USDA
United States Department of Agriculture

Digital Mobile Sketch Mapping (DMSM)

DMSM Desktop Tools

Alternatives to ADS: DTT with Pan and Sketch

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

Alternatives to Aerial Detection Survey (ADS)

When traditional aerial detection survey is not possible, there can be alternative ways to input data for use by the National Forest Health Protection program and its cooperators. The preferred methods are as follows:

1. Use the Pest Event Reporter (PER) to describe the event and capture county-level geography. This requires a login.
2. Use the DMSM tablet with current, high resolution imagery, to collect data in a tablet-based "Pan and Sketch" manner.
3. Similarly use the DMSM Desktop Tools with current, high resolution imagery to collect data in a desktop-based "Pan and Sketch" manner (described in this document).
4. Use the DMSM tablet in "ground check" mode to collect ground-based data in the field.
5. For any other data collected outside the PER or DMSM data streams, use the Insect and Disease (IDS) data submission template.

Important: Remote sensing data can be used to map tree damage, but must be ground verified to be included in the National Insect and Disease Survey (IDS) database.

Desktop Pan & Sketch Process at a Glance

This document is meant as a guide to this specific Desktop "Pan and Sketch" method and assumes the user is familiar with the standard DMSM Desktop Tools check-out, edit and check-in workflow. If you need more information about installing and using the Desktop Tools, please refer to the main DMSM Desktop Tools User's Manual included with the full download package at the following link. This requires an ArcGIS Online (AGOL) login and membership to the DMSM user group.

DMSM Desktop Tools application and user's manual

Quick start steps are as follows.

1. Open a new map document (mxd) in ArcMap
2. Update the settings in the DMSM Desktop Tools (DTT) to point to the DMSM2020 database
3. Load the DTT toolbar if necessary
4. Load reference imagery
5. Save map document (save as a base document to reuse if desired before DMSM data check-out)
6. Sign into ArcGIS Online (requires login and membership to the DMSM user group)
7. Check-out DMSM data to a local replica
8. Start an edit session
9. Create features using DMSM feature templates that represent tree damage
10. Update all required core attributes individually or in batch mode
11. Add information to "Notes" field to characterize project (example: "Pan and Sketch with NAIP")
12. Save edits
13. Check-in edits to central DMSM database
14. Repeat process when necessary until all tree damage data for project is complete

Desktop Pan & Sketch Process

Open a new map document and load the reference imagery

Open a new map (mxd) document and load any reference imagery or map layers. These can be from any number of sources like an image service, tile package (TPK) or other raster layers.

See the companion Available Imagery Resources for FHP document produced by the Geospatial Technology and Applications Center (GTAC) for information on imagery resources (requires an ArcGIS Online (AGOL) login and membership to the DMSM user group).

Tip: Consider creating a "base mxd" that contains all reference layers that can be used for each check-out. 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 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.

The spatial reference of the DMSM data is Web Mercator. It is permissible to use any spatial reference for map display in ArcMap, however, imagery and other reference layers will display and refresh more quickly if stored in the same spatial reference as the DMSM data.

Check-out data: select region, username and AOI

Make sure you are pointed to the DMSM2020 central database by checking and altering the DMSM Settings if necessary.

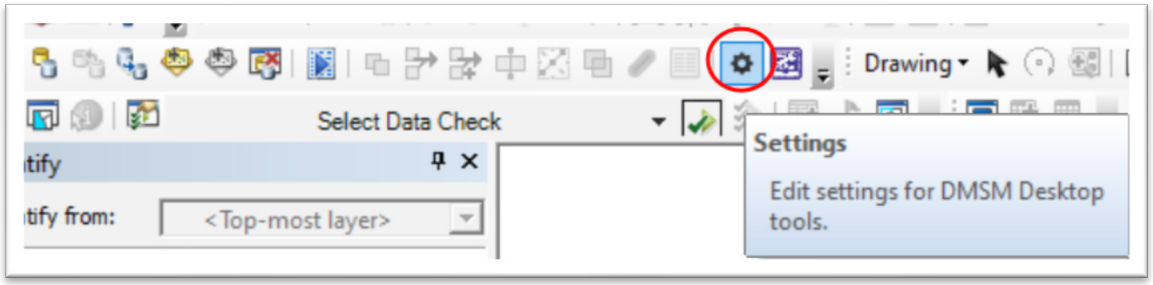


Figure 1 – Desktop Tools Settings button

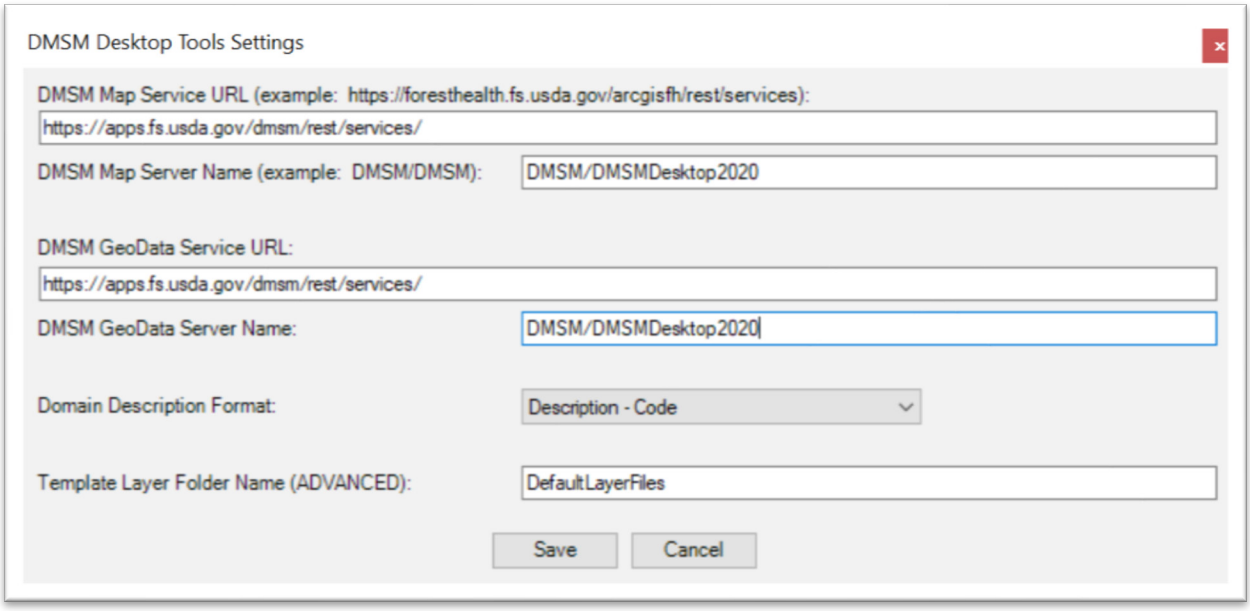


Figure 2 – Desktop Tools Settings for DMSM2020

DMSM Map Service and DMSM GeoData Service URL:

https://apps.fs.usda.gov/dmsm/rest/services

DMSM Map Server Name and GeoData Server Name:

DMSM/DMSMDesktop2020

Begin check-out by selecting the "Check-Out" tool on the tool bar. If you are not currently logged in to AGOL, you will be prompted for a username and password.

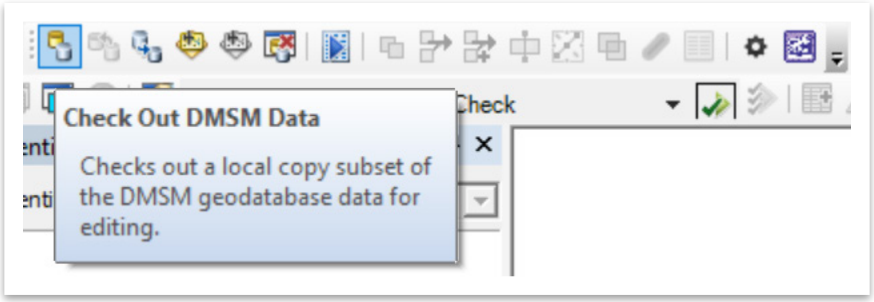


Figure 3 – Check-out tool

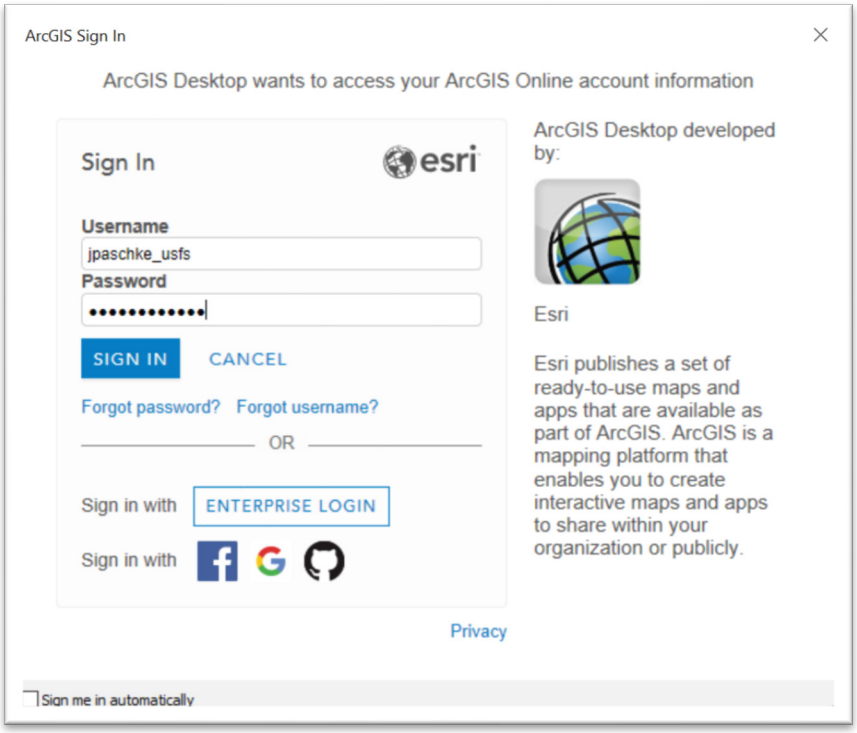


Figure 4 – AGOL sign in

Enter parameters in Step 1 to select the Region, User and date range, then click "Next".

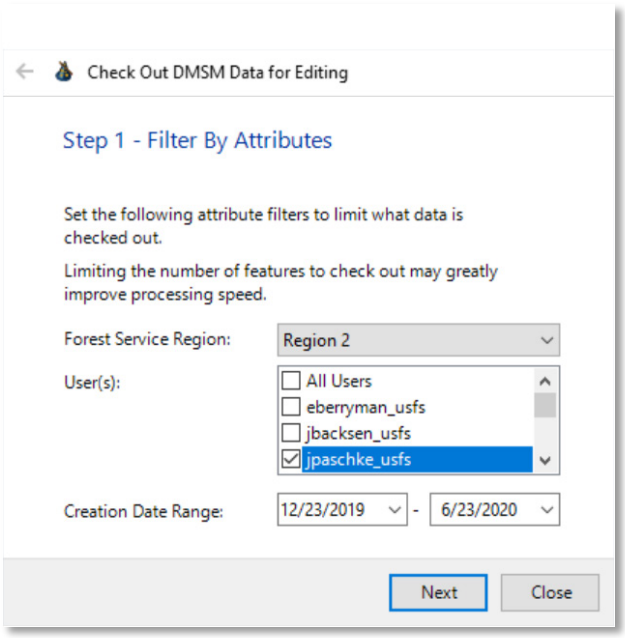


Figure 5 – Check-out Step 1 filter settings

Important: Most users only have access to their own data. If there is currently no data in a region for the desired username, the user(s) list may be blank and the check-out will not work. The workaround is to use a DMSM tablet to create at least one feature in the region with the desired username and sync it, then proceed with the check-out using Desktop Tools. Remember to edit or delete this feature as needed after the pan and sketch workflow is complete. The username selected in this step will be the user of record for all data created with this workflow.

In the Step 2 dialogue box, select the "Check out damage features and geonotes" radio button. Use the map service display button and navigation tools to find the desired area of interest (AOI) before check-out.

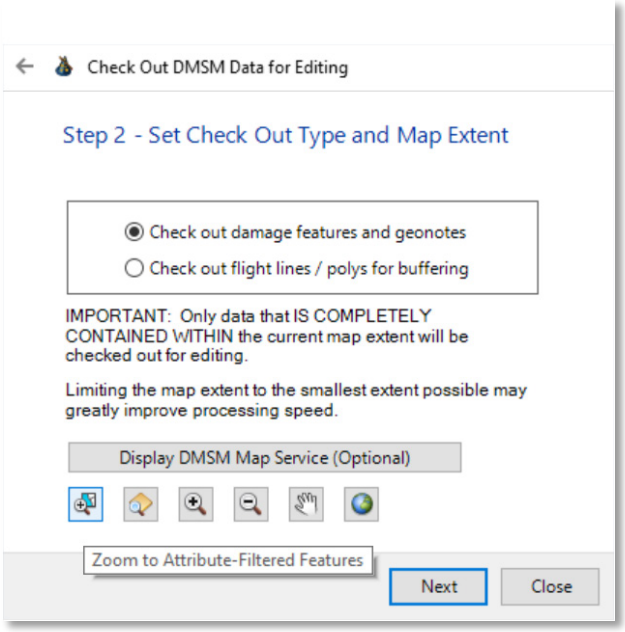


Figure 6 – Check-out Step 2 type and extent

Review the parameters in the Step 3 window and select "Next" to start the check-out process.

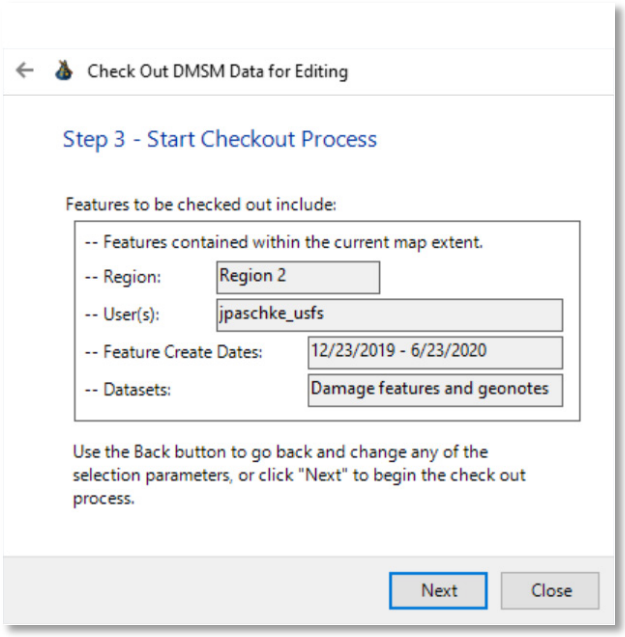


Figure 7 – Check-out Step 3 filter review

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 or creating data.**

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 feature classes 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. Do not place any reference layers or imagery inside the "DMSM Local Edit Layers" group layer, as the group layer will be automatically removed during the check-in process.

Start an edit session and create features

Start an edit session by clicking the "Editor" dropdown menu on the Editor Toolbar and selecting "Start Editing". If the Editor Toolbar is not turned on, Click on the "Customize" menu item, select the "Toolbars" option and check the "Editor" toolbar on.

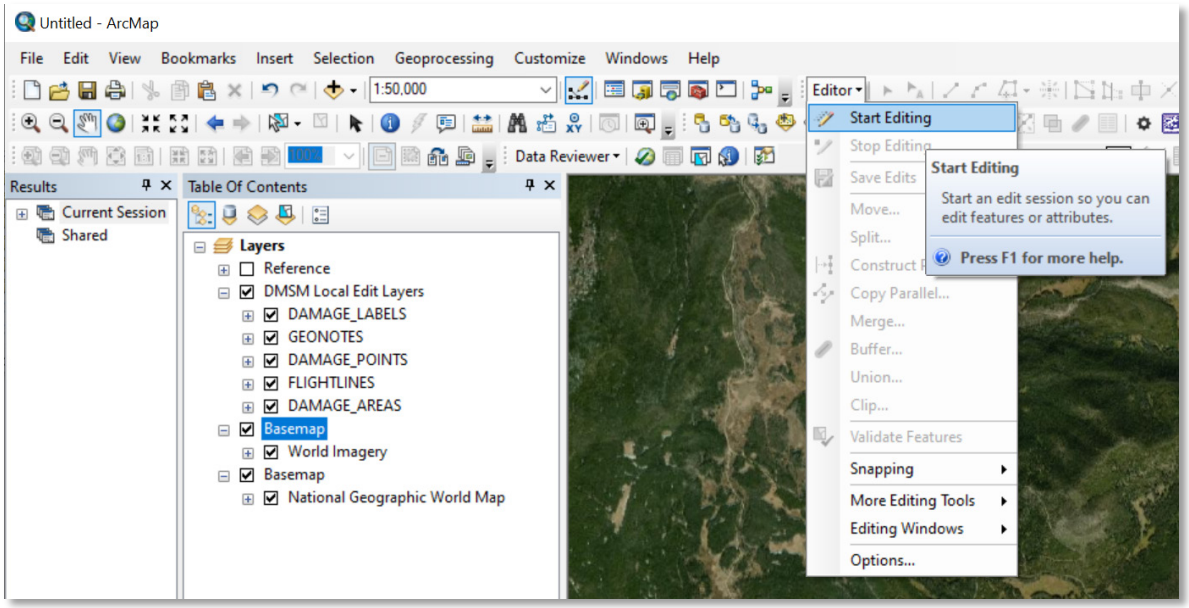


Figure 8 – Start Editing session

Select the "Create Features" tool on the Editor Toolbar.

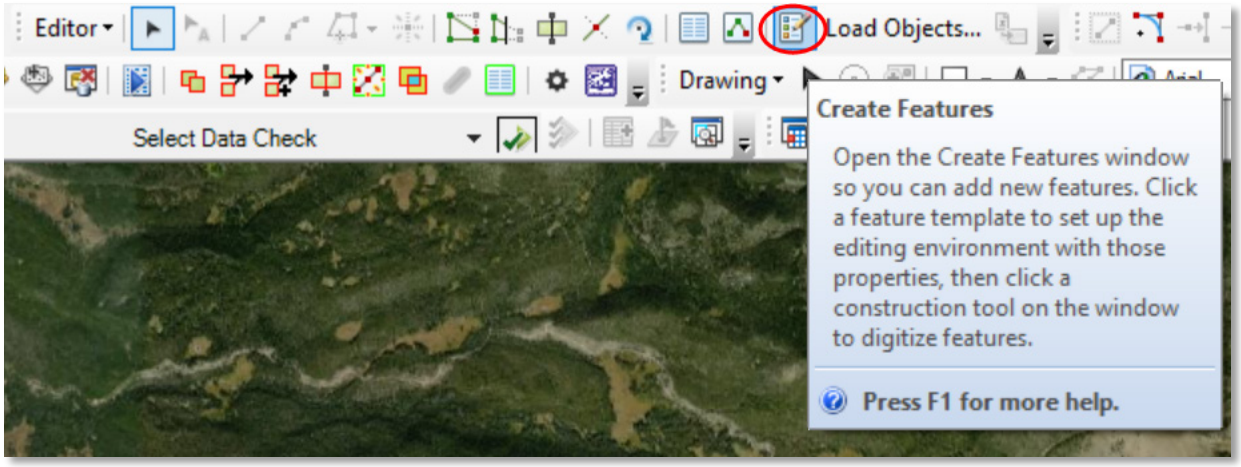


Figure 9 – Create Features tool

The "Create Features" window will display with a list of available feature templates to use for editing. For this workflow, the only features that can be added are **DAMAGE_AREAS** or **DAMAGE_POINTS**. When you select a feature template, the Construction Tools pane lists a range of feature drawing options for that template.

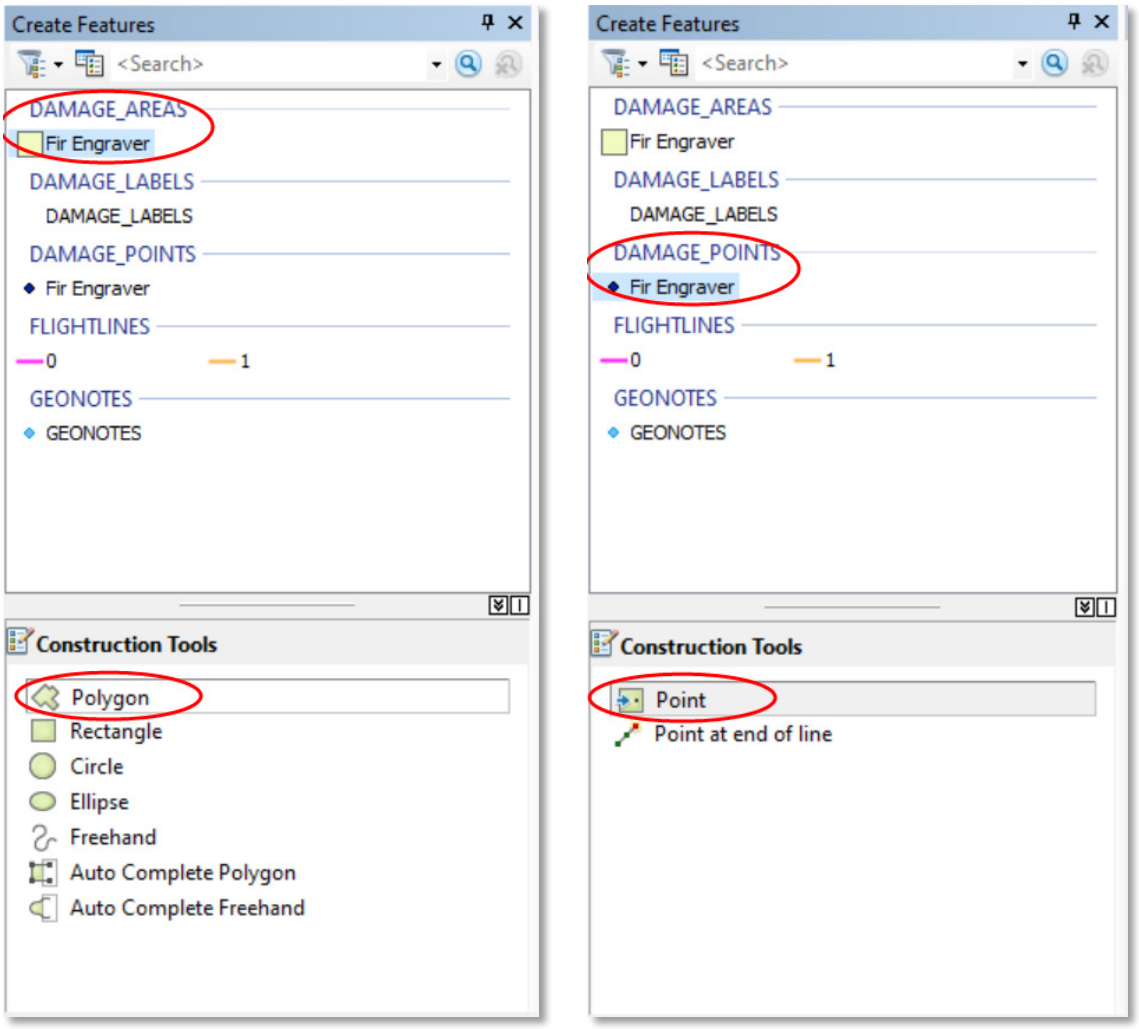


Figure 20 – Example DMSM feature templates and construction tools

For most new features, the "polygon" or "point" construction tools will be used.

Drawing and attributing a single feature

Select the "Damage_Areas" template option and the "Polygon" construction tool to begin creating a new polygon feature. Move the cursor to the map display window and a cross icon will appear. Click and move the cursor to create a polygon shape around the area you want to attribute with an insect and disease damage observation.

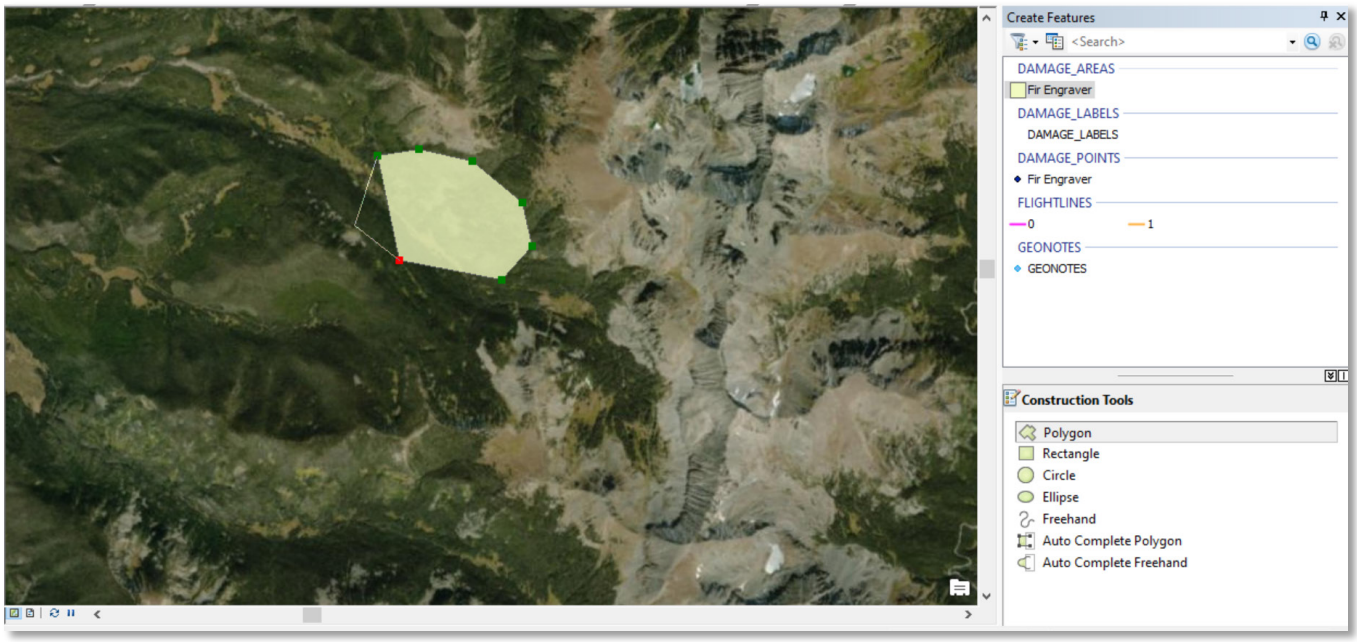


Figure 31 – Draw a polygon feature

To close the feature, double-click the mouse near the end of the shape. The finished shape will have its boundary highlighted.

Figure 42 – Finished feature

To begin adding standard DMSM observation attributes, open the custom "DMSM Attribute Editor" tool found on the DMSM Toolbar.

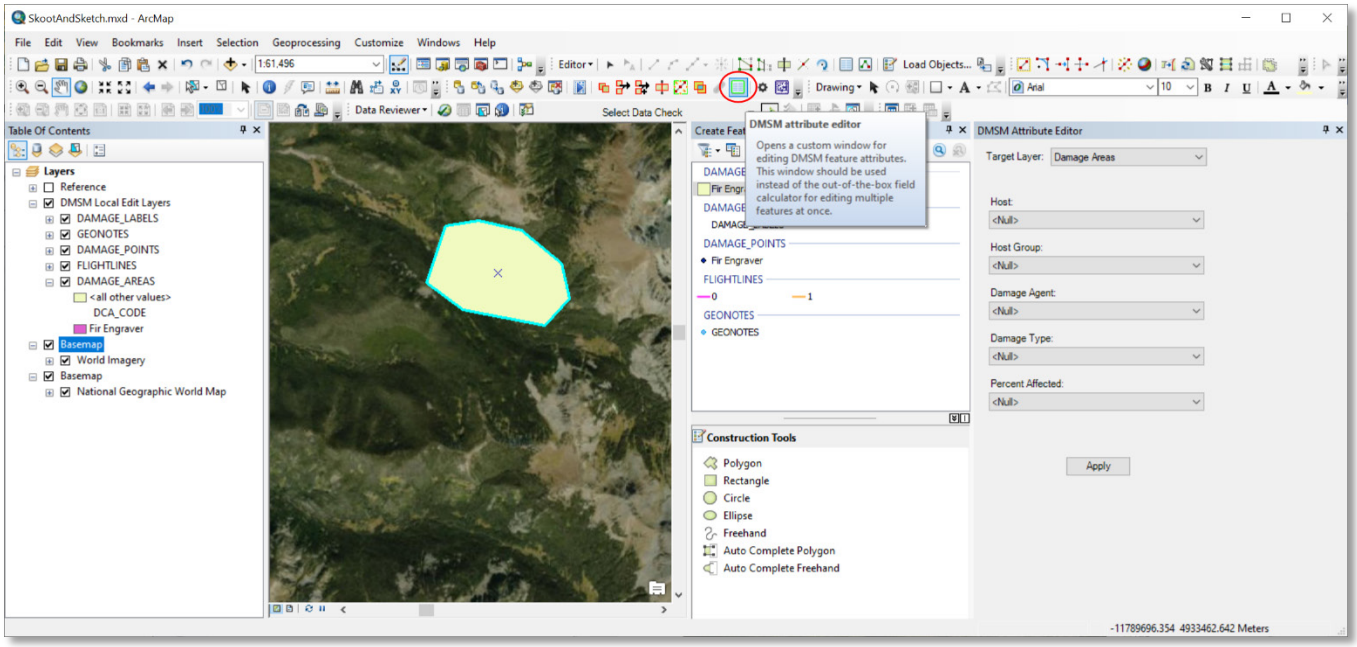


Figure 53 – Custom DMSM attribute editor

Make sure the Target Layer is set to the correct feature type. For this example, the target layer is "Damage Areas".

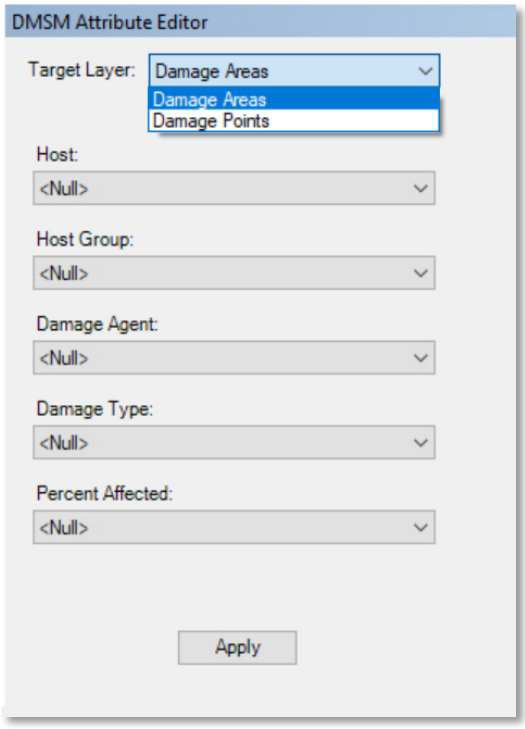


Figure 64 – DMSM target layer

Use the drop-down menus to select values for **all required** core attributes for Damage Areas:

- Host **or** Host Group
- Damage Agent
- Damage Type
- Percent Affected (only available when editing a single feature)

The required attributes for Damage Points are:

- Host **or** Host Group
- Damage Agent
- Damage Type
- Number of Trees **or** Tree Count (only available when editing a single feature)

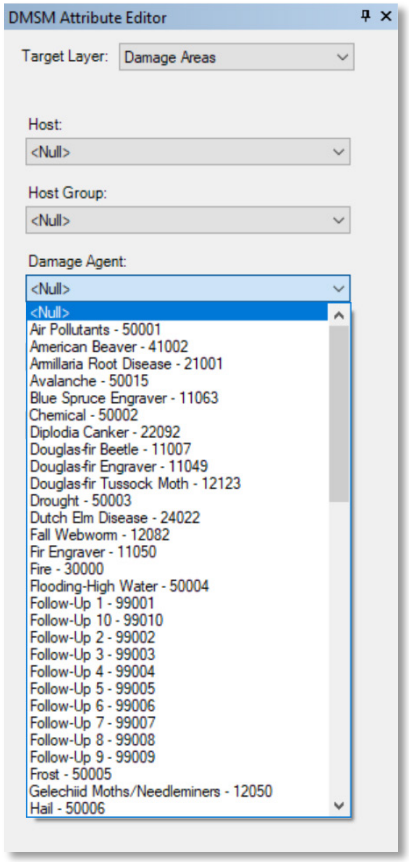


Figure 75 – Damage Agent drop-down list

The code domains for all required attributes are created on the local replica during check-out. Domains are very useful during editing as they allow the user to choose only valid values from a dropdown list. Some domains are customized by Region so that users only see values that make sense for their Region.

Tip: The DMSM Settings dialogue has a Domains Description Format option that controls how the domains are displayed. The default option is "Description – Code" as in "mountain

pine beetle – 11006". This display option can be changed and will be applied at the next check-out.

The Desktop Tools will automatically fill in the remaining attributes required by the central DMSM database. These include:

- CREATED_DATE
- MODIFIED_DATE
- REGION_ID
- DAMAGE_AREA_ID **or** DAMAGE_POINT_ID
- USER_ID
- AREA_TYPE
- OBSERVATION_COUNT
- COLLECTION_MODE

Important: The COLLECTION_MODE value for all data created with this Pan and Sketch method will automatically be set to "Desktop GIS". FHAAST also recommends updating the "Notes" field in the OBSERVATIONS table to include explanatory information, such as "Pan and Sketch using NAIP".

Hit the Apply button after all core attributes are selected.

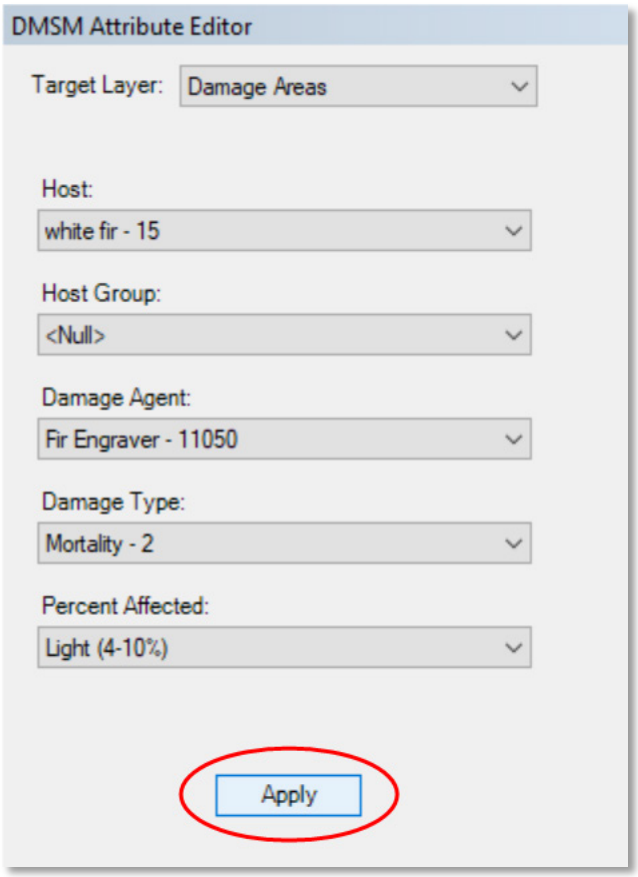


Figure 86 – Apply selected attributes

The Desktop tools will also automatically create a separate, matching DAMAGE_LABEL for each feature. If the combination of core attributes matches an existing DMSM Quick Key (QK) for the region, the QK label will be assigned to the DAMAGE_LABEL feature. Otherwise the label will be the attribute codes with the PCT_AFFECTED or TREE_COUNT as a suffix in the form "Host-DCA-DmgType-Pct/Trees"

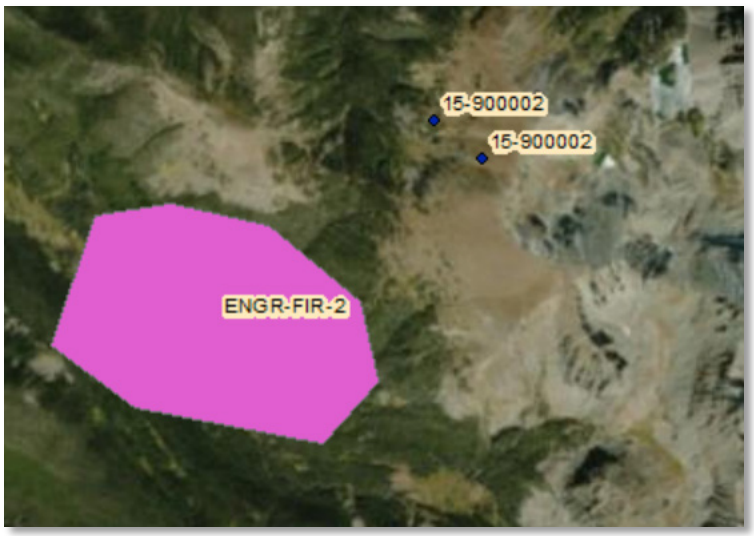


Figure 97 – Examples of DMSM feature labels

Drawing and attributing multiple features

If several features will have the same set of attributes, they can be updated in batch form after all features are created. Use the feature templates outlined above and create as many new features as will have similar attributes.

Select all the features either by using the Select Features tool in the map display or selecting the records in the Attribute Table display.

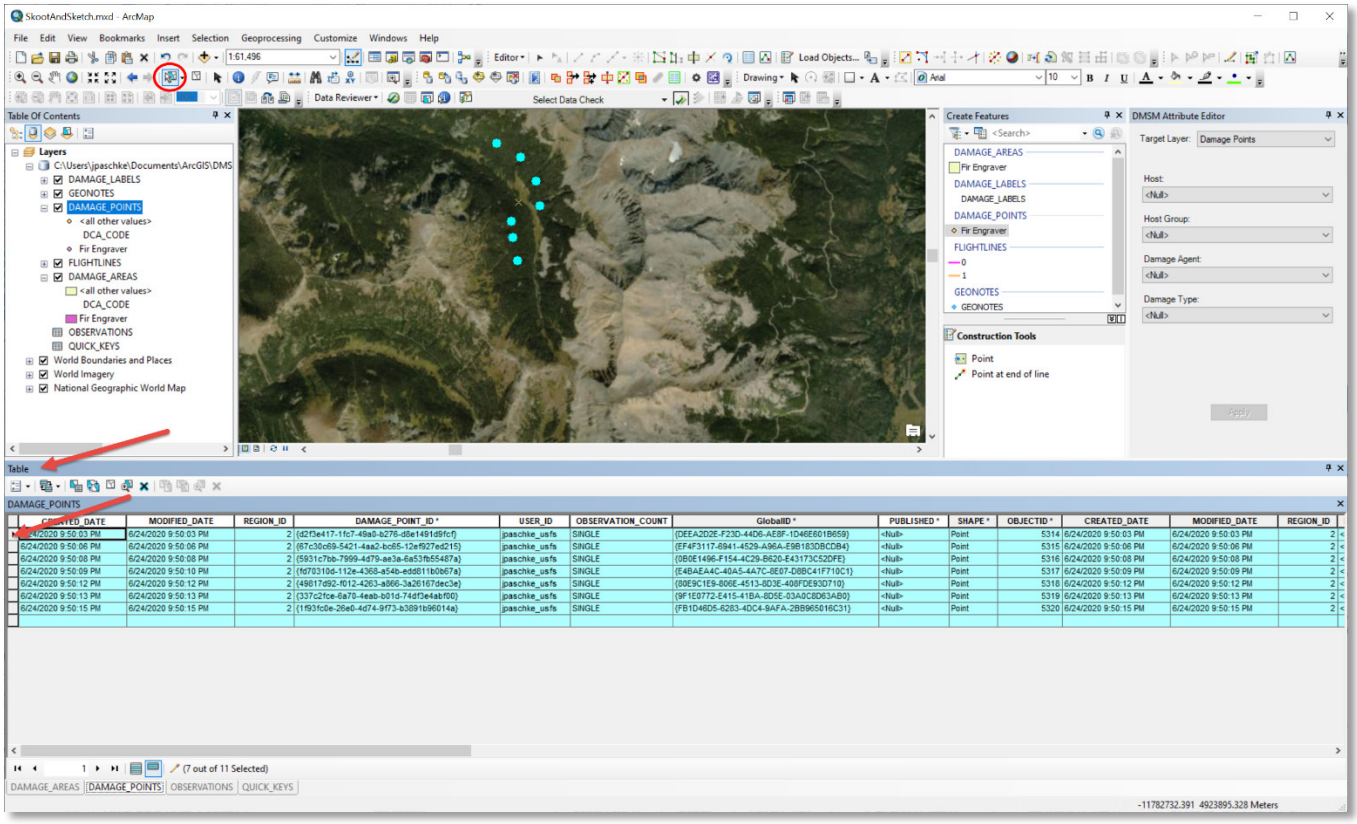


Figure 108 – Select multiple features for batch editing

Once the features are selected, there are a couple options for batch updating

1. **Use the DMSM Attribute Editor**: This method allows for the batch updating of Host/Host Group, Damage Agent and Damage Type only.
   Important: Use method two to update Percent Affected (for polygons) and Number of Trees/Tree Count (for points).
   a. Use the drop-down menus to update attributes
   b. Click the Apply button when finished

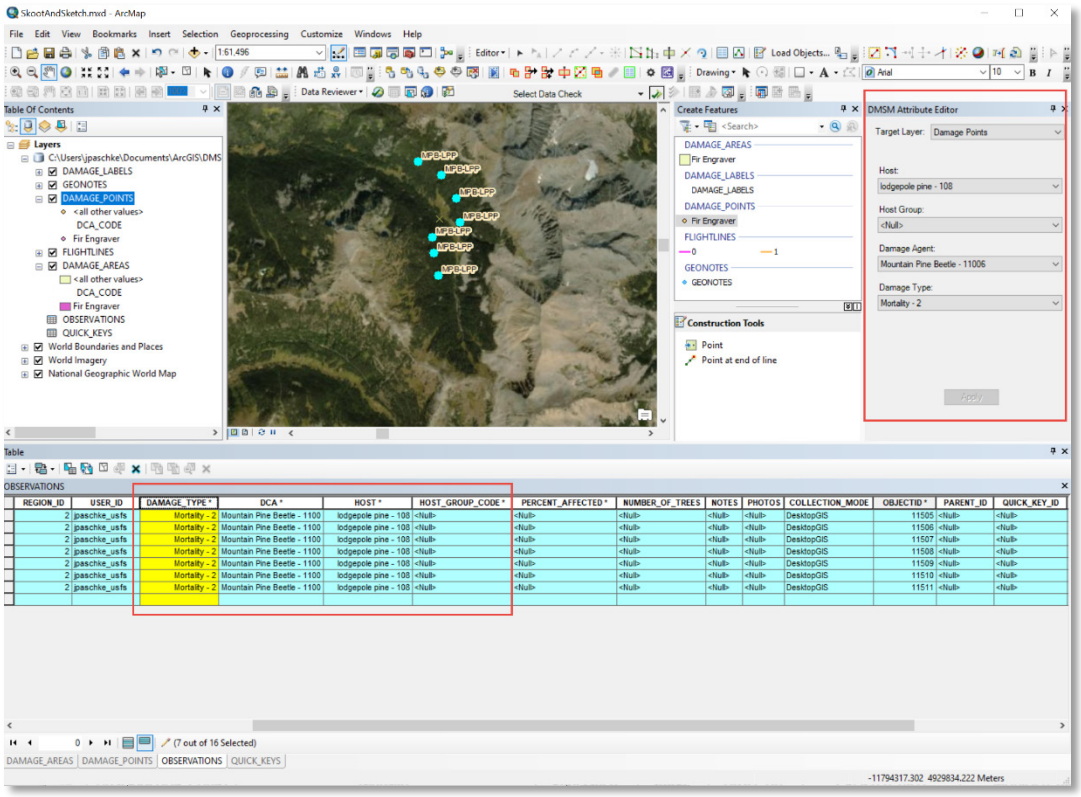


Figure 119 – View of updated observation records

2. **Use the Field Calculator in Table view**: This method allows the batch update of individual table fields.
    a. Follow the relationship from the selected features to their matching records in the OBSERVATIONS table by selecting the Related Tables button in the Table view.

    Important: attributes can only be edited in the OBSERVATIONS table. The check-out process joins certain observation record fields to the Damage Areas and Damage Points feature tables for ease of viewing, but these joined fields are not available for editing.

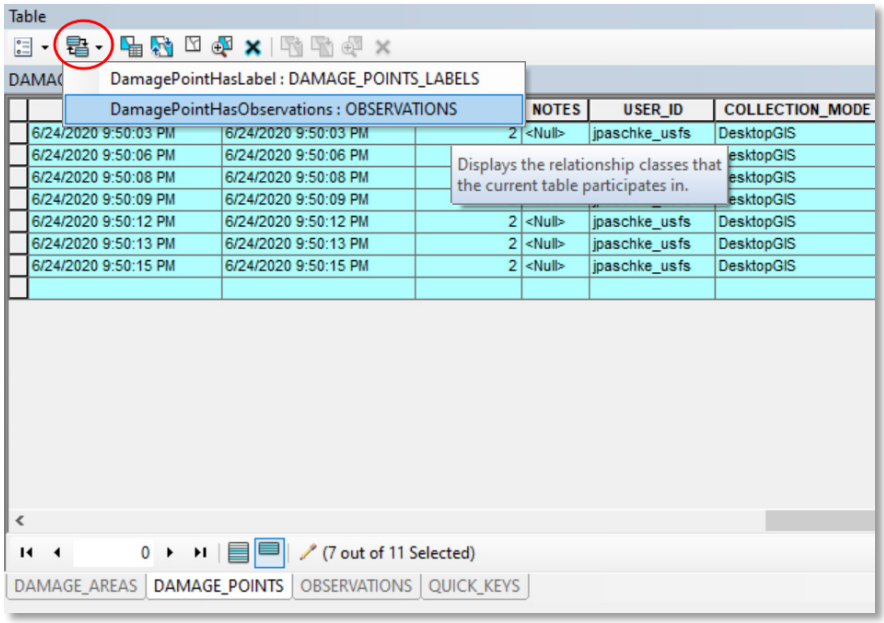


Figure 20 – Related Tables button

b. With the records still selected in the OBSERVATIONS table, click on the field heading you want to update.
c. Right click on the field heading to access the Field Calculator window.

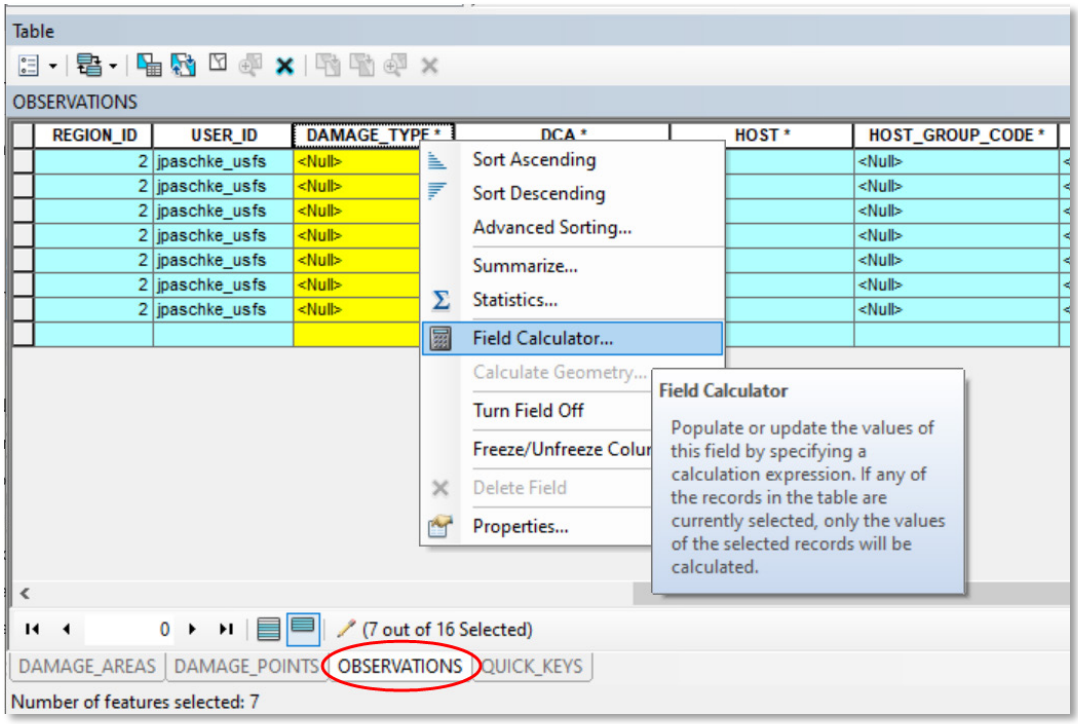


Figure 212 – Access the field calculator

d. Enter the desired code to update the attribute. Only **codes** can be entered to update these fields in the field calculator. Click OK and the field updates all selected records and will display the values using the current domain setting.

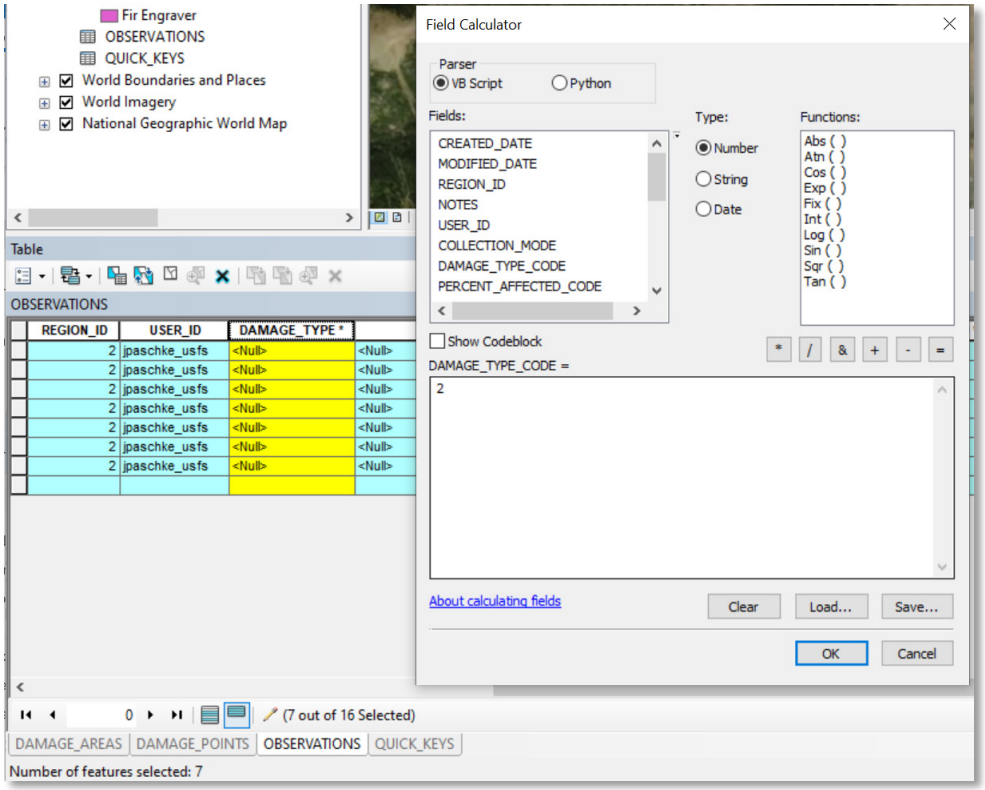


Figure 22 – Field Calculator dialogue

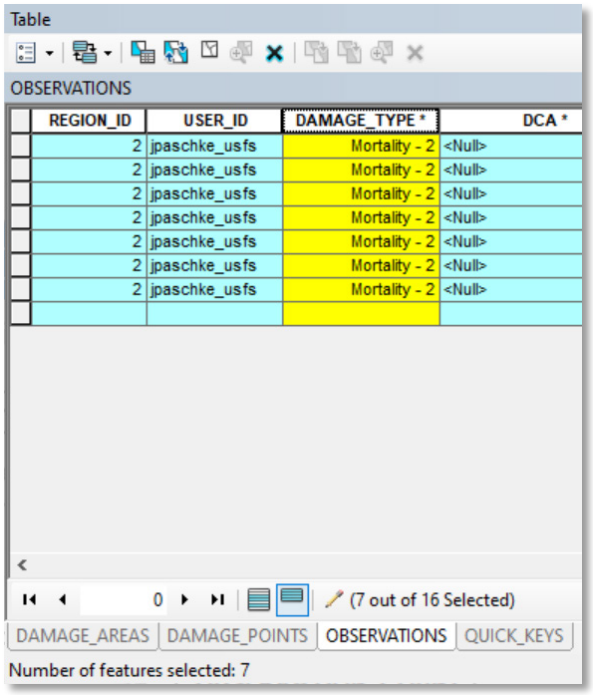


Figure 23 – Field Calculator results

Save and check-in edits

When creating features and editing attributes is complete for an editing session, select Save Edits and then Stop Editing from the Editor drop-down menu.

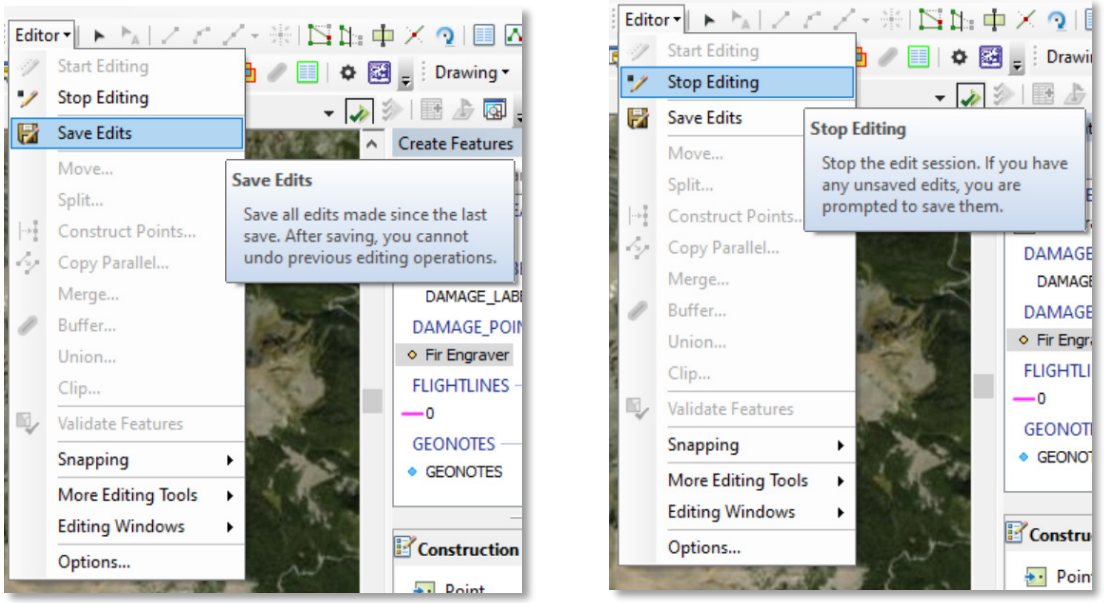


Figure 24 – Save and stop editing

Click the "Check In" button on the toolbar then on the dialog window. The data edits are loaded back up to the master DMSM geodatabase, the replica information and the local file geodatabase map layers are removed and replace by the DMSM service layers.

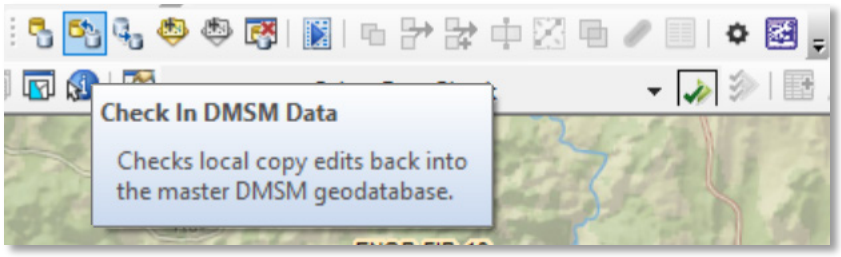


Figure 25 – Check-in tool

Important: The three steps of the "Check-out / Edit / Check-in" workflow must be completed in order. Once the check-in is complete, editing is complete for that cycle. To implement further edits, the "Check-out / Edit / Check-in" workflow should be 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: FHAAST recommends that you keep the "Check-out / Edit / Check-in" workflow relatively brief. Although possible, it is not recommended to keep check-out replicas for several days or weeks without checking them back in. Automated replica clean-up takes place on the central server and **removes all references to replicas older than 21 days**.

If you have trouble with a check-in and think the replica might be older than 21 days, please contact FHAAST.

Scale and feature complexity

While using high resolution imagery in a desktop environment, it may be necessary to zoom in at smaller scales (as close as 1:5,000) to see damage and determine damage type, severity and host. This is different than how typical aerial survey is conducted as the imagery is used mainly for locational reference at scales closer to 1:40,000. Features created on a tablet at scales of 1:40,000 will typically have few vertices that are spaced farther apart than those created at scales closer to 1:5,000. A greater number of highly complex features may impact syncing and database performance. Therefore, it is recommended that once damage areas are located at smaller scales, that users zoom out to create features at larger scales.

Tip: It may be helpful to have previous years' DMSM/ADS data loaded in the map to reference prior feature complexity.

The impact of vertex spacing on feature complexity can be illustrated by looking at settings on the DMSM tablet which have the following minimum vertex spacing for polygons (values in meters):

- 10
- 20
- 40
- 60
- 80
- 100
- 150 (default)

Values at the lower end are more appropriate for ground-based surveys while those at the higher end more appropriate for aerial survey. Figure 26 illustrates the difference in vertex spacing when drawing features on the DMSM tablet. The feature with the 10m minimum spacing setting creates many more vertices for a single feature.

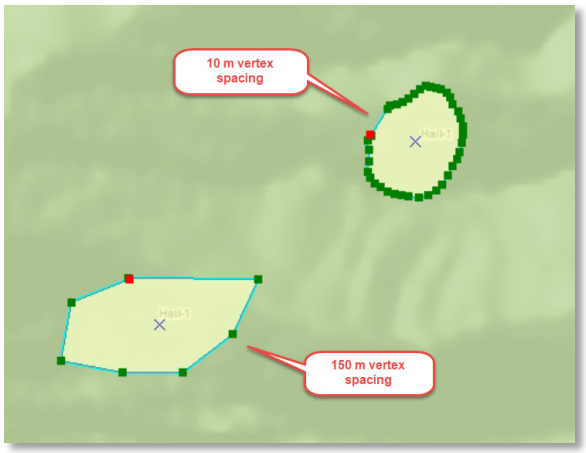


Figure 26 – Compare vertex spacing

ArcMap's "streaming" mode can be used to assist with feature creation by reducing mouse clicks during digitizing. This may be best employed if using a pen-based drawing tablet. The streaming mode settings are found in the Settings tab of the Editing Option dialogue box.

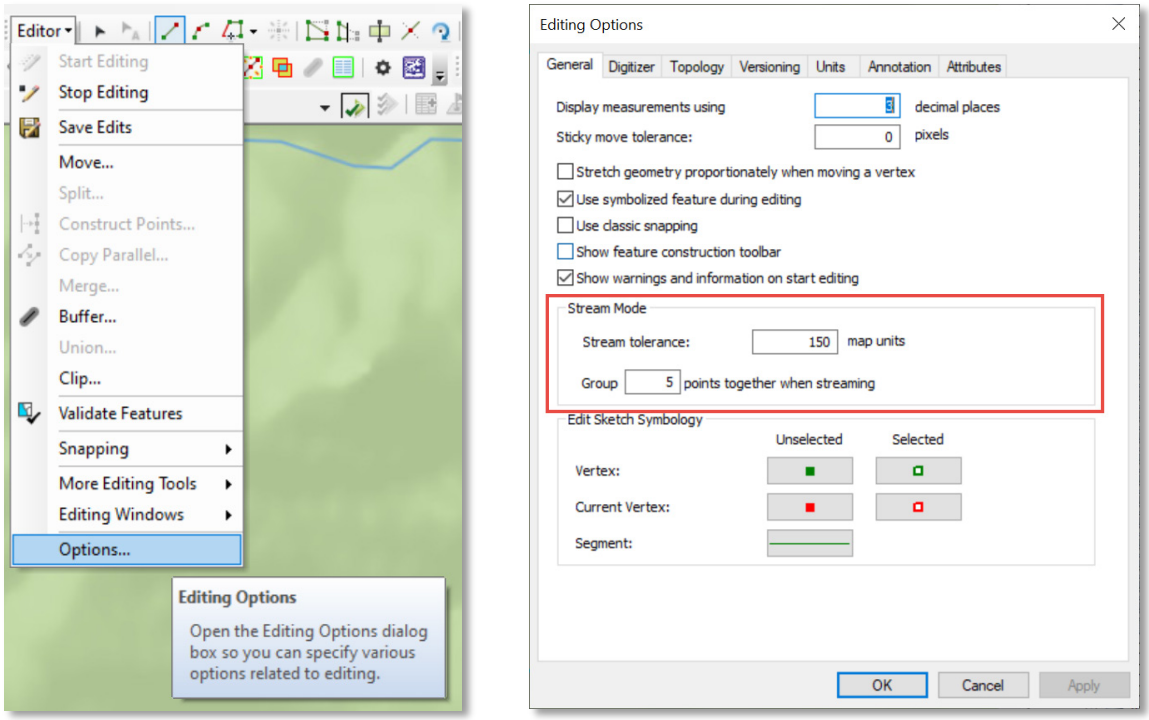


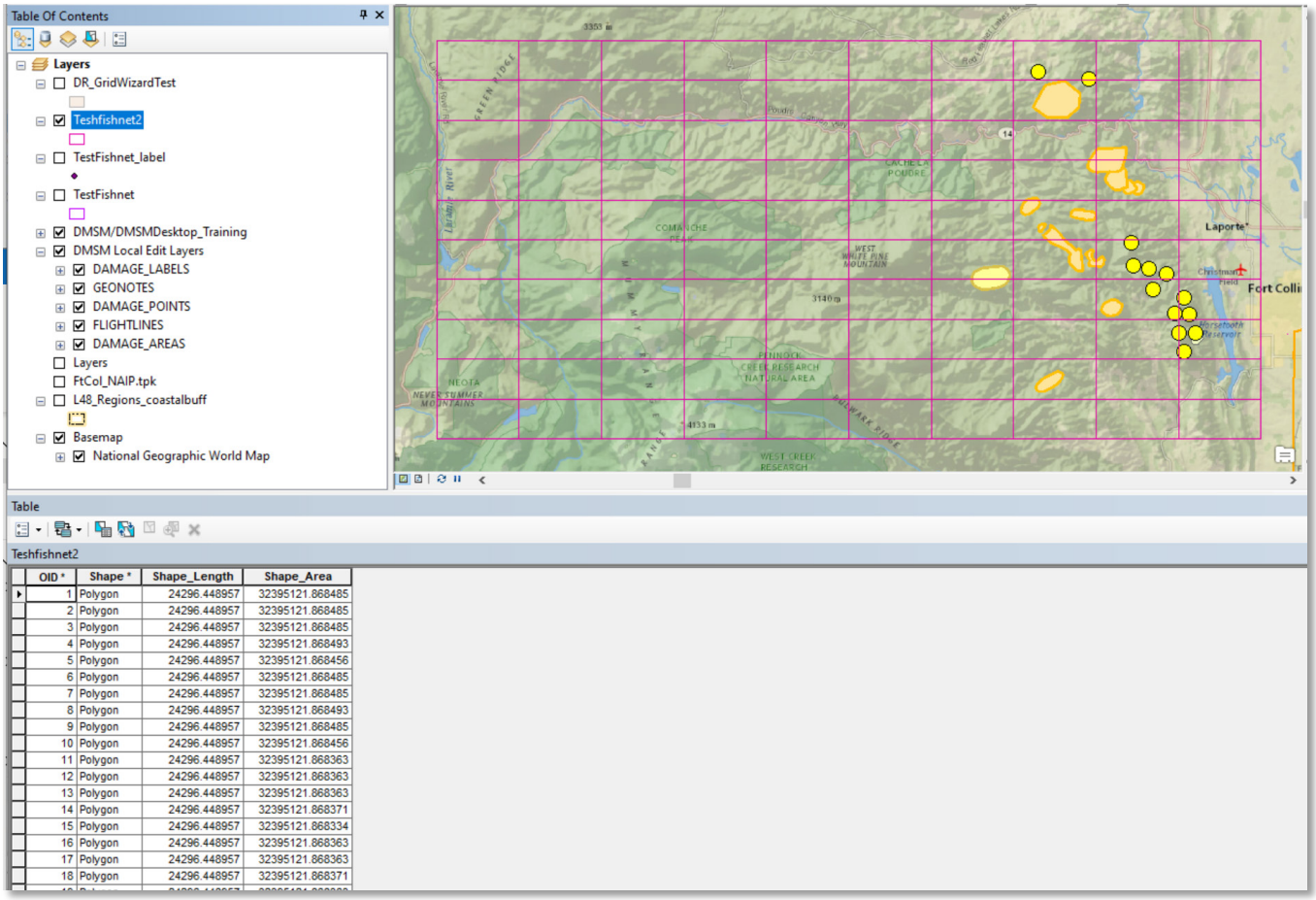
Figure 27 – Stream mode settings

Important: Help reduce polygon complexity by drawing features at an appropriate scale for mimicking aerial survey, typically 1:40,000 or similar. If using streaming mode, please set the vertex tolerance similar to that of a DMSM tablet. If FHAAST notices a large number of highly complex features, they may need to be "generalized" to reduce vertices.

Keeping track of editing areas

It may be useful to create an indexing system to keep track of areas covered during imagery review and feature creation. The following are a few suggestions, but users may come up with their own method.

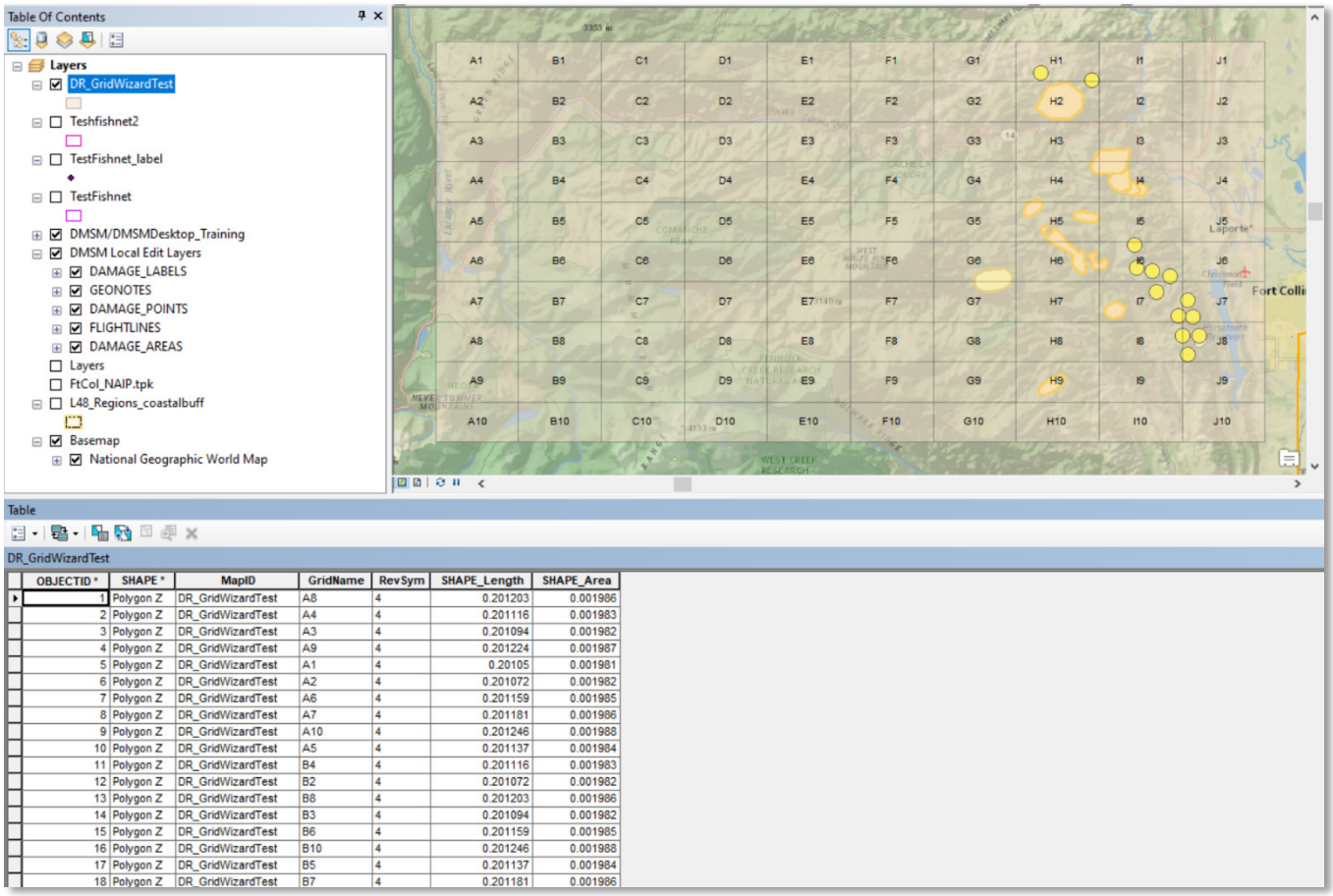
1. Use the "Create Fishnet" tool to create a polygon grid. User will need to create and enter their own index naming system.



OID *	Shape *	Shape_Length	Shape_Area
1	Polygon	24296.448957	32395121.868485
2	Polygon	24296.448957	32395121.868485
3	Polygon	24296.448957	32395121.868485
4	Polygon	24296.448957	32395121.868493
5	Polygon	24296.448957	32395121.868456
6	Polygon	24296.448957	32395121.868485
7	Polygon	24296.448957	32395121.868485
8	Polygon	24296.448957	32395121.868493
9	Polygon	24296.448957	32395121.868485
10	Polygon	24296.448957	32395121.868456
11	Polygon	24296.448957	32395121.868363
12	Polygon	24296.448957	32395121.868363
13	Polygon	24296.448957	32395121.868363
14	Polygon	24296.448957	32395121.868371
15	Polygon	24296.448957	32395121.868334
16	Polygon	24296.448957	32395121.868363
17	Polygon	24296.448957	32395121.868363
18	Polygon	24296.448957	32395121.868371

Figure 28 – Feature and table results for "Create Fishnet" tool

2. For users that have access to the Data Reviewer extension, the "Create Polygon Grid Wizard" tool makes it easy to define an area, specify index names and create the polygon grid features.



OBJECTID *	SHAPE *	MapID	GridName	RevSym	SHAPE_Length	SHAPE_Area
1	Polygon Z	DR_GridWizardTest	A8	4	0.201203	0.001986
2	Polygon Z	DR_GridWizardTest	A4	4	0.201116	0.001983
3	Polygon Z	DR_GridWizardTest	A3	4	0.201094	0.001982
4	Polygon Z	DR_GridWizardTest	A9	4	0.201224	0.001987
5	Polygon Z	DR_GridWizardTest	A1	4	0.20105	0.001981
6	Polygon Z	DR_GridWizardTest	A2	4	0.201072	0.001982
7	Polygon Z	DR_GridWizardTest	A6	4	0.201159	0.001985
8	Polygon Z	DR_GridWizardTest	A7	4	0.201181	0.001986
9	Polygon Z	DR_GridWizardTest	A10	4	0.201246	0.001988
10	Polygon Z	DR_GridWizardTest	A5	4	0.201137	0.001984
11	Polygon Z	DR_GridWizardTest	B4	4	0.201116	0.001983
12	Polygon Z	DR_GridWizardTest	B2	4	0.201072	0.001982
13	Polygon Z	DR_GridWizardTest	B8	4	0.201203	0.001986
14	Polygon Z	DR_GridWizardTest	B3	4	0.201094	0.001982
15	Polygon Z	DR_GridWizardTest	B6	4	0.201159	0.001985
16	Polygon Z	DR_GridWizardTest	B10	4	0.201246	0.001988
17	Polygon Z	DR_GridWizardTest	B5	4	0.201137	0.001984
18	Polygon Z	DR_GridWizardTest	B7	4	0.201181	0.001986

Figure 29 – Feature and table results for "Create Polygon Grid Wizard"

Survey Boundary data

Survey boundary data, like a buffered flight path, ground transect or imagery extent, should accompany all submissions to determine areas of no damage versus areas not surveyed. For this "Pan & Sketch" process, survey boundaries may be the extent of the indexing system used. All submission should follow the standards outlined in the Insect and Disease (IDS) data submission template.

Tip: If a check-out includes any flight line data, it is permissible to create buffers with the Desktop Tools "Buffer flight line" tool and edit them to create a survey boundary area. If no flight line data exists, then survey boundary data will need to be created from scratch.