

How to Generate a Watershed Analysis using a Custom Watershed Polygon



Antecedent Precipitation Tool
Version 1.0

Written by Jason Deters
U.S. Army Corps of Engineers

ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance

Cut Copy Paste Copy Path Explore Bookmarks Go To XY Basemap Add Data Add Preset Select Select By Attributes Select By Location Attributes Pause Lock Infographics Measure Locate Sync View Unplaced Convert To Annotation More Download Map Remove Clipboard Navigate Layer Selection Inquiry Labeling Offline Catalog Geoprocessing Element Label Class Raster Functions Export Raster Symbology Create Features Modify Features Chart Properties

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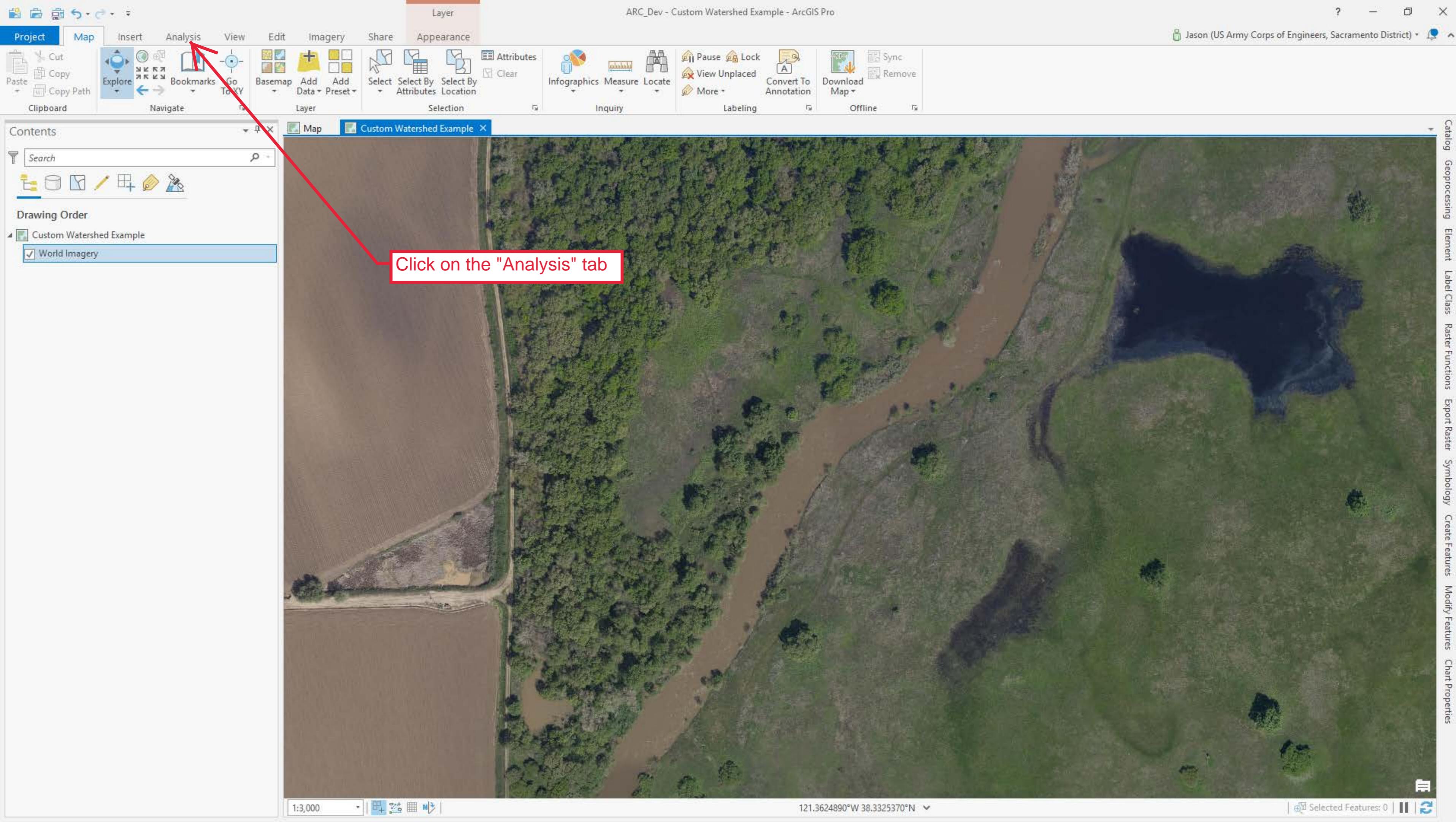
Custom Watershed Example

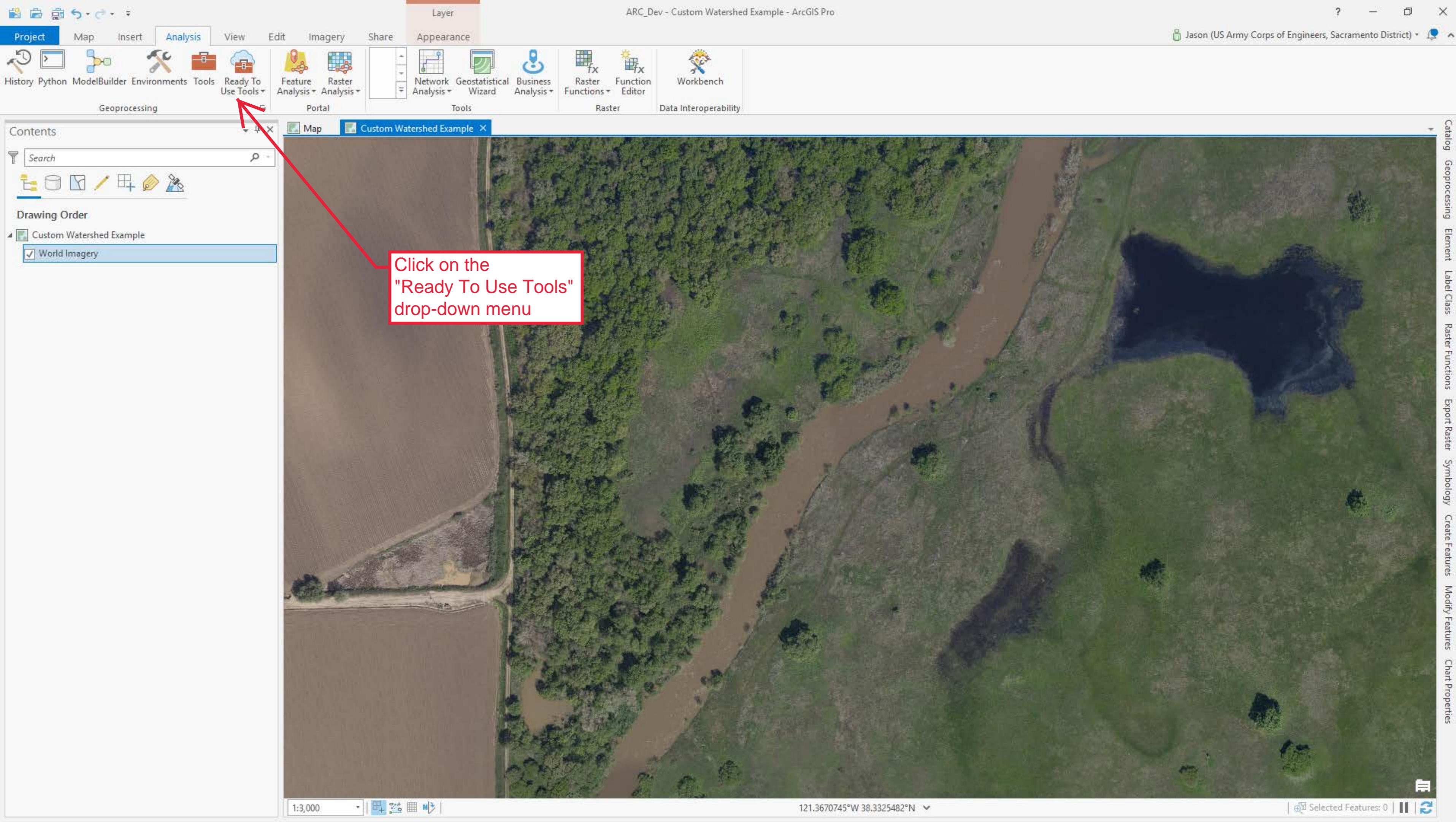
World Imagery

Map Custom Watershed Example

There are countless ways to generate a custom watershed polygon, but for the sake of simplicity, this walkthrough will be limited to the use of ArcGIS Pro's Watershed tool.

1:3,000 | Selected Features: 0 | 121.3624890°W 38.3325370°N





ARC_Dev - Custom Watershed Example - ArcGIS Pro

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Ready To Use Tools Feature Analysis Raster Analysis Network Analysis Geostatistical Wizard Business Analysis Raster Functions Function Editor Workbench Data Interoperability

Elevation

- Profile
- Summarize Elevation
- Viewshed

Hydrology

- Trace Downstream
- Watershed

Network Analysis

- Find Closest Facilities
- Find Routes
- Generate Service Areas
- Solve Location Allocation
- Solve Vehicle Routing Problem

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Click on the "Watershed" tool

The screenshot shows the ArcGIS Pro interface with the 'Analysis' tab selected. In the 'Ready To Use Tools' panel, the 'Watershed' tool is highlighted with a red arrow and a callout box containing its description: 'Determines the contributing area above each input point. A watershed is the upslope area that contributes flow.' A red box highlights the 'Watershed' tool icon in the 'Hydrology' section. The map view shows a satellite image of a river network and fields.

ARC_Dev - Custom Watershed Example - ArcGIS Pro

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Watershed

Parameters Environments

* Input Points 

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution

Generalize Watershed Polygons

Return Snapped Points

Click on the "Create Points" button, which looks like a pencil, to add a temporary point feature class to the map.



1:3,000 121.3608916°W 38.3309538°N Run

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

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Geoprocessing

Watershed

Parameters Environments

Input Points
Watershed_Input_Points_Points
 Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units
Meters

Data Source Resolution

Generalize Watershed Polygons

Return Snapped Points

Click on the "Watershed_Input_points_points" feature template, if it is not already active, to enable the "Point" tool.

1:3,000 | Run | 121.3624391°W 38.3312000°N

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

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 - Watershed_Input_Points_Points
- World Imagery

With the "Point" tool active, click within the flow path of a riverine feature for which we want the watershed.

Geoprocessing

Watershed

Parameters Environments

Input Points
Watershed_Input_Points_Points

Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units
Meters

Data Source Resolution

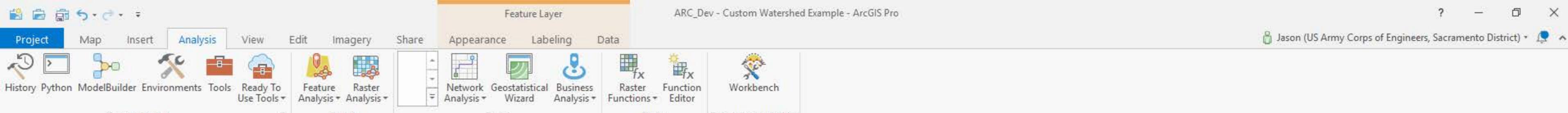
Generalize Watershed Polygons

Return Snapped Points

Run

1:3,000 | Selected Features: 0 | C... G... El... La... R... Ex... Sy... Cr... M... C...

121.3617402°W 38.3311720°N



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Map Custom Watershed Example

Note the Latitude and Longitude of the point you created.

We will use this for our inputs in the APT.

Watershed

Parameters Environments

Input Points Watershed_Input_Points_Points

Watershed_Input_Points_Points:Point

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution

Generalize Watershed Polygons

Return Snapped Points

Run

1:3,000

Selected Features: 0

121.3622893°W 38.3315580°N

The screenshot displays the ArcGIS Pro interface for a 'Custom Watershed Example'. In the center is a map view showing a landscape with green fields and brown water bodies. A specific point feature is highlighted with a blue circle and labeled 'Watershed_Input_Points_Points:Point'. A red callout box with white text and a black border contains the instructions: 'Note the Latitude and Longitude of the point you created.' and 'We will use this for our inputs in the APT.' In the bottom right corner of the map, there is a coordinate display showing '121.3622893°W 38.3315580°N'. To the left of the map is the 'Contents' panel, which lists 'Custom Watershed Example' and 'Watershed_Input_Points_Points' under 'Drawing Order'. On the right side, the 'Geoprocessing' pane is open, showing the 'Watershed' tool under 'Parameters'. It includes fields for 'Input Points' (set to 'Watershed_Input_Points_Points'), 'Point Identification Field', 'Snap Distance', 'Snap Distance Units' (set to 'Meters'), 'Data Source Resolution' (with options for 'Generalize Watershed Polygons' and 'Return Snapped Points'), and a 'Run' button. The top of the screen shows the ArcGIS Pro title bar and ribbon menu.

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

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Custom Watershed Example

Watershed

Parameters Environments

Input Points Watershed_Input_Points_Points

Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution

- FINEST
- 10m
- 30m
- 90m

Select "Finest" to request that the calculation be performed with the highest resolution elevation data available.

Run

1:3,000 | Selected Features: 0 | C... G... El... La... R... Ex... Sy... Cr... M... C...

121.3595295°W 38.3298909°N

The screenshot displays the ArcGIS Pro interface with a focus on a 'Custom Watershed Example' project. The 'Geoprocessing' pane on the right shows the 'Watershed' tool parameters. Under 'Input Points', 'Watershed_Input_Points_Points' is selected. In the 'Data Source Resolution' section, a callout box highlights the 'FINEST' option, which is described in red text as requesting the highest resolution elevation data available. Other resolution options shown are 10m, 30m, and 90m.

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

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Custom Watershed Example

Watershed

Parameters Environments

Input Points Watershed_Input_Points_Points

- Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution FINEST

Generalize Watershed Polygons

Return Snapped Points

Click the "Run" button to send our point off to ESRI's server and await a response.

Run

1:3,000 | Selected Features: 0 | C... G... El... La... R... Ex... Sy... Cr... M... C...

121.3595295°W 38.3298909°N

The screenshot shows the ArcGIS Pro interface with a 'Custom Watershed Example' project open. The map view shows a river network and agricultural fields. In the Contents pane, 'Watershed_Input_Points_Points' is selected. The Geoprocessing pane on the right shows a 'Watershed' tool with 'Watershed_Input_Points_Points' selected as the input. A red callout box with the text 'Click the "Run" button to send our point off to ESRI's server and await a response.' points to the 'Run' button in the Geoprocessing pane. A red arrow also points from the bottom right towards the 'Run' button.

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share

Cut Copy Paste Copy Path Explore Bookmarks Go To XY Basemap Add Data Preset Select Selection Layer Inquiry Labeling Offline

Note that the point we selected falls within the watershed polygon, so using it for the APT will not be a problem.

Lock Selected Convert To Annotation Download Map Remove

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Map Custom Watershed Example

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Custom Watershed Example

Output Snapped Points

Watershed_Input_Points_Points

Output Watershed

World Imagery

To examine the scale of the watershed ESRI's server generated, right-click on the "Output Watershed" layer in the Table of Contents

Geoprocessing Watershed

Parameters Environments

Input Points Watershed_Input_Points_Points

Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution FINEST

Generalize Watershed Polygons

Return Snapped Points

Run

Watershed completed. View Details Open History

1:3,000 121.3650207°W 38.3316978°N Selected Features: 0

C... G... El... La... R... Ex... Sy... Cr... M... C...

ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

Cut Copy Paste Copy Path Clipboard Navigate Layer Selection Inquiry Labeling Offline

Explore Bookmarks Go To XY Basemap Add Data Add Preset Select By Attributes Select By Location Infographics Measure Locate Convert To Annotation More View Unplaced Download Map Clear Sync Remove

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Map Custom Watershed Example

Geoprocessing Watershed Parameters Environments Input Points Watershed_Input_Points_Points Watershed_Input_Points_Points Point Identification Field Snap Distance Snap Distance Units Meters Data Source Resolution FINEST Generalize Watershed Polygons Return Snapped Points Run

Watershed completed. View Details Open History

1:3,000 121.3679802°W 38.3312167°N Selected Features: 0 C... G... El... La... R... Ex... Sy... Cr... M... C...

Click "Zoom To Layer"

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

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Output Snapped Points

Watershed_Input_Points_Points

Output Watershed

World Imagery

As this polygon fits my rough expectations, the next step is to export this feature into a format the APT can read (Shapefiles only so far). Right-click on the "Output Watershed" layer once more.

Geoprocessing Watershed

Parameters Environments

Input Points Watershed_Input_Points_Points

Watershed_Input_Points_Points

Point Identification Field

Snap Distance

Snap Distance Units Meters

Data Source Resolution FINEST

Generalize Watershed Polygons

Return Snapped Points

Run

Watershed completed. View Details Open History

Selected Features: 0

1:485,941 121.2813346°W 38.5796712°N

C... G... El... La... R... Ex... Sy... Cr... M... C...

ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

Cut Copy Paste W. Copy Path Clipboard Explore Bookmarks Go To XY Basemap Add Data Add Preset Select Select By Attributes Select By Location Attributes Pause Lock Infographics Measure Locate Sync Clear View Unplaced Convert To Annotation Download Map More More Labeling Offline

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Map Custom Watershed Example

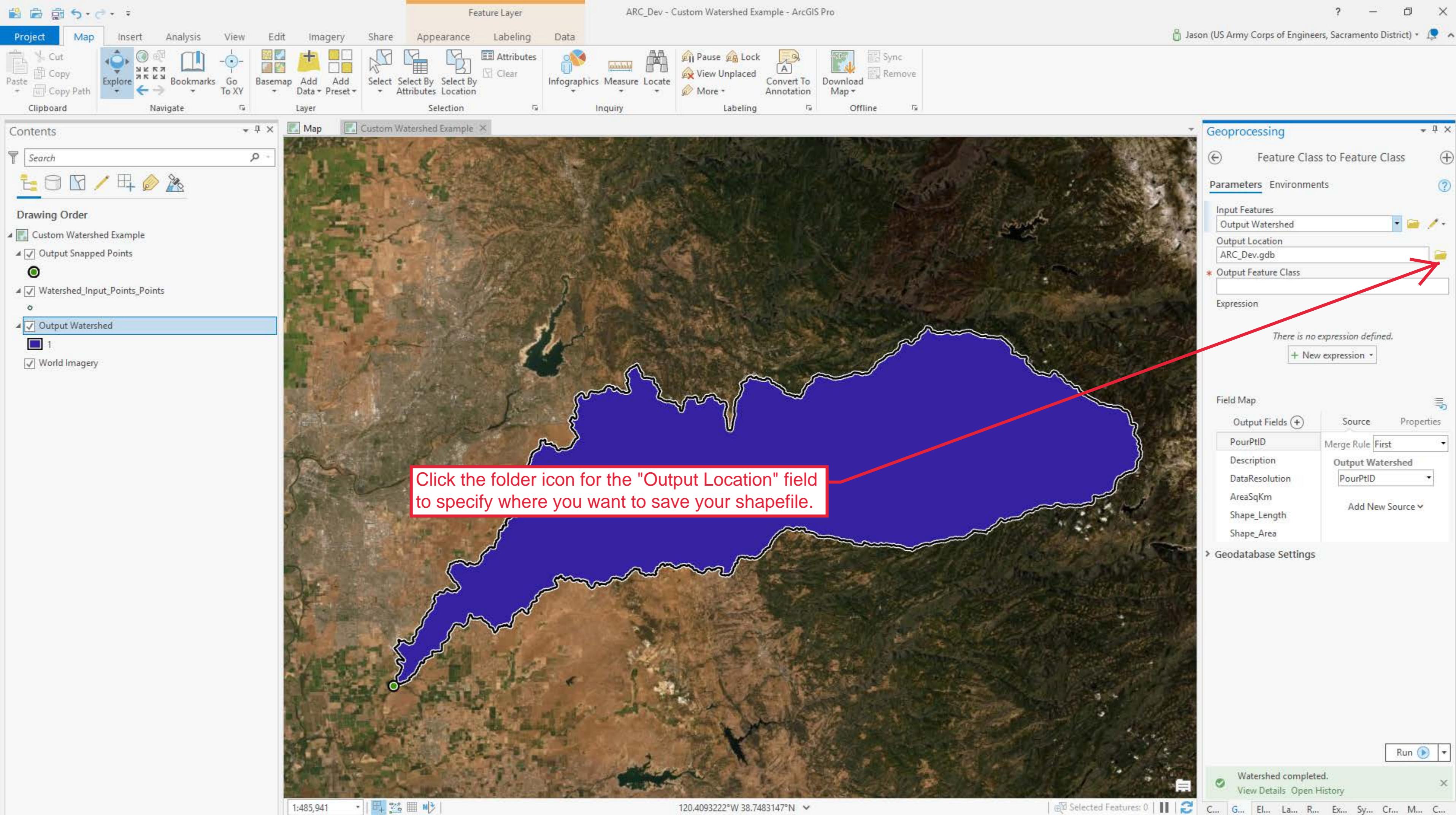
Geoprocessing Watershed Parameters Environments Input Points Watershed_Input_Points_Points Watershed_Input_Points_Points Point Identification Field Snap Distance Snap Distance Units Meters Data Source Resolution FINEST Generalize Watershed Polygons Return Snapped Points Run

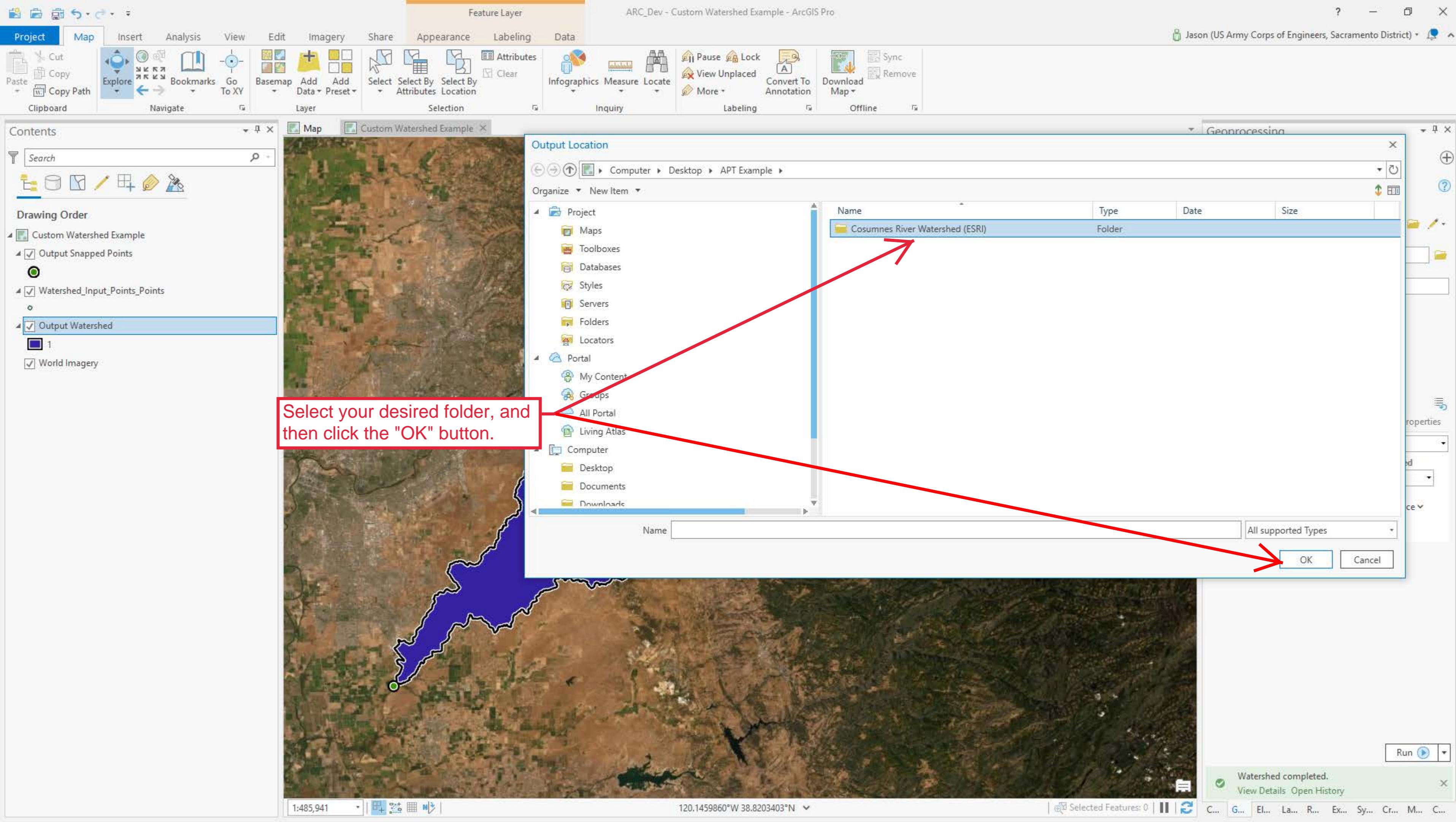
Watershed completed. View Details Open History

1:485,941 121.5157963°W 38.6924448°N Selected Features: 0 C... G... El... La... R... Ex... Sy... Cr... M... C...

Hover over the "Data" sub-menu, and then select "Export Features."

The screenshot shows the ArcGIS Pro interface with a satellite map of a watershed area. A large blue polygon represents the watershed boundary. In the bottom-left corner of the map, there is a small green circular marker. A red arrow points from the 'Data' sub-menu in the ribbon to the 'Export Features' option in the context menu that appears when right-clicking the green marker. A red callout box contains the text: "Hover over the 'Data' sub-menu, and then select 'Export Features.'". The ribbon at the top has tabs for Project, Map, Insert, Analysis, View, Edit, Imagery, Share, Appearance, Labeling, and Data. The Data tab is currently selected. The left pane shows the 'Contents' panel with various layers listed, and the main workspace shows the map with the watershed polygon.





Select your desired folder, and then click the "OK" button.

Watershed completed.
View Details Open History

Feature Layer ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

Cut Copy Paste Copy Path Explore Bookmarks Go To XY Basemap Add Data Add Preset Select Select By Attributes Select By Location Attributes Pause Lock Infographics Measure Locate View Unplaced Convert To Annotation More Sync Download Map Clear Labeling Offline

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Give your new shapefile any name, as long as it doesn't include spaces and ends in ".shp"

Geoprocessing

Feature Class to Feature Class

Parameters Environments

Input Features Output Watershed

Output Location Cosumnes River Watershed (ESRI)

* Output Feature Class

Expression There is no expression defined.

+ New expression

Field Map

Output Fields + Source Properties

PourPtID Merge Rule First

Descriptio

DataResolu

AreaSqKm

Shape_Leng

Shape_Area

Add New Source

Run

Watershed completed.

View Details Open History

Selected Features: 0

1:485,941 120.1448310°W 38.7447115°N

C... G... El... La... R... Ex... Sy... Cr... M... C...

The screenshot shows the ArcGIS Pro interface with a map titled "Custom Watershed Example". The map displays a satellite view of a landscape with a large blue-shaded area representing the watershed. A green dot marks the point of origin. A red callout box with a red arrow points from the text "Give your new shapefile any name, as long as it doesn't include spaces and ends in '.shp'" to the "Output Feature Class" field in the Geoprocessing pane. The "Output Feature Class" field is empty. The "Output Watershed" layer is selected in the Contents pane.

ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

Cut Copy Paste Copy Path Explore Bookmarks Go To XY Basemap Add Data Add Preset Select By Attributes Select By Location Infographics Measure Locate Convert To Annotation More View Unplaced Download Map Sync Clear

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Feature Layer

Custom Watershed Example

Click "Run" to execute the export process.

Geoprocessing

Feature Class to Feature Class

Parameters Environments

Input Features Output Watershed

Output Location Cosumnes River Watershed (ESRI)

* Output Feature Class Cosumnes_River_Watershed.shp

Expression There is no expression defined. + New expression

Field Map

Output Fields +

PourPtID	Merge Rule First
Descriptio	Output Watershed
DataResolu	PourPtID
AreaSqKm	Add New Source
Shape_Leng	
Shape_Area	

Run

Watershed completed.

View Details Open History

1:485,941 120.1448310°W 38.7447115°N Selected Features: 0

ARC_Dev - Custom Watershed Example - ArcGIS Pro

Project Map Insert Analysis View Edit Imagery Share Appearance Labeling Data

Cut Copy Paste Copy Path Clipboard Explore Bookmarks Go To XY Basemap Add Data Add Preset Select By Attributes Select By Location Infographics Measure Locate Convert To Annotation More View Unplaced Download Map Sync Clear

Selected Features: 0 | Run | Feature Class to Feature Class completed. View Details Open History

Contents Search Drawing Order Custom Watershed Example Output Snapped Points Watershed_Input_Points Points Cosumnes_River_Watershed Output Watershed 1 World Imagery

Map Custom Watershed Example

With the file exported, we can minimize ArcGIS Pro

Geoprocessing Feature Class to Feature Class

Parameters Environments

Input Features Output Watershed

Output Location Coseumnes River Watershed (ESRI)

Output Feature Class Coseumnes_River_Watershed.shp

Expression There is no expression defined. + New expression

Field Map Output Fields PourPtID Descriptio DataResolu AreaSqKm Shape_Leng Shape_Area

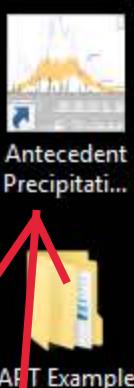
Merge Rule First Output Watershed PourPtID Add New Source

Run

Jason (US Army Corps of Engineers Sacramento District)

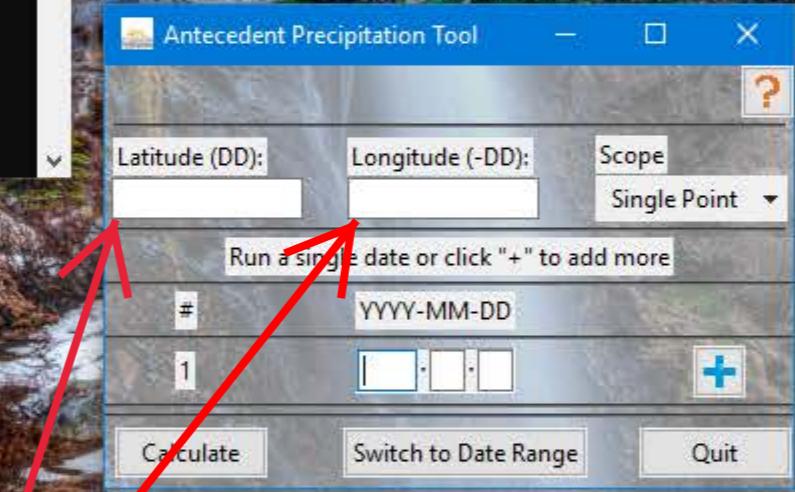
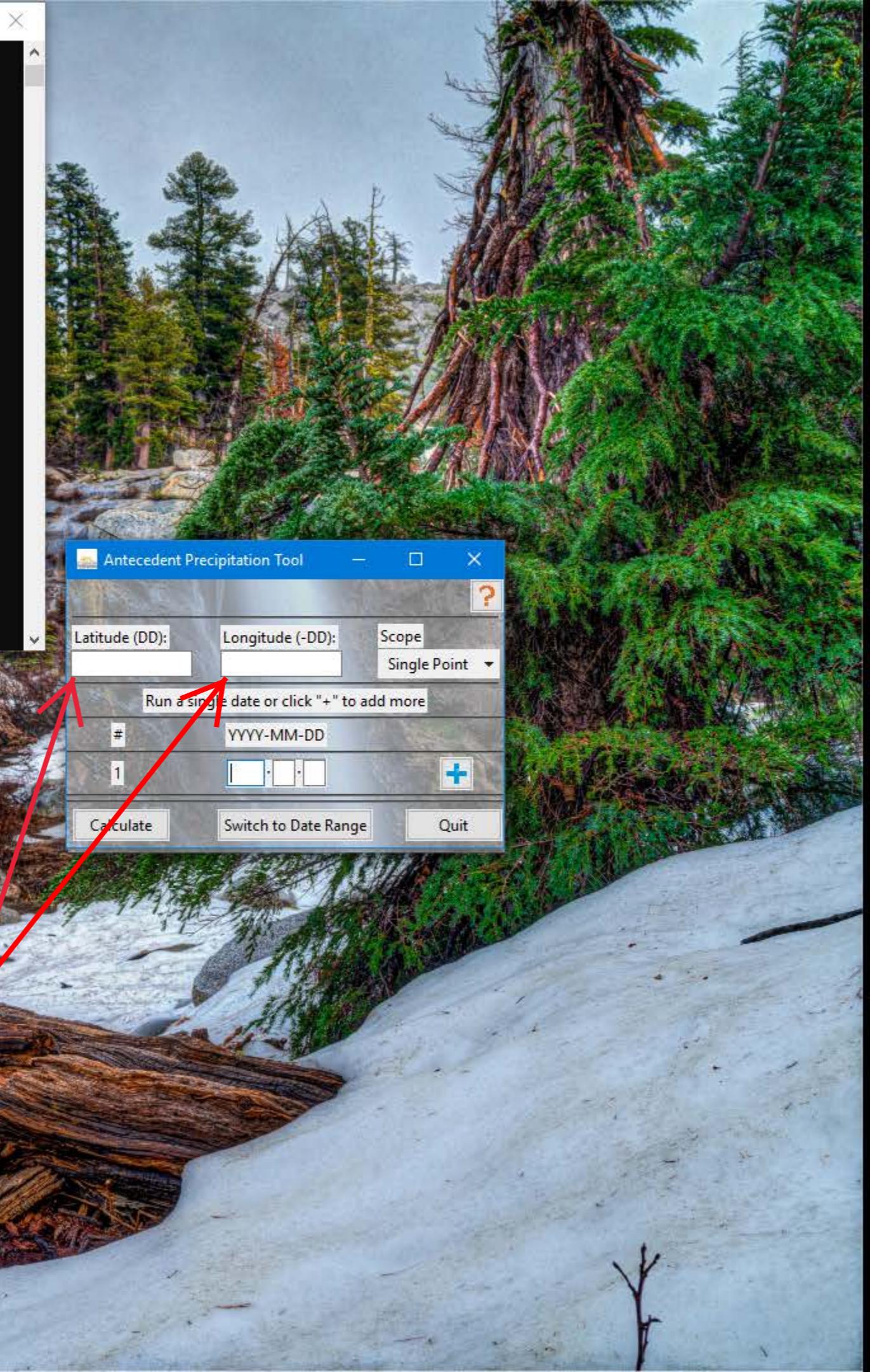
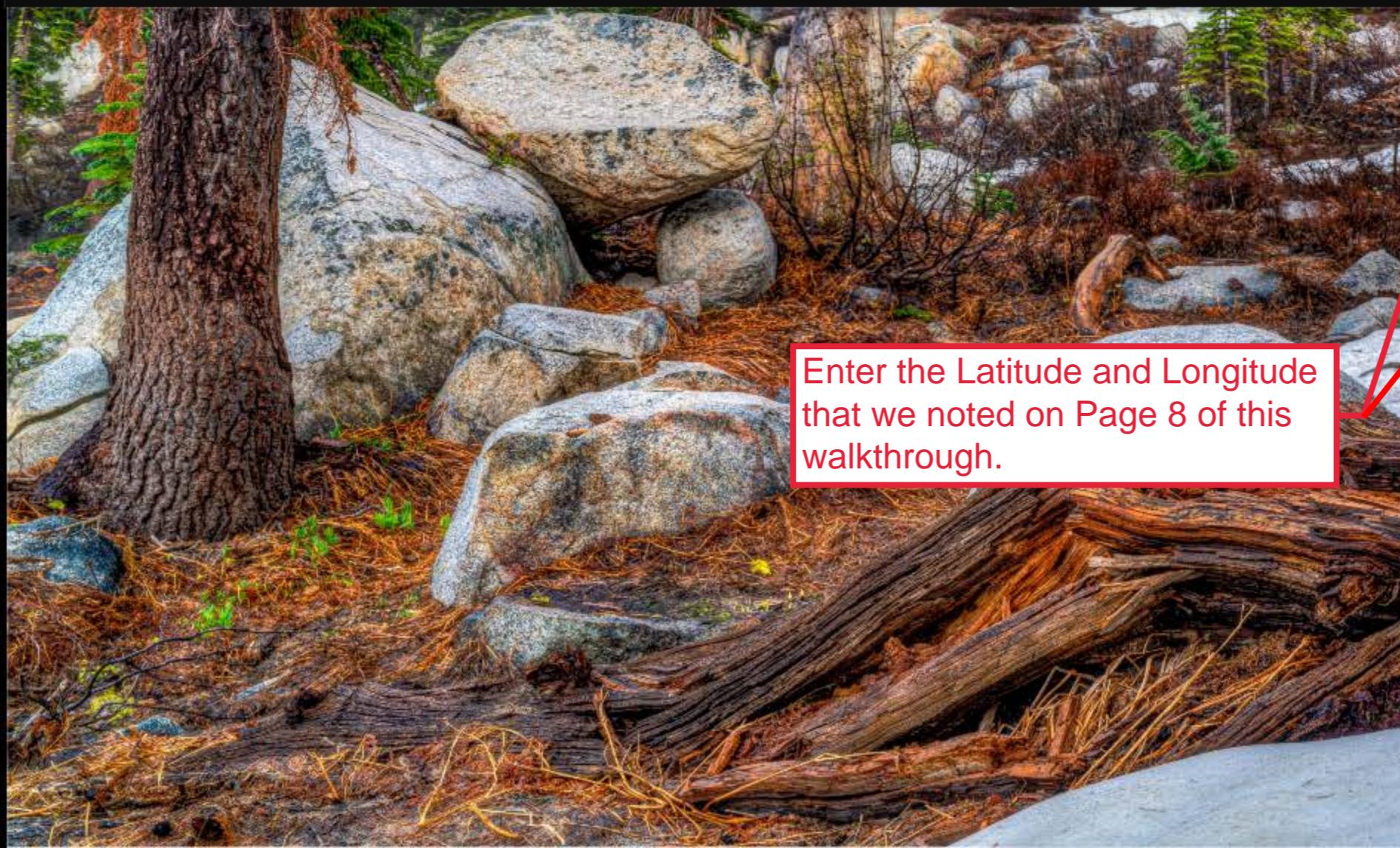
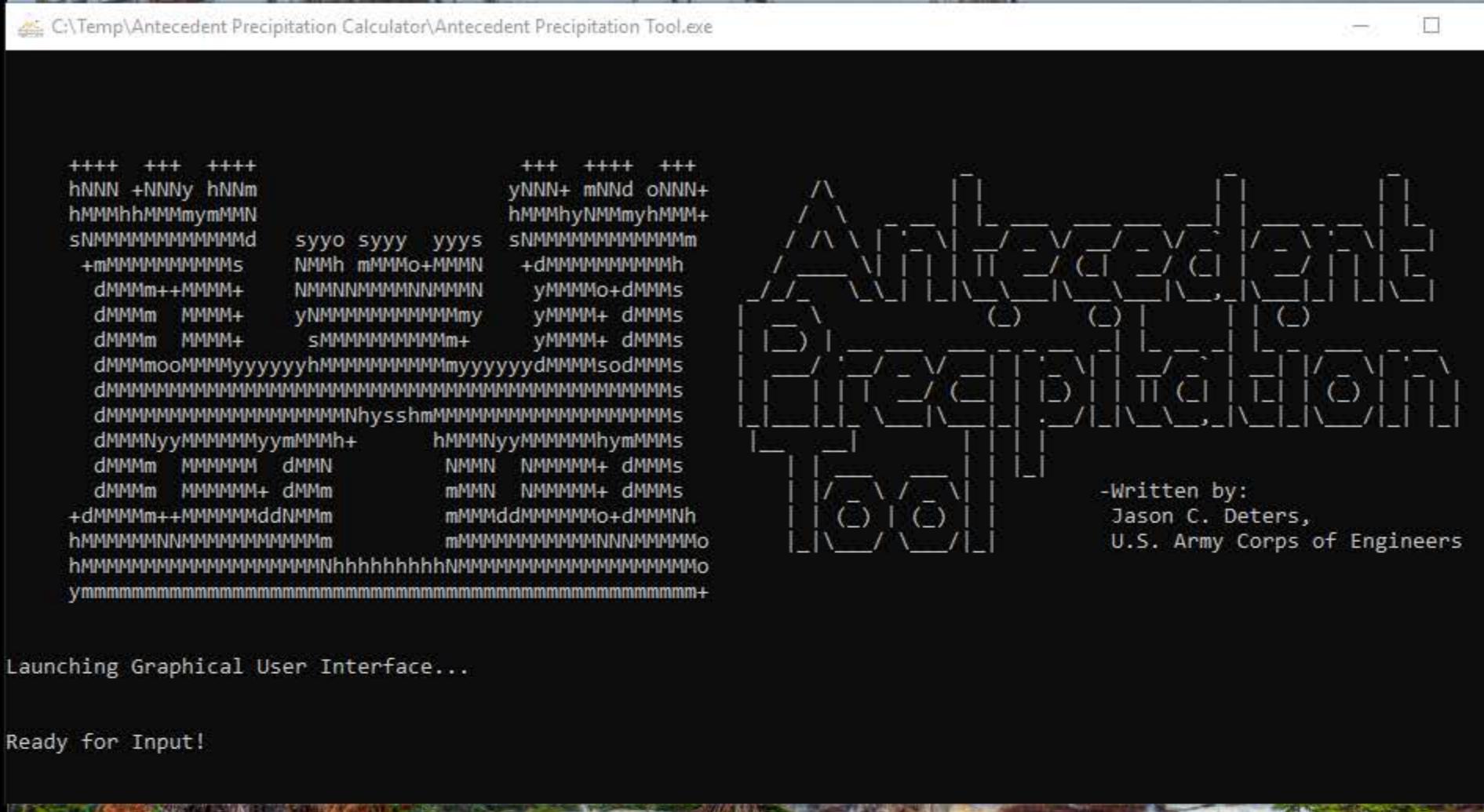
1:485,941 120.1448310°W 38.7447115°N Selected Features: 0 | G... El... La... R... Ex... Sy... Cr... M... C...

The screenshot illustrates a workflow for creating a watershed boundary. In the center is a map of a river basin with a purple-shaded area representing the watershed. A green dot marks a point on the river. The left panel shows the project's contents, including layers like 'Custom Watershed Example', 'Output Snapped Points', 'Watershed_Input_Points Points', 'Cosumnes_River_Watershed', 'Output Watershed', and 'World Imagery'. The right panel is the 'Geoprocessing' pane, which is currently running a 'Feature Class to Feature Class' task. The task's parameters are set to output a feature class named 'Coseumnes_River_Watershed.shp' to the 'Coseumnes River Watershed (ESRI)' location. The 'Output Features' dropdown is set to 'Output Watershed'. The 'Field Map' section lists fields such as 'PourPtID', 'Descriptio', 'DataResolu', 'AreaSqKm', 'Shape_Leng', and 'Shape_Area'. A red callout box with the text 'With the file exported, we can minimize ArcGIS Pro' points to the 'Geoprocessing' pane.

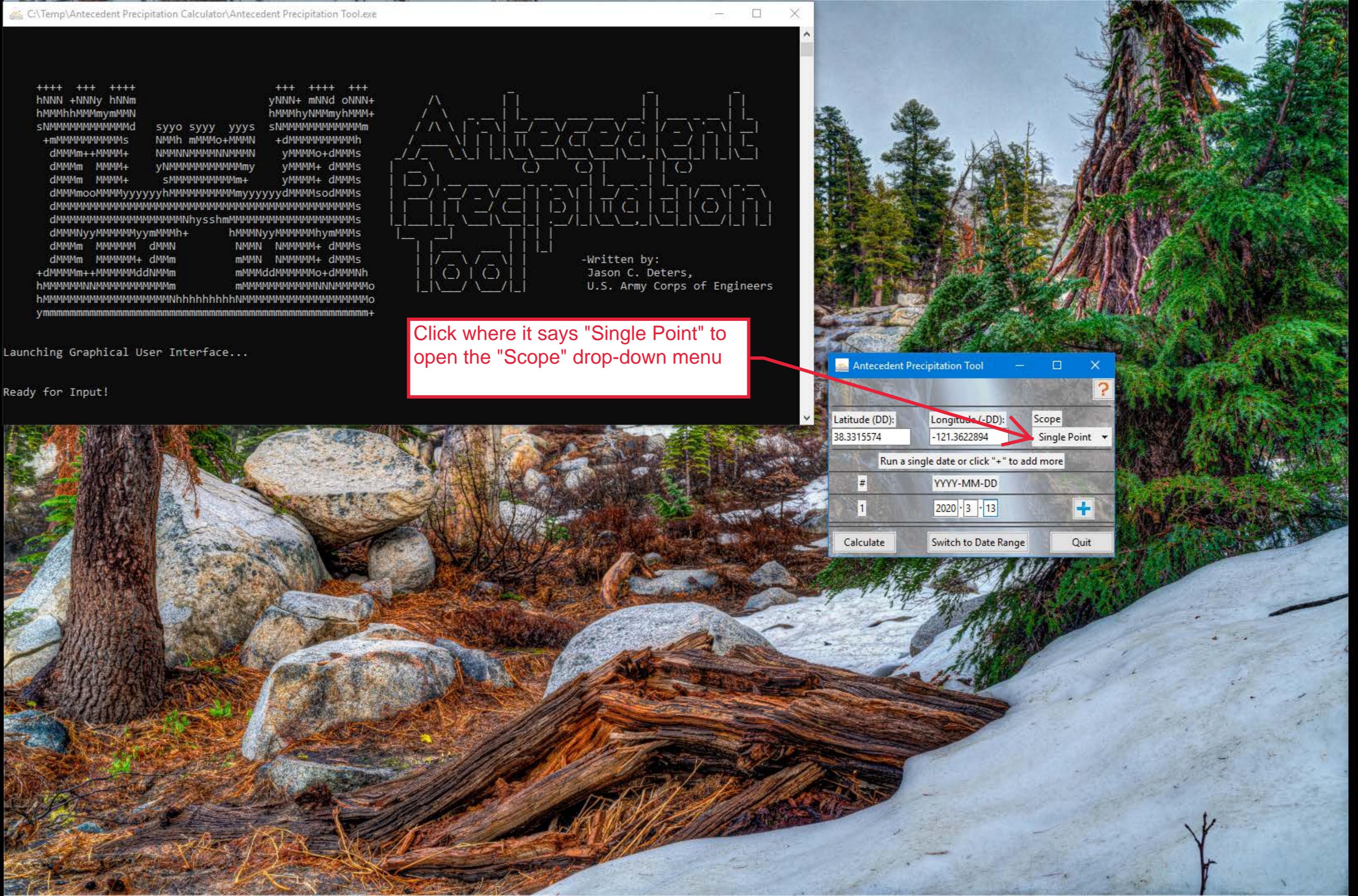


APT Example

Launch
the
APT







Antecedent
Precipitati...

Antecedent
Precipitati...

APT Example

```
++++ +++ +++
hNNN +NNNy hNNm      +++ ++++
yNNN+ mNNd oNNN+
hMMMyhNMMMyhMM+
sNMMMMMMMMMMMMMd    syo syyy yyys
+mMMMMMMMMMMMs      NMMh mMMMo+MMMN
dMMNm+++MMMM+      NMMNNMMMMNMNNM
dMMNm MMM+        yNMMMMMMMMMMMy
dMMNm MMM+        yMMMM+ dMMMs
dMMMooyMMMyyyyyhMMMMMyyyyyyhdMMMsodMMMs
dMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
dMMMMMMMMMMMMMMMMhysshMhMMMMMMMMMMMMMMMM
dMMNyMMMMMyymMMh+   hMMNyMMMMMyhmMMs
dMMNm MMMMd dMMN     NMMN NMMMM+ dMMMs
dMMNm MMMMM+ dMMm     mMMN NMMMM+ dMMMs
+dMMMMm+++MMMMMdNNMm mMMddMMMMMo+dMMNh
hMMMMMMNNMMMMMMMMMMm mMMMMMMMMMMNNMMMMMo
hMMMMMMMMMMMMMMMMMMhyyyyyhhhNNMMMMMMMMMM
ymmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm+
```

-Written by:
Jason C. Deters,
U.S. Army Corps of Engineers

Launching Graphical User Interface...

Ready for Input!



Antecedent Precipitation Tool

(DD): 38.3315574 Longitude (-DD): 121.3622894 Scope: Single Point

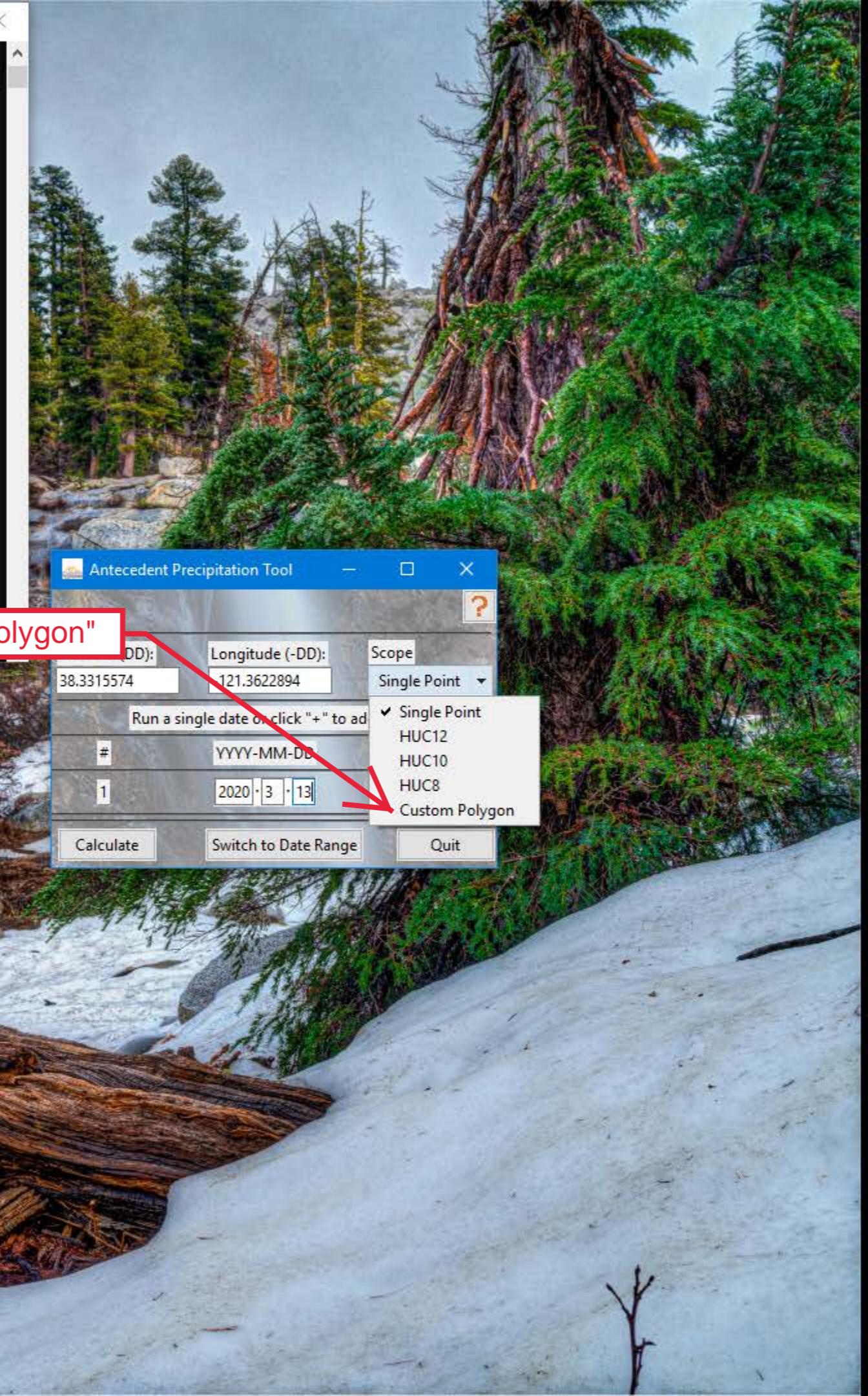
Run a single date or click "+" to add

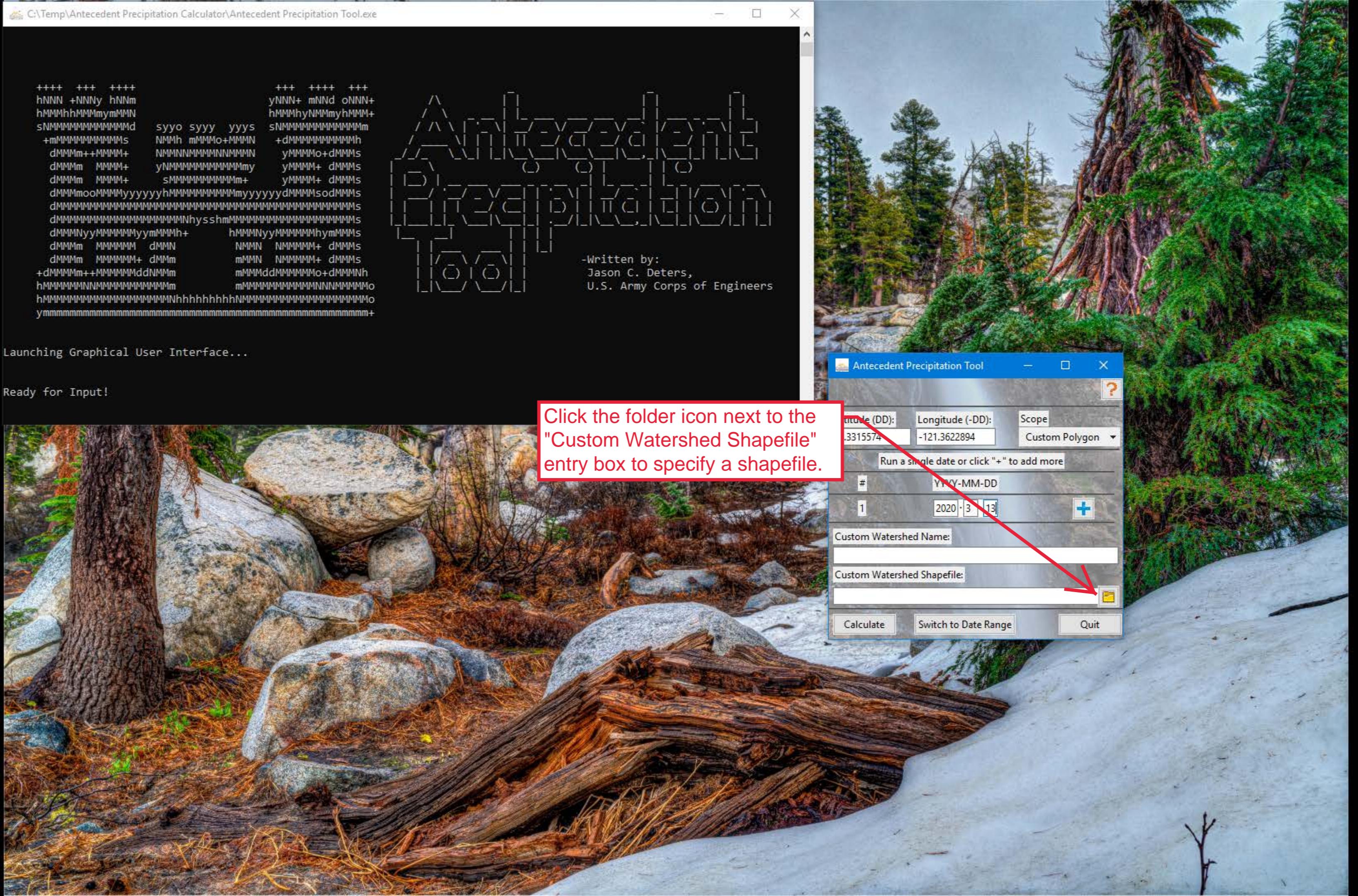
YYYY-MM-DD

1 2020 · 3 · 13

Calculate Switch to Date Range Quit

A red box highlights the "Custom Polygon" option in the Scope dropdown menu.





Click the folder icon next to the
"Custom Watershed Shapefile"
entry box to specify a shapefile.



C:\Temp\Antecedent Precipitation Calculator\Antecedent Precipitation Tool.exe

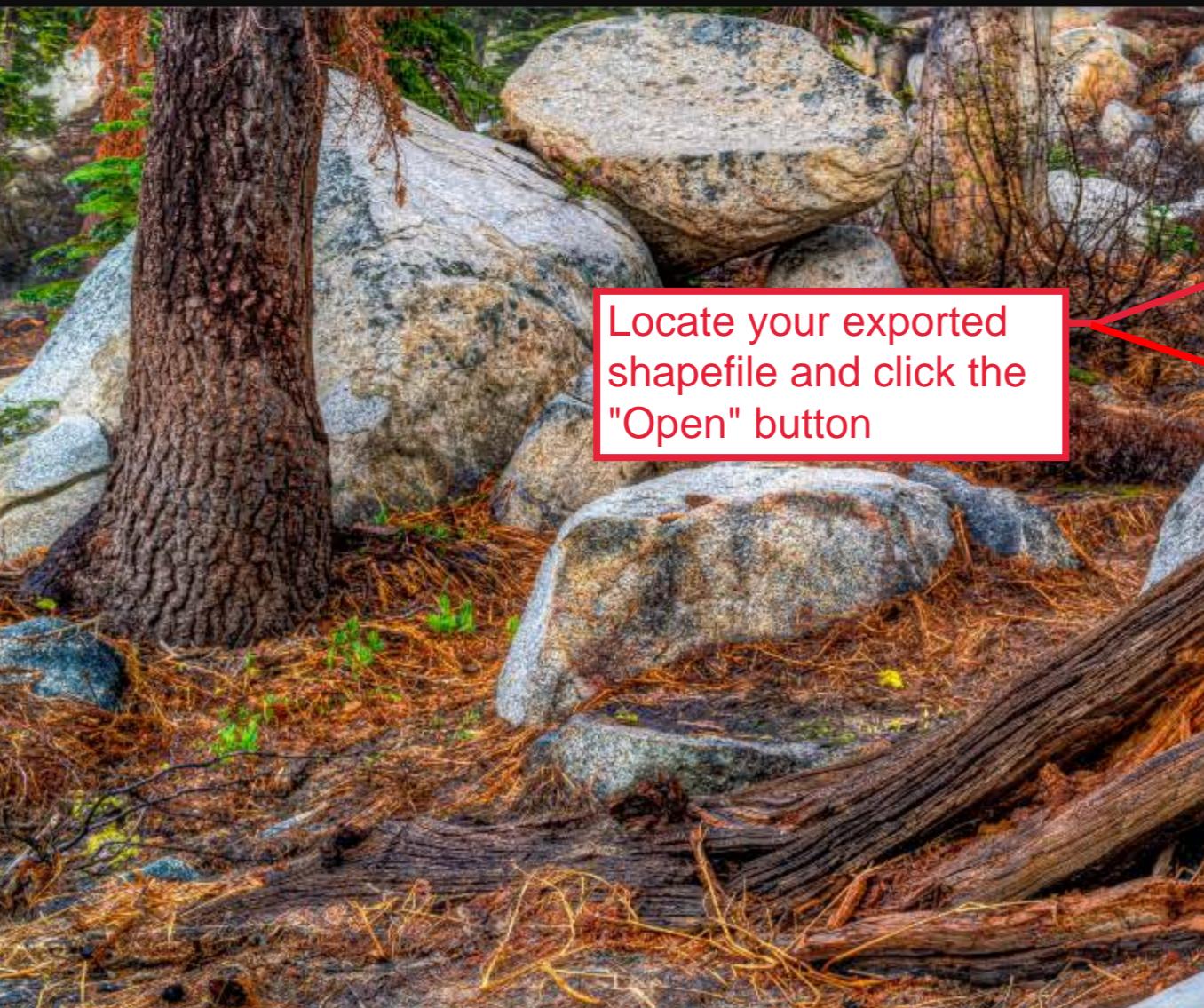
```
++++ +++ +++
hNNN +NNNy hNNm      +++ ++++
yNNN+ mNNd oNNN+
hMMMhyNMMMyhMM+
sNMMMMMMMMMMMMMd    syo syy yys
NMMh mMMMo+MMMN    sNMMMMMMMMMMMM
+dMMMMMMMMMMh
dMMMm+++MMMM+
dMMm MMM+           yNMMMMMMMMMy
yMMMM+ dMMMs
dMMm MMM+           sMMMMMMMMMMm+
yMMMM+ dMMMs
dMMmooMMMyyyyyyhMMMMMMMMMyyyyyydMMMsodMMMs
dMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
dMMMMMMMMMMMMMMMMhysshMhMMMMMMMMMMMMMMMM
dMMNyMMMMMyymMMh+   hMMNyMMMMMyhmMMs
dMMm MMMMd dMMN     NMMN NMMMM+ dMMMs
dMMm MMMMM+ dMMm   mMMN NMMMM+ dMMMs
+dMMMMm+++MMMMMdNm  mMMddMMMMMo+dMMNh
hMMMMMNMMMMNMNMNMm  mMMMMNMNMNMNMNMNM
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yMMMMNMNMNMNMNMNM  ymmmmmmmmmmmmmmmmmmmmmmmmmmmm
```



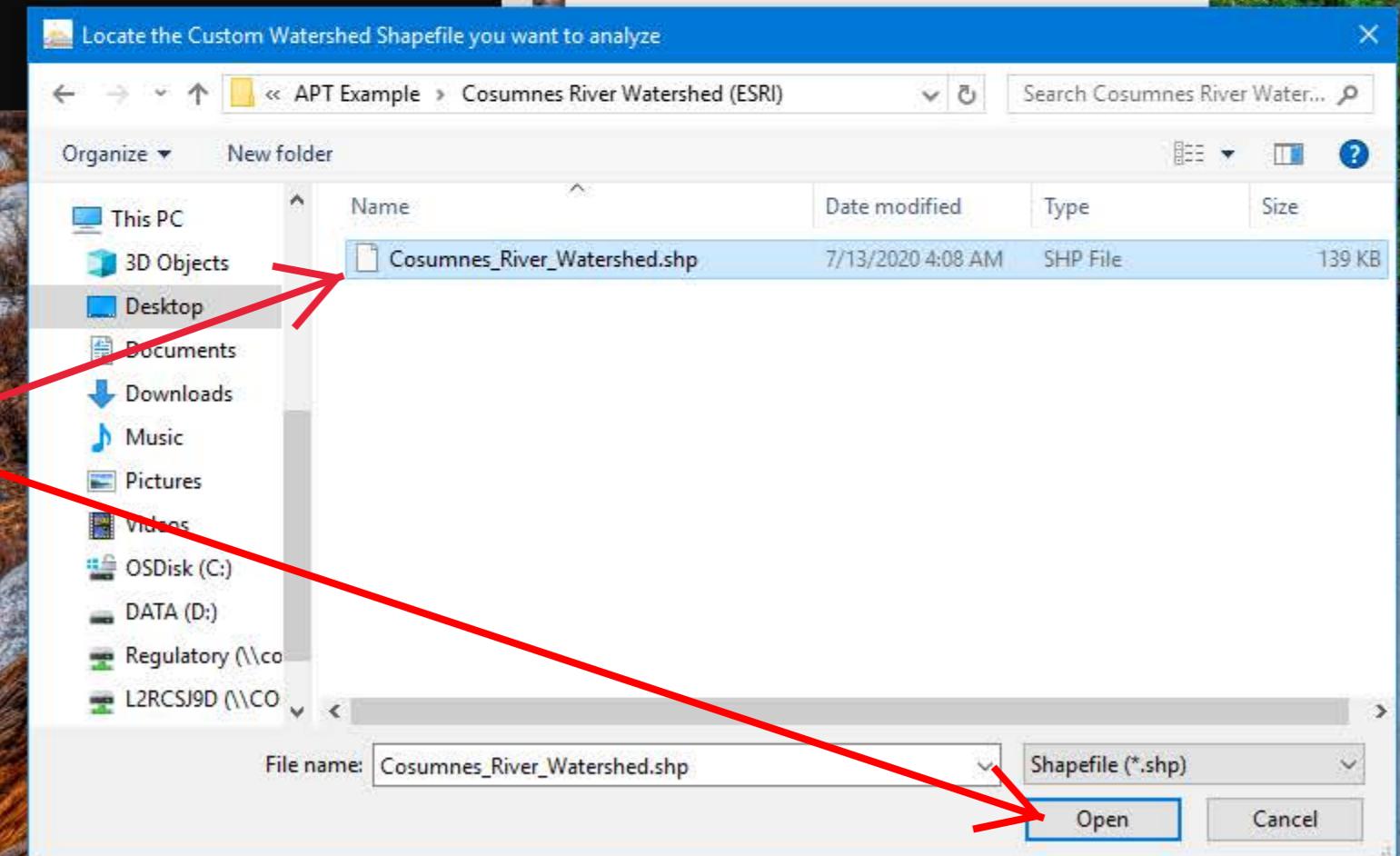
-Written by:
Jason C. Deters,
U.S. Army Corps of Engineers

Launching Graphical User Interface...

Ready For Input!



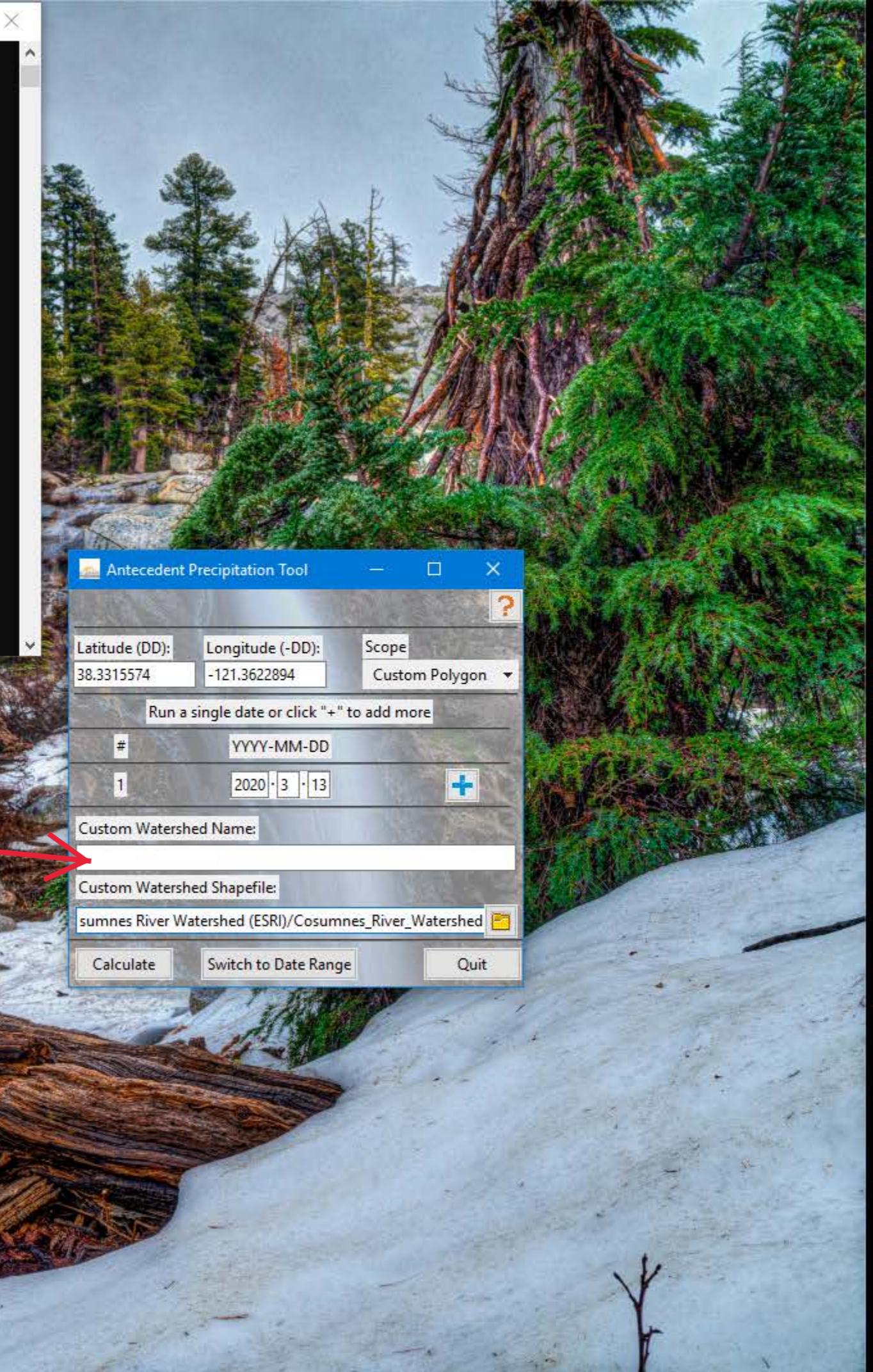
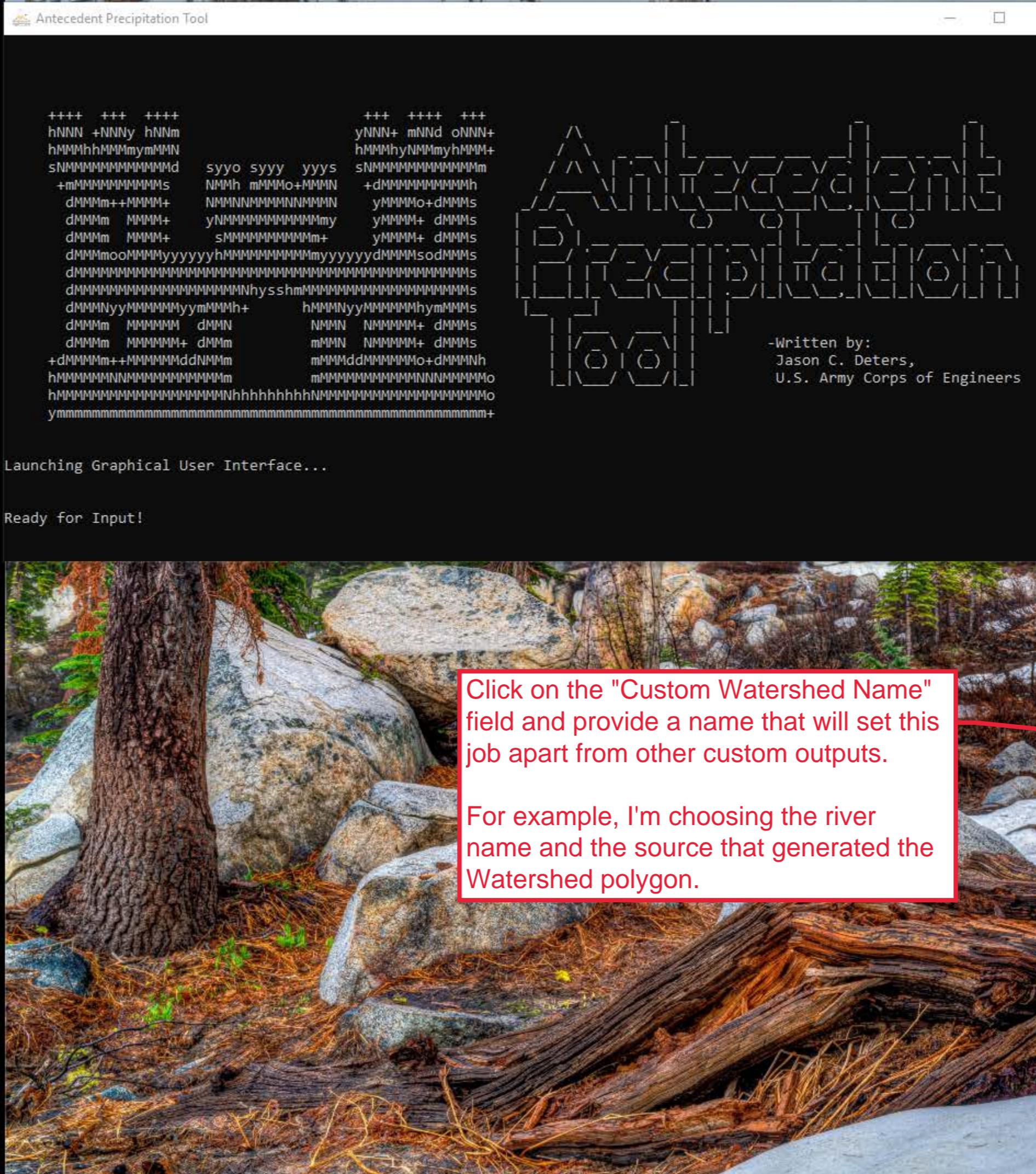
Locate your exported shapefile and click the "Open" button

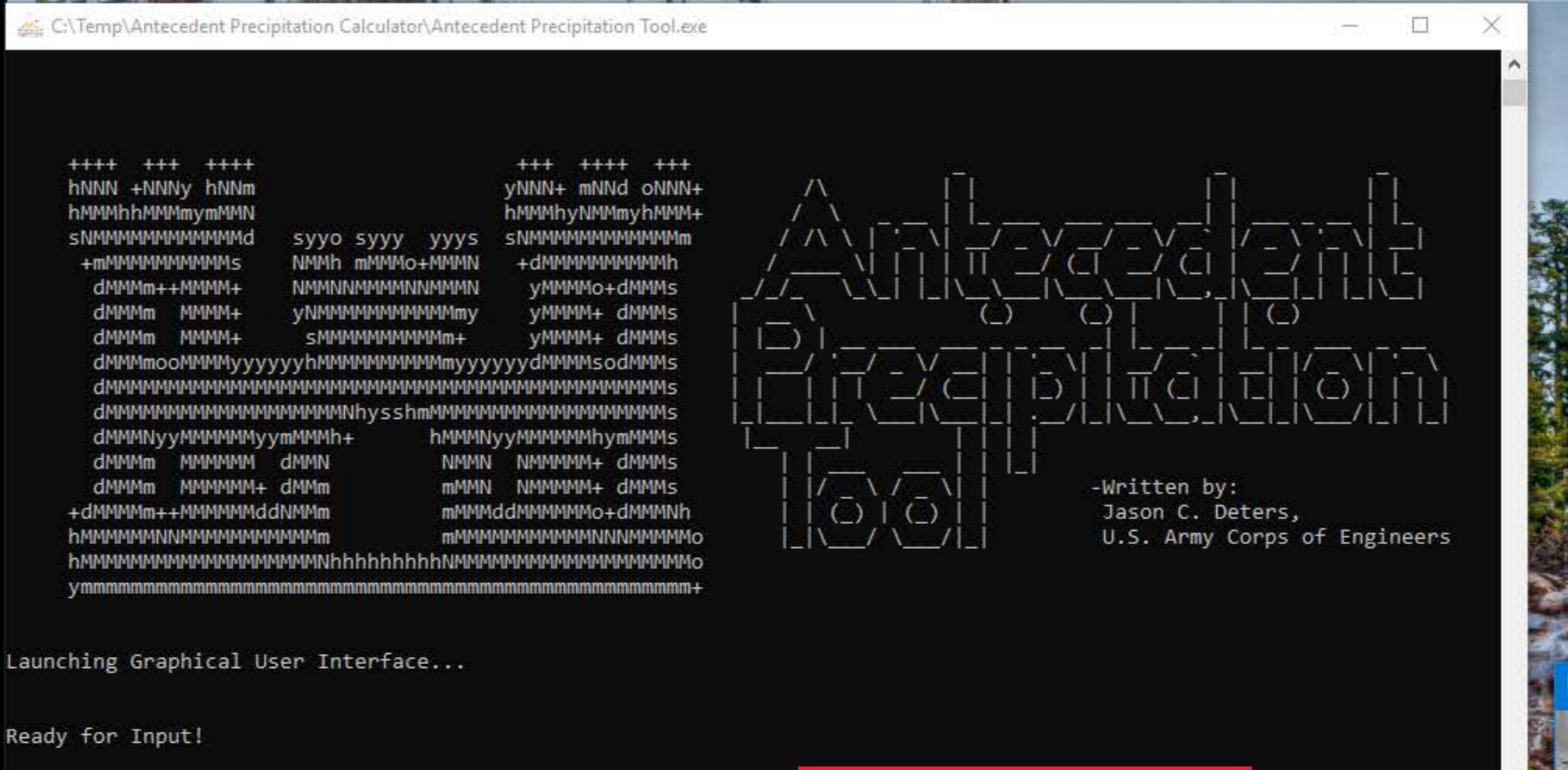


Antecedent
Precipitati...



APT Example

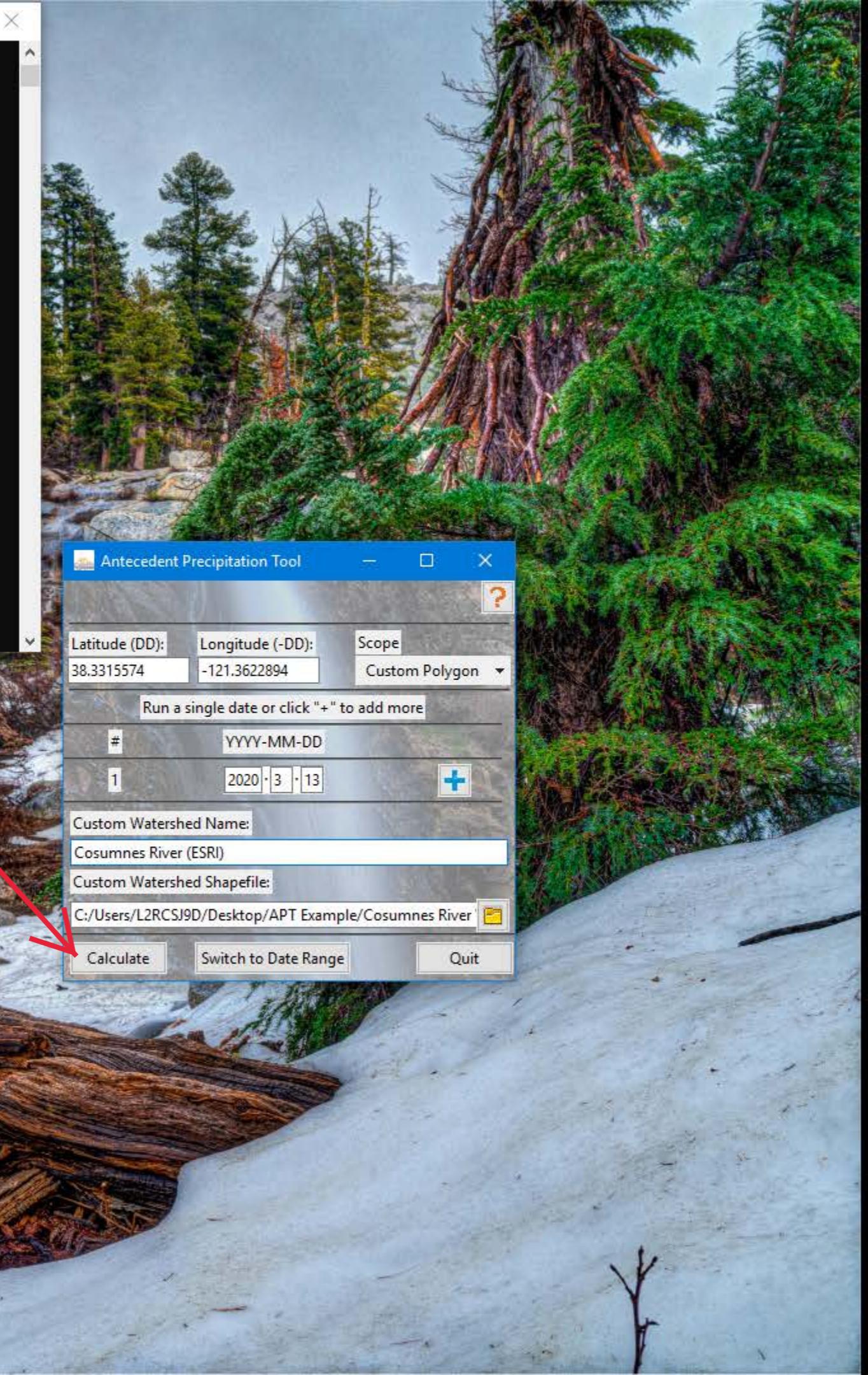
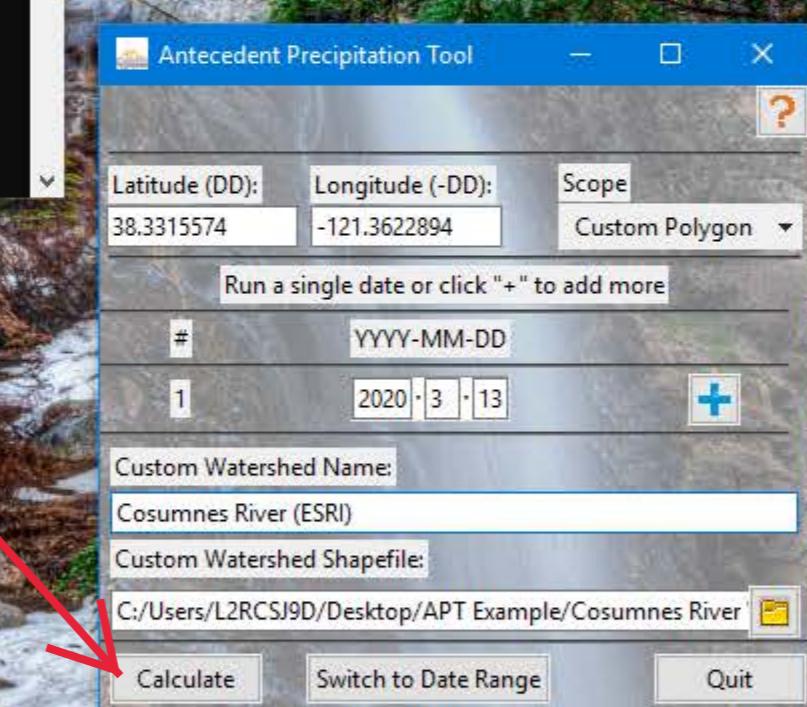


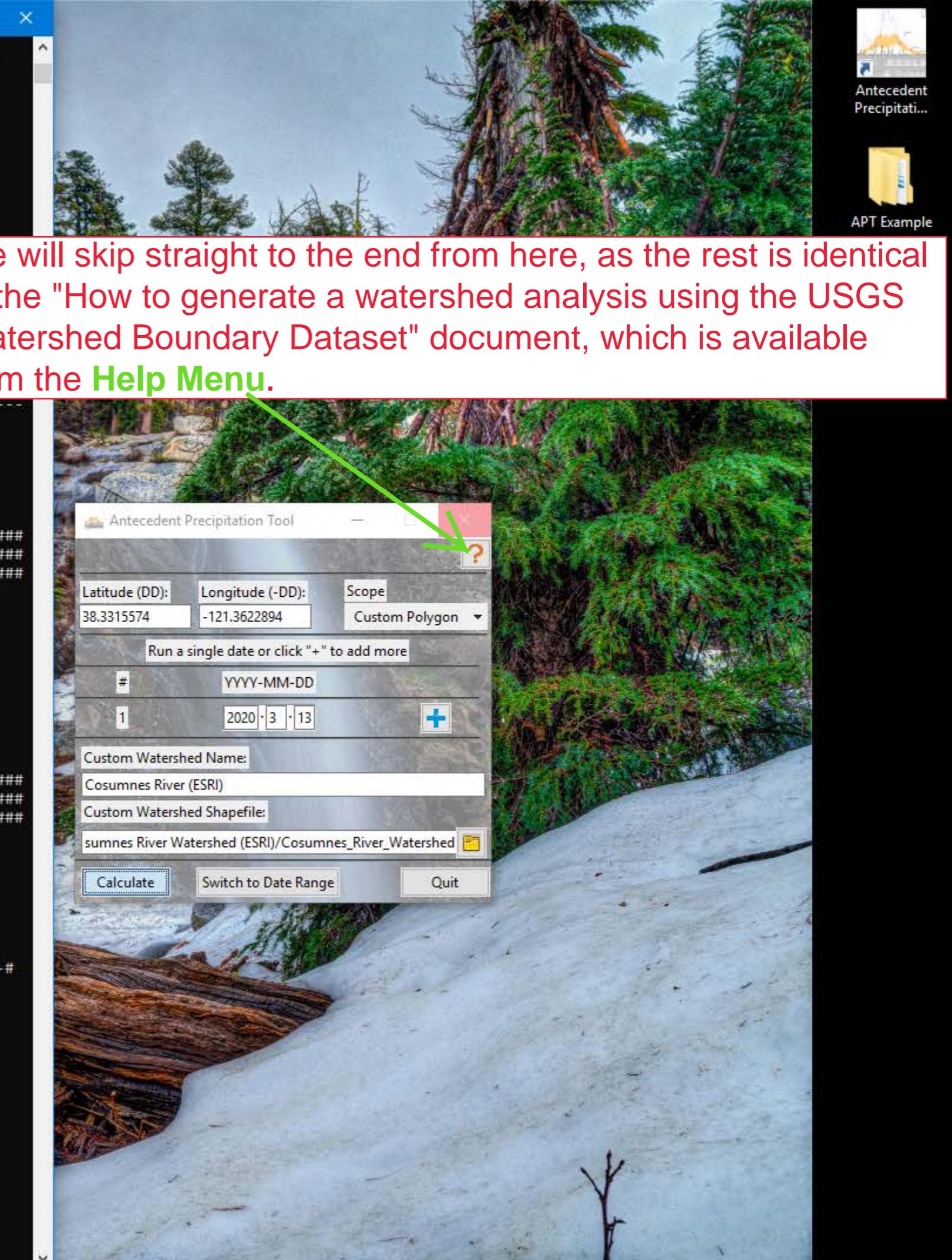
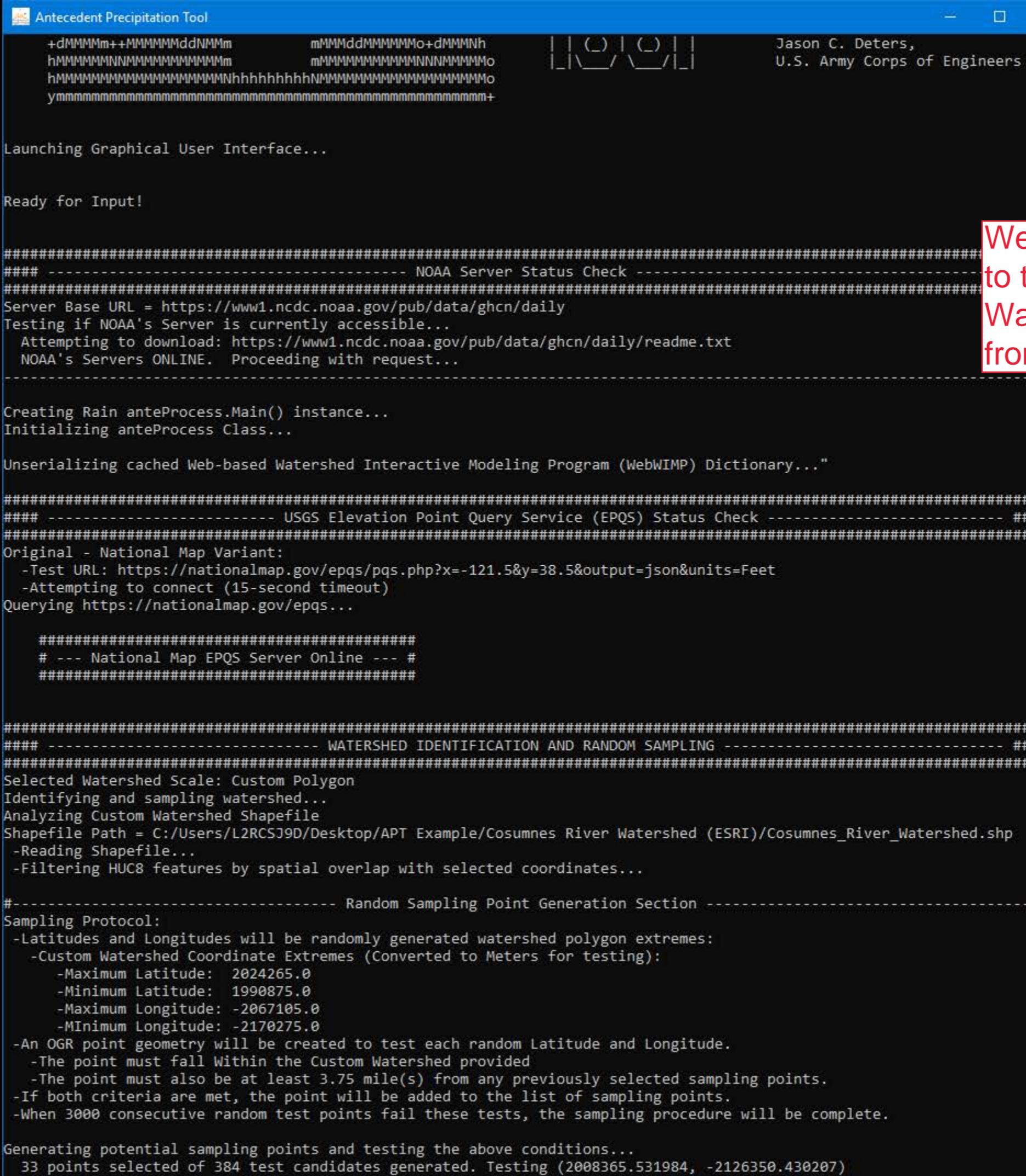


Launching Graphical User Interface...

Ready for Input!

Once happy with the
input values, click the
"Calculate" button.





File Edit View Window Help

Home Tools 2020-03-13 - Cos... x

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102%

Information about this output can be found in the "How to read the output of a watershed analysis" document, available from the Help Page (The orange question mark button on the tool's main interface)

Antecedent Precipitation Tool v.1.0 - Watershed Sampling Summary

Generated on 2020-07-13

User Inputs

Coordinates	38.331557, -121.362289
Date	2020-03-13
Geographic Scope	Custom Polygon

Intermediate Data

Custom Watershed Name	Cosumnes River (ESRI)
Watershed Size	726.44 mi ²
# Random Sampling Points	40

Preliminary Result

Average Antecedent Precipitation Score	6.35
Preliminary Determination	Drier than Normal

100.0%

Drier than Normal

Sampling Point Breakdown

Antecedent Precipitation Score	Antecedent Precipitation Condition	WebWIMP H ₂ O Balance	Drought Index (PDSI)	# of Points
9	Drier than Normal	Wet Season	Moderate drought	2
7	Drier than Normal	Wet Season	Moderate drought	8
6	Drier than Normal	Wet Season	Moderate drought	30

