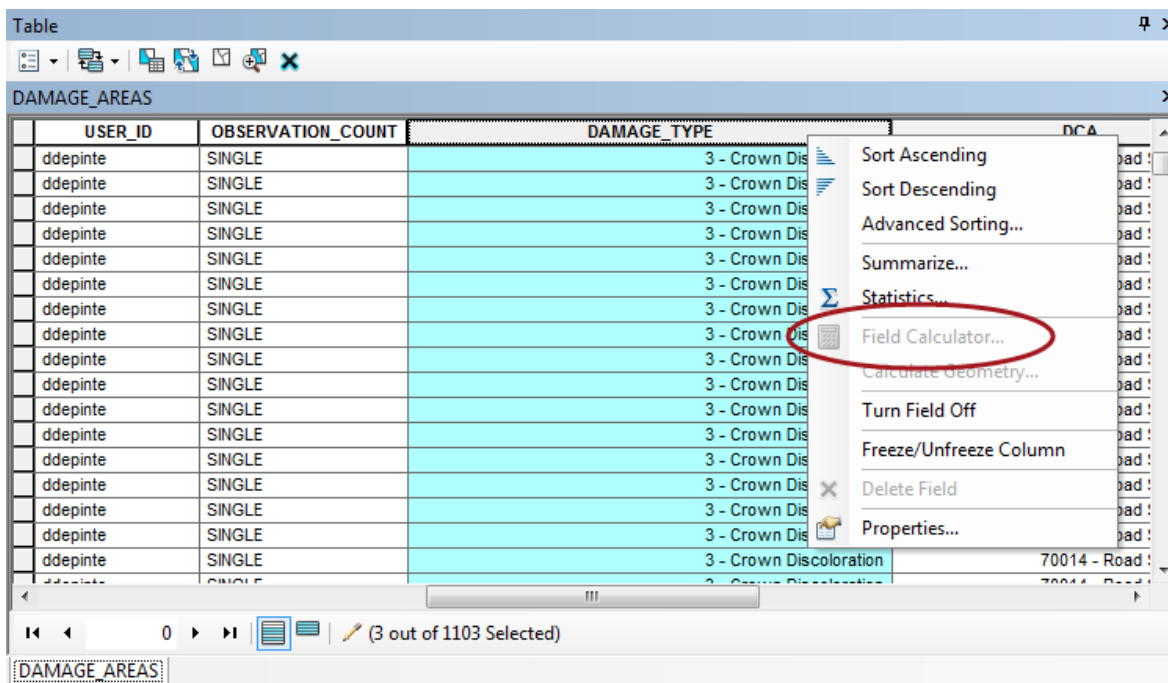


Figure 20. The DAMAGE_AREAS attribute table open for editing. Note that the Field Calculator is not available on the fields joined from the Observations table

Instead, you must select the features of interest and then switch the table view to the Observations table, and then apply updates with the Field Calculator. (Optionally you could make the initial selections in the Observations table itself).

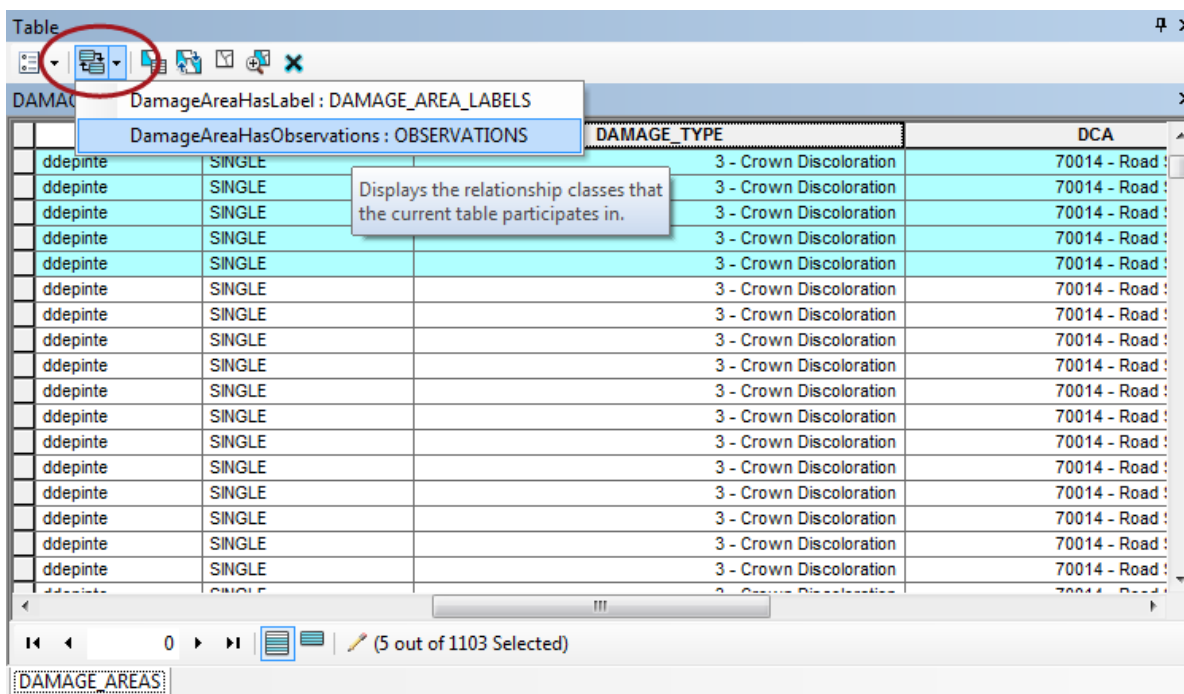


Figure 21. Using the Related Tables button in ArcMap to switch from the DAMAGE_AREAS attribute table to the related Observations table



After switching to the related Observations table, note that the rows related to the previously selected damage area features are now selected in the Observations table. At this point, the Field Calculator is available for use:

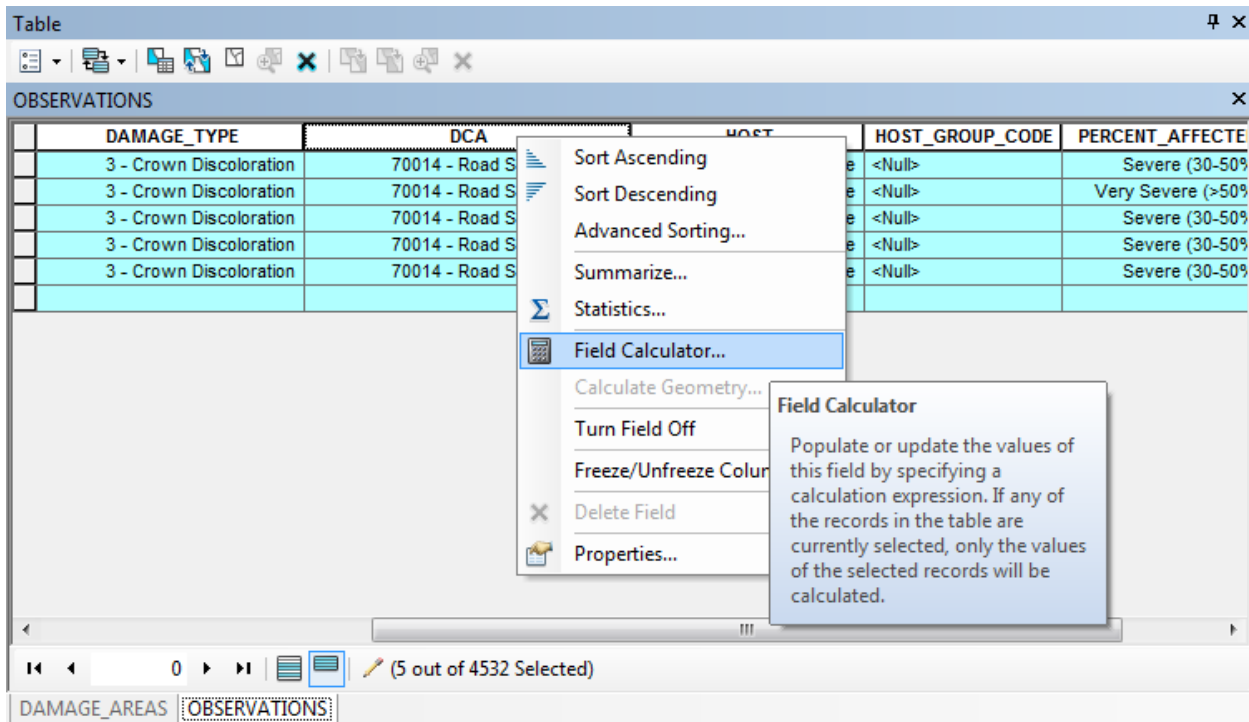


Figure 22. Field Calculator is available for use on attributes of interest in the Observations table itself, but not on the joined Observations fields in the damage areas or points featureclass attribute tables

The second issue with the Field Calculator is that it does not respect the database domains applied to some of the fields, such as DCA, HOST and DAMAGE_TYPE. To change the value of a domain attribute field with the Field Calculator, you must know and use the code, rather than the description, when changing the value.

For example, to change the value of HOST on multiple features in DAMAGE_AREAS:

1. Select the features to edit on the map, or in the DAMAGE_AREAS attribute table.
2. Switch to the Observations attribute table as described above, using the Related Tables button.
3. Verify that only the rows to be edited are selected and displayed in the Observations attribute table.
4. Right-click on the column header for HOST and choose "Field Calculator".
5. In the Field Calculator dialog, type the new HOST_CODE in the text box. This is where you must enter the numeric code, as the host description will not work.



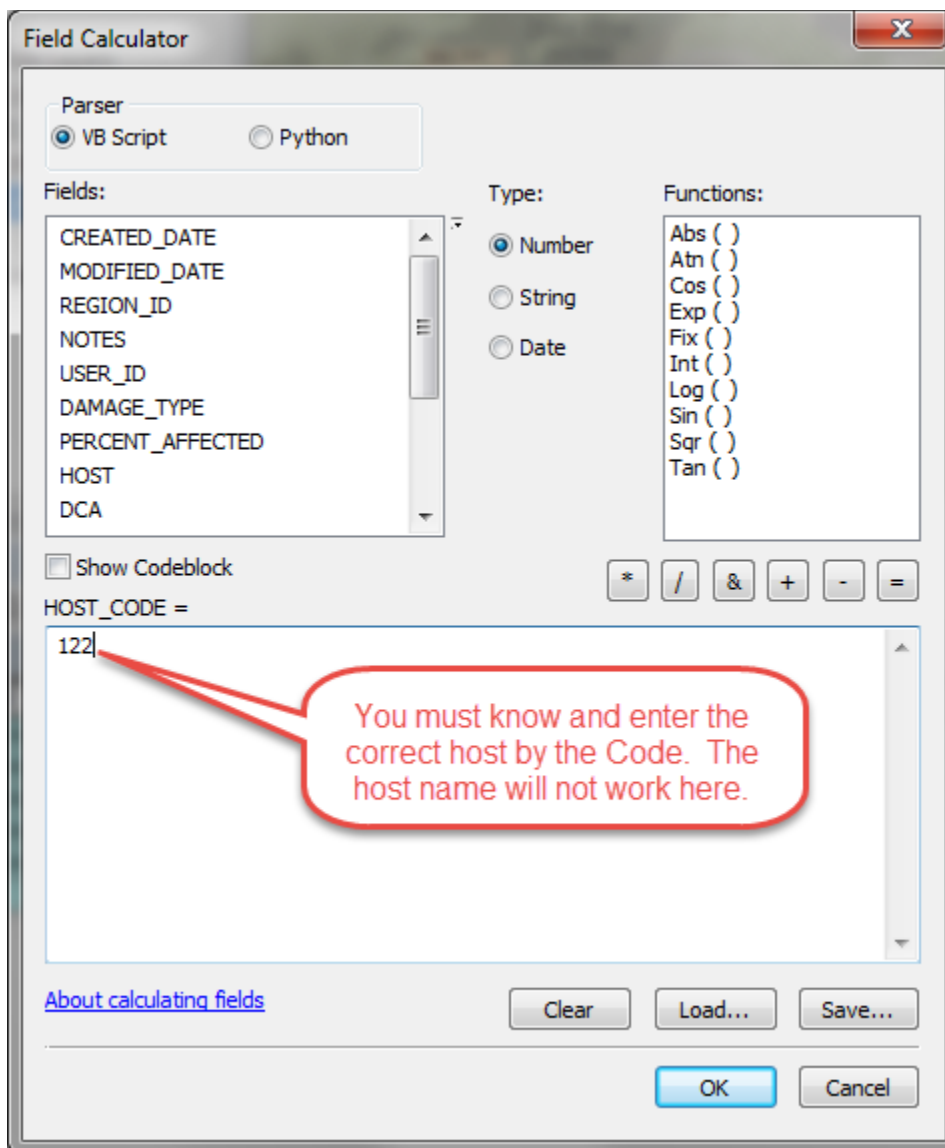


Figure 23. Updating the Host_Code in the Field Calculator

- Click "OK" to apply the edit to all selected rows. Note that if you enter a valid HOST_CODE in the Field Calculator, the cells in the attribute table will then display the appropriate description from the domain.

HOST	
122 - ponderosa pine	<
122 - ponderosa pine	<
122 - ponderosa pine	<
122 - ponderosa pine	<
122 - ponderosa pine	<

Figure 24. Updated HOST field displays the domain description for the applied code of 122



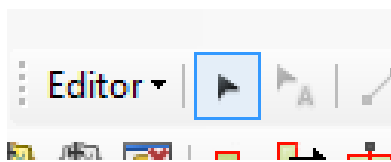
If you enter an incorrect code, the field will still be calculated but will display just the code rather than the description from the domain. (Note also that sorting on a field with any incorrect codes may cause ArcMap to crash).

Editing Multiple Observations on a Damage Feature

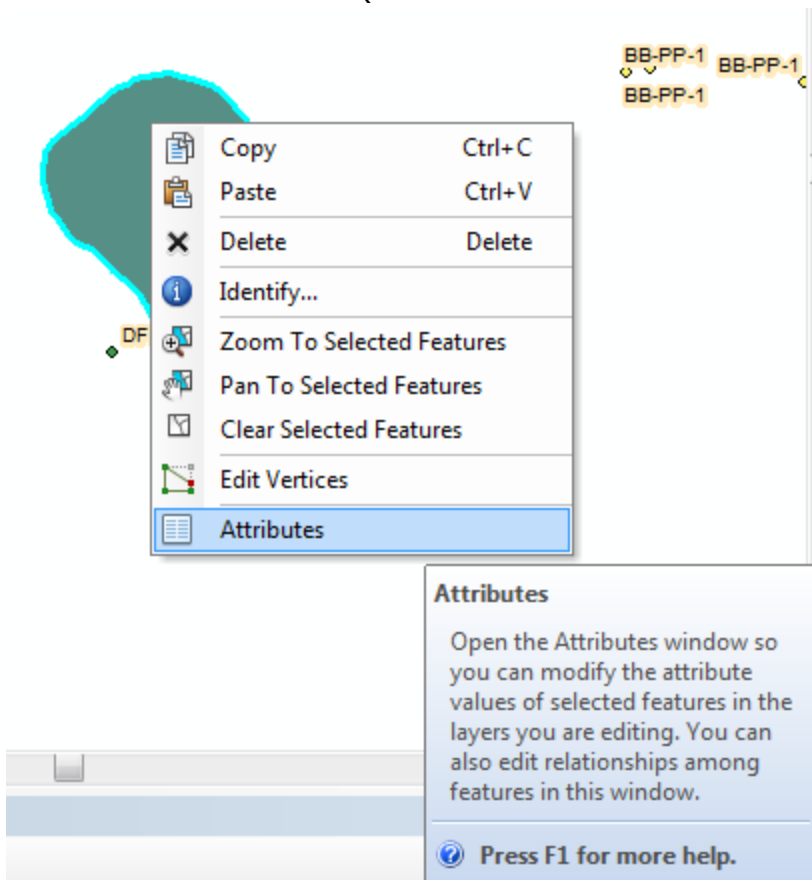
In the DMSM database structure, it is valid to have one or more Observations related to a single damage area or point feature.

Use the following steps to add an observation to an existing feature within an edit session:

1. Click the "Edit Tool" on the editor toolbar to activate the tool:



2. Click on the feature that needs a new Observation to select it, and then right-click and choose "Attributes" (or click the "Attributes" button on the ArcMap Editor toolbar)



3. In the Attributes dialog, expand the treeview under the selected damage area, right-click on OBSERVATIONS, and choose "Add New":



Attributes

DAMAGE_AREAS

28661

DAMAGE_LABELS - DAMAGE_AREA_LABELS

OBSERVATIONS

11015

CREATED_DATE 8/1

MODIFIED_DATE 8/1

OBSERVATION_ID {97}

Context menu options:

- Add Selected
- Add New
- Remove All
- Table

4. Click on the newly added Observation in the treeview to open its attributes:

Attributes

DAMAGE_AREAS

28661

DAMAGE_LABELS - DAMAGE_AREA_LABELS

OBSERVATIONS

11015 - Western Balsam Bark Beetle

52770

CREATED_DATE	9/27/2016 6:18:26 PM
MODIFIED_DATE	9/27/2016 6:18:26 PM
OBSERVATION_ID	{4fea3a10-3f83-4ba0-aba1-c35935430f86}
DAMAGE_POINT_ID	<Null>
DAMAGE_AREA_ID	{6d7a6ccd-e1cc-41d5-879a-dadb7085028e}
REGION_ID	3
USER_ID	jcowardin@fs
DAMAGE_TYPE	<Null>
DCA	<Null>
HOST	<Null>
HOST_GROUP_CODE	<Null>
PERCENT_AFFECTED	<Null>
NUMBER_OF_TREES	<Null>
NOTES	<Null>
PHOTOS	<Null>



- Use the dropdowns and text boxes to set the attributes as desired:

Attributes

- DAMAGE_AREAS
 - 28661
 - DAMAGE_LABELS - DAMAGE_AREA_LABELS
 - OBSERVATIONS
 - 11015 - Western Balsam Bark Beetle
 - 11007 - Douglas-fir Beetle

CREATED_DATE	9/27/2016 6:18:26 PM
MODIFIED_DATE	9/27/2016 6:19:54 PM
OBSERVATION_ID	{4fea3a10-3f83-4ba0-aba1-c35935430f86}
DAMAGE_POINT_ID	<Null>
DAMAGE_AREA_ID	{6d7a6ccd-e1cc-41d5-879a-dadb7085028e}
REGION_ID	3
USER_ID	jcowardin@fs
DAMAGE_TYPE	2 - Mortality
DCA	11007 - Douglas-fir Beetle
HOST	15 - white fir
HOST_GROUP_CODE	<Null>
PERCENT_AFFECTED	Very Light (1-3%)
NUMBER_OF_TREES	<Null>
NOTES	<Null>
PHOTOS	<Null>

Similarly, you can use the Attributes dialog for the selected damage feature to delete one or more of the multiple Observations:

- Open the Attributes dialog for the selected feature, and expand the treeview to display the related Observations, as described above.
- Right-click on the Observation to be deleted, and select "Delete".

Attributes

- DAMAGE_AREAS
 - 28661
 - DAMAGE_LABELS - DAMAGE_AREA_LABELS
 - OBSERVATIONS
 - 11015 - Western Balsam Bark Beetle
 - 11007 - Douglas-fir Beetle

CREATED_DATE	9/27/2016 6:18:26 PM
MODIFIED_DATE	9/27/2016 6:19:54 PM
OBSERVATION_ID	{4fea3a10-3f83-4ba0-aba1-c35935430f86}
DAMAGE_POINT_ID	<Null>
DAMAGE_AREA_ID	{6d7a6ccd-e1cc-41d5-879a-dadb7085028e}
REGION_ID	3
USER_ID	jcowardin@fs
DAMAGE TYPE	2 - Mortality

- Copy Attributes
- Paste Attributes
- Select
- Remove From Relationship
- Delete**
- Open Attribute Table
- Table Properties...



Note that if you delete all of the Observations for a damage feature, when the last Observation is deleted the related damage feature and the label point will also be deleted automatically by the DMSM Desktop Tools.

Buffer Flight Lines Tool

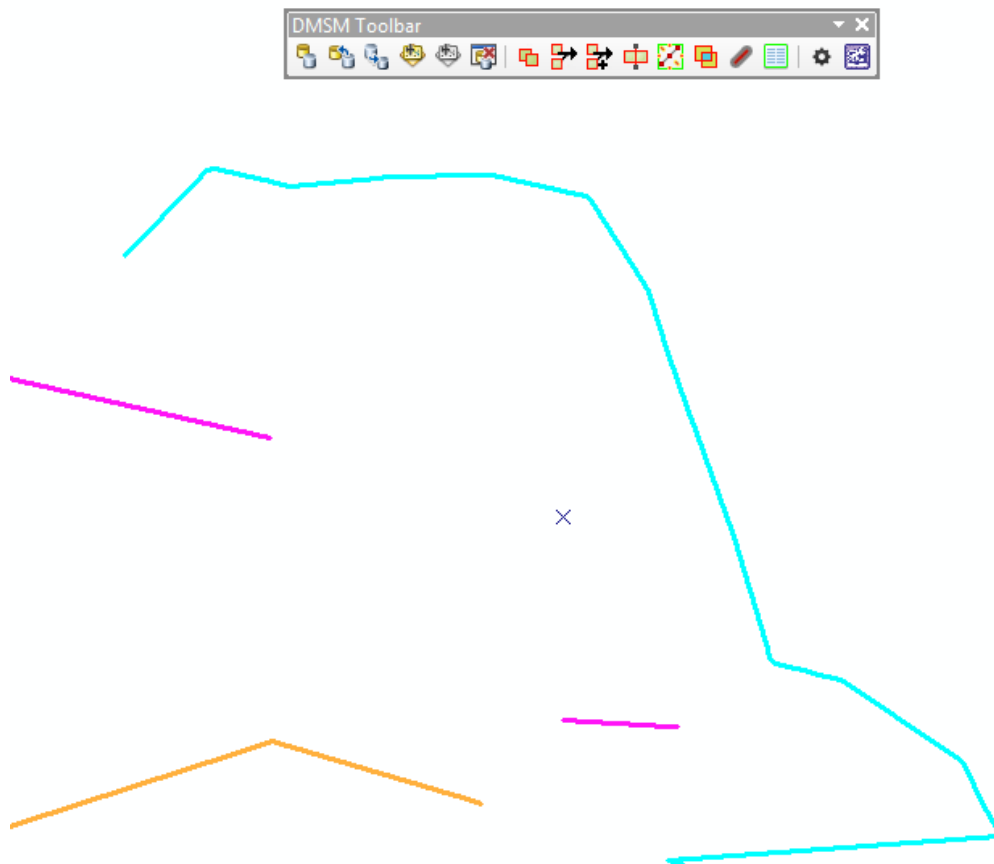


Buffer Tool – The “Buffer Flight Lines” tool is used to create buffered polygons in the Flightpolys layer from the selected features in the Flightlines layer, at a user specified buffer distance. All relevant attributes from the flight lines are automatically transferred to the corresponding buffered polygons.

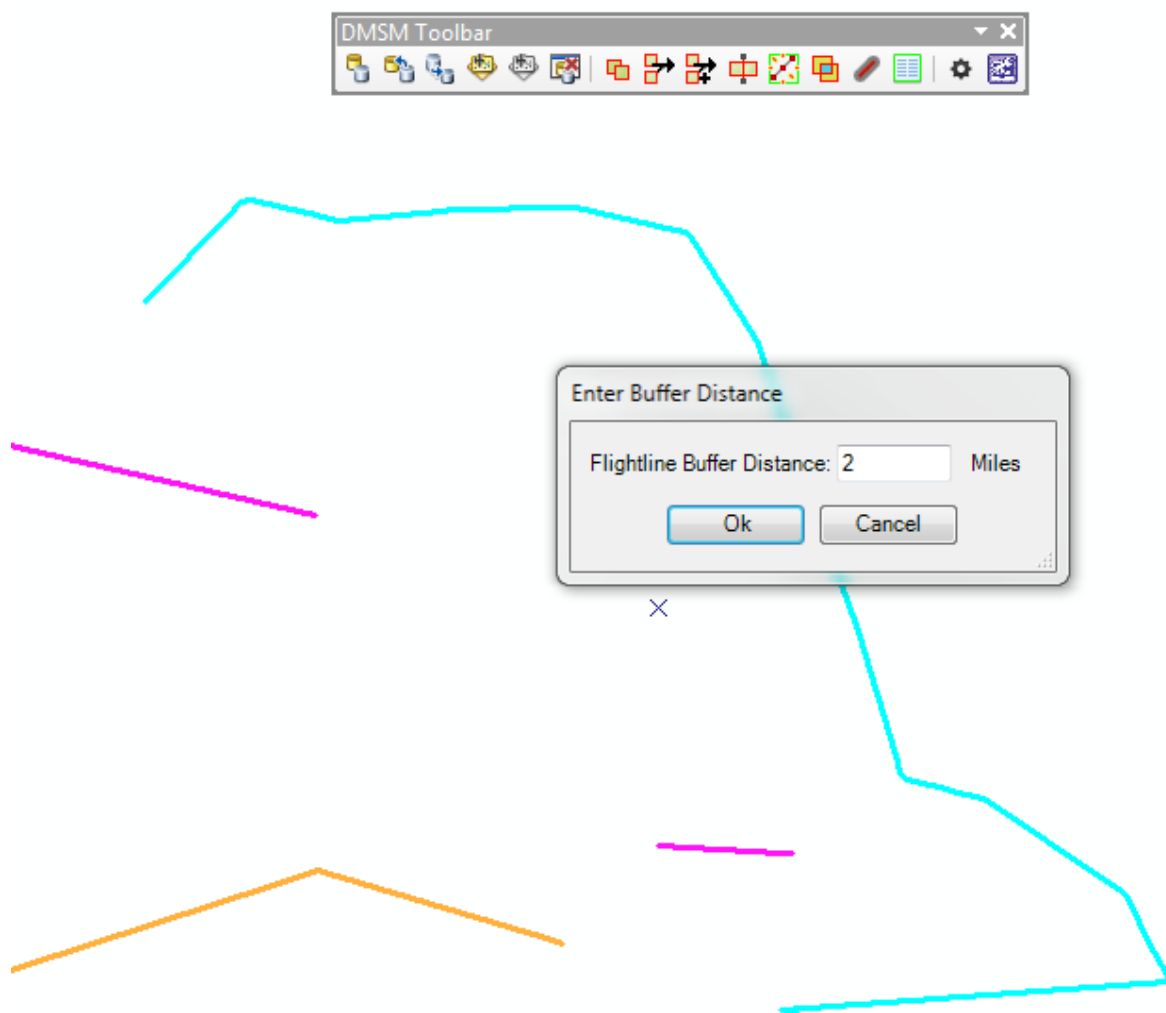
Important: Best practice is to create buffers for all relevant flight lines and then merge the resulting polygons **by date**. For more information about this and other post survey tasks, see the [Data Reviewer and Other Post Survey Tasks](#) document.

To create buffered flight lines:

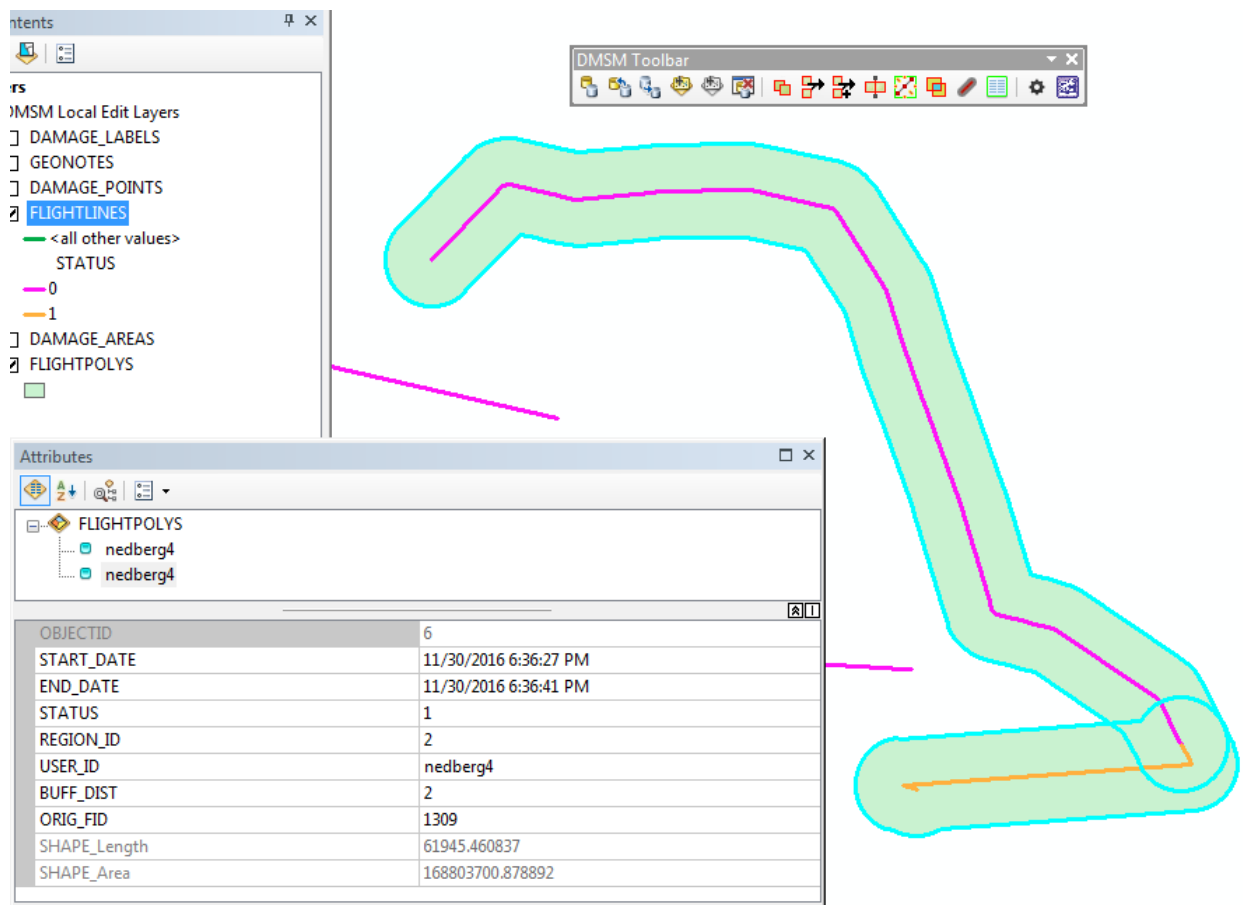
1. Select at least one line in the Flightlines layer:



2. Click the "Buffer Flight Lines" tool on the toolbar. A dialog box opens, in which the buffer distance must be entered.



3. Enter the desired buffer distance, in Miles (decimals are allowed), and click "Ok". The tool creates the desired buffer polygons in the Flightpolys layer, and transfers relevant attributes such as the USER_ID, REGION_ID, etc. to the new polygons.



Tip: The Flightlines layer is not editable in DMSM Desktop Tools. However, the flight polygons may be edited after the buffering process creates them. The flight polygons are included in the replica and will be uploaded to the master DMSM geodatabase during the check-in process (see the [Check-In tool](#)).



About



About – The “About” button on the toolbar opens a dialog that reports the current version number of the DMSM Desktop Tools. For example:

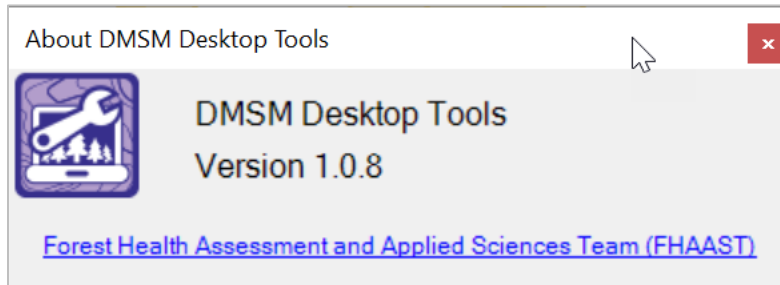


Figure 25. About dialog

Create Acreage Reports



Acreage Reports – The “Create Acreage Reports” button opens a tool that provides real-time, regional acres reports employing a standard summary process used by FHAAST. The output is a Microsoft Excel spreadsheet with separate tabs for various types of summaries.

The opening page of the wizard dialog provides an overview of the tool and access to a PDF document with very important information about how the acreage reports are generated and how the data should be interpreted.



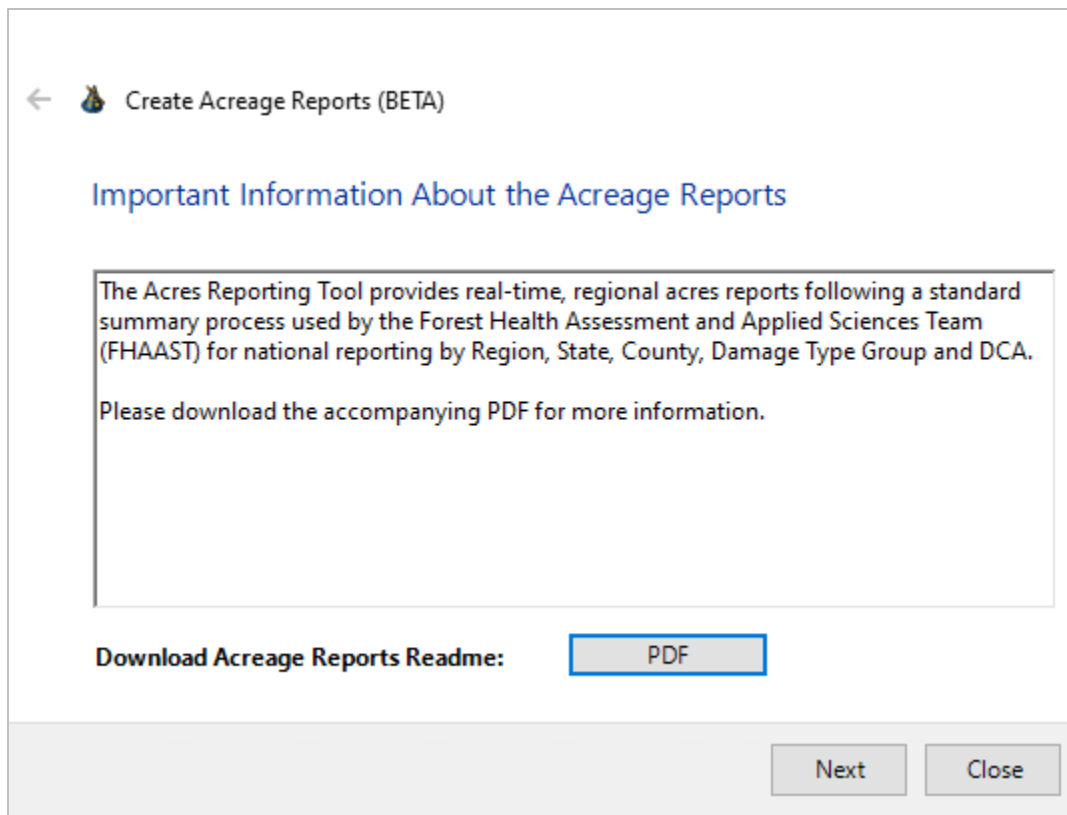



Figure 26. Create Acreage Reports, important information

Important: The first time you run this tool, you must click "PDF" to open the read me document before the "Next" button will become enabled and allow you to move to the next step. Please click the "PDF" button and read the important "read me" information in detail.

Steps 1 is similar to the [Check-Out](#) and [Extract](#) tools, for specifying an attribute filter by Region, users, and date range on the data for which to create the report.

←  Create Acreage Reports (BETA)

Step 1 - Filter By Attributes

Set the following attribute filters to limit what data will be included in the reports.

Forest Service Region: Region 5

User(s):

- ☒ All Users
- ☒ ddepinte_usfs
- ☒ dlnr_jbrito
- ☒ dlnr_jzlonis
- ☒ dlnr_mosullivan

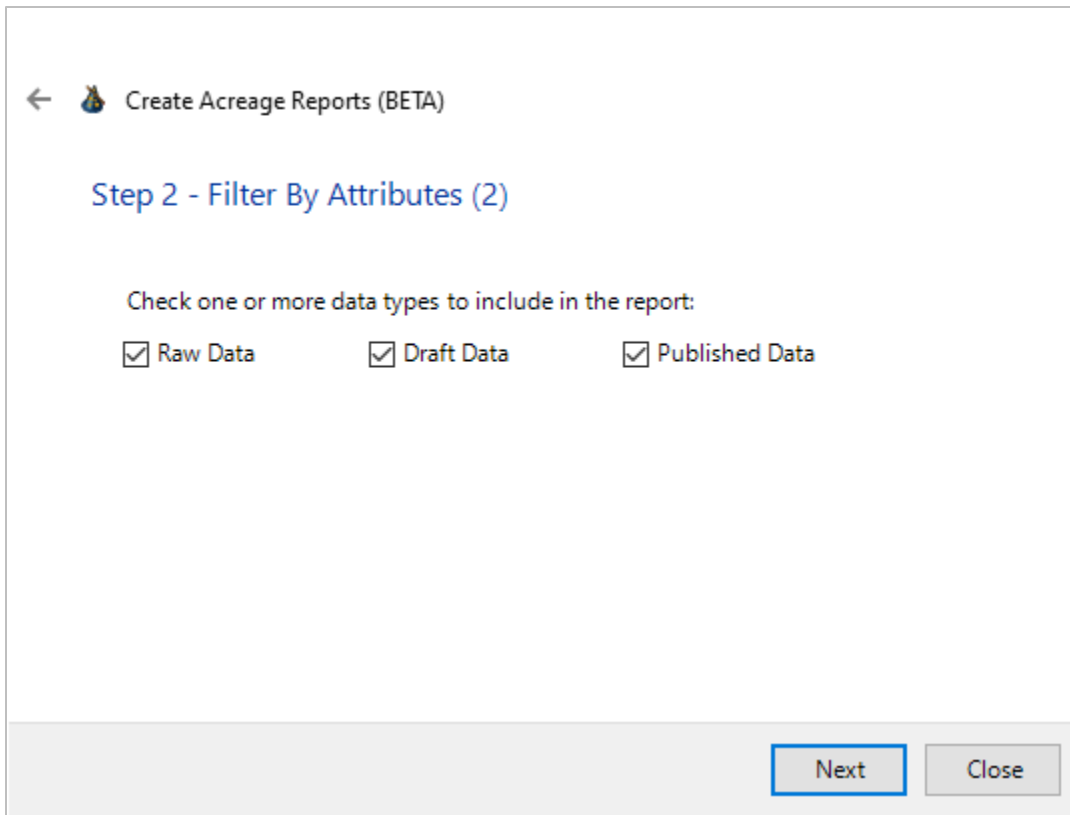
Creation Date Range: 1/ 1/2019 6/ 4/2020


Next Close

Figure 27. Create Acreage Reports, filter by attributes

Step 2 provides a further attribute filter by the published data flag. Select any combination of raw data, draft data, and published data.





←  Create Acreage Reports (BETA)

Step 2 - Filter By Attributes (2)

Check one or more data types to include in the report:

☒ Raw Data ☒ Draft Data ☒ Published Data

Next Close

Figure 28. Create Acreage Reports, filter by data published flag

Step 3 further filters the reporting data by the current map extent. Zoom and pan to include features to include in the report. Note that only features completely within the map extent will be included; features that intersect the map extent but go outside of it will be excluded from the report.



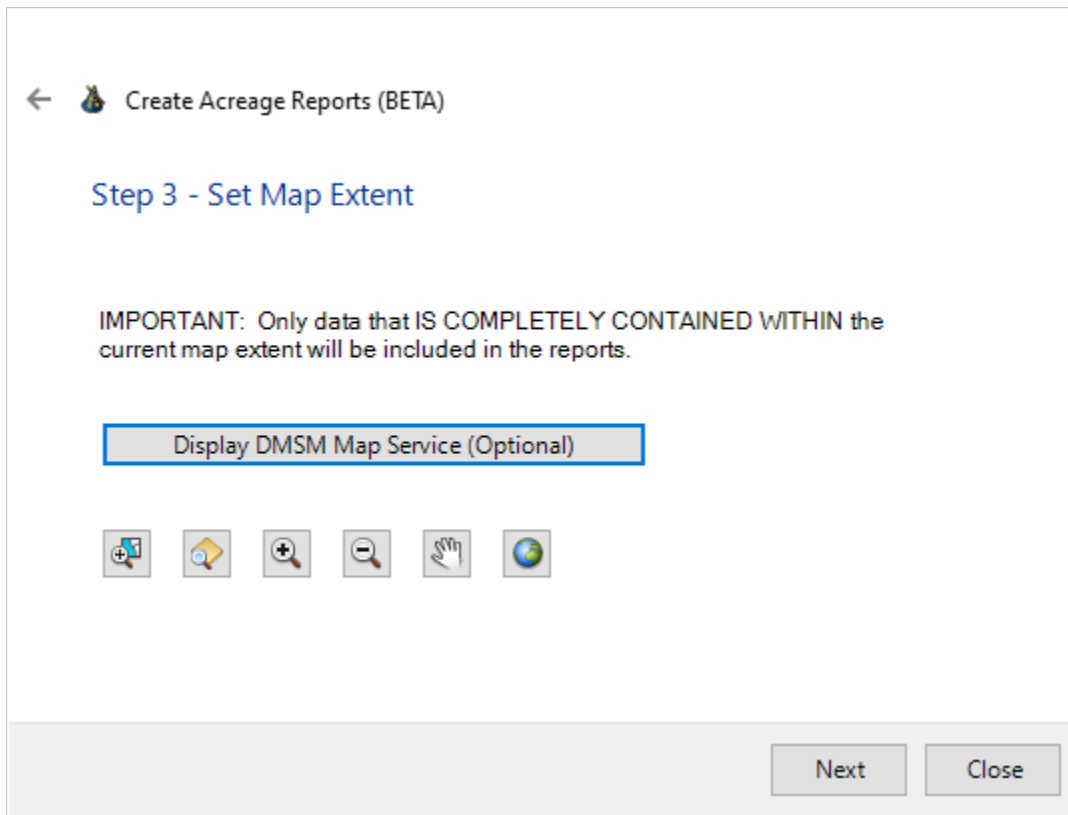
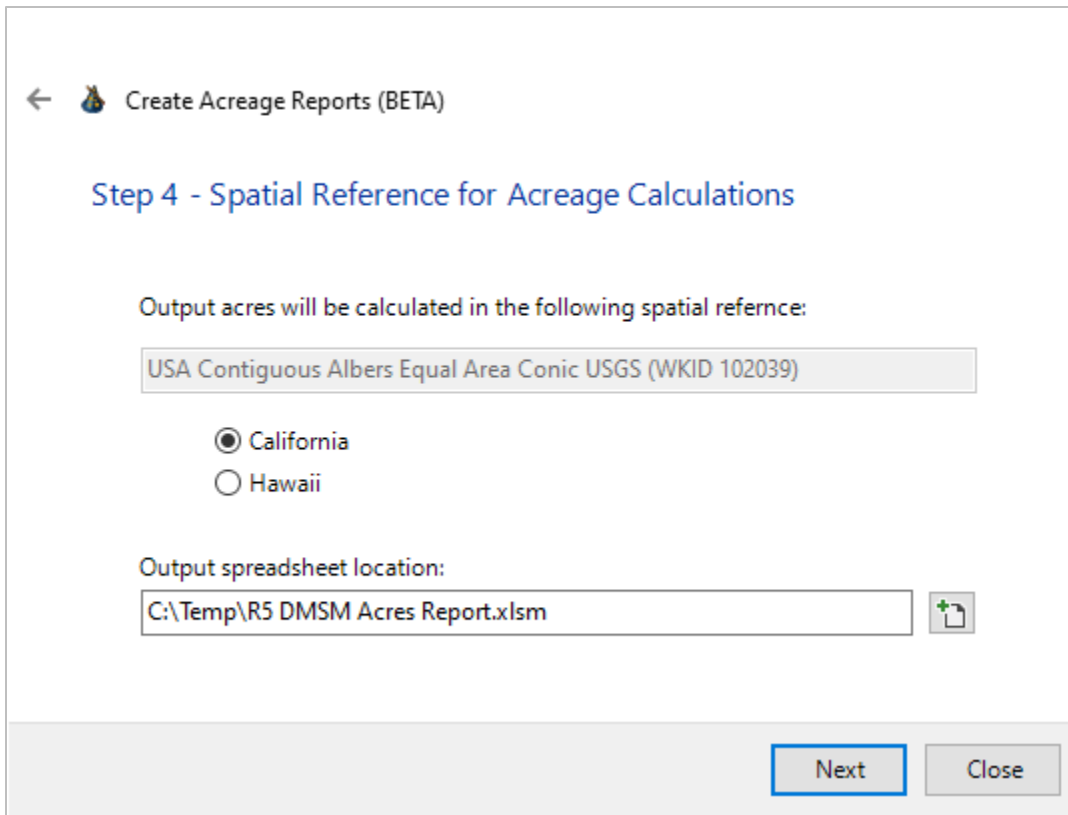



Figure 29. Create Acreage Reports, filter by map extent

Step 4 displays the spatial reference that will be used for calculating the acreage reports. This is auto-set, except in the case of Region 5, in which case you must verify either Hawaii or California as the area of interest. Also set the location and name of the output Microsoft Excel spreadsheet.





←  Create Acreage Reports (BETA)


Step 4 - Spatial Reference for Acreage Calculations

Output acres will be calculated in the following spatial reference:

USA Contiguous Albers Equal Area Conic USGS (WKID 102039)

☒ California
☐ Hawaii

Output spreadsheet location:

C:\Temp\R5 DMSM Acres Report.xlsm 

Next Close

Figure 30. Create Acreage Reports, spatial reference and output spreadsheet location

Step 5 provides a display of the input parameters for review prior to executing the report. Review the inputs carefully, and if edits are necessary, use the back button (left-pointing arrow in the upper left of the dialog) to go back to make changes. When ready to execute the reports, click "Next".

Figure 31. Create Acreage Reports, input parameter review

As the report is executing, the final page of the wizard dialog will display the status and individual steps of the report process as they proceed. When the report creation completes, the final status message will be "Report generation complete". At this point, the output spreadsheet will open in Microsoft Excel (you must have that software installed), and the wizard dialog can be closed by clicking "Close".

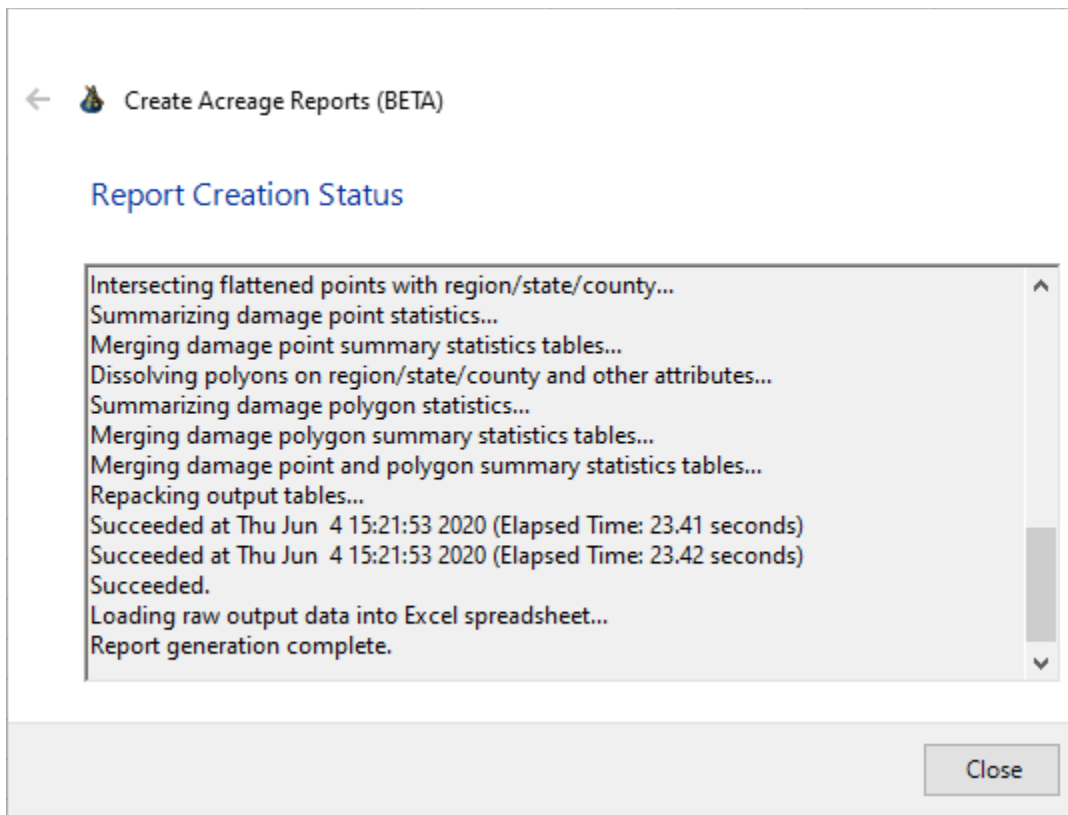


Figure 32. Create Acreage Reports, report creation status

The Excel spreadsheet may initially display a message indicating that macros need to be enabled. If so, click the "Enable Content" button in Excel to continue.



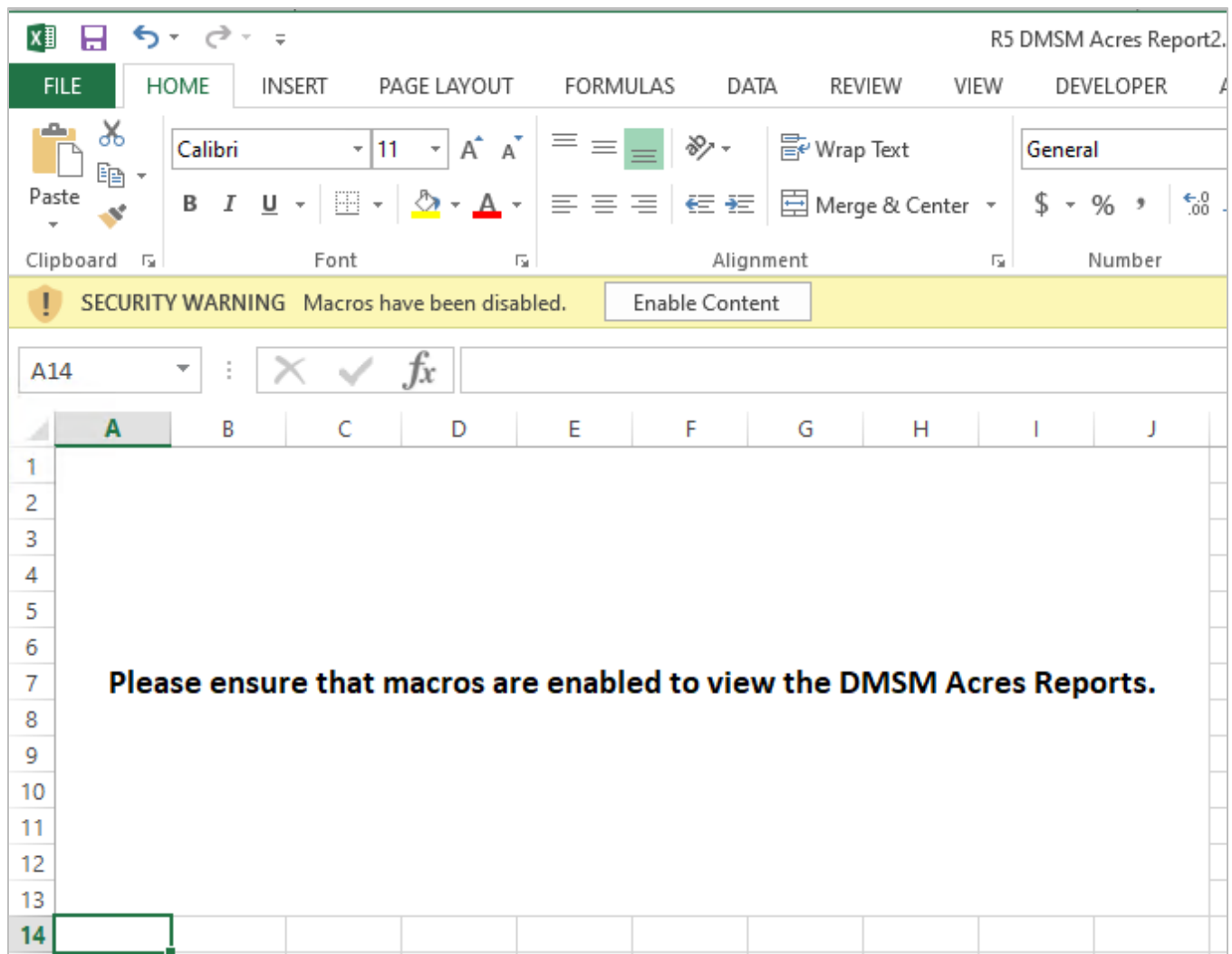


Figure 33. Create Acreage Reports, Microsoft Excel output spreadsheet, Enable Content

When macros are enabled, the acreage reports will be displayed. The first worksheet in the spreadsheet ("Notes") summarizes the report date and input parameters, along with general notes about the report.



The screenshot shows the Microsoft Excel interface with the 'R5 DMSM Acres Report2.xlsm' file open. The 'Notes' worksheet is active, displaying a table with the following data:

	A	B
1		
2	Report Date	6/4/2020
3	Extent	-13977854.8825491, 4715611.4696862, -13426197.5292344, 5179294.68871931
4	Region	5
5	Date Range	1/4/2019 - 6/4/2020
6	Users	ddepinte_usfs, dlnc_jbrito, dlnc_jzlonis, dlnc_mosullivan, dlnc_sandrade, drswan, JParker808, jwmoore02_usfs, mtntmac1_partner, oiscfs
7	Published Flags	Raw, Draft, Published

A large text box is overlaid on the worksheet, containing the following text:

Acres summaries reflect current year's damage observations.

The pivot table filter "(All)" and "Select Multiple Items" options have been disabled. Selecting multiple options can lead to unreliable subtotals due to multiple counting issues and should be avoided.

Tabs are color coded to indicate summary groupings.

Green indicates damage causing agent (DCA) based summaries.

Blue indicates footprint damage type summaries.

Please see the "**Desktop Tools Acreage Reports Readme**" document for more details about the summarizing process.

The bottom of the Excel window shows the worksheet tab bar with the following tabs: Notes, SumFootprintStateAcres, SumFootprintCountyAcres, RawAcresTable1, SumAcresByState, SumAcresByCounty, and SumAcresByCounty...

Figure 34. Create Acreage Reports, Microsoft Excel "Notes" worksheet

The remaining worksheets include two with raw data, and additional worksheets with pivot tables based on the raw data, that summarize the acres.

Important: Please read the acreage reports read me file available from the first page of the wizard dialog for detailed information about the report outputs, and how the reports are generated.



Object Class Extensions

In addition to the User Interface, the DMSM Desktop Tools also include custom “object class extensions”. This is custom code that runs “in the background” and helps to keep intact the integrity of the DMSM relational database structure.

Tip: The object class extension code runs automatically in the background, and there is nothing the user must do, but it is good to understand that these extensions exist and are running during editing in ArcMap. Also, note that these extensions are created and applied by the [Check-Out tool](#), but not by the [Extract tool](#).

Here is a partial list of some of the things the object class extensions do automatically:

1. Attempted edits to non-editable fields are cancelled, and the user is notified. A few of these fields include the various ID fields such as USER_ID, OBSERVATION_ID, DAMAGE_AREA_ID, REGION_ID, QUICK_KEY_ID, etc.
2. The HOST_CODE and HOST_GROUP_CODE in the Observations table may not both be attributed--only one or the other must be coded. If the user attempts to set a value other than <null> in one of these fields when the opposing field is already coded, the edit is rolled back and the user is notified.
3. In the Observations table, the NUMBER_OF_TREES field must be populated if it is an observation on a point feature, and conversely the PERCENT_AFFECTED_CODE field must be attributed if it is a polygon feature. The class extension for the Observations table will enforce this rule as the user makes edits.
4. Damage label points must be located at the same geographic point as the associated damage point feature. If the user edits the location of a damage point, the object class extension for the damage points automatically moves the label point to the new location.
5. Similarly, if the user edits the shape of a damage area polygon, the associated label point is automatically moved to the centroid of the polygon (and always within the polygon) by the object class extension for the damage areas.
6. Damage label points may not be directly edited. Any attempt to change the geometry or attributes of a damage label point will automatically be rolled back and the user



will be notified. All necessary edits to the damage label points are done by the object class extensions, based on valid edits to the observation attributes.

7. The `CREATED_DATE` field is always automatically attributed, for all tables that have that field, whenever a new feature is created. (Note, this is not implemented for the Geonotes layer).
8. The `MODIFIED_DATE` field is always automatically updated, for all tables that have that field, whenever a feature is edited.
9. Geometry edits to grid cell features in the damage areas featureclass are prohibited. If you attempt to change the shape of a grid cell, the edit will be rolled back.

