Agents	Add Agents Interactively	Need Doc
Agents	Draw Agents from Table	Need Doc
Causes	Add Causes Interactively	Need Doc
Causes	Factor Analysis for Mixed Data	R
Causes	Model Selection (OLS)	Need Doc
Environmental Analysis	CO2 Emissions	Need Doc
Environmental Analysis	Coastal Blue Carbon (InVEST 3.14.2)	Need Doc
Environmental Analysis	Coastal Blue Carbon Preprocessor (InVEST 3.14.2)	Need Doc
Environmental Analysis	Forest Carbon Edge Effect (InVEST 3.14.2)	Need Doc
Environmental Analysis	Habitat Quality (InVEST 3.14.2)	Need Doc
Environmental Analysis	Habitat Risk Assessment (InVEST 3.14.2)	Need Doc
Environmental Analysis	Habitat Risk Assessment Preprocessor (InVEST 3.14.2)	Need Doc
Environmental Analysis	Nutrient Delivery Ratio (InVEST 3.14.2)	Need Doc
Environmental Analysis	Seasonal Water Yield (InVEST 3.14.2)	Need Doc
Environmental Analysis	Sediment Delivery Ratio (InVEST 3.14.2)	Need Doc
Flows	Commodity Trade	Need Doc
Flows	Add Media Information Flows	No need to do due to LexisNexis url changed
Flows	Draw Radial Flows	Need Doc
Socioeconomic Analysis	Cost-Benefit Analysis	Need Doc

Socioeconomic Analysis	Crop Production (InVEST 3.14.2)	There will be 2 Crop Production In Arcgis Pro 3.0. :Crop Production Percentile ; Crop Production：Regression [Need Doc]
Socioeconomic Analysis	Fisheries Harvest (InVEST 3.11.0)	Can't be done due to Model itself has been deprecated. https://community.naturalcapitalproject.org/t/fisheries-model-not-availabe-in-users-guide/2540
Socioeconomic Analysis	Food Security	Need Google earthengine authenticate!!!!!
Socioeconomic Analysis	Nutrition Metrics	Need Doc
Socioeconomic Analysis	Population Count and Density	Need Doc
Socioeconomic Analysis	Visitation: Recreation and Tourism (InVEST 3.14.2)	Need Doc
Systems	Add Systems Interactively	Need Doc
Systems	Draw Systems from Table	Need Doc
Systems	Network Analysis Grouping	R Need Doc

Telecoupling Toolbox Update Instruction

1. Introduction

The Evolution of Telecoupling Research

In the ever-changing landscape of global interactions, the Telecoupling Toolbox has been a pioneering instrument, enabling a nuanced understanding of the complex relationships between human and natural systems across distances. Originally developed for ArcGIS Desktop and leveraging Python 2.7, the toolbox has served a diverse audience in visualizing and analyzing telecouplings. However, with the rapid evolution of technology and the retirement of Python 2, it is essential to update our tools to meet current standards and to integrate new capabilities.

A New Era with ArcGIS Pro and Python 3

The transition to ArcGIS Pro represents a significant advancement in the GIS domain, offering a more powerful, flexible, and user-friendly platform. Python 3, the current industry standard for Python programming, provides improved performance, security, and an expanded feature set. The Telecoupling Toolbox update is designed to harness the strengths of these new platforms, ensuring that our users have access to the most effective and efficient tools for their research and decision-making.

Why Update Now?

The timing of this update is critical for several reasons:

- End of Life for Python 2: Python 2 has reached the end of its life, meaning it no longer receives updates or support, including security updates.
- ArcGIS Pro Advancements: ArcGIS Pro has introduced groundbreaking features that are not available in ArcGIS Desktop, such as multi-factor authentication and enhanced 3D mapping capabilities.
- Community and Support: By updating to the latest platforms, the Telecoupling Toolbox community can benefit from broader support, a wealth of resources, and a collaborative user base.

Getting Started with the Update

This guide will walk you through updating your Telecoupling Toolbox, from assessing your current setup to installing the new version and exploring its enhanced features. We will provide detailed instructions, troubleshooting tips, and resources for further learning and support.

2. GETTING STARTED

2.0 Prerequisite:

- ArcGIS Pro:
  - Version 3.3.0 [download link need to be added]
- Python:
  - When ArcGIS Pro is installed, it automatically installs a Python program in the path [arcgisPro_installed path]/bin/Python, for example, "C:\Program Files\ArcGIS\Pro\bin\Python". Within this directory, an environment named "arcgispro-py3" is stored in the "envs" folder. The ArcPy script can be imported and executed in this environment. Additionally, when running toolboxes in ArcGIS Pro, the scripts are executed under this environment.
  - However, it is necessary to install a separate Python instance alongside the one installed with ArcGIS Pro. The reason for this is that some Python packages cannot be installed in the "arcgispro-py3" environment, as ArcGIS Pro uses a non-public version of GDAL (3.8.1e) for ArcGIS Pro 3.3. Updating, downgrading, or reinstalling GDAL in this environment is impossible, as it would render ArcGIS Pro inoperable. Therefore, a separate "free" Python is required to perform tasks outside of this environment. It is recommended to install Anaconda to create this public Python environment. In this update process, Anaconda 24.1.2 with Python 3.11.7 was utilized.
- R:
  - Version 4.4.1 is currently in use, and the following libraries need to be installed: Rtools (4.4.1), RColorBrewer (1.1-3), missMDA (1.19), FactoMineR (2.11), arcgisbinding (1.0.1.306), dplyr (1.1.4), sp (2.1-4), and igraph (2.0.3).
- InVEST 3.14.2 Workbench:
  - The InVEST 3.14.2 Workbench must be downloaded via the URL: https://storage.googleapis.com/releases.naturalcapitalproject.org/invest/3.14.2/workbench/invest_3.14.2_workbench_win32_x64.exe. After installation, the InVEST CLI model will be used to run the InVEST model for data processing. The reason for not using the InVEST Python package directly is that it cannot be installed due to its dependencies on a version of GDAL that is newer than 3.4.2, which is incompatible with the GDAL version in the ArcGIS Pro environment.

Please follow the steps below to prepare the environment for utilizing the Telecoupling Toolbox ArcGISProV3.3.

2.1 Installation of ArcGIS Pro V3.3.

2.1.1 Download ArcGIS Pro from ArcGIS Online:

Follow these steps to download ArcGIS Pro from ArcGIS Online. Optionally, you can download a localized version.

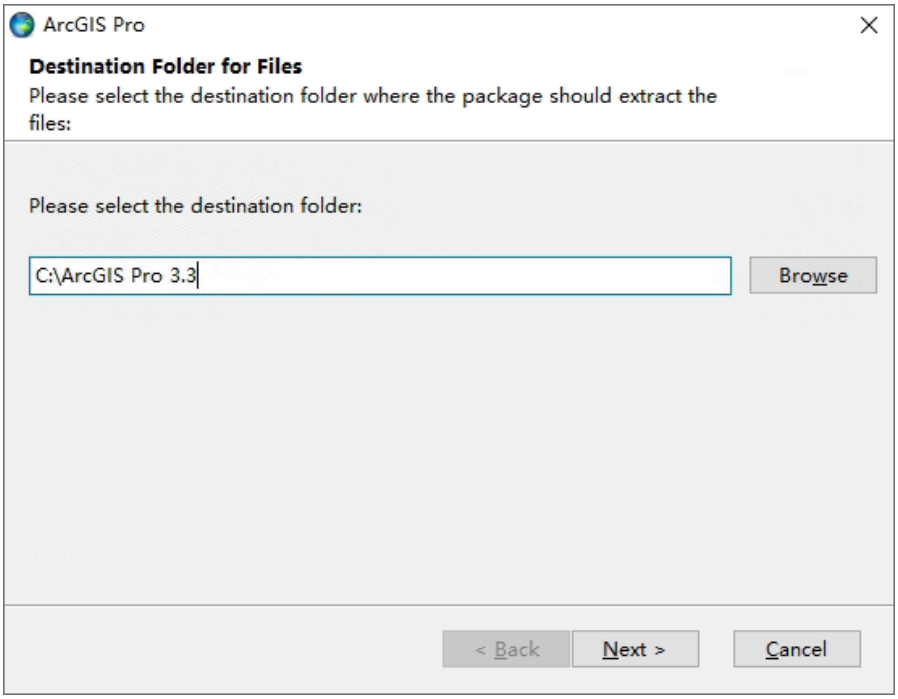
1. Sign in to your ArcGIS Online organization.

2. At the top of the page, click your username and click My settings.
3. On the My Settings page, click the Licenses side tab.
4. Your user type, role, and assigned licenses are listed. If you don't see ArcGIS Pro listed under your licensed products, or if the Download ArcGIS Pro link does not appear, contact your ArcGIS organization administrator.
5. Next to ArcGIS Pro, click Download ArcGIS Pro.
6. In the Download ArcGIS Pro window, review the language setting. To download a localized version of ArcGIS Pro, change the setting to the language you want.
7. Click Download. An executable file (.exe) is downloaded to your computer.

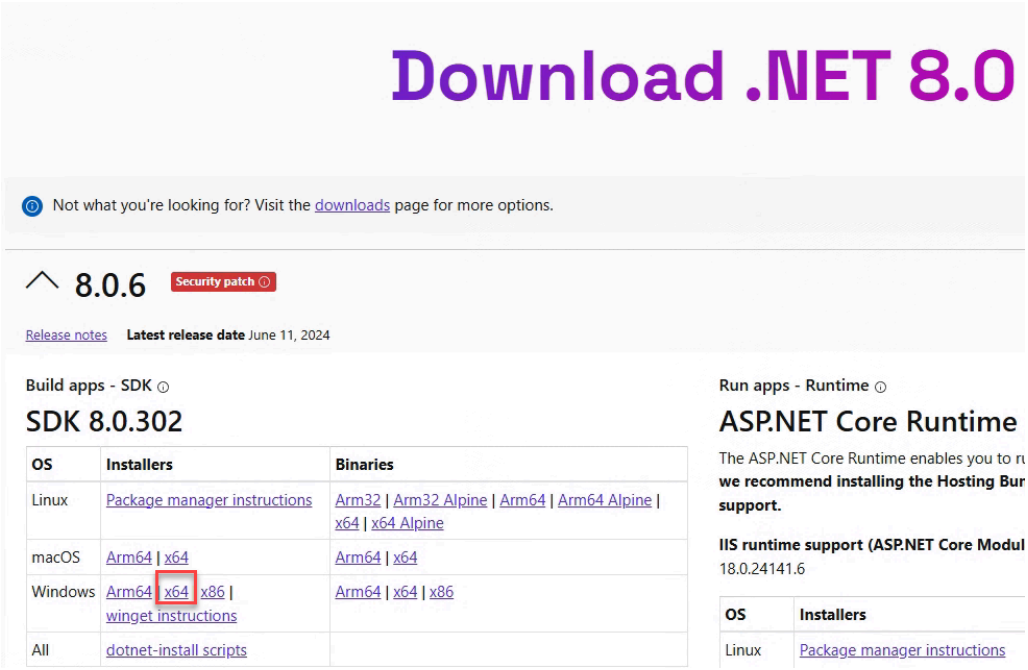
2.1.2 Install ArcGIS Pro V3.3.

When you get the executable file of ArcGIS Pro V3.3.0, you can follow up the steps to install it below:

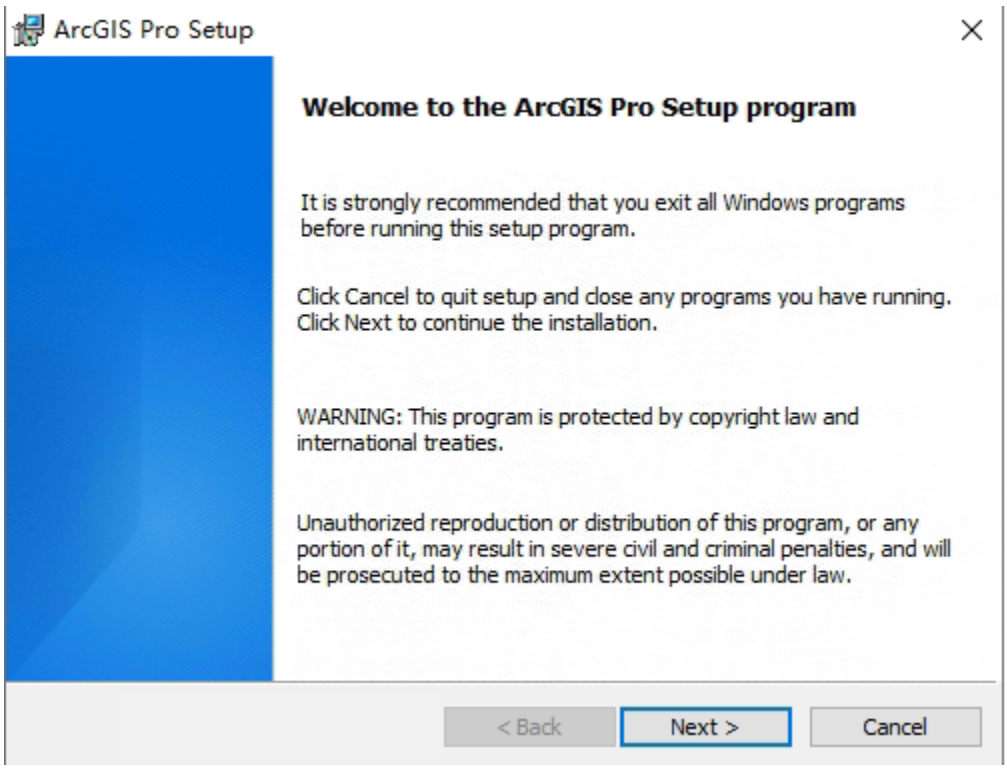
1. Double-click to start the unpackaging process and set the destination folder for unpackaging the file. Here, the path is set as “C:\ArcGIS Pro 3.3”:



2. You may have an error as “Miss Prerequisite” and it means that “ArcGIS Pro requires Microsoft .NET Desktop Runtime 8.0.x (x64)”. It needs to be downloaded from the “Download .NET Desktop Runtime x64” (https://dotnet.microsoft.com/en-us/download/dotnet/8.0) by selecting the “x64” version for Windows.

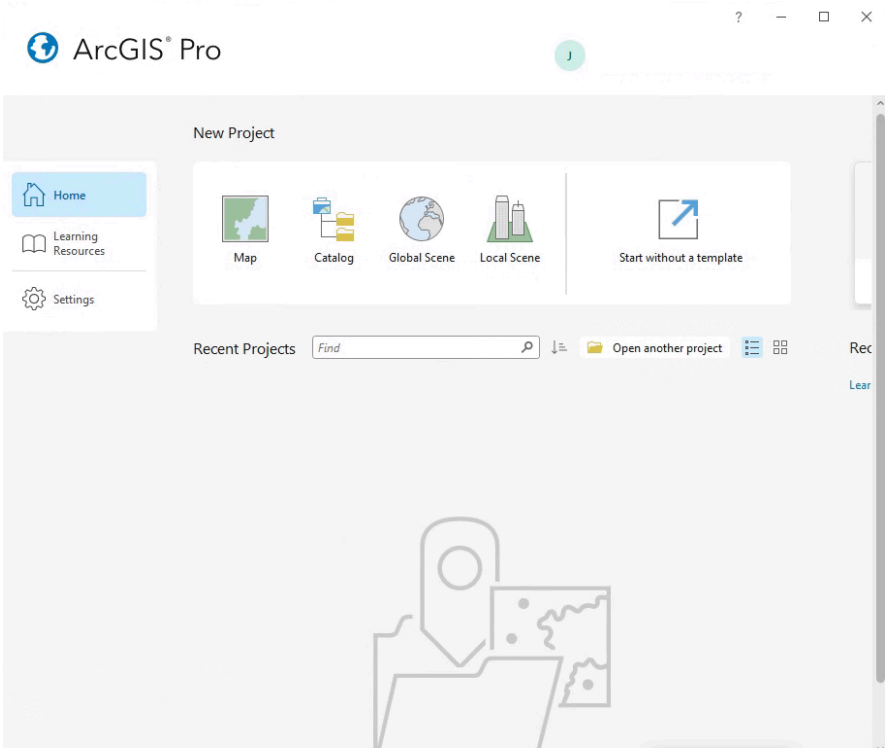


3. After completion of unpackaging and installing .NET Desktop Runtime, double-clicking the setup file to start the process of installation of ArcGIS Pro.



Click “Next” multiple times to finish the installation process and the program is installed in the path “C:\Program Files\ArcGIS\Pro”.

4. To start the ArcGIS Pro V3.3.0, user needs to input the account and passwords:



2.2 Install InVEST 3.14.2 Workbench:

Due to some tools in the Telecoupling Toolbox ArcGISProV3.3 depending on InVEST model calculator, InVEST workbench need to be download from here (https://storage.googleapis.com/releases.naturalcapitalproject.org/invest/3.14.2/workbench/invest_3.14.2_workbench_win32_x64.exe) and installed in the path “C:\Program Files\InVEST 3.14.2 Workbench”

2.3 Install Python environment

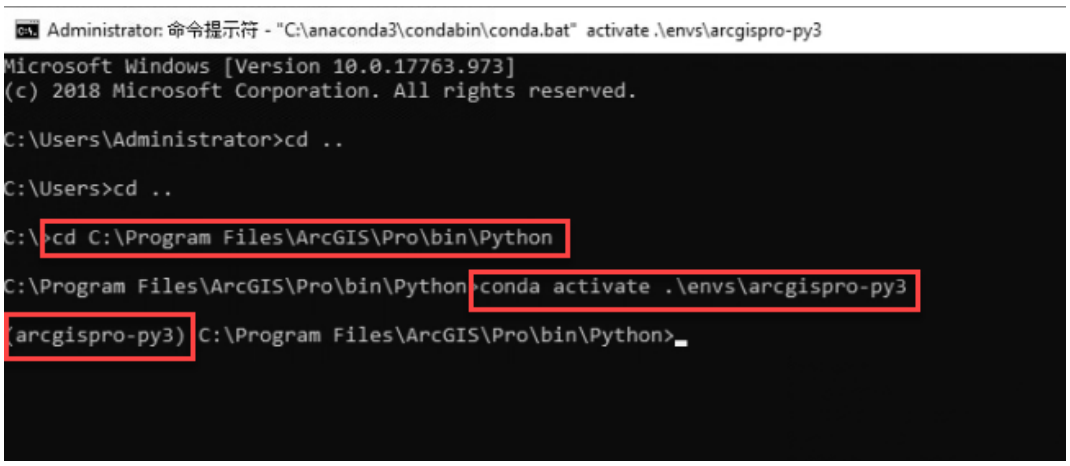
Although ArcGIS Pro provides its Python interpreter and environment as"arcgispro-py3", the GDAL package in this environment can not be utilized by InVEST, due to this version of GDAL is a special version for ArcGIS Pro only. Therefore, a public python needs to be installed and it is highly recommended to download Anaconda in Windows version from here (https://www.anaconda.com/download/success) which includes Python interpreter and some basic Python packages. After installing Anaconda (Here, it is installed in “C:\anaconda3”), the following paths “C:\anaconda3; C:\anaconda3\Scripts; C:\anaconda3\Library\bin” need to be added to the system PATH environment. Then, open the CMD prompt on Windows and type: “conda”, the following output will be displayed below:

```
Microsoft Windows [Version 10.0.17763.973]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>conda
usage: conda-script.py [-h] [-v] [--no-plugins] [-V] COMMAND ...

conda is a tool for managing and deploying applications, environments and packages.

options:
  -h, --help            Show this help message and exit.
  -v, --verbose         Can be used multiple times. Once for detailed output, twice for INFO
 logging, thrice for DEBUG
                        logging, four times for TRACE logging.
  --no-plugins          Disable all plugins that are not built into conda.
  -V, --version         Show the conda version number and exit.

commands:
  The following built-in and plugins subcommands are available.

  COMMAND
    activate            Activate a conda environment.
    build               Build conda packages from a conda recipe.
    clean               Remove unused packages and caches.
    compare             Compare packages between conda environments.
    config              Modify configuration values in .condarc.
    content-trust       Signing and verification tools for Conda
    convert             Convert pure Python packages to other platforms (a.k.a., subdirs).
    create              Create a new conda environment from a list of specified packages.
    deactivate          Deactivate the current active conda environment.
    debug               Debug the build or test phases of conda recipes.
```

Install Python libraries for 3rd party external software:

It is essential to install 3rd party package in the python environment "arcgispro-py3":

- Open CMD, change dictionary to the ArcGIS python path and use conda to activate the python environment.



- Install pygal: you can install this package by using the whl file we prepared.

```
(arcgispro-py3) C:\Program Files\ArcGIS\Pro\bin\Python>pip install  c:\Users\Administrator
\Downloads\pythonpackage_whl\pygal-3.0.4-py2.py3-none-any.whl
```

Then get result:

```
(arcgispro-py3) C:\Program Files\ArcGIS\Pro\bin\Python>pip install  c:\Users\Administrator
\Downloads\pythonpackage_whl\pygal-3.0.4-py2.py3-none-any.whl
Processing c:\users\administrator\downloads\pythonpackage_whl\pygal-3.0.4-py2.py3-none-any
.whl
Requirement already satisfied: importlib-metadata in c:\program files\arcgis\pro\bin\pytho
n\envs\arcgispro-py3\lib\site-packages (from pygal==3.0.4) (7.0.1)
Requirement already satisfied: zipp>=0.5 in c:\program files\arcgis\pro\bin\python\envs\ar
cgispro-py3\lib\site-packages (from importlib-metadata->pygal==3.0.4) (3.17.0)
Installing collected packages: pygal
Successfully installed pygal-3.0.4
```

Install earthengine-api: you can install this package by using the whl file we prepared.

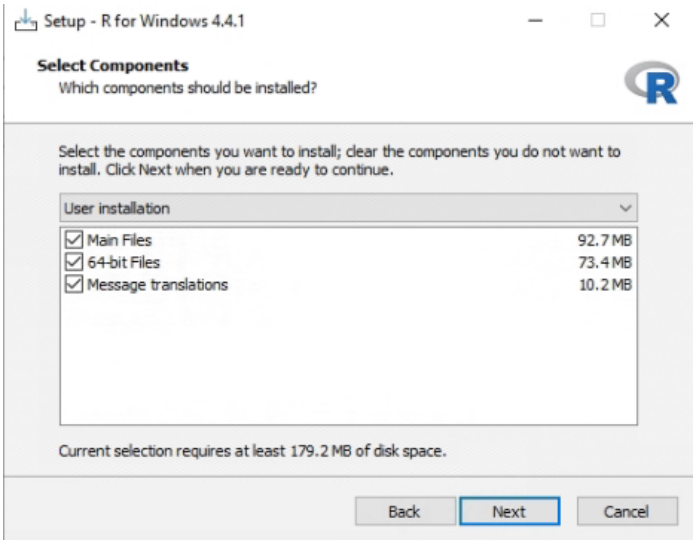
```
(arcgispro-py3) C:\Program Files\ArcGIS\Pro\bin\Python>pip install  c:\Users\Administrator
\Downloads\pythonpackage_whl\earthengine_api-0.1.406-py3-none-any.whl
Processing c:\users\administrator\downloads\pythonpackage_whl\earthengine_api-0.1.406-py3-
none-any.whl
Collecting google-cloud-storage (from earthengine-api==0.1.406)
  Using cached google_cloud_storage-2.17.0-py2.py3-none-any.whl.metadata (6.6 kB)
Collecting google-api-python-client>=1.12.1 (from earthengine-api==0.1.406)
  Downloading google_api_python_client-2.133.0-py2.py3-none-any.whl.metadata (6.7 kB)
Collecting google-auth>=1.4.1 (from earthengine-api==0.1.406)
  Downloading google_auth-2.30.0-py2.py3-none-any.whl.metadata (4.7 kB)
Collecting google-auth-httplib2>=0.0.3 (from earthengine-api==0.1.406)
```

Then get result:

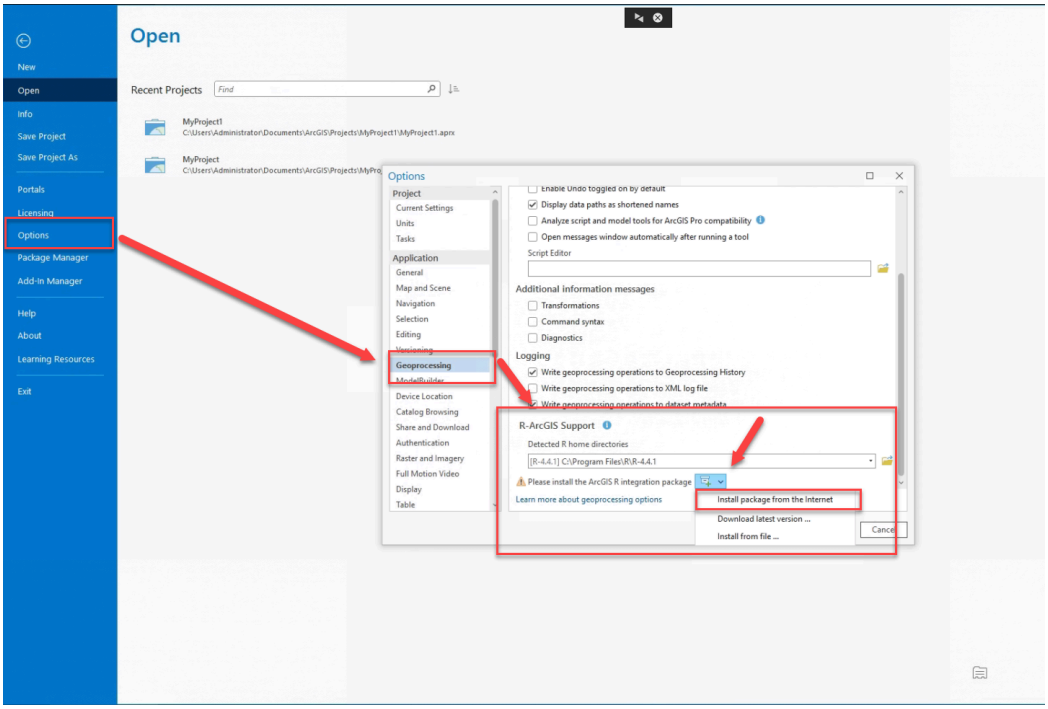
```
Installing collected packages: uritemplate, pyasn1, proto-plus, httplib2, googleapis-commo
n-protos, google-crc32c, rsa, pyasn1-modules, google-resumable-media, google-auth, google-
auth-httplib2, google-api-core, google-cloud-core, google-api-python-client, google-cloud-
storage, earthengine-api
Successfully installed earthengine-api-0.1.406 google-api-core-2.19.0 google-api-python-cl
ient-2.133.0 google-auth-2.30.0 google-auth-httplib2-0.2.0 google-cloud-core-2.4.1 google-
cloud-storage-2.17.0 google-crc32c-1.5.0 google-resumable-media-2.7.1 googleapis-common-pr
otos-1.63.1 httplib2-0.22.0 proto-plus-1.23.0 pyasn1-0.6.0 pyasn1-modules-0.4.0 rsa-4.9 ur
itemplate-4.1.1

(arcgispro-py3) C:\Program Files\ArcGIS\Pro\bin\Python>
```

2.4 Install R environment

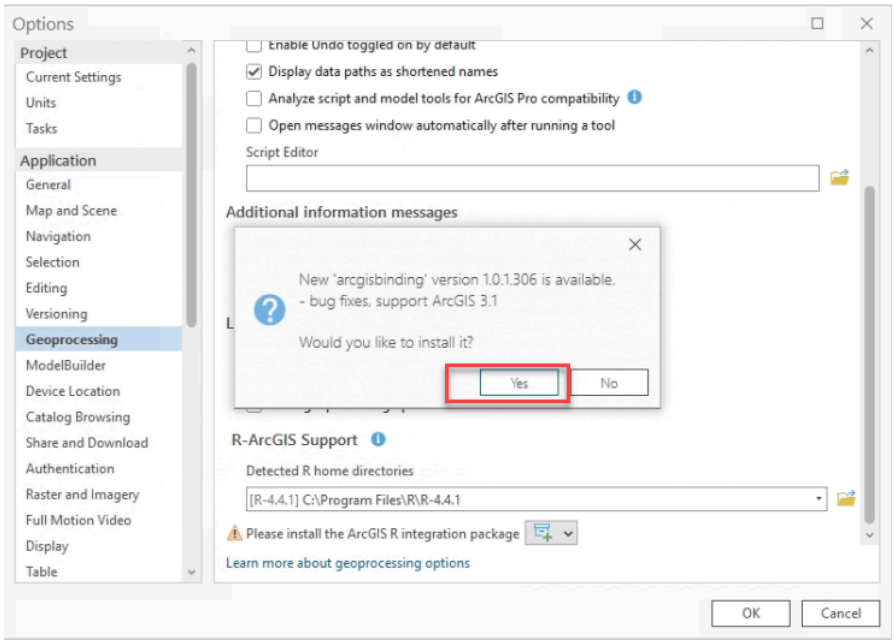
Download R-4.4.1-win.exe (64bits) from here (https://cran.r-project.org/bin/windows/base/) and install it in the path of “C:\Program Files\R\R-4.4.1”.



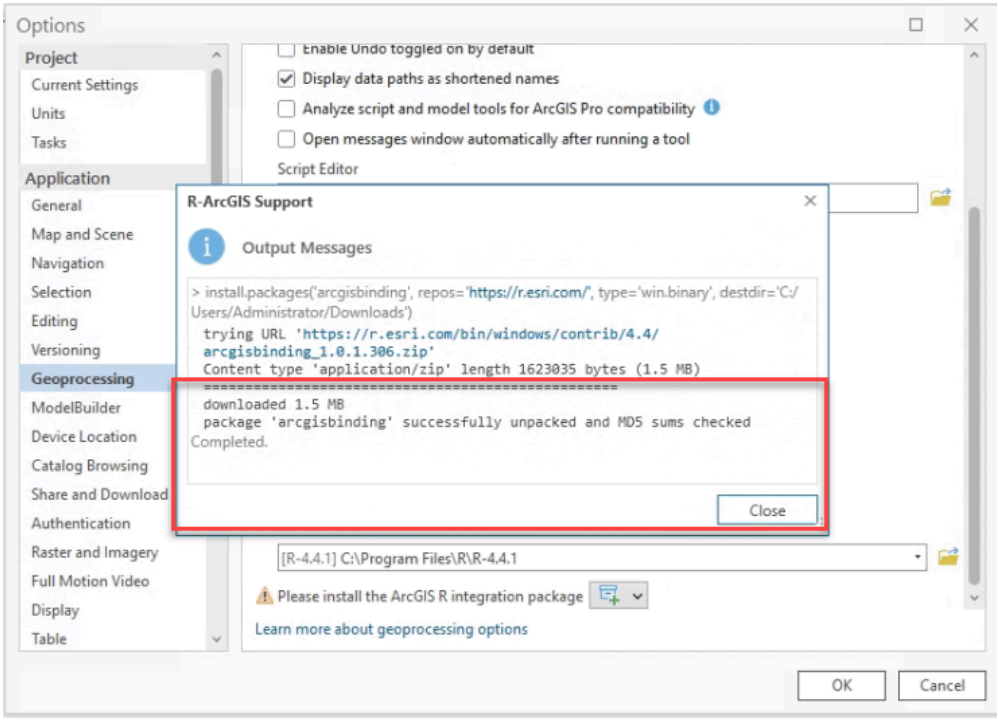
Open ArcGIS Pro V3.3.0, and click “Options”, then select “Geoprocessing” and you will find the R-ArcGIS Support options. Then you need to install the ArcGIS R integration pacakge as below:

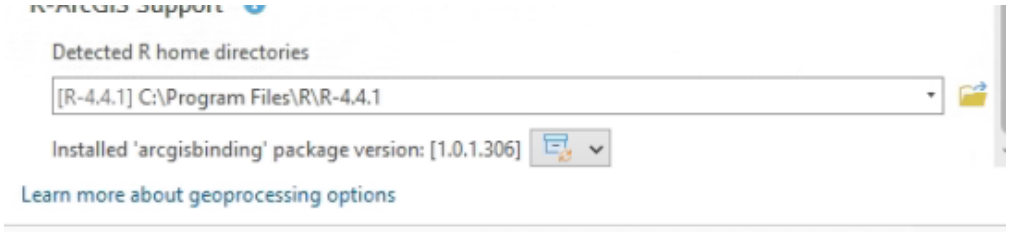


You might get a dialog like this and click “Yes”

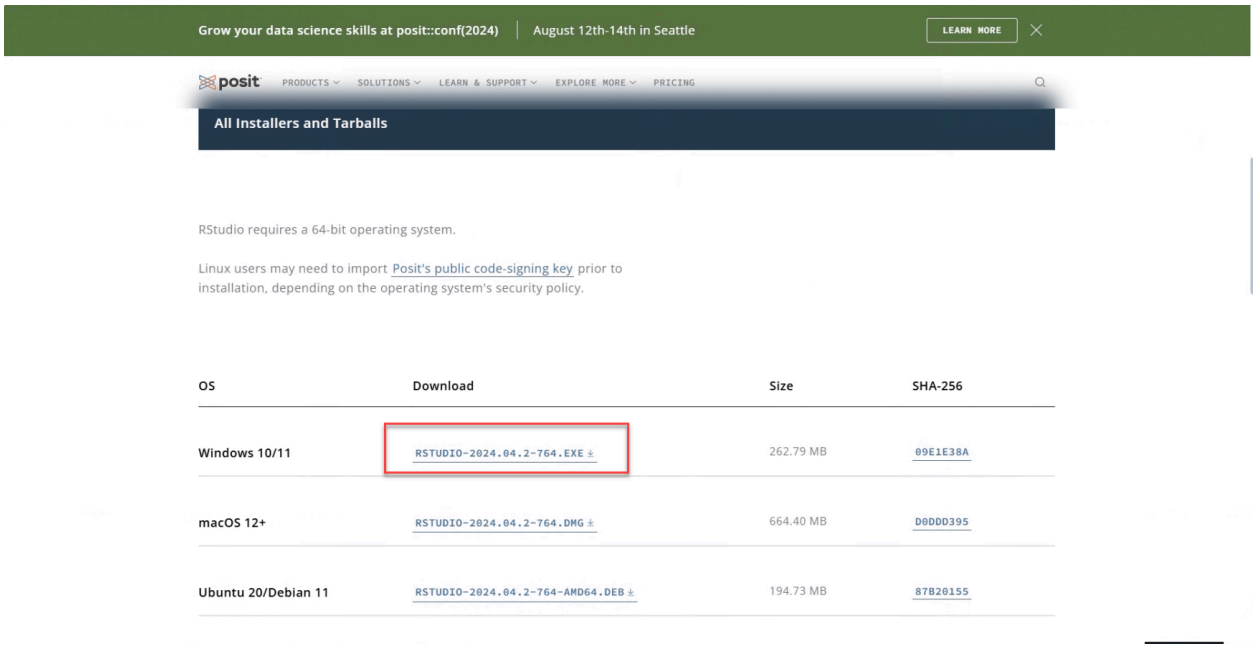


When completed, it will show like below:

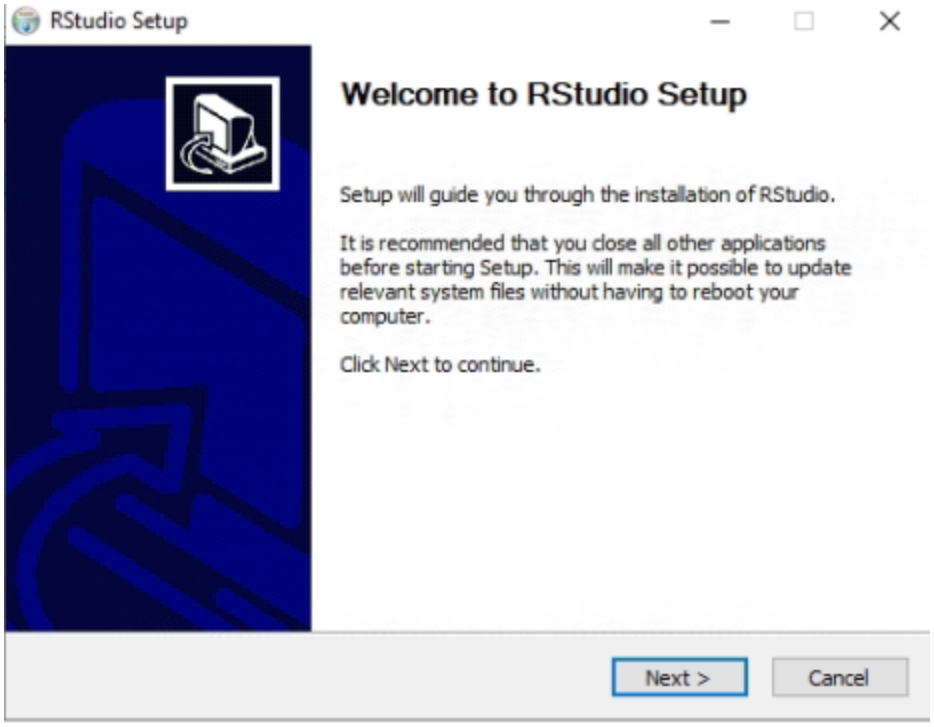


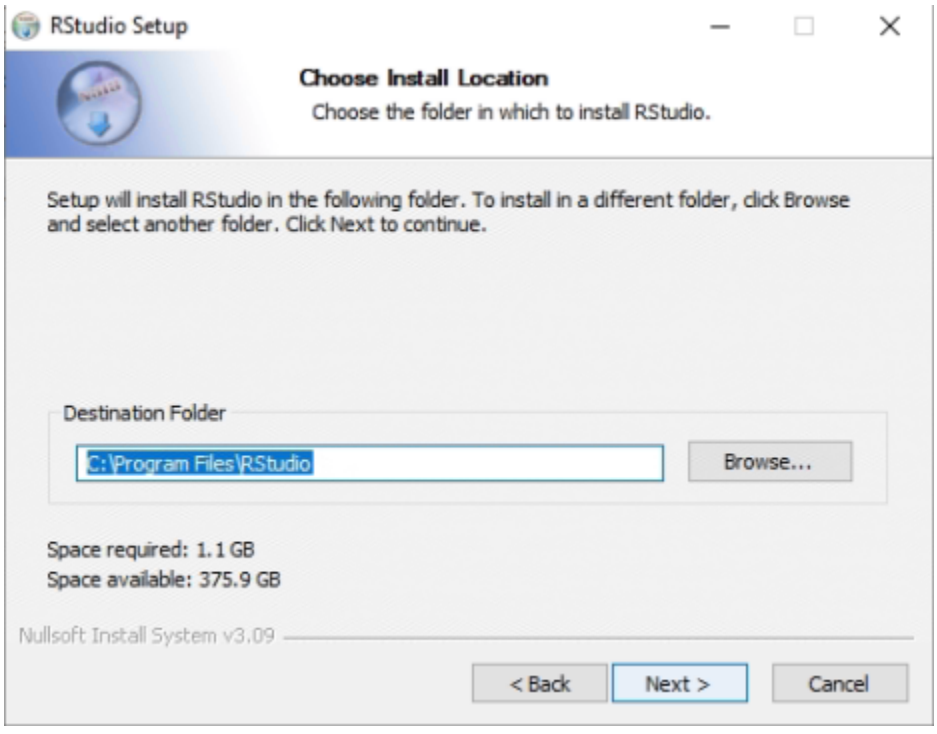


Due to some scripts needs some extra R packages, it is necessary to install them via R interface. For this step, it is highly recommended to download Rstuido and install it at first. You may find the Rstudio installer at here ("https://posit.co/download/rstudio-desktop").

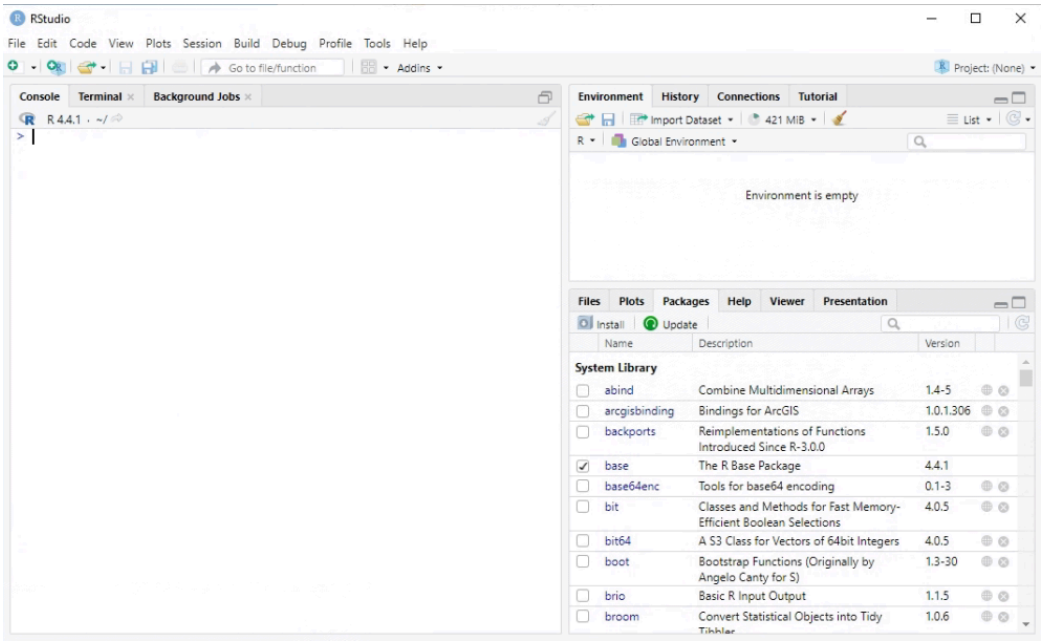


When you complete the downloading process, double-click the Rstudio installer:

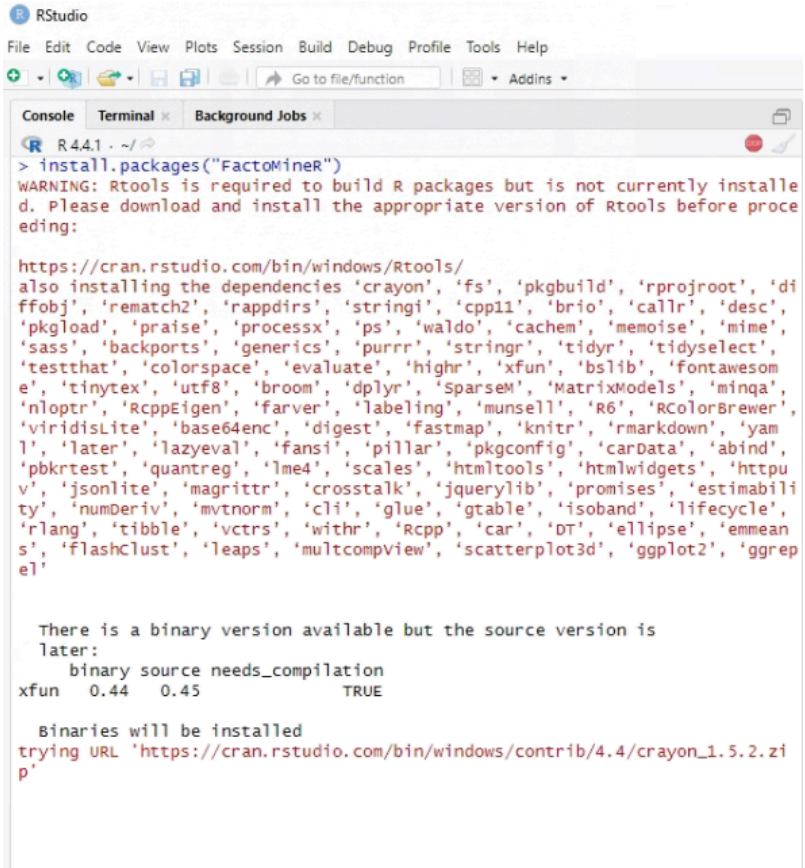




Open the Rstuido and start to install the necessary R libraries:



- FactoMineR:



Waiting for the installation process to complete, you can check by:

```
package 'leaps' successfully unpacked and MD5 sums checked
package 'multcompView' successfully unpacked and MD5 sums checked
package 'scatterplot3d' successfully unpacked and MD5 sums checked
package 'ggplot2' successfully unpacked and MD5 sums checked
package 'ggrepel' successfully unpacked and MD5 sums checked
package 'FactoMineR' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\Administrator\AppData\Local\Temp\RtmpkTBLrZ\downloaded_pac
kages
> library(FactoMineR)
>
```

- dplyr

```
> install.packages("dplyr")
WARNING: Rtools is required to build R packages but is not currently installe
d. Please download and install the appropriate version of Rtools before proce
eding:

https://cran.rstudio.com/bin/windows/Rtools/
trying URL 'https://cran.rstudio.com/bin/windows/contrib/4.4/dplyr_1.1.4.zip'
Content type 'application/zip' length 1581291 bytes (1.5 MB)
```

Waiting for the installation process to complete, you can check by:

```
> library(dplyr)

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union

>
```

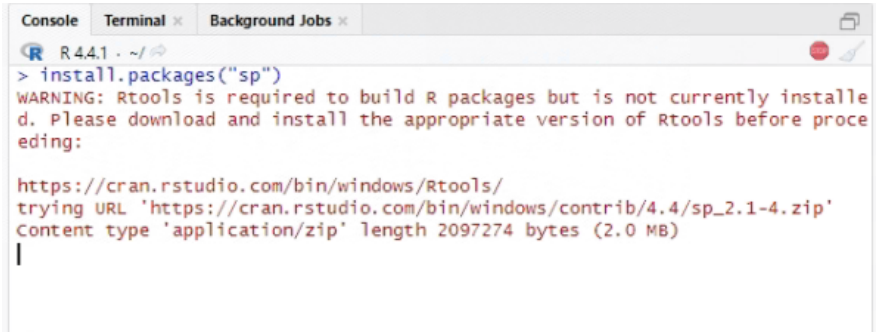
- missMDA

```
Console  Terminal  Background Jobs
R 4.4.1 · ~/
> install.packages("missMDA")
WARNING: Rtools is required to build R packages but is not currently installe
d. Please download and install the appropriate version of Rtools before proce
eding:

https://cran.rstudio.com/bin/windows/Rtools/
also installing the dependencies 'bit', 'prettyunits', 'bit64', 'progress',
'ucminf', 'clipr', 'vroom', 'tzdb', 'ordinal', 'forcats', 'hms', 'readr', 'sh
ape', 'pan', 'jomo', 'haven', 'glmnet', 'mitml', 'iterators', 'mice', 'doPara
llel', 'foreach'

trying URL 'https://cran.rstudio.com/bin/windows/contrib/4.4/bit_4.0.5.zip'
Content type 'application/zip' length 1147732 bytes (1.1 MB)
```

Waiting for the installation process to complete, you can check by:

```
package 'glmnet' successfully unpacked and MD5 sums checked
package 'mitml' successfully unpacked and MD5 sums checked
package 'iterators' successfully unpacked and MD5 sums checked
package 'mice' successfully unpacked and MD5 sums checked
package 'doParallel' successfully unpacked and MD5 sums checked
package 'foreach' successfully unpacked and MD5 sums checked
package 'missMDA' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\Administrator\AppData\Local\Temp\RtmpkTBLrZ\downloaded_pac
kages
> library(missMDA)
>
```

- sp



Waiting for the installation process to complete, you can check by:

```
package 'sp' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\Administrator\AppData\Local\Temp\RtmpkTBLrZ\downloaded_packa
ges
> library(sp)
>
```

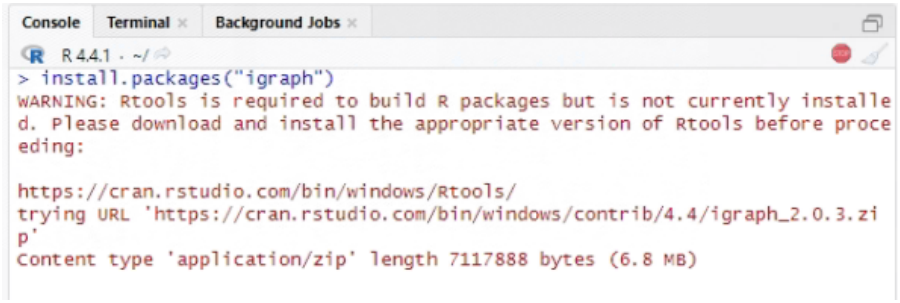
- RColorBrewer

```
> install.packages("RColorBrewer")
WARNING: Rtools is required to build R packages but is not currently installe
d. Please download and install the appropriate version of Rtools before proce
eding:

https://cran.rstudio.com/bin/windows/Rtools/
trying URL 'https://cran.rstudio.com/bin/windows/contrib/4.4/RColorBrewer_1.1
-3.zip'
Content type 'application/zip' length 54471 bytes (53 KB)
downloaded 53 KB
```

Waiting for the installation process to complete, you can check by:

```
package 'RColorBrewer' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
        C:\Users\Administrator\AppData\Local\Temp\RtmpkTBLrZ\downloaded_packa
ges
> library(RColorBrewer)
>
```

- igraph

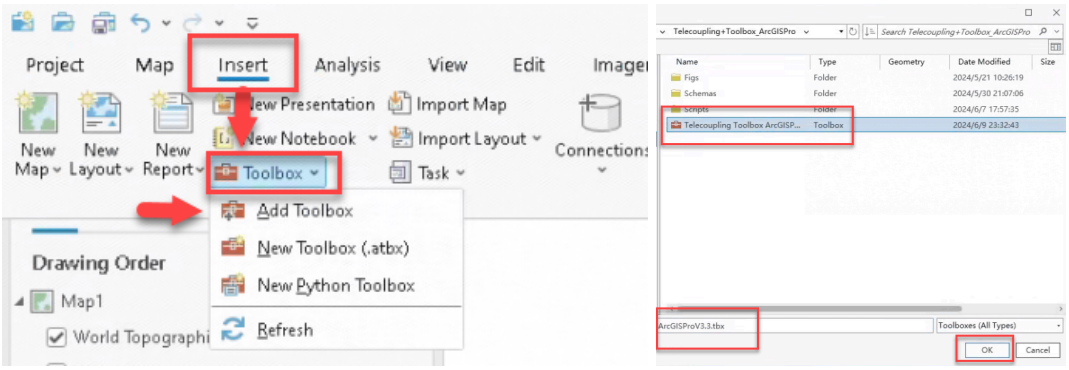


Waiting for the installation process to complete, you can check by:

2.5 Install the Telecoupling Toolbox ArcGISProV3.3

To add the "Telecoupling+Toolbox" to ArcGIS Pro Version 3.3, follow these steps:

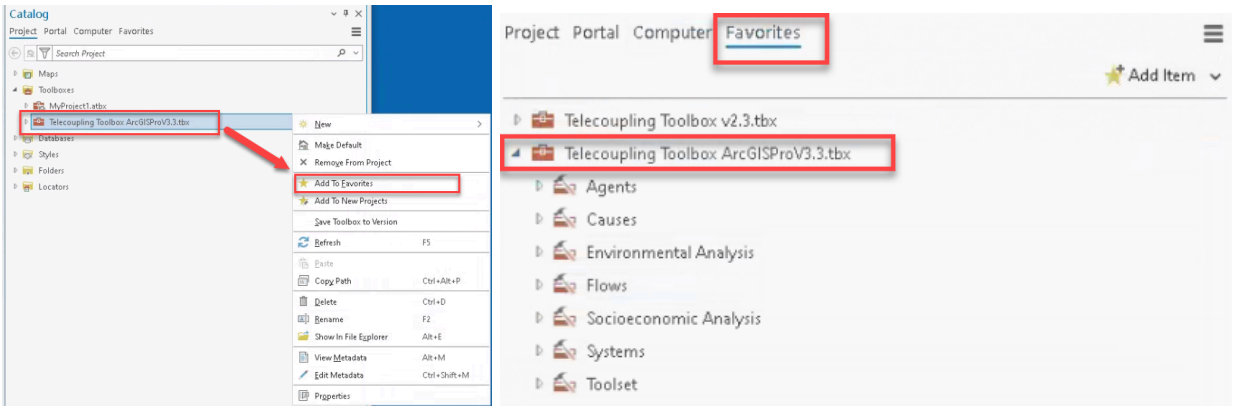
1. Open ArcGIS Pro Version 3.3.
2. Click on the "Insert" tab in the ribbon.
3. Select "Toolbox" from the available options.
4. Choose "Add Toolbox" from the dropdown menu.
5. In the file dialog, locate and select the file named "Telecoupling+Toolbox ArcGISPROV3.3.tbx".
6. Click "OK" to add the toolbox to your ArcGIS Pro session.



Once added, the "Telecoupling+Toolbox" will be visible in the catalog panel. To make it more accessible:

- You can select the toolbox in the catalog panel.
- Right-click on the selected toolbox.
- Choose "Add to Favorites" from the context menu.

This will add the toolbox to the favorites bar for quick access in future sessions. Utilizing the scripts within the toolbox will require you to follow the specific instructions provided for each script to ensure proper execution and results.



To utilize the scripts within the "Telecoupling+Toolbox" in ArcGIS Pro Version 3.3, follow these steps:

1. Locate the toolbox in the catalog panel or the favorites bar.
2. Expand the toolbox to reveal its contents.
3. Identify the relevant script category, such as "Agents".
4. Click on the "Agents" category to expand it and display the available scripts.
5. Right-click on the specific script you wish to execute.
6. From the context menu, select "Open" to launch the script.

By doing so, the script will open in a new window, where you can configure its parameters and initiate the execution process. Ensure that you have the necessary data and settings configured according to the script's requirements for successful execution.

3. TUTORIALS

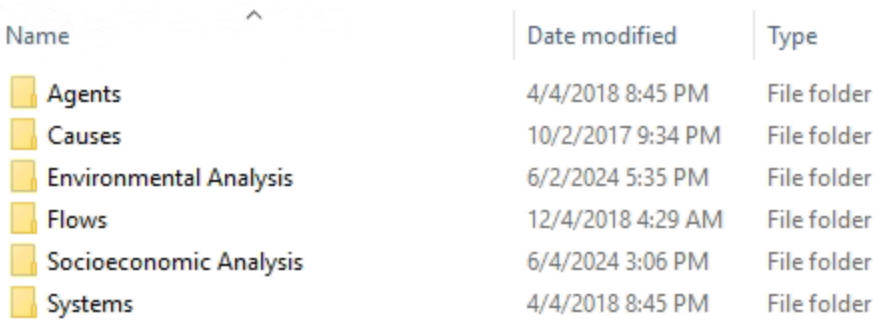
The following tutorials will guide you through examples of potential applications of each script tool using the sample data provided with the toolbox (SampleDataTelecoupling+Toobox_ArcGISProV3.3.zip). All ESRI basemaps are by default, typically found in most online web applications (e.g. Google Maps, Bing Maps). Suppose you decide to use your background administrative layer that is in a different coordinate system. In that case, ArcGIS will automatically re-project any additional layers (including output from geoprocessing tools) on-the-fly to the coordinate system of the first layer in your map.

Before using the toolbox, it is essential to initiate a New project via the ArcGIS Pro, here for the tutorials, we create a new project as “Myproject1” and store it in the path of “C:\Users\Administrator\Dcouments\ArcGIS\Projects\MyProject1”.

NOTE: Although ArcGIS projects on-the-fly to avoid projection mismatch, we always encourage the user to have all layers in the same coordinate system appropriate for the scale of analysis and case study.
NOTE: some basic level of proficiency in ArcGIS Pro is necessary to better follow the tutorial examples.

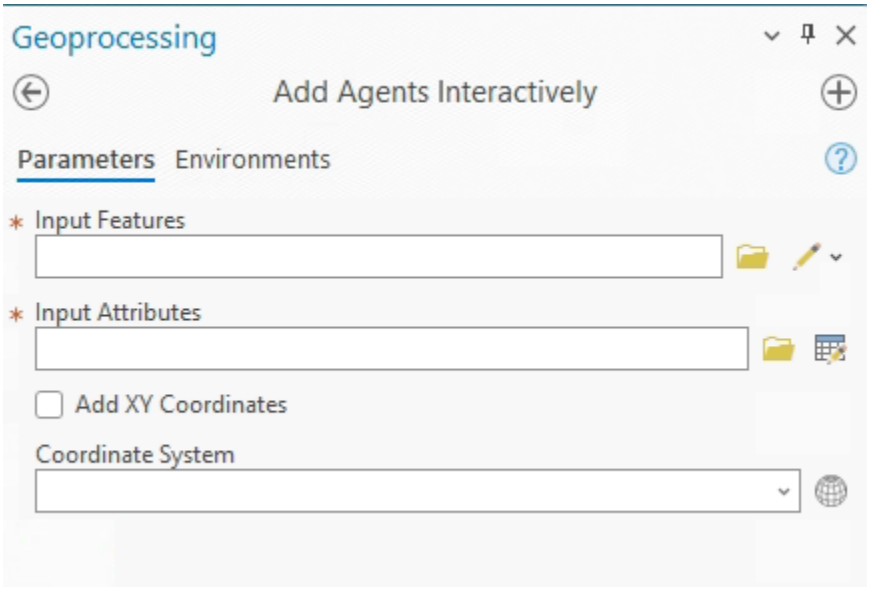
3.1 SAMPLE DATASET

The sample dataset provided with the telecoupling toolbox has data on six different types of telecoupling: wildlife transfer, tourism (eco-tourism), agricultural trade, industrial trade, conservation subsidies, and information dissemination. Inside the SampleDataTelecoupling+Toobox_ArcGISProV3.3 folder, you will also find several other subfolders divided by topic which will be used in some of the following tutorials.
DISCLOSURE ON DATA USAGE: the sample datasets were either partially modified, or their format changed in some cases from the original datasets to protect privacy and sensitive data when deemed appropriate. Use the sample datasets for learning purposes only and under no circumstances data should be used to inform any policy. Please refer to the Telecoupling Toolbox license agreement for more details.



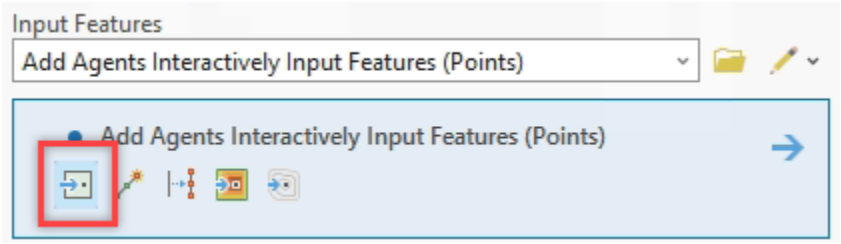
3.2 AGENTS TOOLSET

3.2.1 Add Agents Interactively

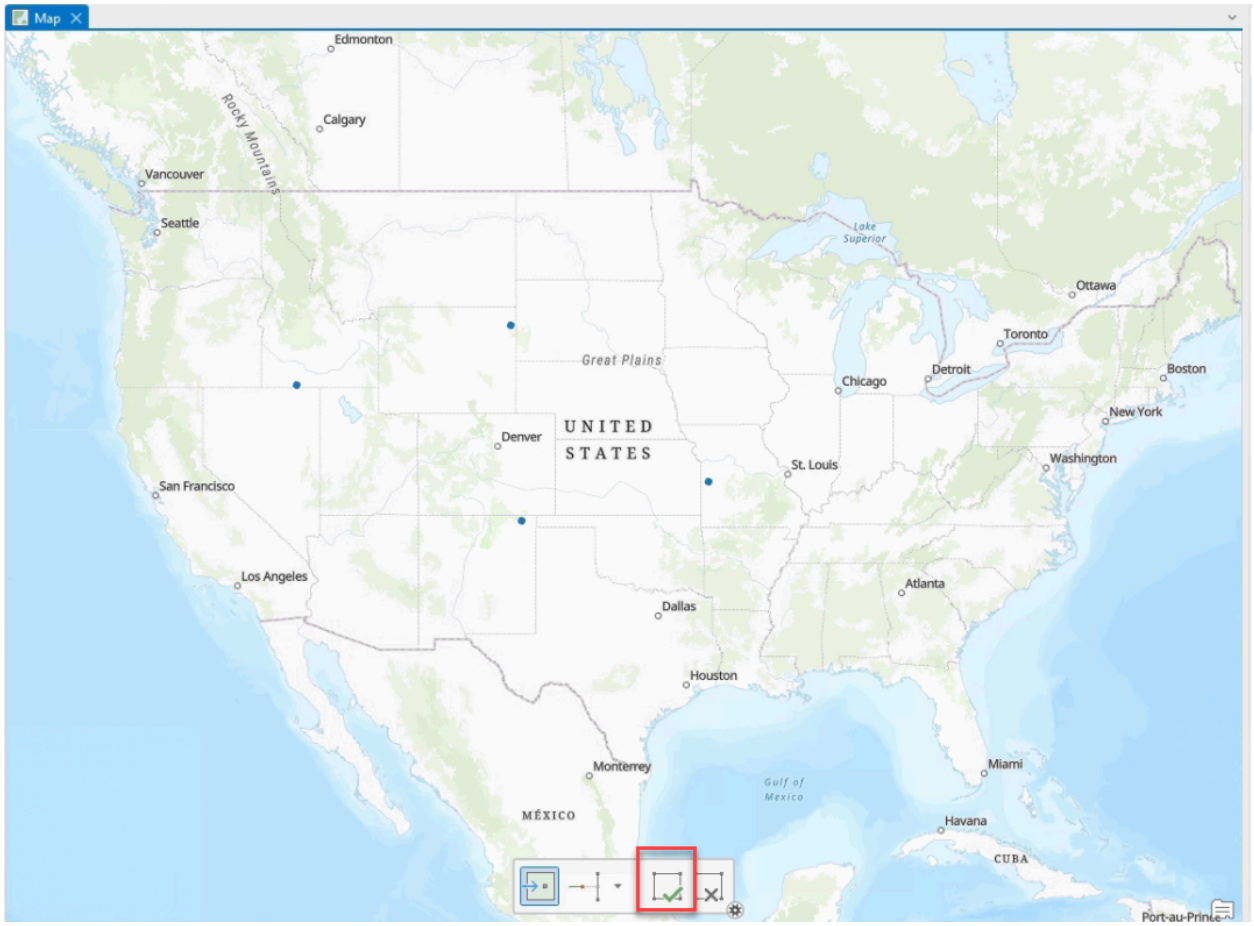


Right click the script and open it

- Click  to create new features in the current map to use as input
- Select “Points” and Move the mouse cursor over the map and you should see points ready to be placed.

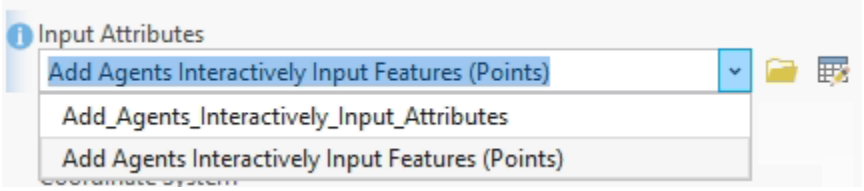


- Then, click on the map to mark the position your agents down.

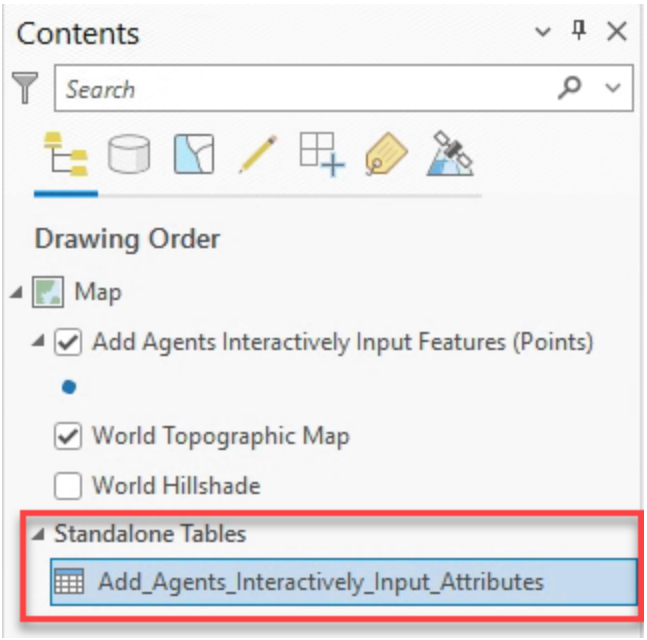


And then, you need to click the button in red frame to finshi,

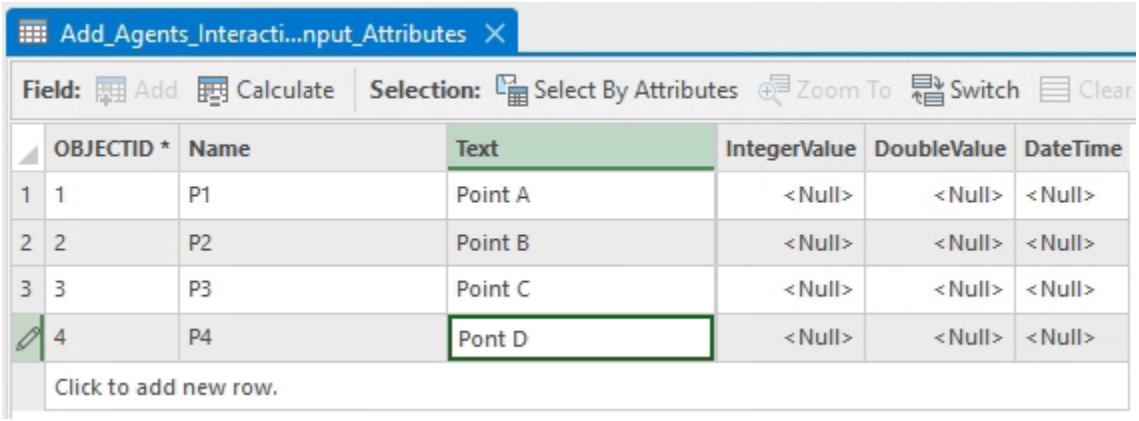
- Select the feature layer and Click  to create an attribute table



- You will get a table in the “Contents” tab and need to open it by right click and select “Open”



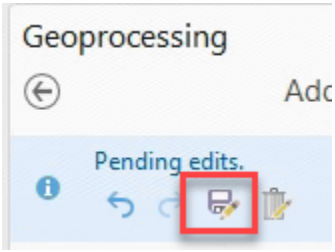
- In the opened table, you can input the description in “Name” or/And “Text” column



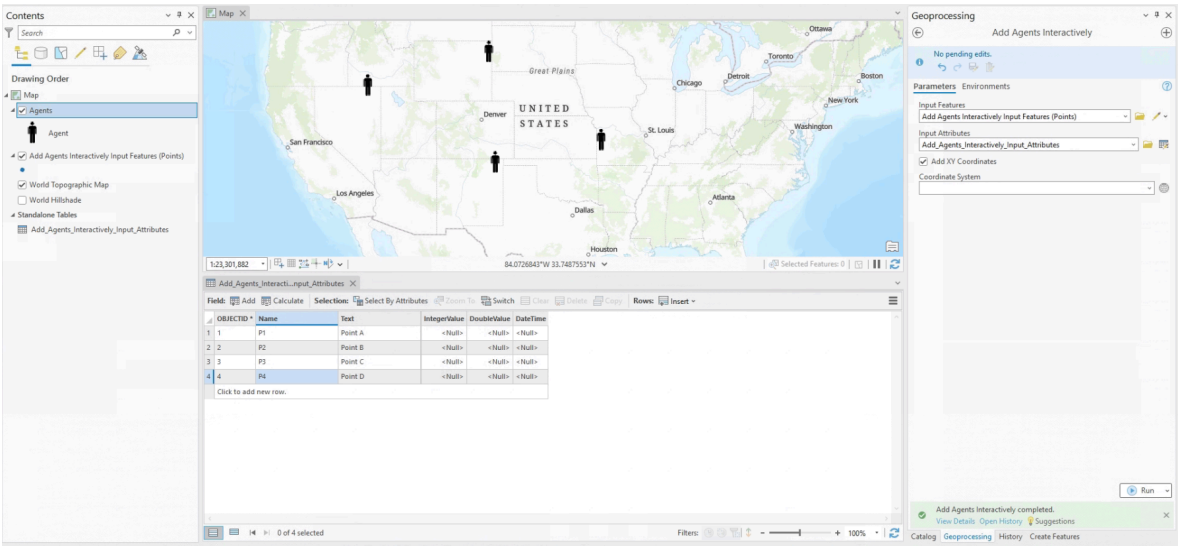
	OBJECTID *	Name	Text	IntegerValue	DoubleValue	DateTime
1	1	P1	Point A	<Null>	<Null>	<Null>
2	2	P2	Point B	<Null>	<Null>	<Null>
3	3	P3	Point C	<Null>	<Null>	<Null>
	4	P4	Pont D	<Null>	<Null>	<Null>

Click to add new row.

You need to click save button to save the editing table:



- Then, select the “Add XY Coordinates” as optional and run button.
- You will get the final results as below:

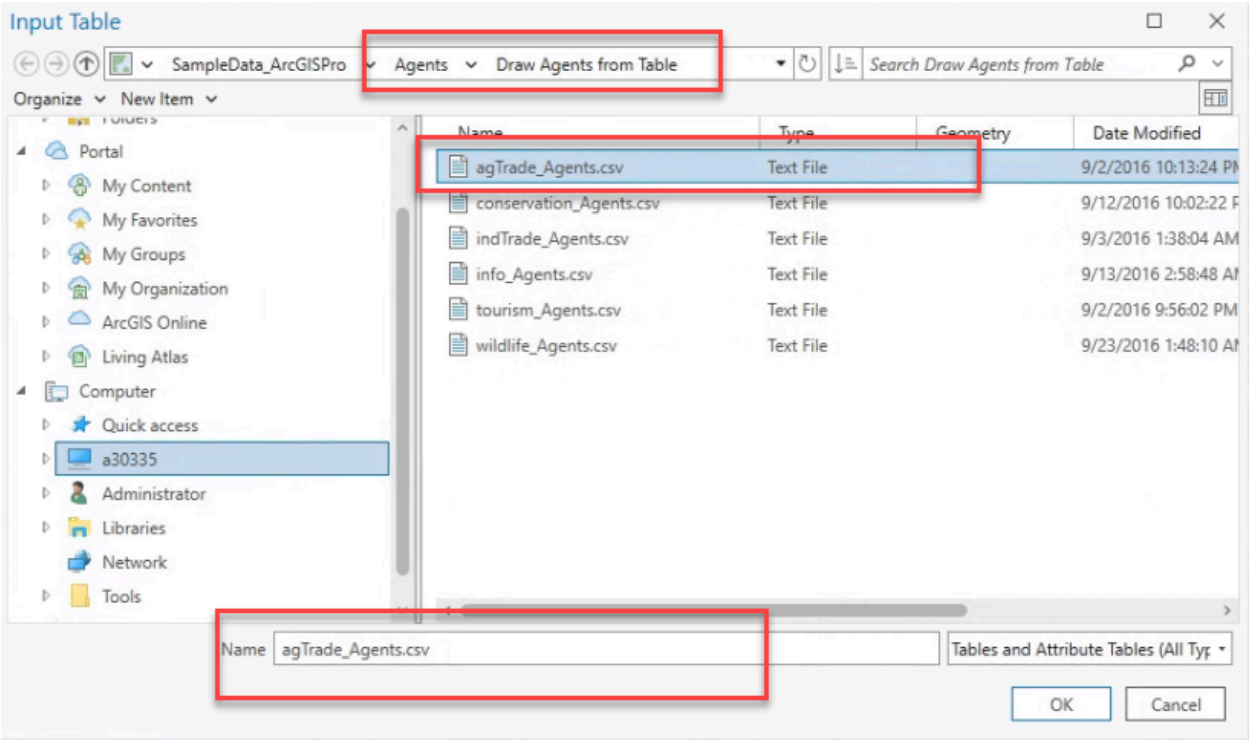


- Coordinate System: can be an optional selection and just keep it empty.

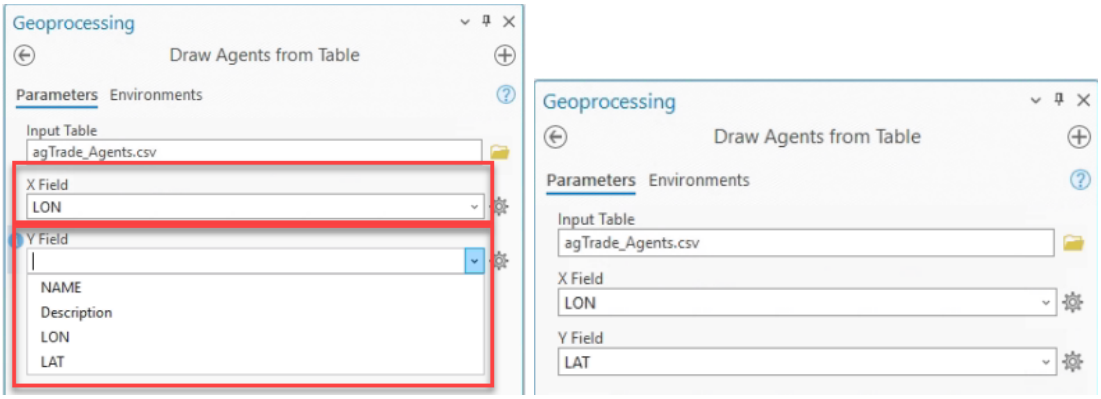
3.2.2 Draw Agents from Table

Right click the script and open it

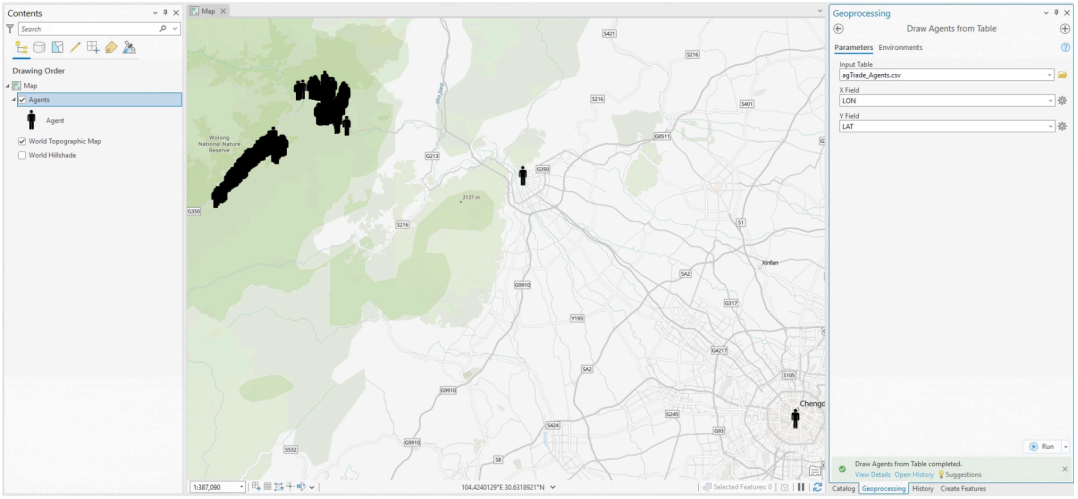
- Click  and select the input table. In this example, we selected the table as “agTrade_Agents.csv” from the subfolder of “Agents” in the sample datasets.



- Then, select X Field and Y Field by picking the value of the droplist.



- Click Run button and get results as below:

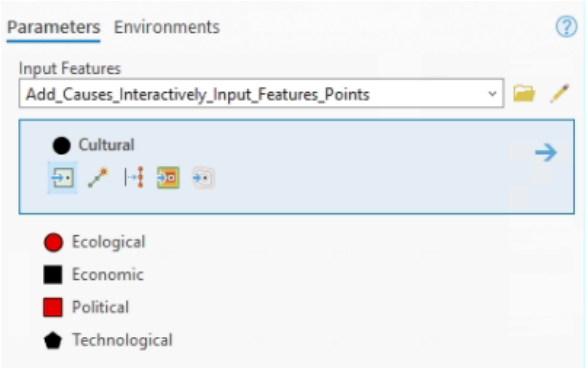


3.3 Causes

3.3.1 Add Causes Interactively

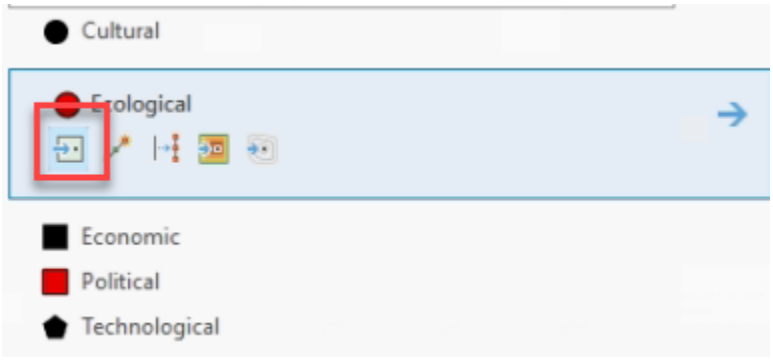
Right click the script and open it

- Click  to create new features in the current map to use as input

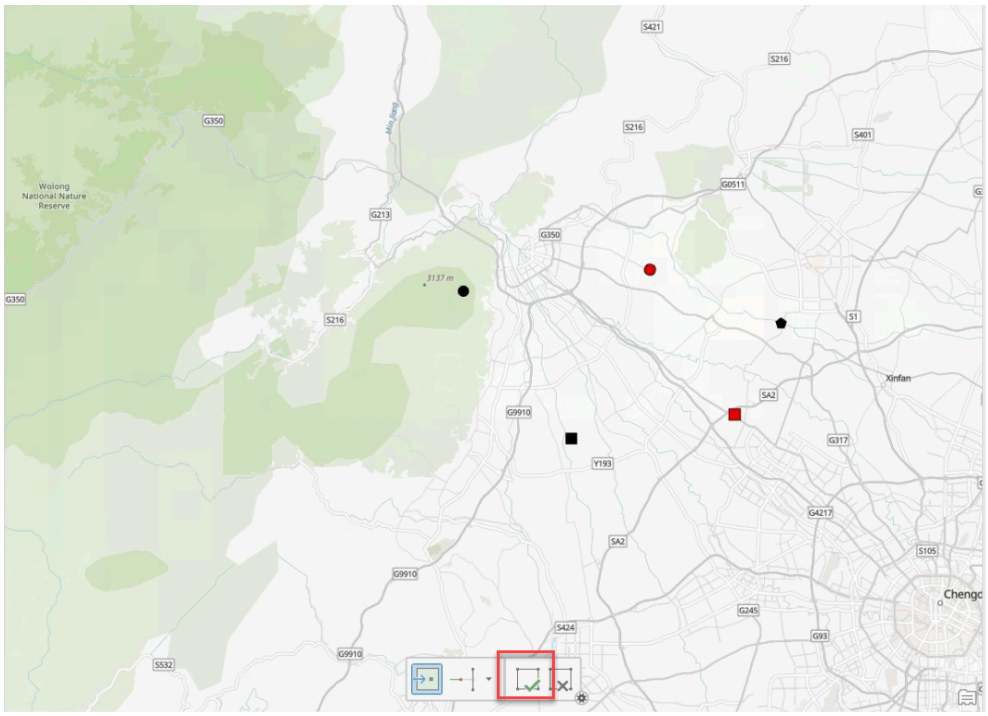


Different categories are represented by different symbols.

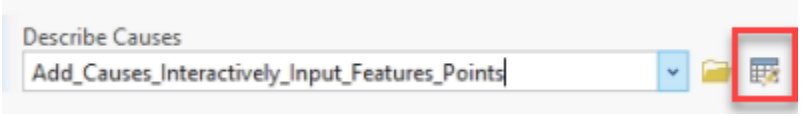
- Select  from different categories and mark it in the map.



- When completing the marking step, please click finish button in the map.

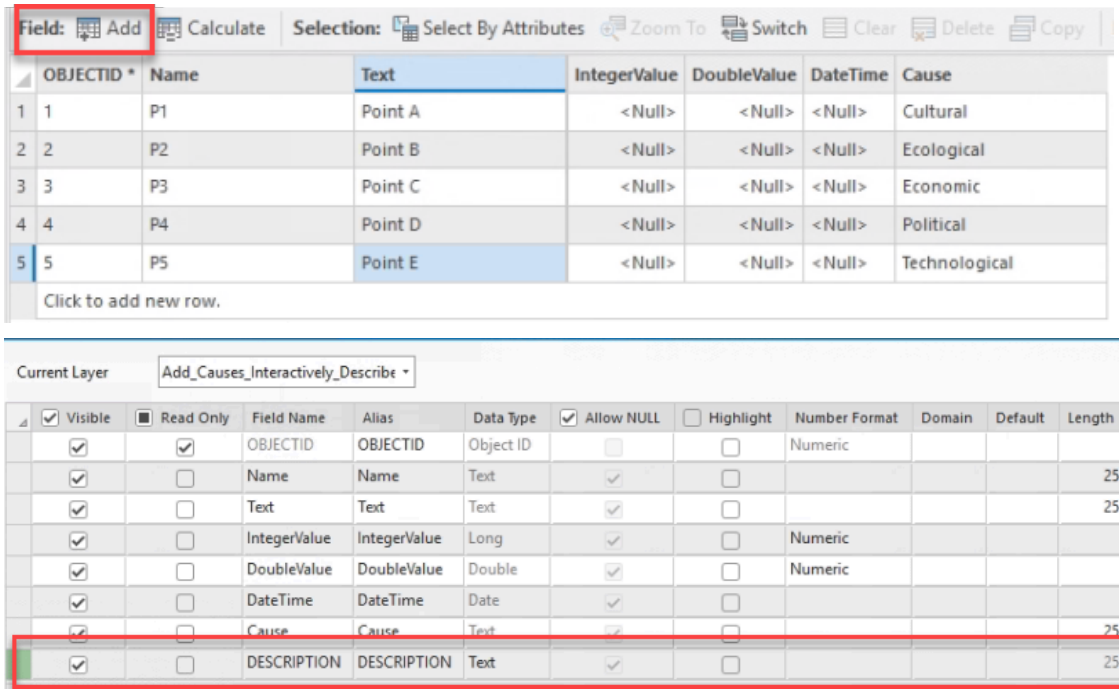


- Select “Describe Causes” in the droplist and click  to create table.

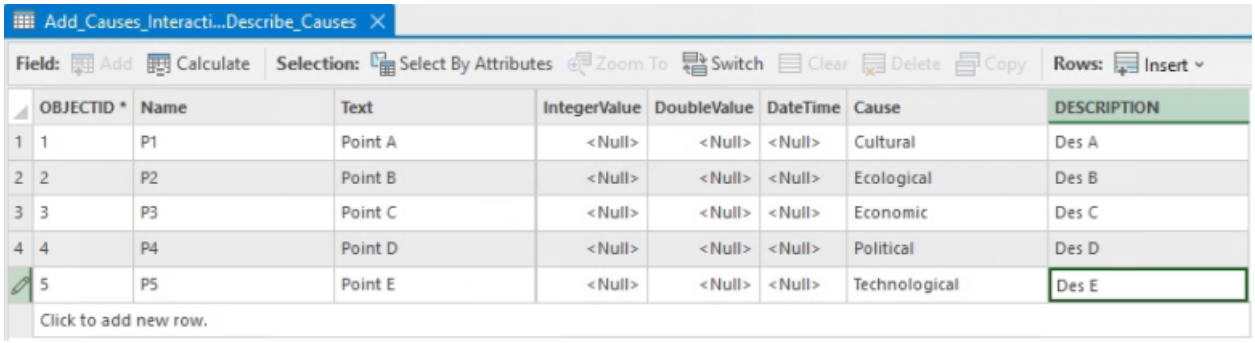


- Right click the created table and click “open”

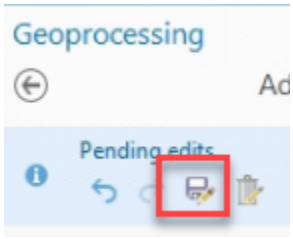
- Click “Add” to add new field as “DESCRIPTION”, then close it and save.



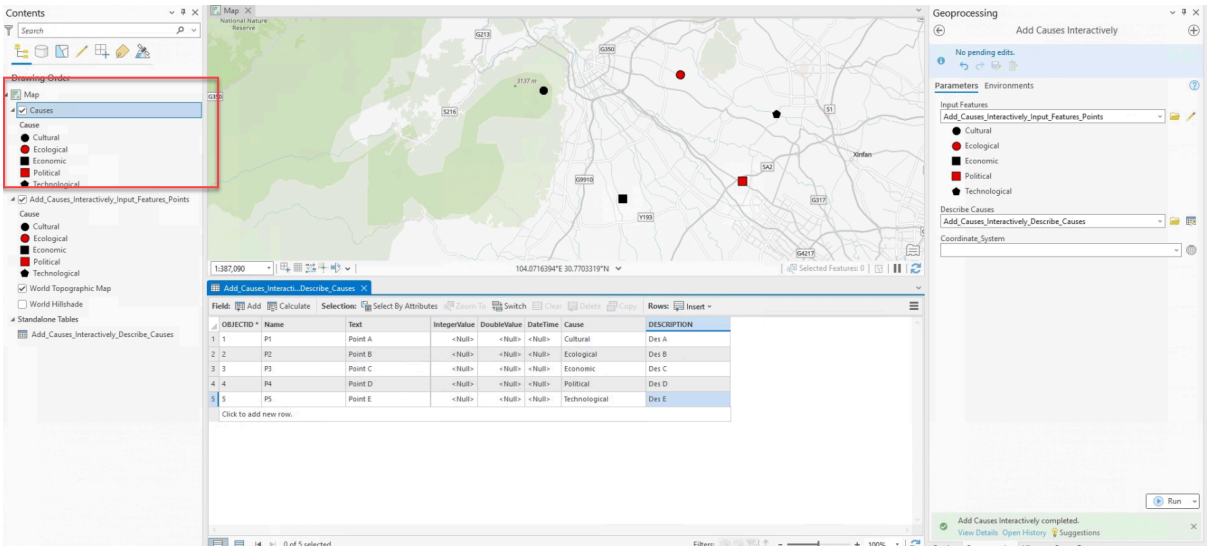
- Input description text into the table as below:



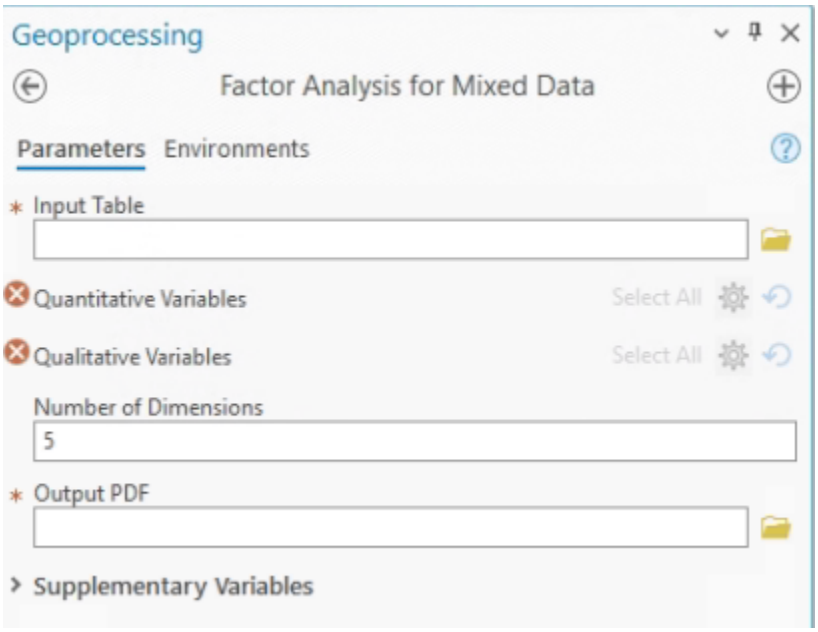
- Then to click save to save the editing.



- Click “Run” and keep the “Coordinate_System” empty as default. And the result shows here: The new layer as “Causes” will be created:



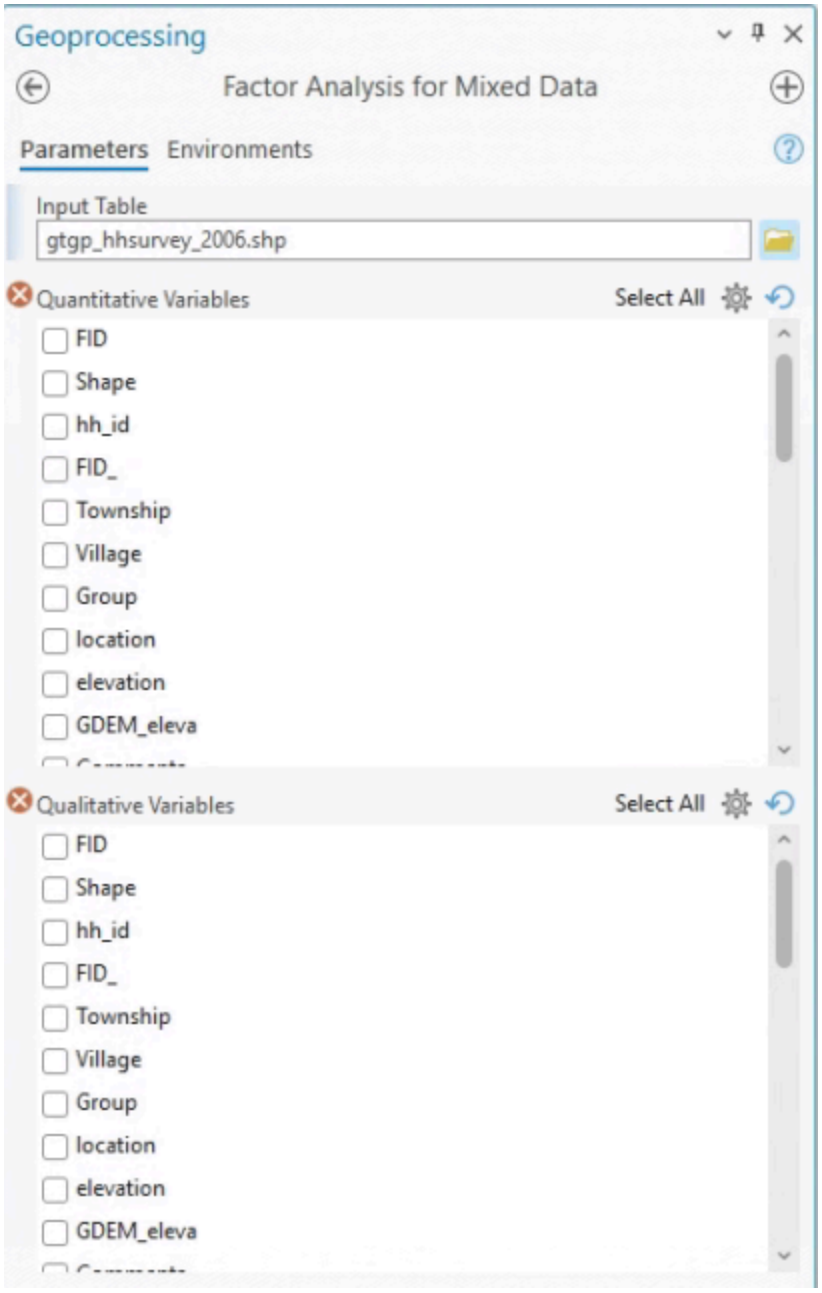
3.3.2 Factor Analysis for Mixed Data



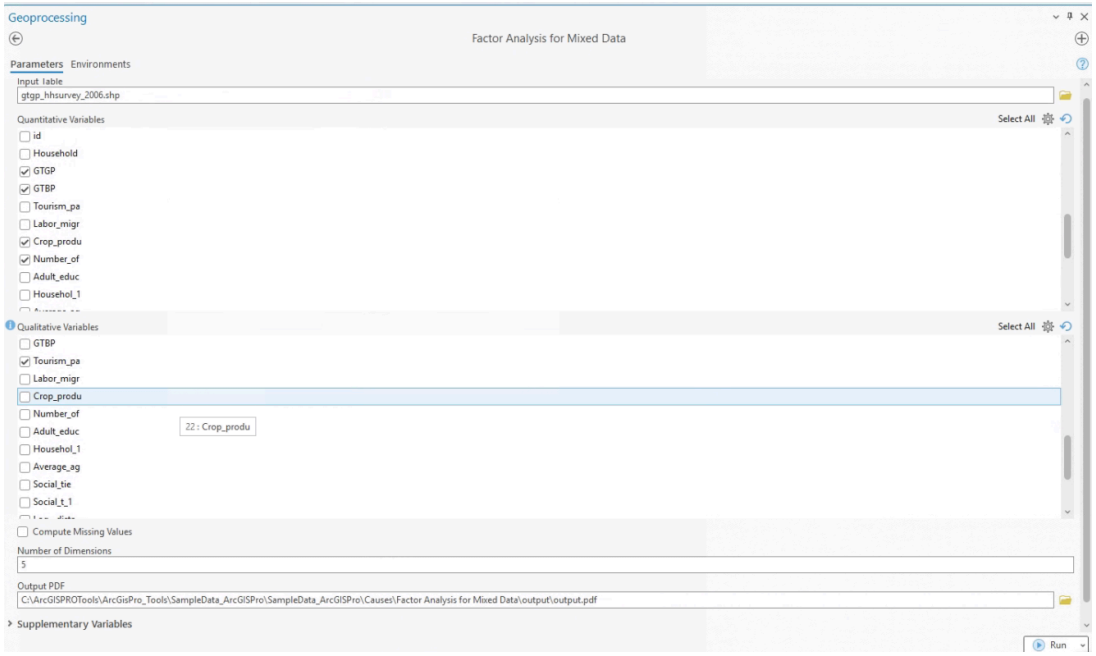
Note: For “Quantitative Variables” and “Qualitative Variables”, ONLY after the input the “Input Table”, you can select value from the list

Right click the script and open it

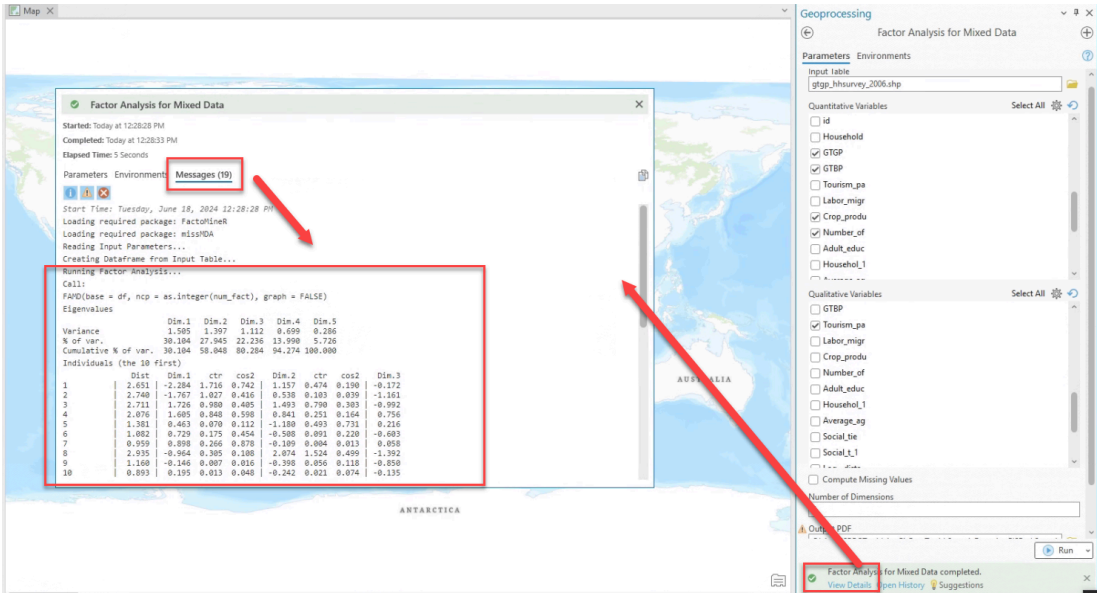
- Click  and select the input Table.. In this example, we selected the file as “gtgp_hhsurvey_2006.shp” from the subfolder of “Causes/Factor Analysis for Mixed Data” in the sample datasets. Then you will see the lists for “Quantitative Variables” and “Qualitative Variables”.



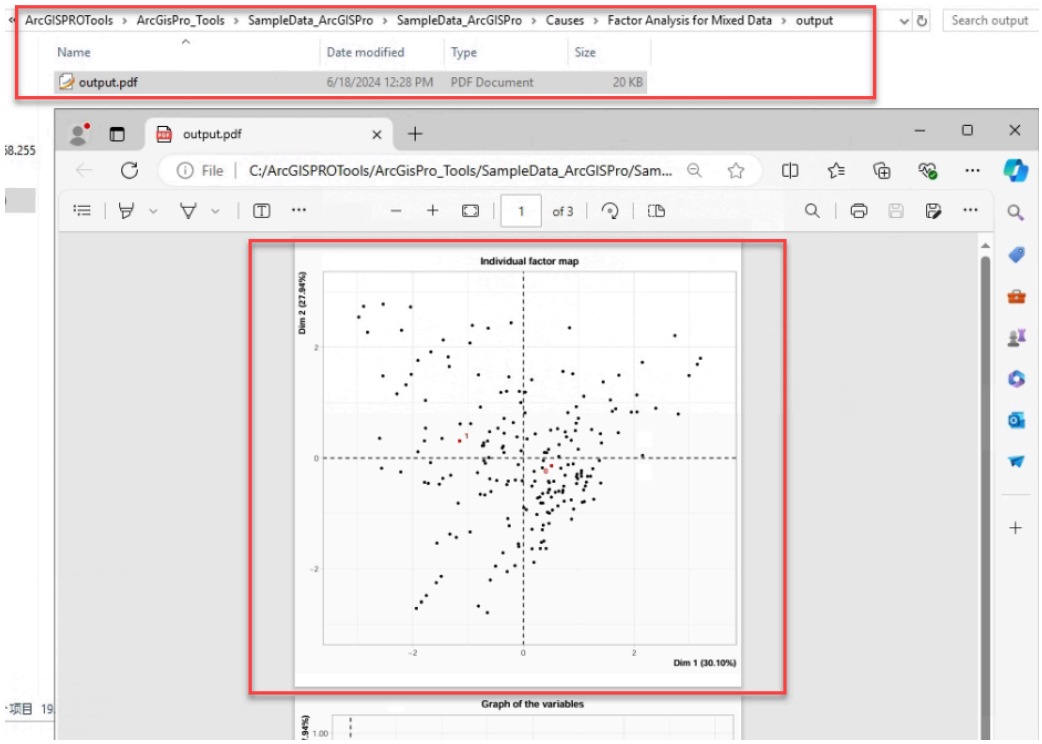
- For “Quantitative Variables”, select “GTGP”, “GTBP”, “Crop_produ”, and “Number_of”.
- For “Qualitative Variables”, select “Tourism_pa”
- Check the “Compute Missing Values”
- Input “Output PDF” path as “/Causes\Factor Analysis for Mixed Data\output\output.pdf ”
- Keep other parameters as default and it looks like:



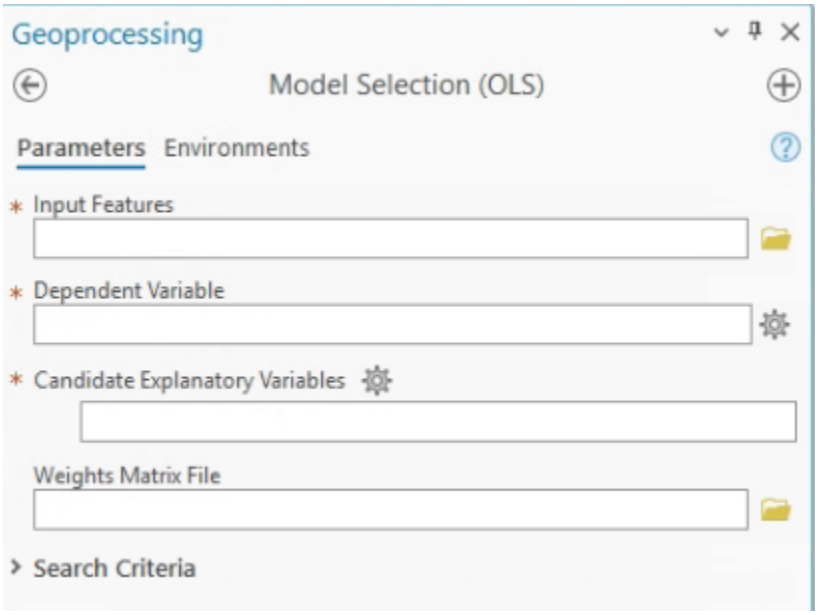
- Click Run to execute the script and get the result.
- Check the text output like the following:



- Check the PDF file from the Output PDF path as “/Causes\Factor Analysis for Mixed Data\output\output.pdf ”

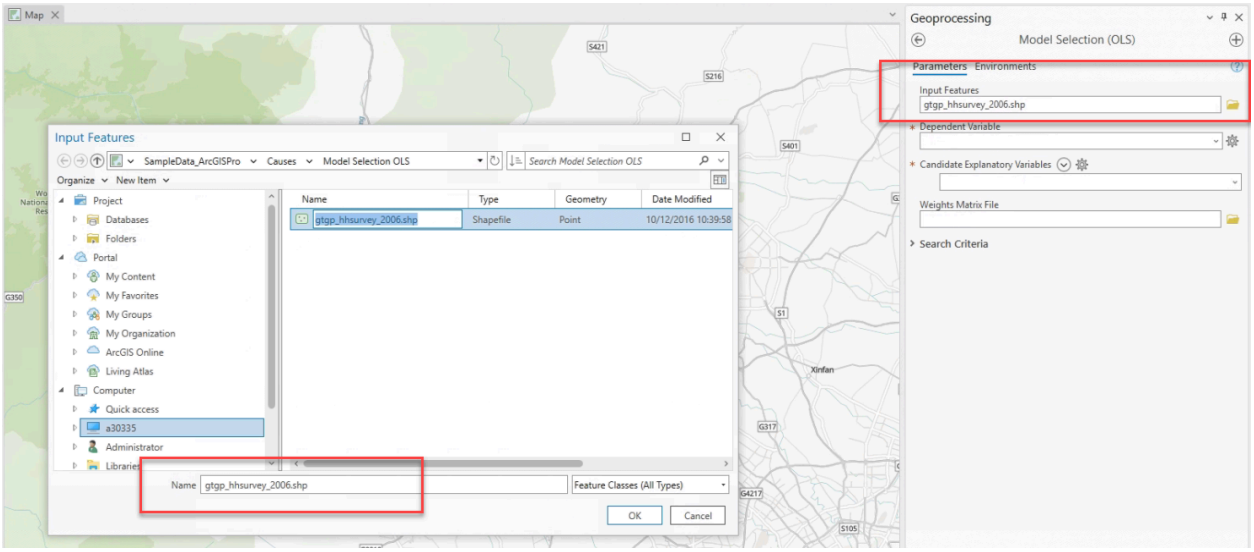


3.3.3 Model Selection (OLS)

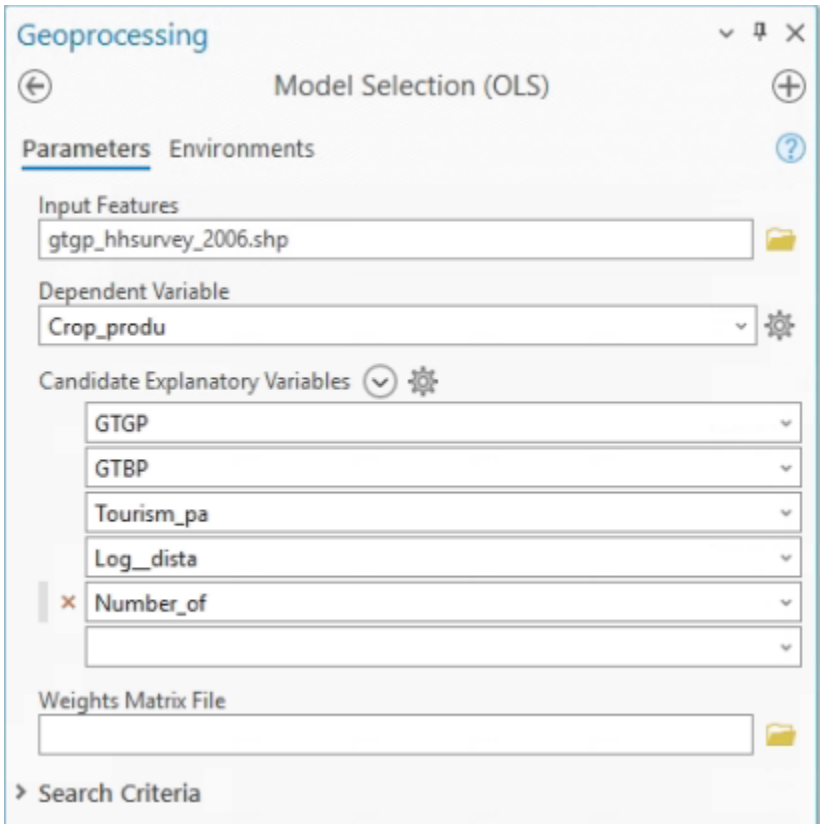


Right click the script and open it

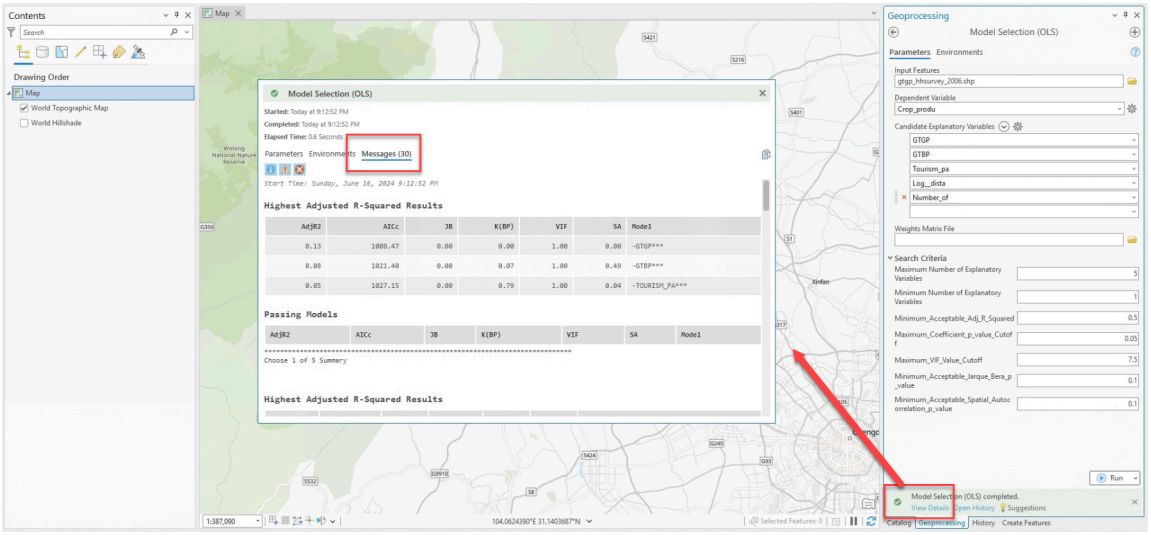
- Click  and select the input features. In this example, we selected the features file as “gtgp_hhsurvey_2006.shp” from the subfolder of “Causes/Model Selection OLS” in the sample datasets.



- For the Dependent Variable, select “Crop_produ” from the drop list.
- For Candidate Explanatory Variables, multiple values can be selected from the drop list as “GTGP”, ”GTBP”, “Tourism_pa”, “Log_dista”, and “Number_of”.
- You will get the parameter setting as below and leave all other tool options unaltered and click run.

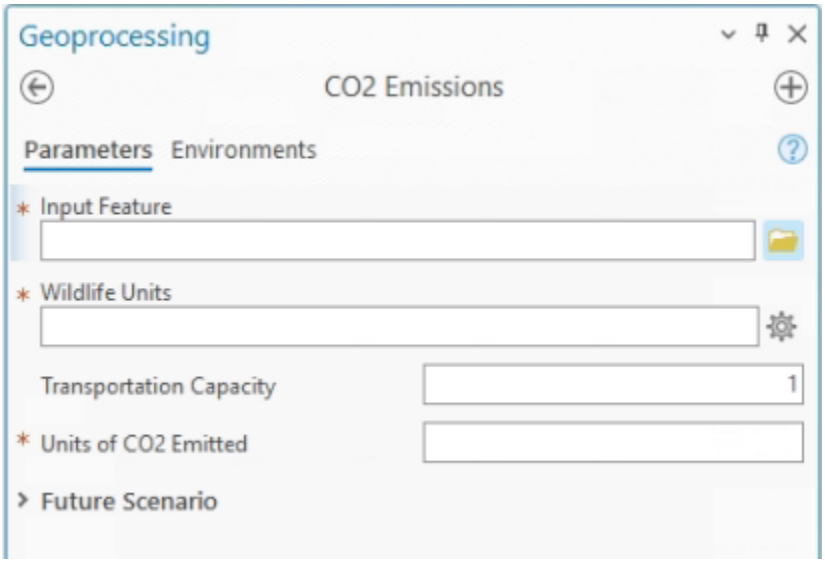


- When run it successfully, click the “View Details” on the bottom right side and click “Message” to check the results:



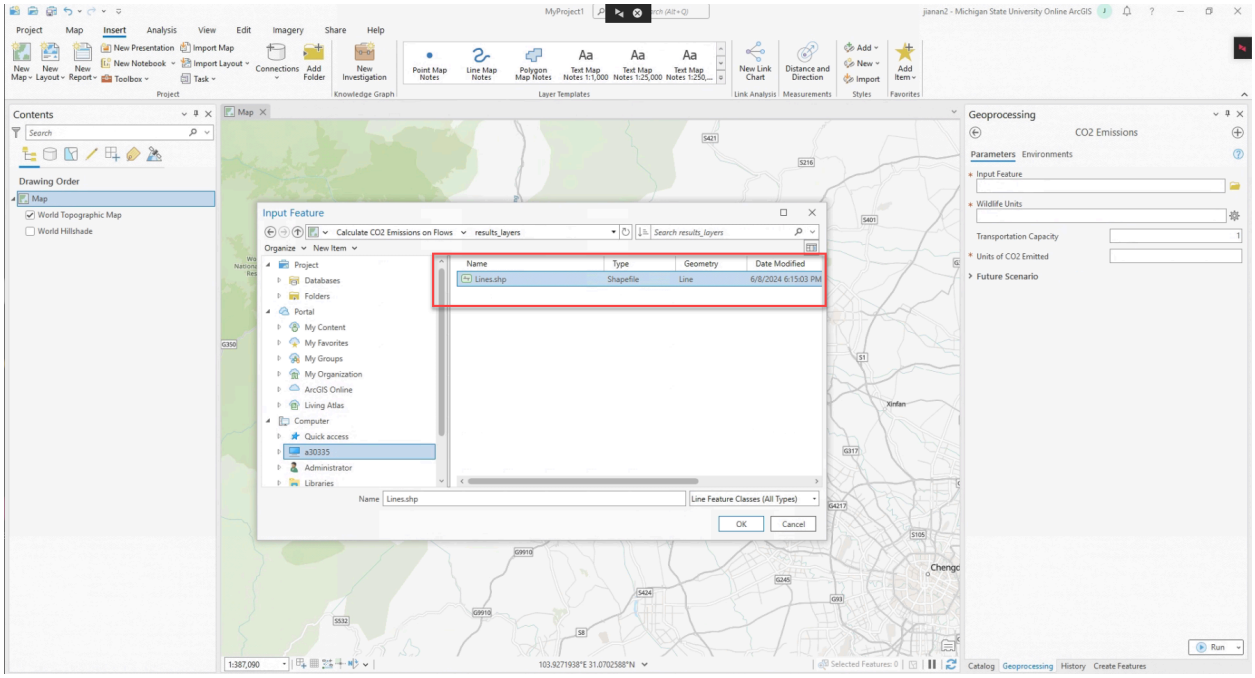
3.4 Environment Analysis

3.4.1 CO2 Emissions

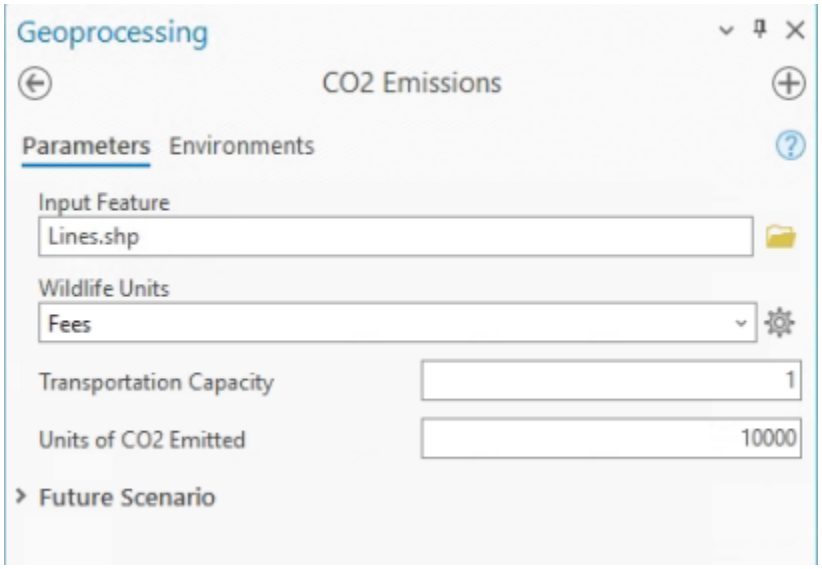


Right click the script and open it

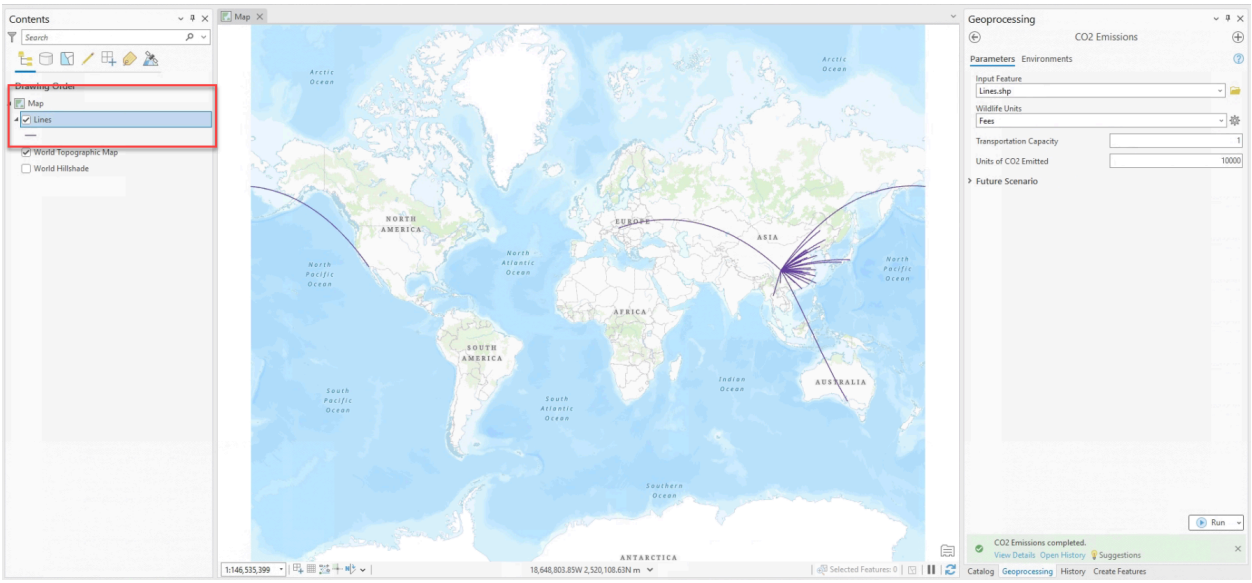
- Click  and select the input features. In this example, we selected the features file as “Lines.shp” from the subfolder of “Calculate CO2 Emissions on Flows/results_layers” in the sample datasets.



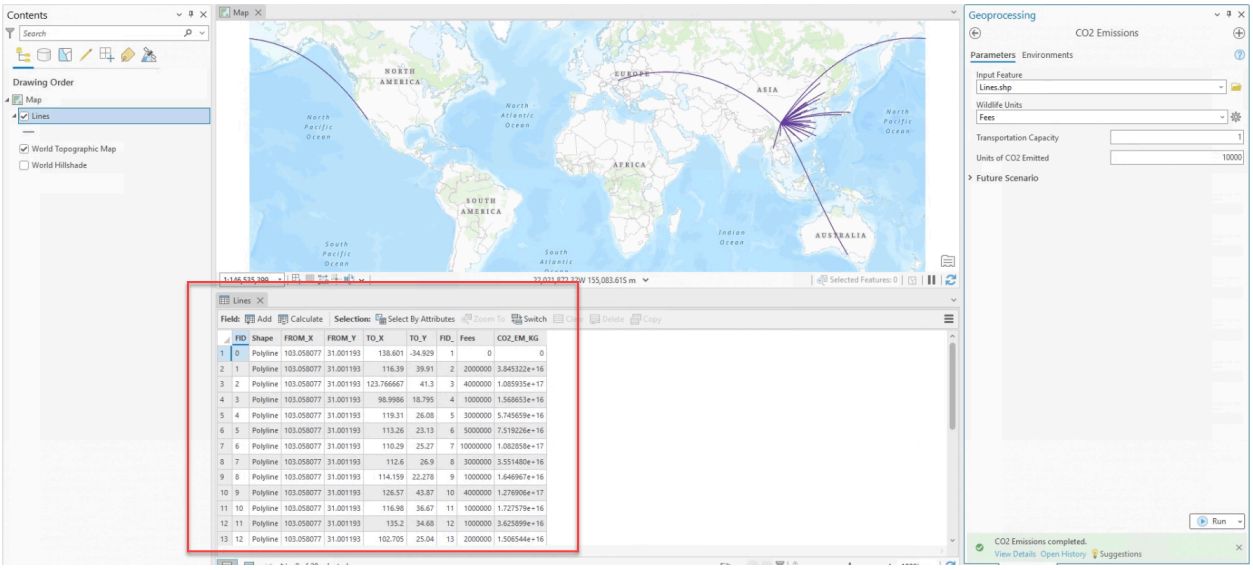
- Select “Fees” in the droplist of Wildlife Units. Set Transportation Capacity as 1 and Units of CO2 Emitted as 10000 for example.



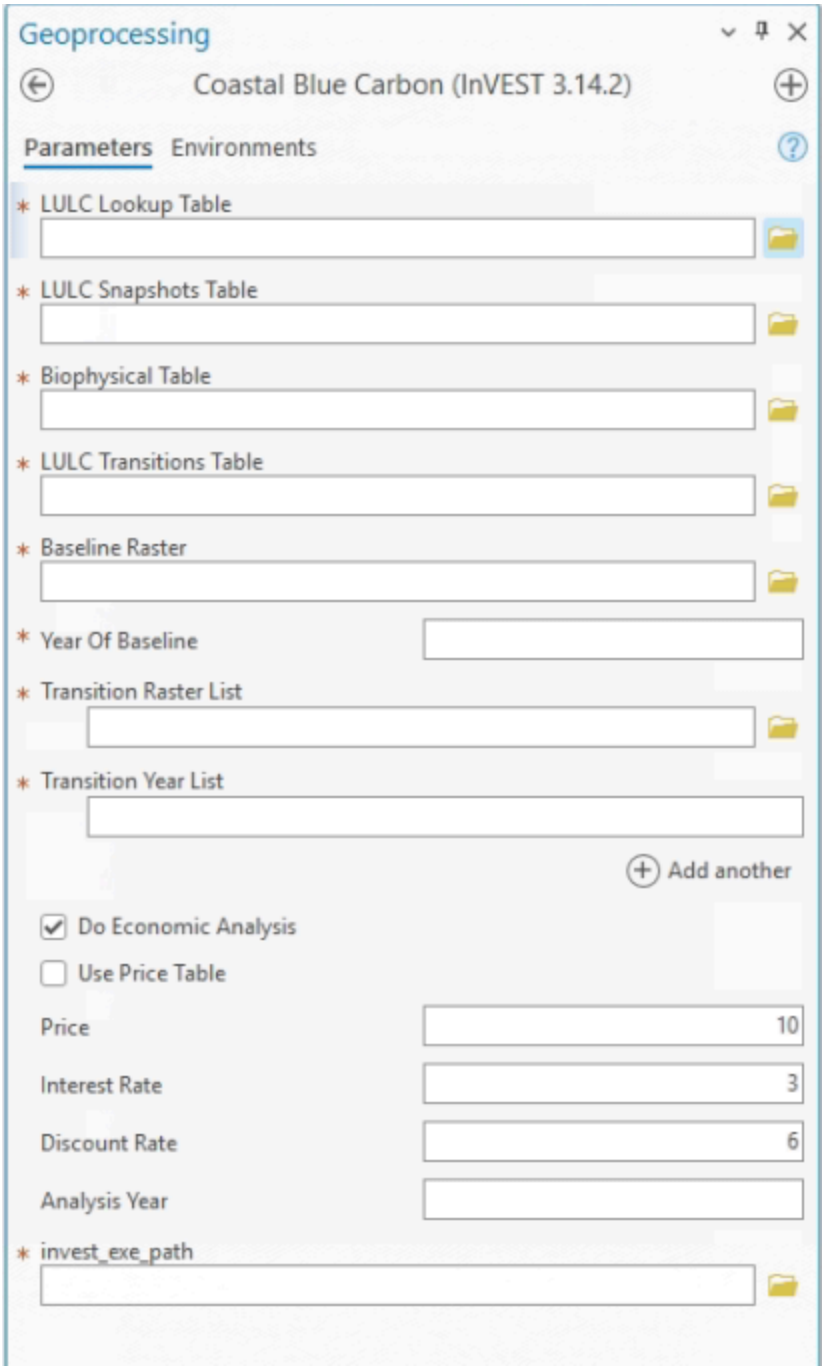
- Then click run to execute the script and results will be shown as below:



- The “Lines” layer will be added into the map and right click it with selecting “Attribute Table”, the details on the table will be shown.



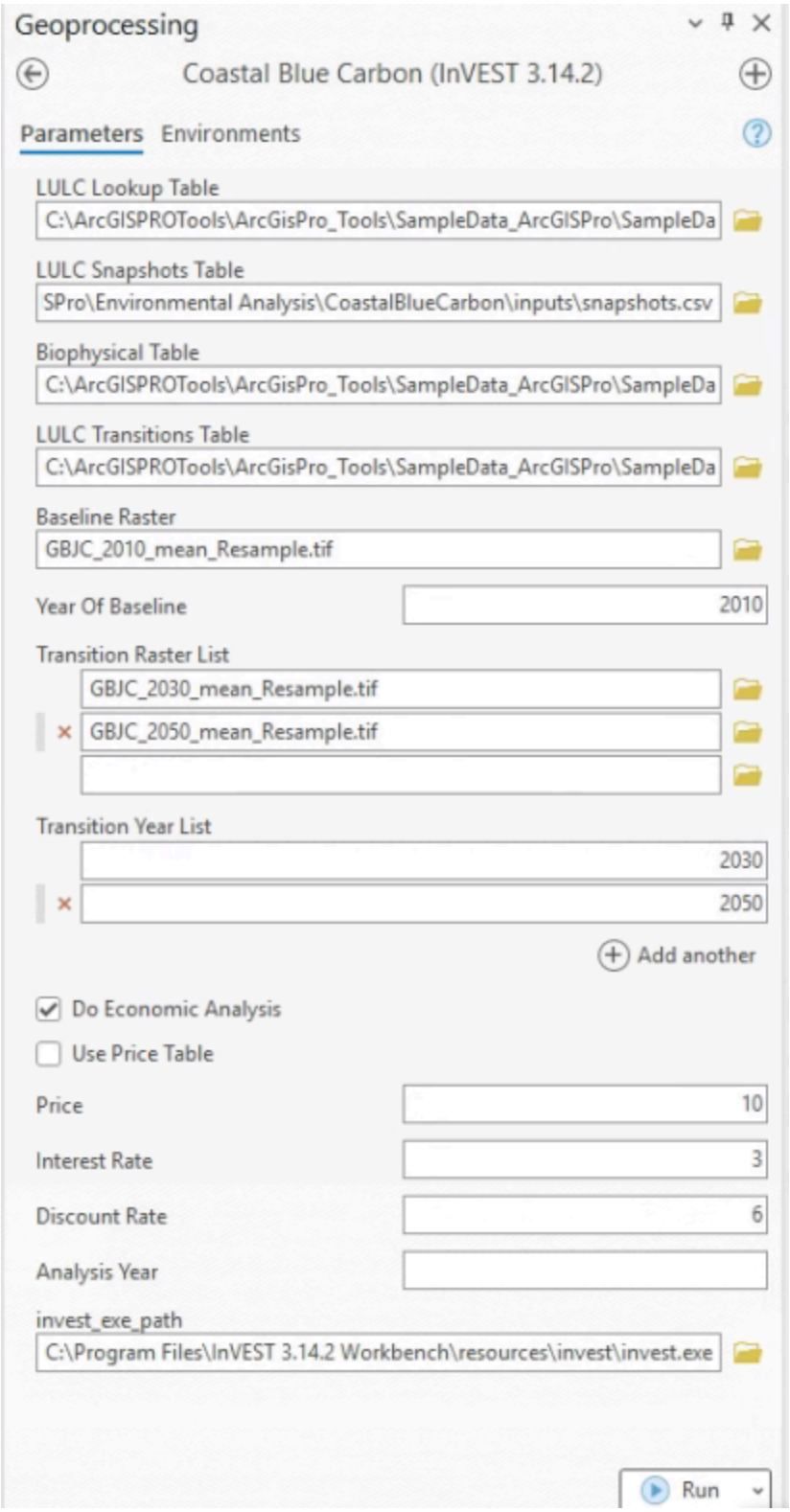
3.4.2 Coastal Blue Carbon (InVEST 3.14.2)



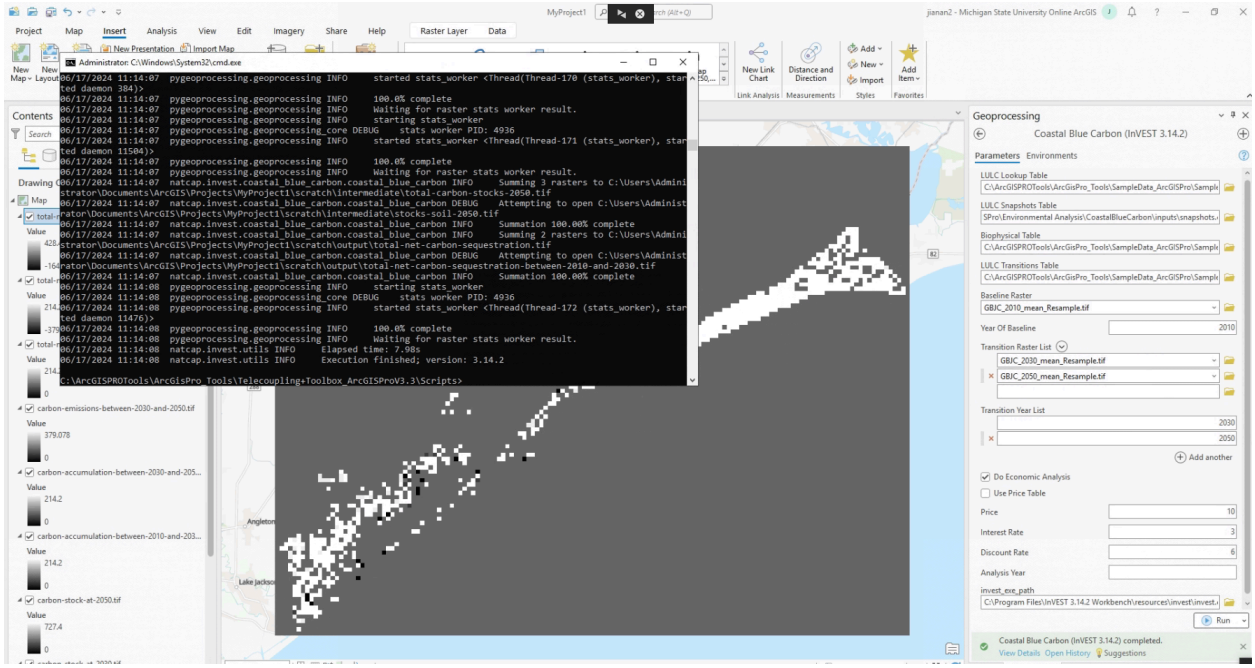
Right click the script and open it

- Click  and select the LULC Lookup Table. In this example, we will use”lulc_lookup.csv” from the folder “\Environmental Analysis\CoastalBlueCarbon\inputs” .
- By the same operation, for LULC Snapshots Table, use “snapshots.csv” from the folder “\Environmental Analysis\CoastalBlueCarbon\inputs” .

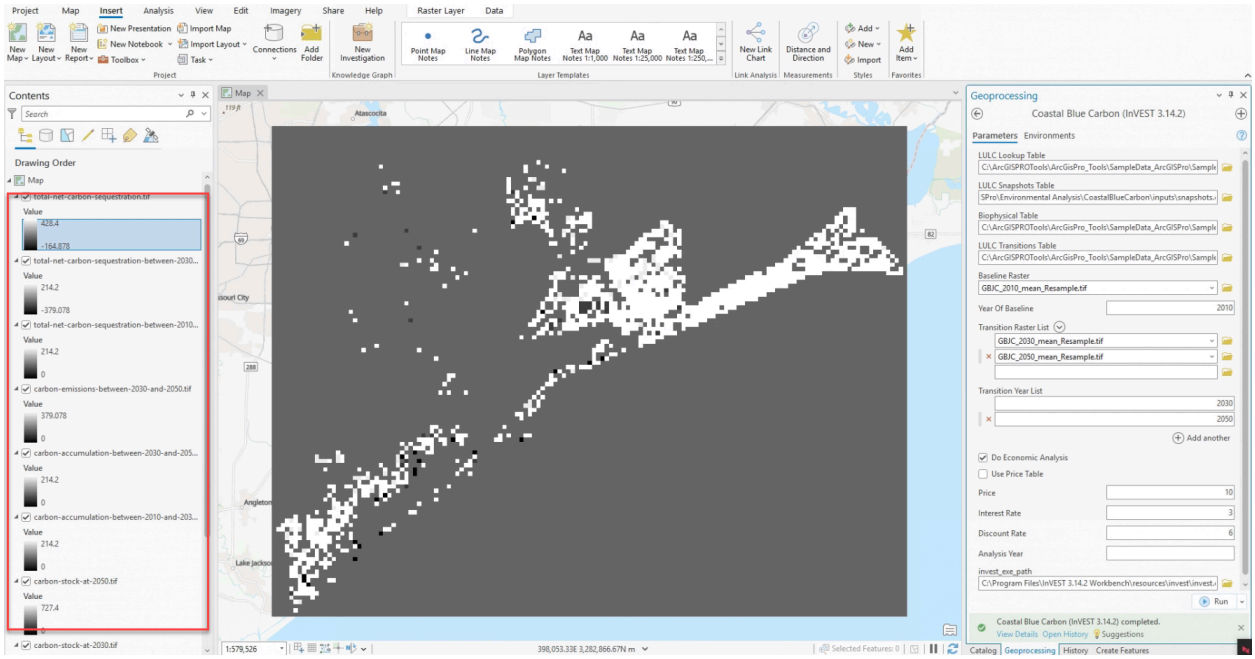
- For Biophysical Table, use “biophysical_table_sample.csv” from the folder “\Environmental Analysis\CoastalBlueCarbon\outputs_preprocessor”.
- For LULC Transitions Table, use “transitions_sample.csv” from the folder “\Environmental Analysis\CoastalBlueCarbon\outputs_preprocessor”.
- For Baseline Raster, use “GBJC_2010_mean_Resample.tif” from the folder “\Environmental Analysis\CoastalBlueCarbon\inputs”.
- For the “Year of Baseline”, input “2010”
- For “Transition Raster List”, select “GBJC_2030_mean_Resample” and “GBJC_2050_mean_Resample” from the folder “\Environmental Analysis\CoastalBlueCarbon\inputs” and add them to the list.
- For “Transition Year List”, input “2030” and “2050” to the list.
- Keep other parameters as default, except the invest_exe_path.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- The Final parameters setting is below:



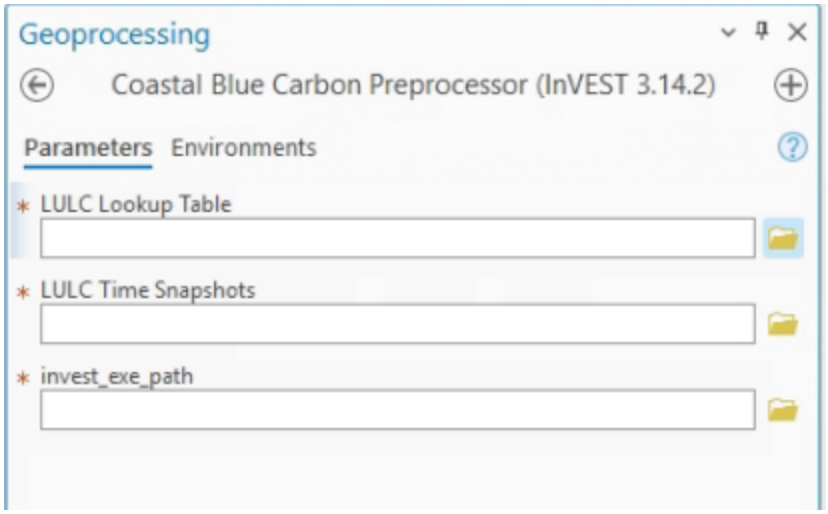
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When the script run completed, you can get results as following:

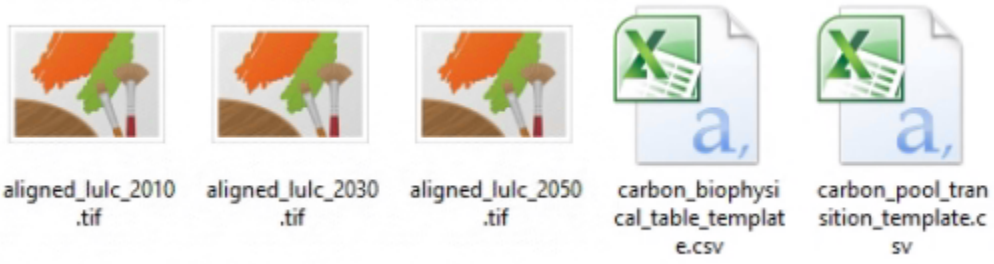


3.4.3 Coastal Blue Carbon Preprocessor (InVEST 3.14.2)

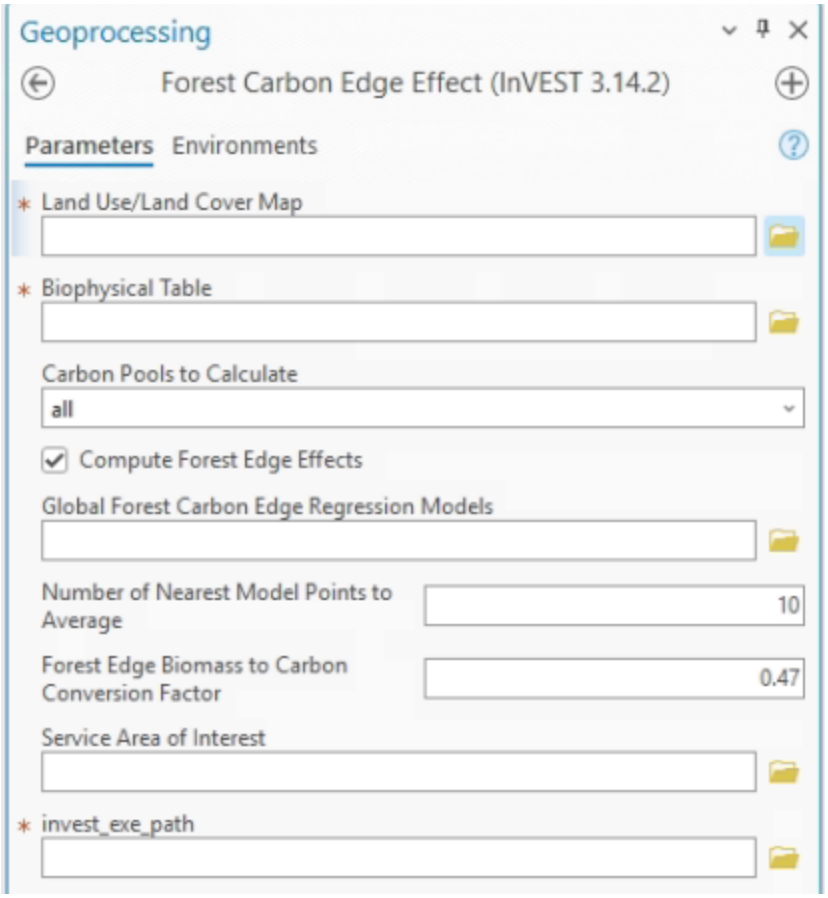


Right click the script and open it

- Click  and select the LULC Lookup Table. In this example, we will use”lulc_lookup.csv” from the folder “\Environmental Analysis\Coastal Blue Carbon Preprocessor” .
- By the same operation, for LULC Snapshots Table, use “snapshots.csv” from the folder “\Environmental Analysis\Coastal Blue Carbon Preprocessor” .
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Then Click Run to execute the script and you will get result files in the Scratch folder of the project. Here it is “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\scratch\outputs_preprocessor”



3.4.4 Forest Carbon Edge Effect (InVEST 3.14.2)

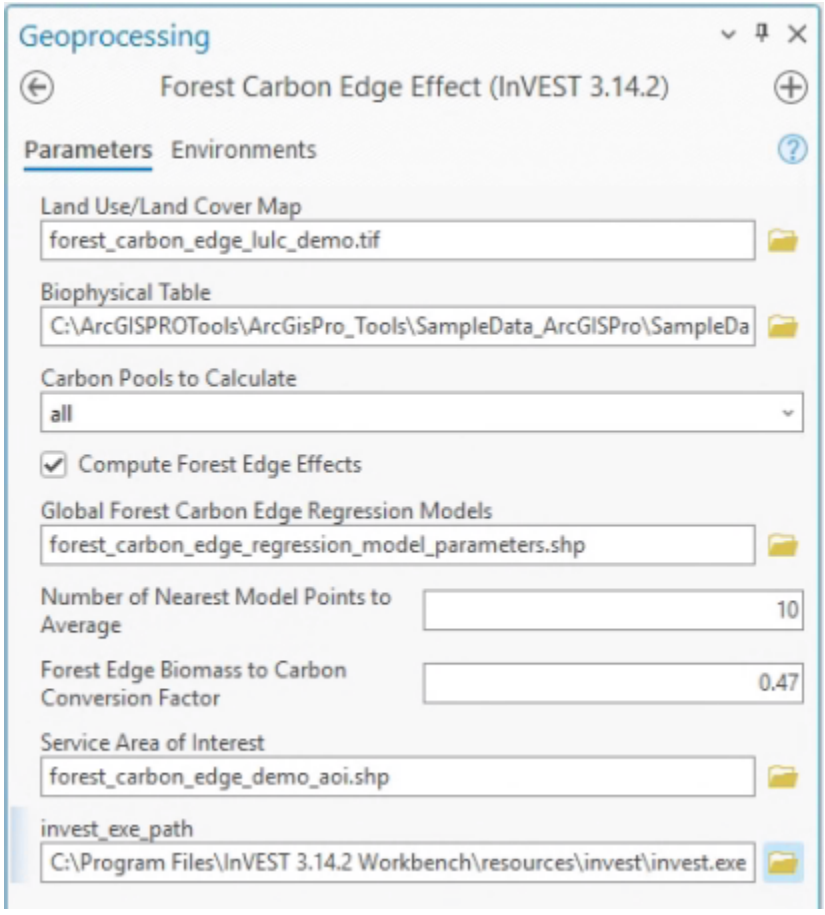


Right click the script and open it

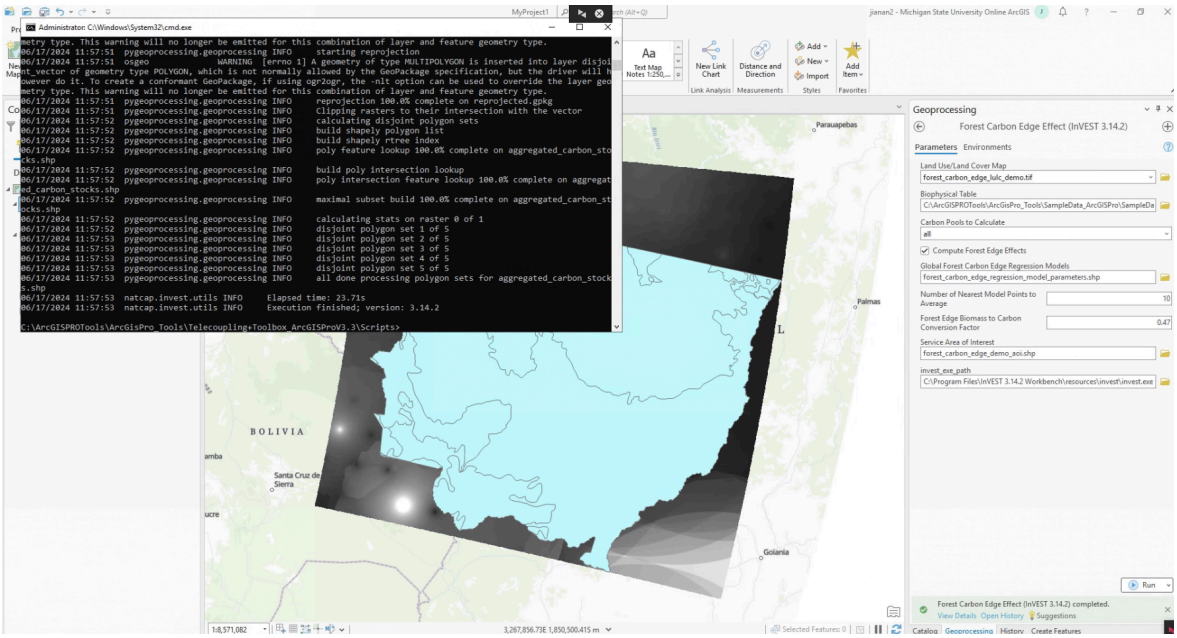
- Click  and select the LULC image. In this example, we will use"forest_carbon_edge_lulc_demo.tif" from the folder "\Environmental Analysis\forest_carbon_edge_effect".
- By the same operation, for Biophysical Table, use "forest_edge_carbon_lu_table.csv" from the folder "\Environmental Analysis\Coastal Blue Carbon Preprocessor".
- Set "Carbon Pools to Calculate" as "all" and check "Compute Forest Edge Effects"
- For "Global Forest Carbon Edge Regression Models", select the file of "forest_carbon_edge_regression_model_parameters.shp" from the folder "\Environmental Analysis\forest_carbon_edge_effect\core_data" .
- For "Service Area of Interest", select "forest_carbon_edge_demo_aoi.shp" from the folder "\Environmental Analysis\forest_carbon_edge_effect" .
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of "invest_exe_path". Because, currently, the InVEST was installed in the pathe of "C:\Program Files\InVEST 3.14.2 Workbench", we can input the

path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.

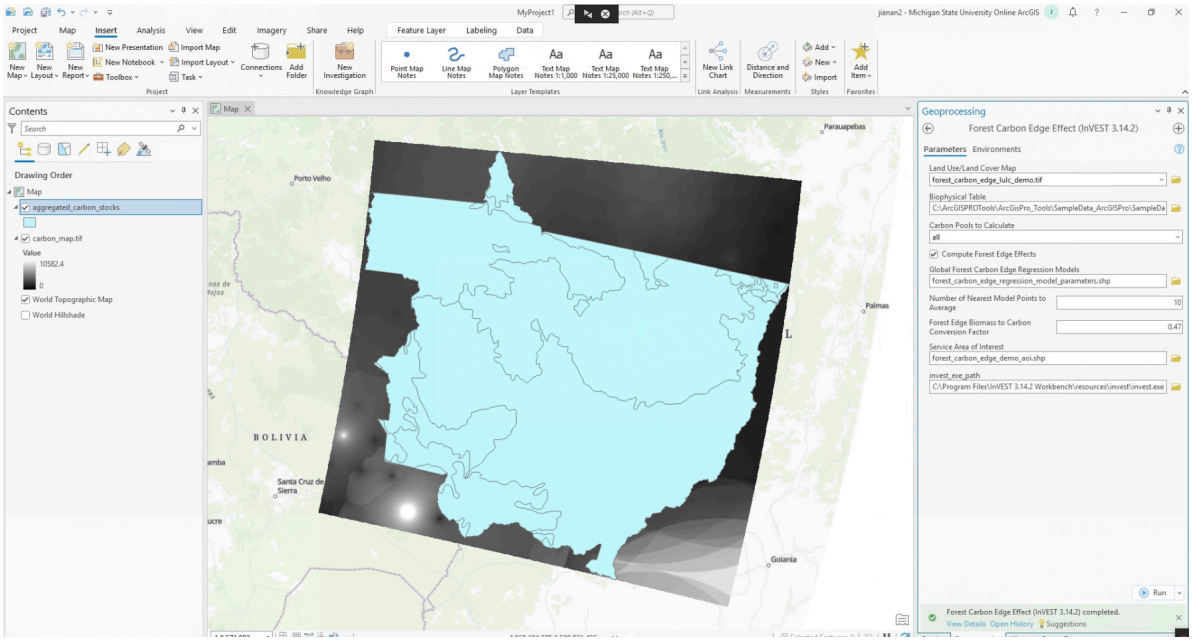
- Keep other parameters as default. And the final parameters are setting like below:



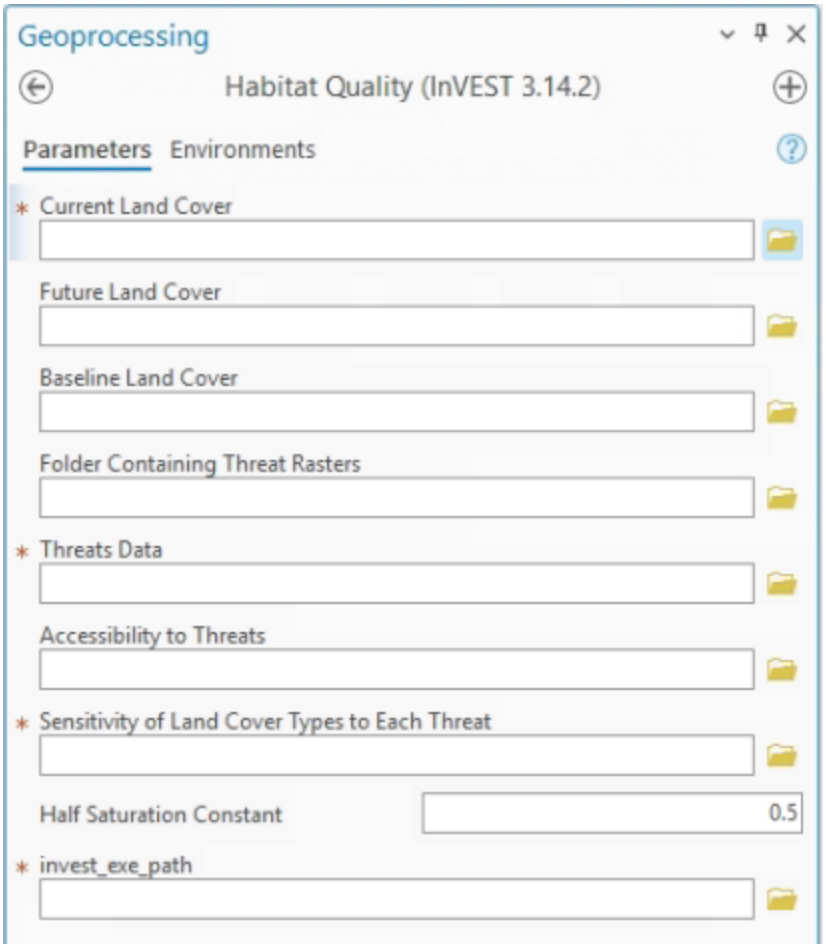
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- And finally, you will have the results like:



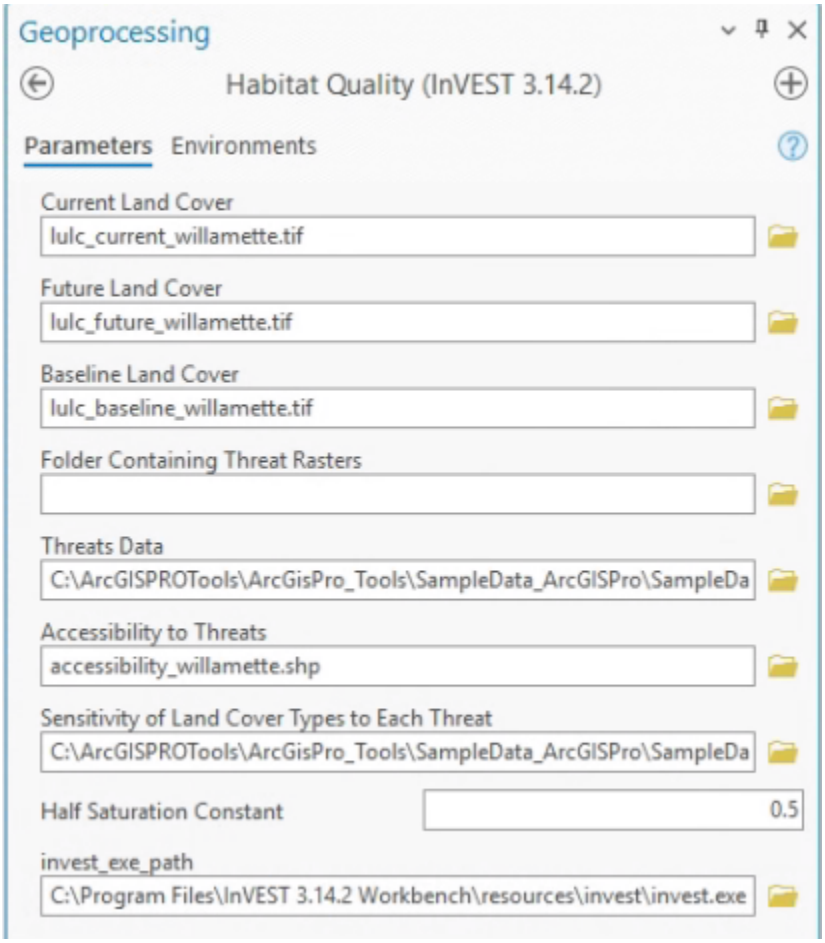
3.4.5 Habitat Quality (InVEST 3.14.2)



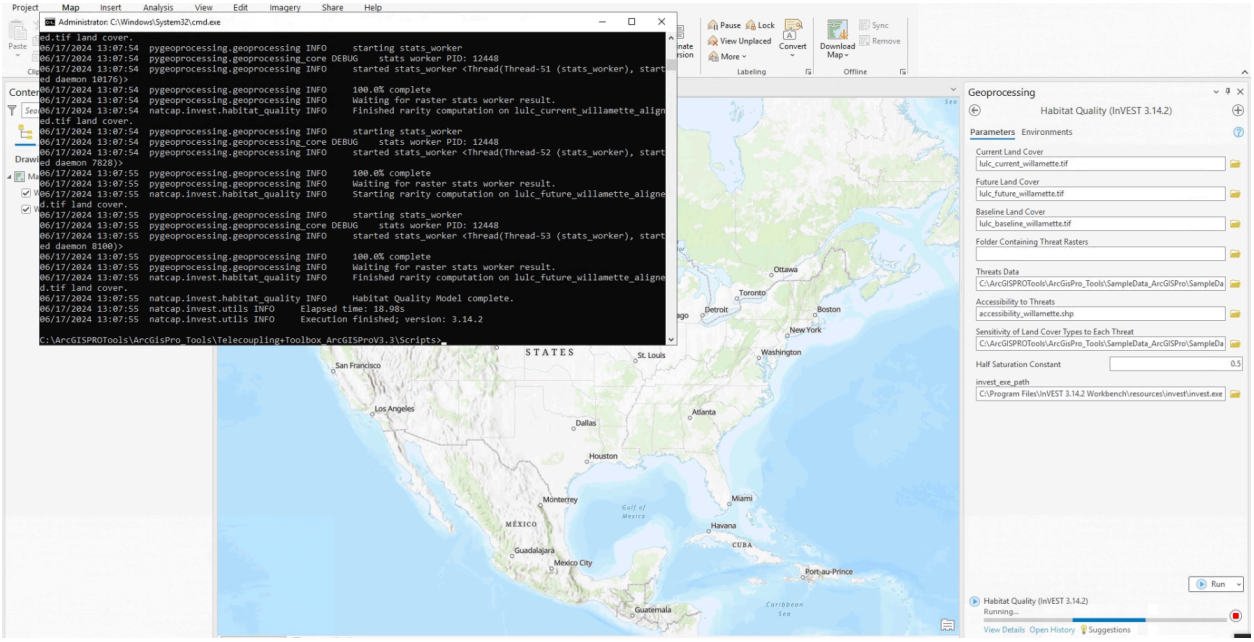
Right click the script and open it

- Click  and select the “Current Land Cover”. In this example, we will use”lulc_current_willamette.tif” from the folder “\Environmental Analysis\HabitatQuality” .
- By the same operation, for “Future Land Cover”, use “lulc_future_willamette.tif” from the folder “\Environmental Analysis\HabitatQuality” .
- for “Baseline Land Cover”, use “lulc_baseline_willamette.tif” from the folder “\Environmental Analysis\HabitatQuality” .
- For “Threats Data”, use “threats_willamette.csv” from the folder “\Environmental Analysis\HabitatQuality” .
- For “Accessibility to Threats”, use “accessibility_willamette.shp” from the folder “\Environmental Analysis\HabitatQuality” .
- For “Sensitivity of Land Cover Types to Each Threat”, use “sensitivity_willamette.csv” from the folder “\Environmental Analysis\HabitatQuality” .

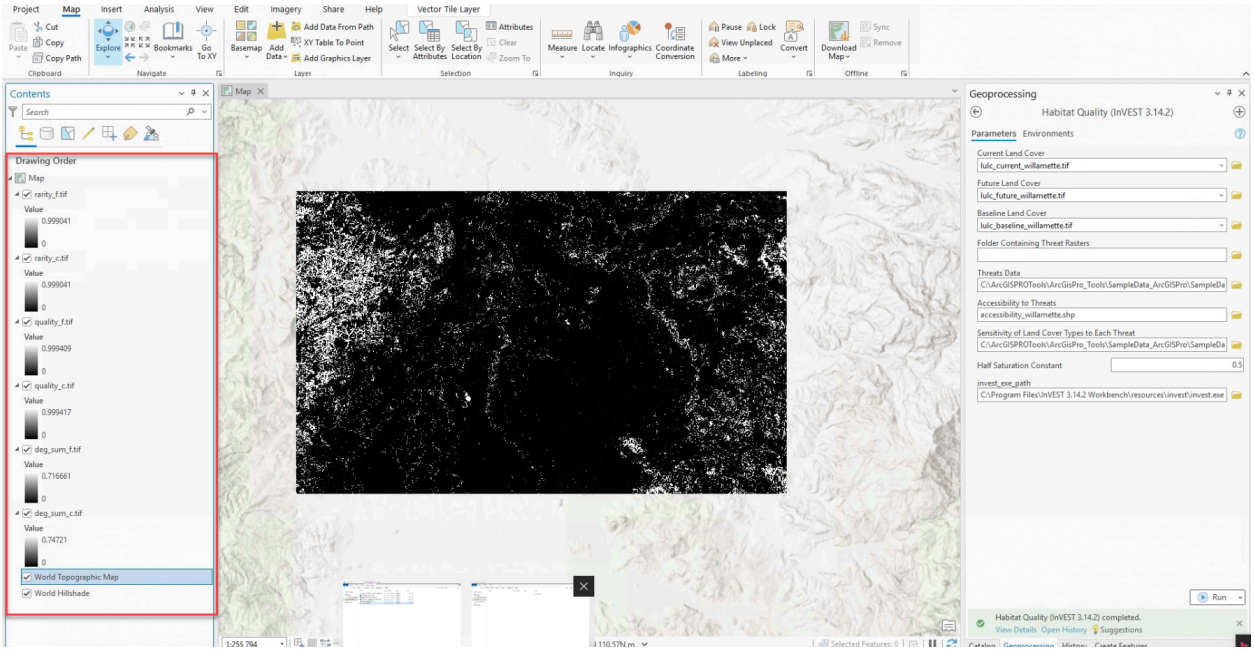
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- All parameters are set like below:



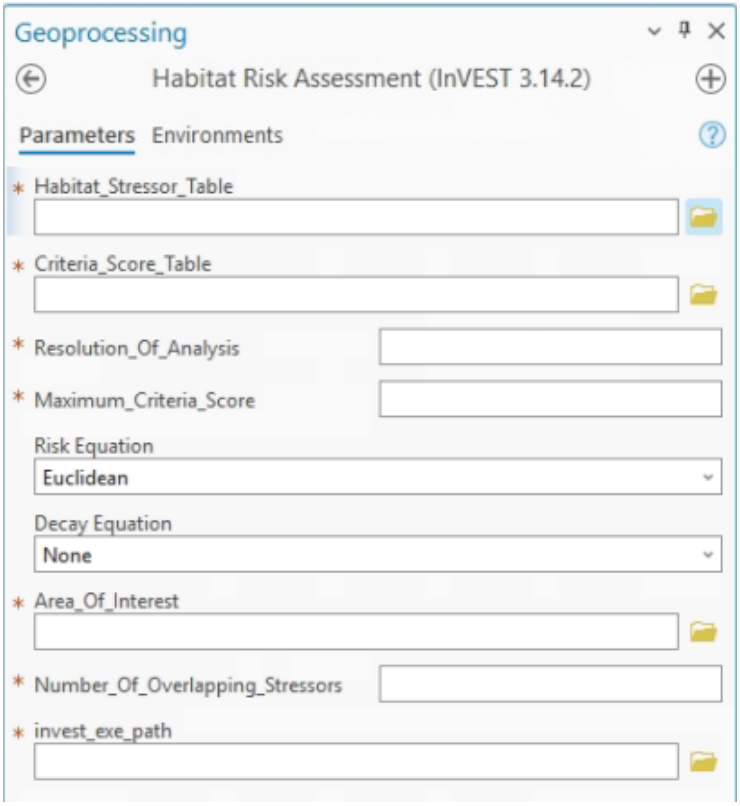
- Keep other parameters as default and please remove all contents in the Scratch folder and click run
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:

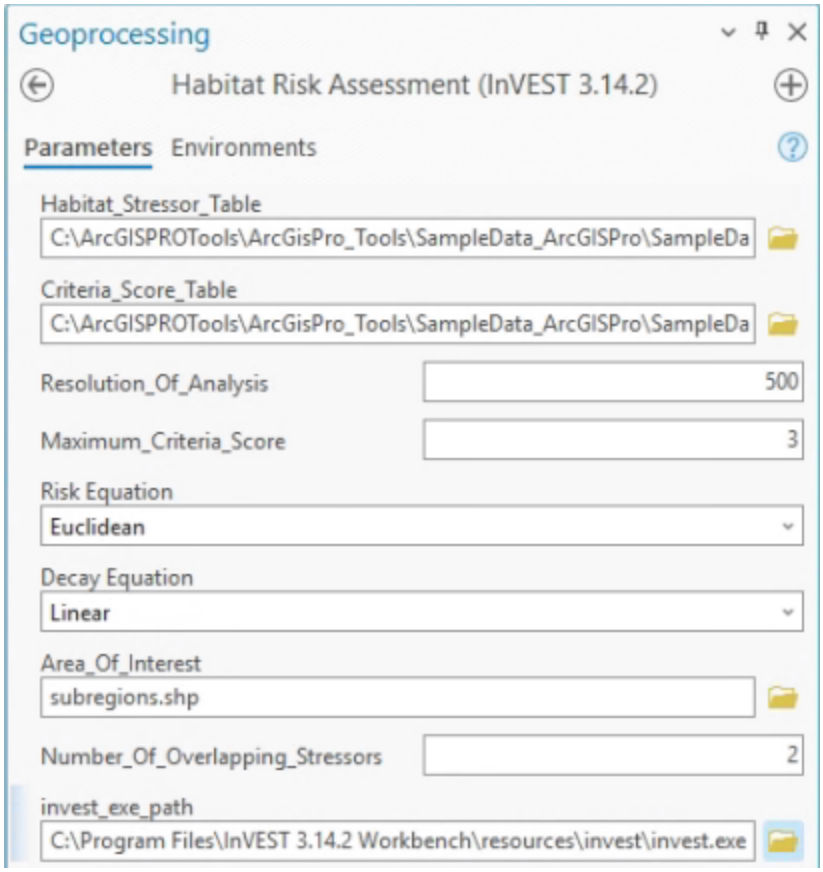


3.4.6 Habitat Risk Assessment (InVEST 3.14.2)

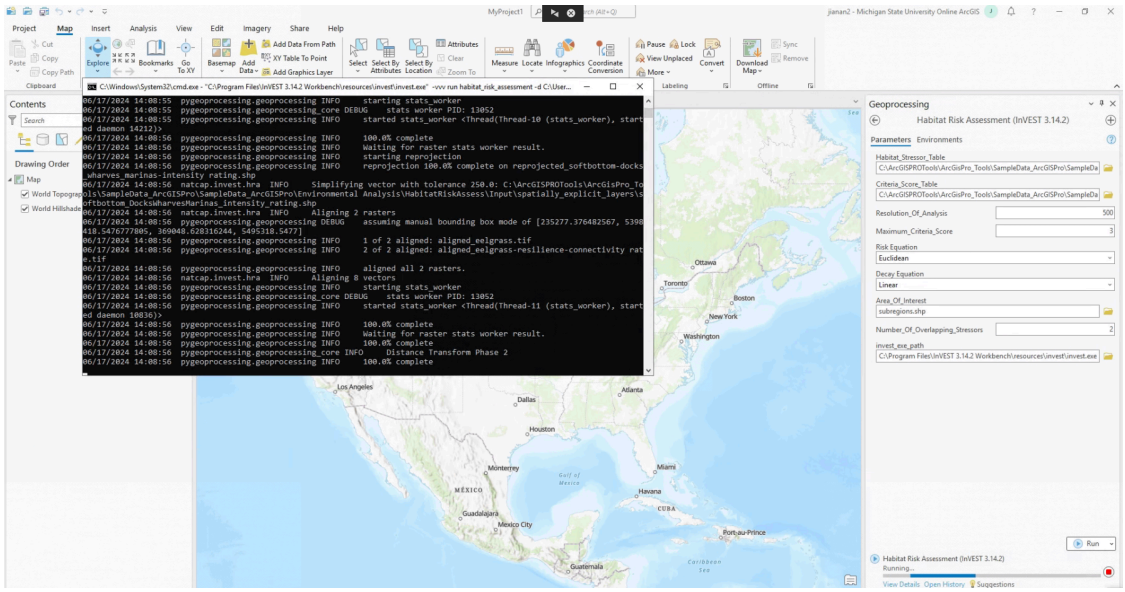


Right click the script and open it

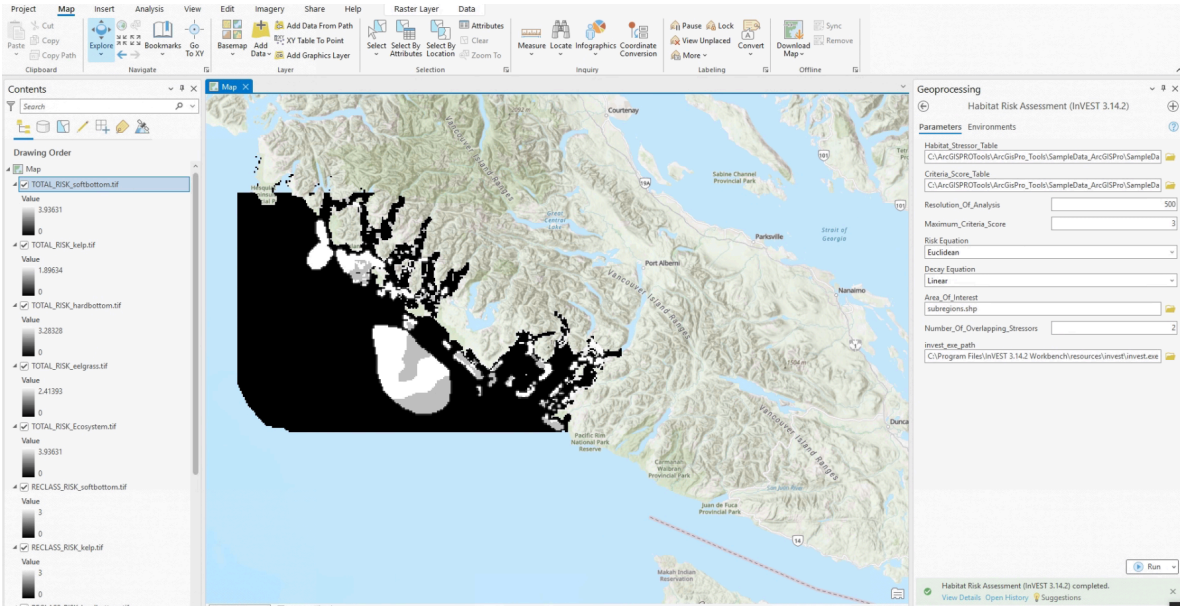
- Click  and select the “Habitat_Stressor_Table”. In this example, we will use”habitat_stressor_info.csv” from the folder “\Environmental Analysis\HabitatRiskAssess\input” .
- By the same operation, for “Criteria_Score_Table”, use “exposure_consequence_criteria.csv” from the folder “\Environmental Analysis\HabitatRiskAssess\input” .
- Set “Resolution_Of_Analysis” as 500 and “Maximum_Criteria_Score” as 3.
- Set “Risk Equation” as “Euclidean” and “Decay Equation” as “Linear”
- For “Area_Of_Interest”, select “subregions.shp” from the folder “\Environmental Analysis\HabitatRiskAssess\input” .
- Set “Number_Of_Overlapping_Stressors” as 2
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- All parameters are set like below:



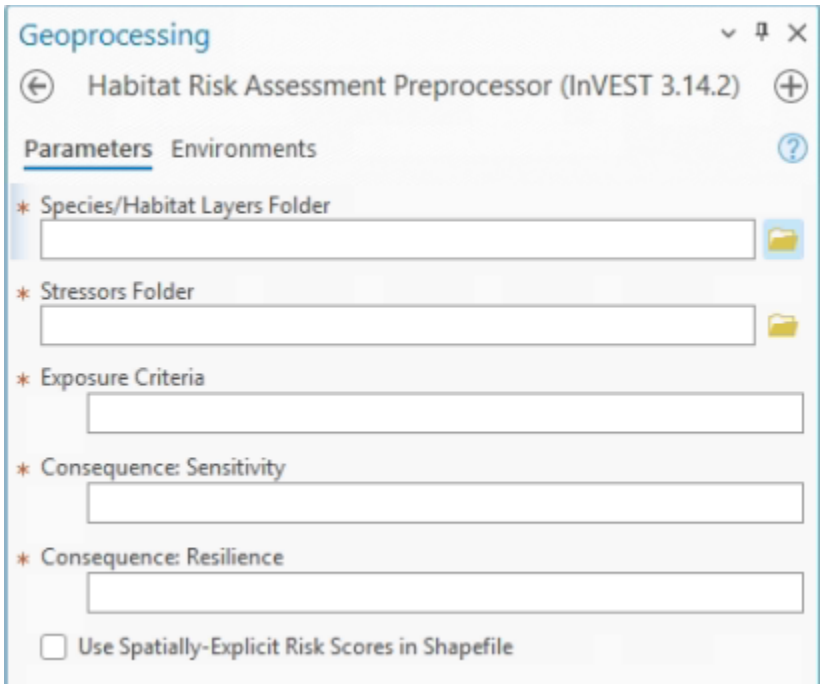
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:



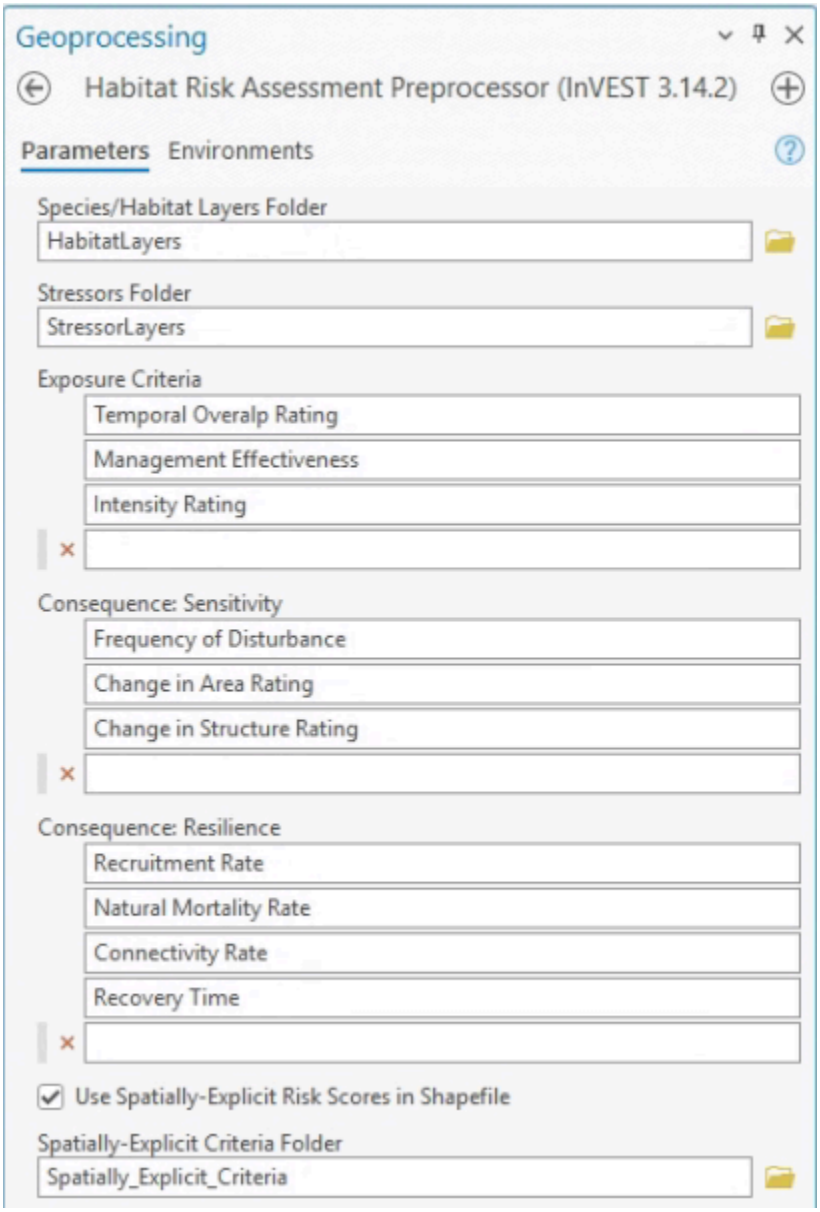
3.4.7 Habitat Risk Assessment Preprocessor (InVEST 3.14.2)



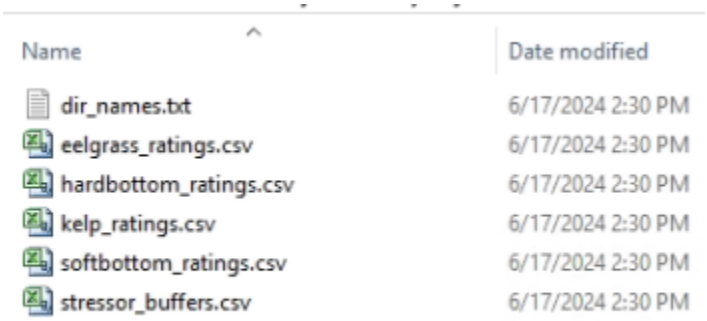
Right click the script and open it

- Click  and select the “Species/Habitat Layers Folder”. In this example, we will use the folder “\Environmental Analysis\Habitat Risk Assessment Preprocessor\HabitatLayers” .
- For the “Stressors Folder”, we will use the folder “\Environmental Analysis\Habitat Risk Assessment Preprocessor\StressorLayers” .

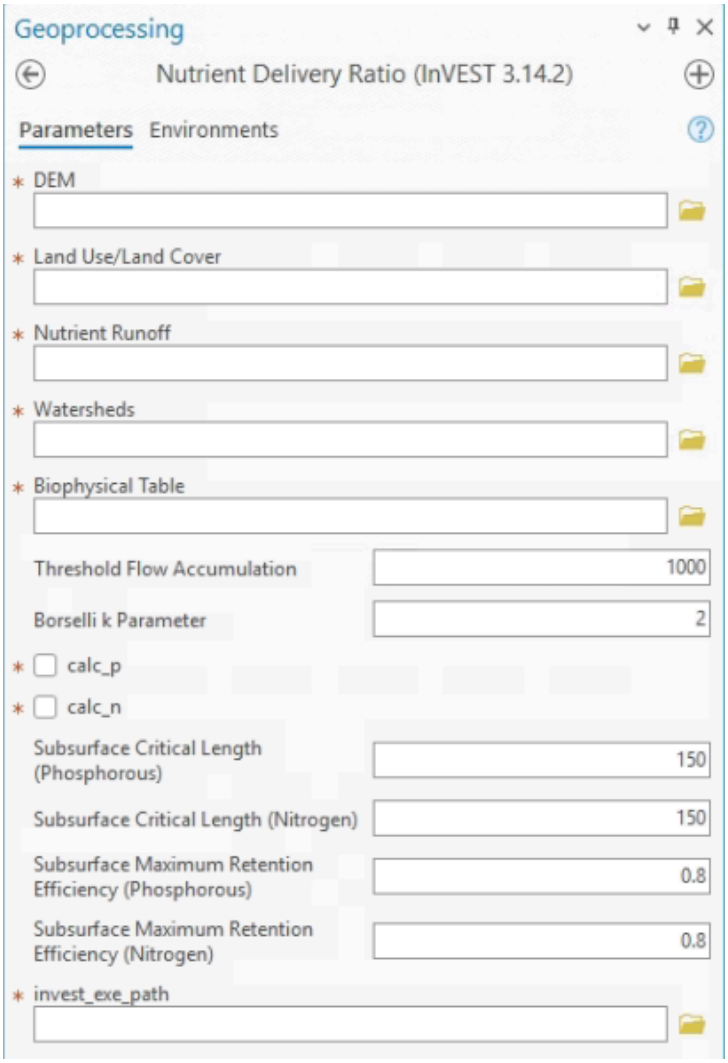
- For the “Exposure Criteria”, input “Temporal Overlap Rating”, “Management Effectiveness” and “Intensity Rating”
- For the “Consequence: Sensitivity”, input “Frequency of Disturbance”, “Change in Area Rating” and “Change in Structure Rating”
- For the “Consequence: Resilience”, input “Recruitment Rate”, “Natural Mortality Rate”, “Connectivity Rate” and “Recovery Time”
- Check the “Use Spatially-Explicit Risk Scores in Shapefile”
- For the “Spatially-Explicit Criteria Folder”, we will use the folder “\Environmental Analysis\Habitat Risk Assessment Preprocessor\Spatially_Explicit_Criteria” .
- All parameters are set like below:



- Then, click Run and when running is completed, the result files are stored in the Scratch folder. In this example, these files are in the path “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\scratch\habitat_stressor_ratings”, showing like:

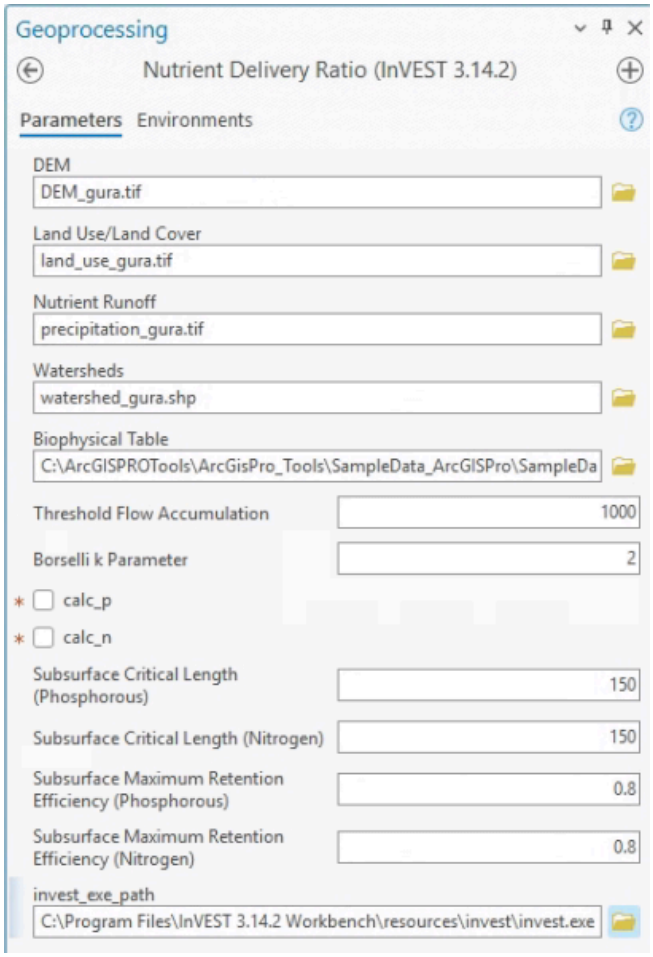


3.4.8 Nutrient Delivery Ratio (InVEST 3.14.2)

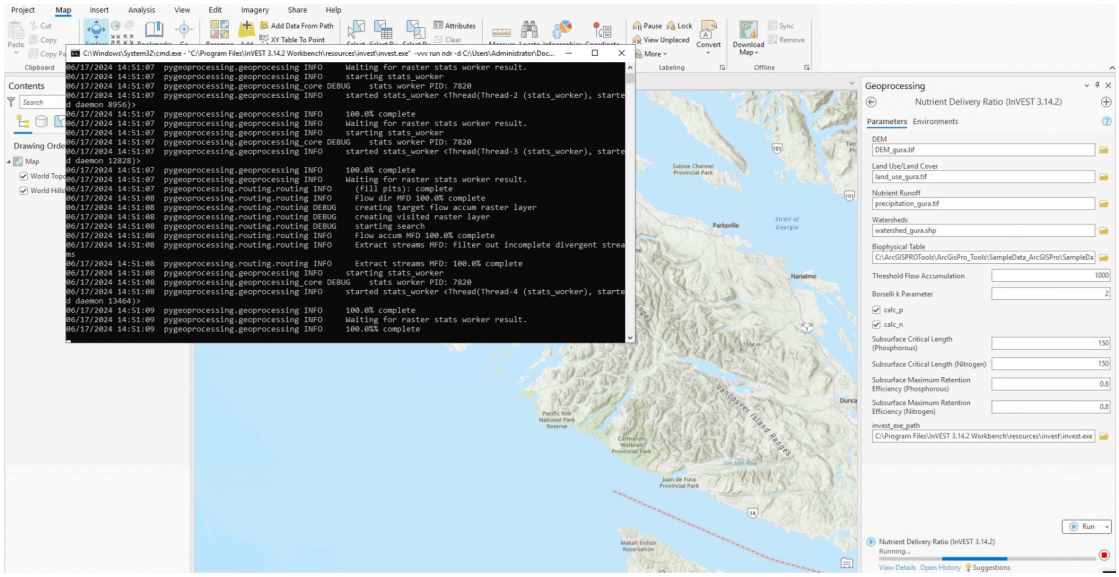


Right click the script and open it

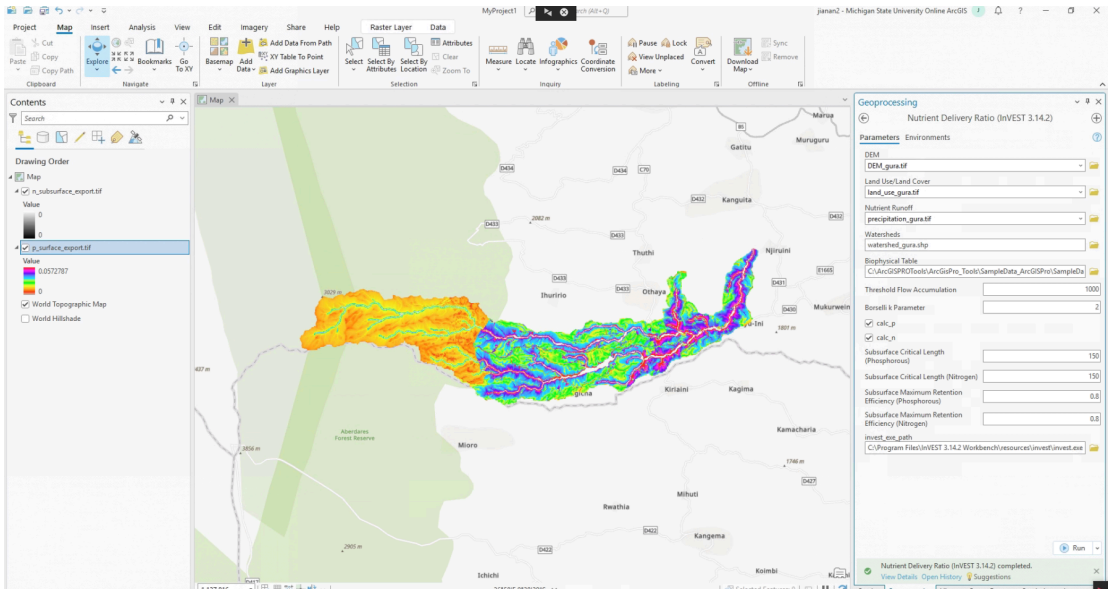
- Click  and select the “DEM”. In this example, In this example, we will use”DEM_gura.tif” from the folder “\Environmental Analysis\NDR” .
- For the “Land Use/Land Cover”, we will use ”land_use_gura.tif” from the folder “\Environmental Analysis\NDR” .
- For the “Nutrient Runoff”, we will use ”precipitation_gura.tif” from the folder “\Environmental Analysis\NDR” .
- For the “Watersheds”, we will use ”watershed_gura.shp” from the folder “\Environmental Analysis\NDR” .
- For the “Biophysical Table”, we will use “biophysical_table_gura.csv” from the folder “\Environmental Analysis\NDR” .
- Check the “calc_p” and “calc_n”
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Keep other parameter as default and it looks like:



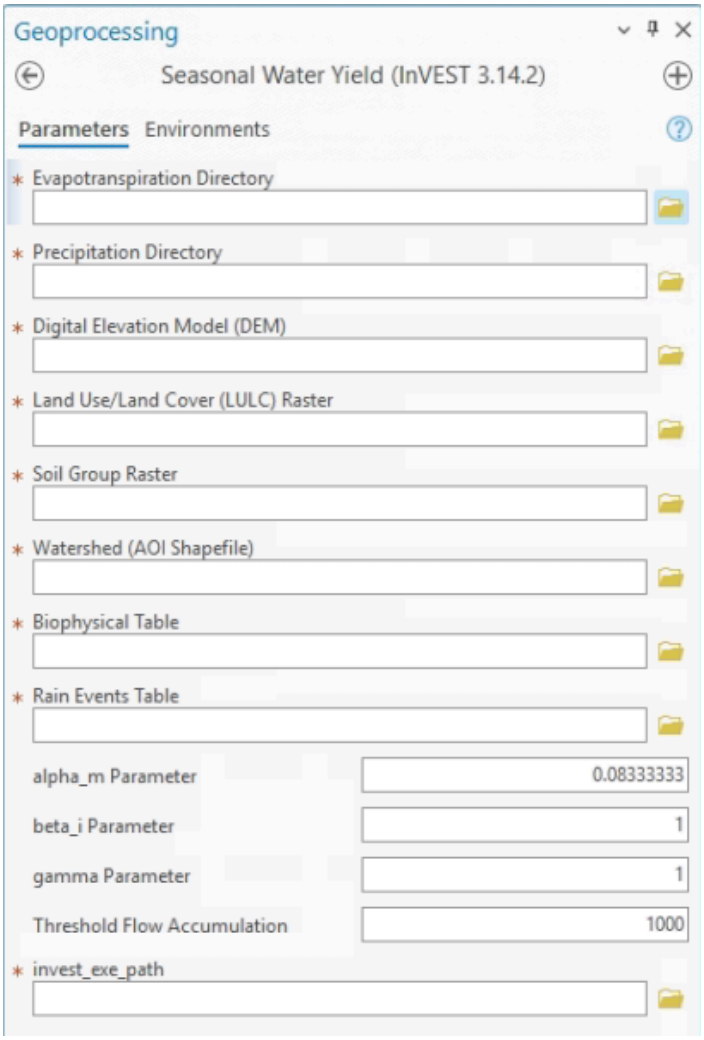
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:



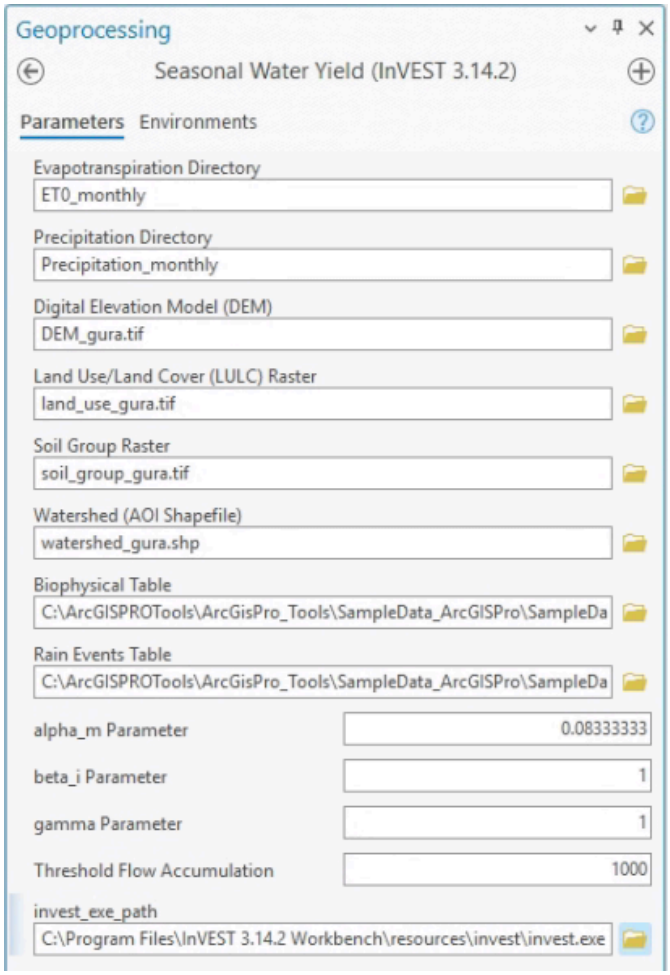
3.4.9 Seasonal Water Yield (InVEST 3.14.2)



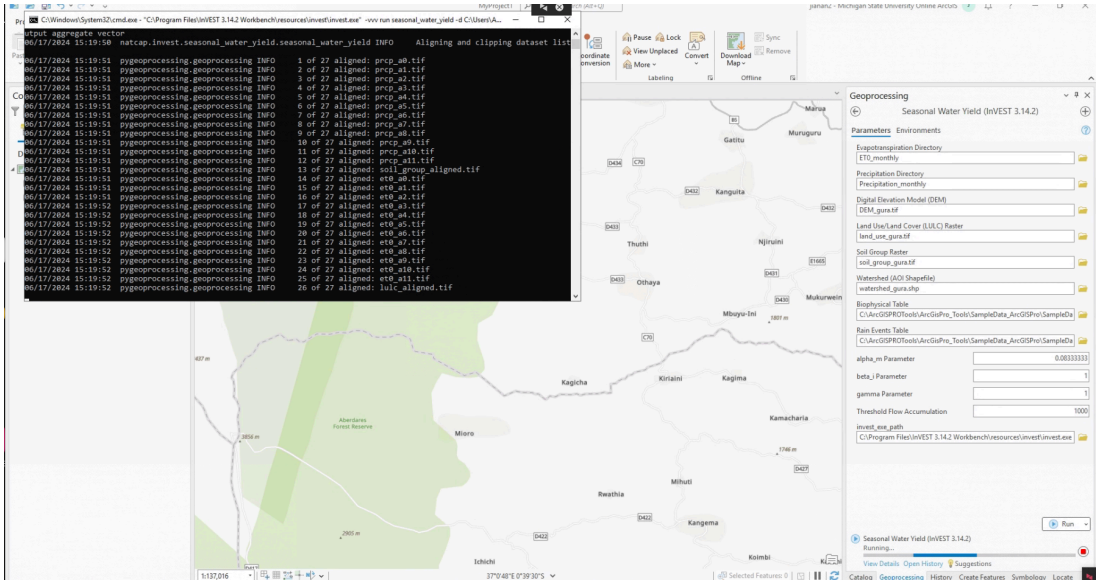
Right click the script and open it

- Click  and select the “Evapotranspiration Directory”. In this example, we will use the path as “\Environmental Analysis\Seasonal_Water_Yield\ET0_monthly”
- For the parameter “Precipitation Directory”, it is set as “\Environmental Analysis\Seasonal_Water_Yield\Precipitation_monthly”
- For the “Digital Elevation Model (DEM)”, it is set as “DEM_gura.tif” from the folder “\Environmental Analysis\Seasonal_Water_Yield”
- For the “Land Use/Land Cover (LULC) Raster”, it is set as “land_use_gura.tif” from the folder “\Environmental Analysis\Seasonal_Water_Yield”
- For the “Soil Group Raster”, it is set as “soil_group_gura.tif” from the folder “\Environmental Analysis\Seasonal_Water_Yield”
- For the “Watershed (AOI Shapefile)”, it is set as “watershed_gura.shp” from the folder “\Environmental Analysis\Seasonal_Water_Yield”
- For the “Biophysical Table”, it is set as “biophysical_table_gura_SWY.csv” from the folder “\Environmental Analysis\Seasonal_Water_Yield”

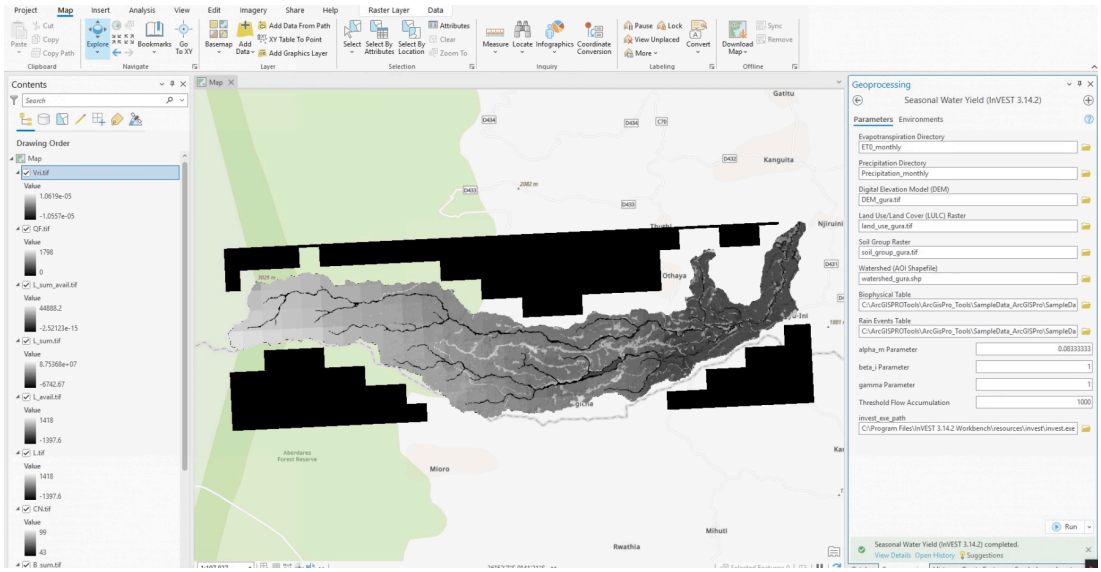
- For the “Rain Events Table”, it is set as “rain_events_gura.csv” from the folder “\Environmental Analysis\Seasonal_Water_Yield”.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Keep other parameters as default. And the all parameters are shown like:



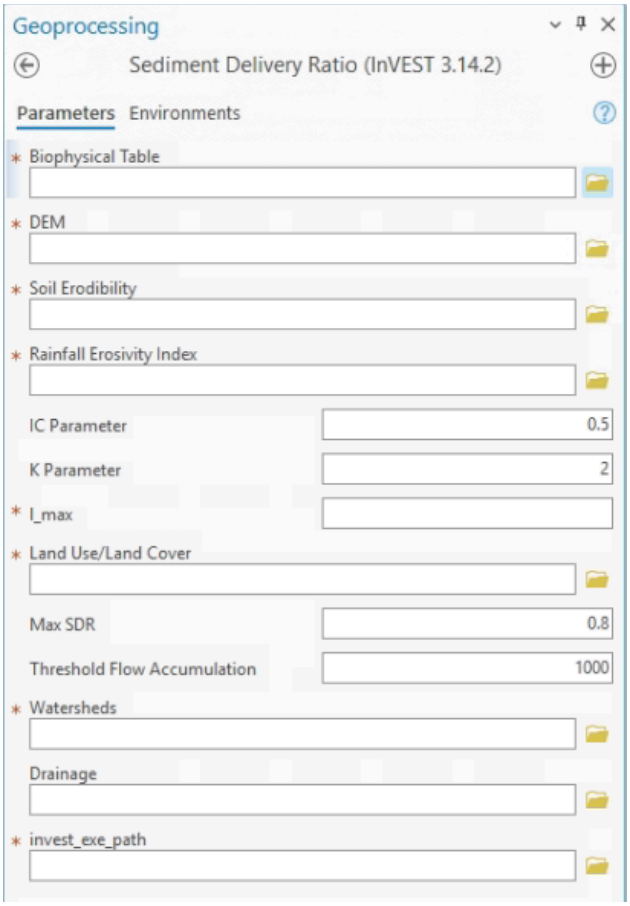
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:



3.4.10 Sediment Delivery Ratio (InVEST 3.14.2)

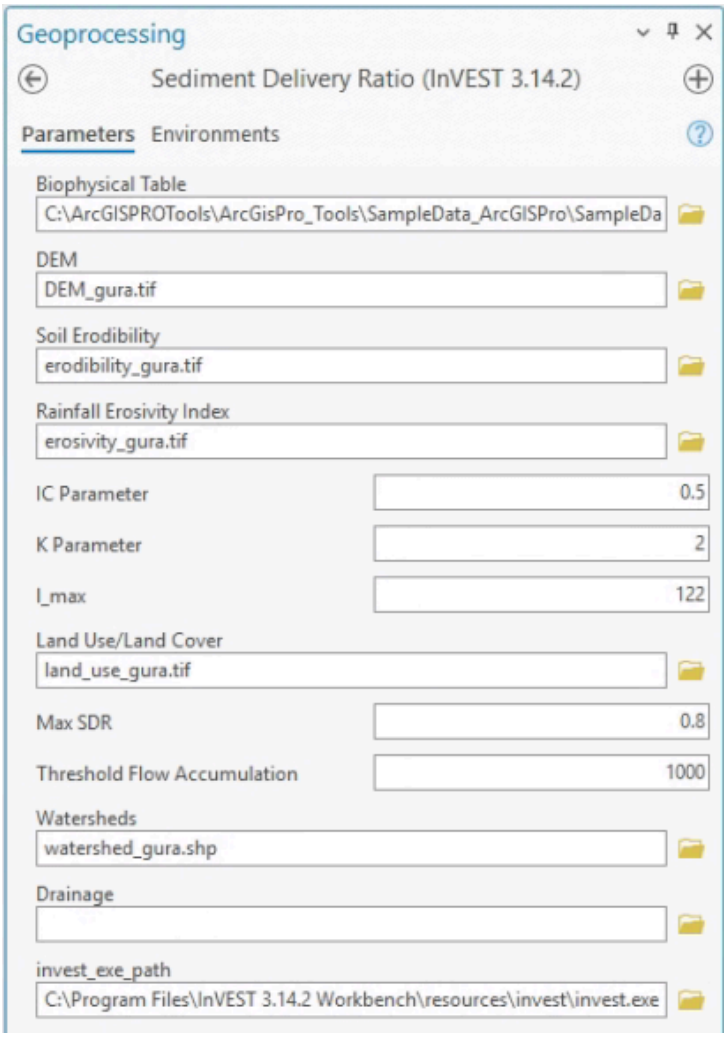


Right click the script and open it

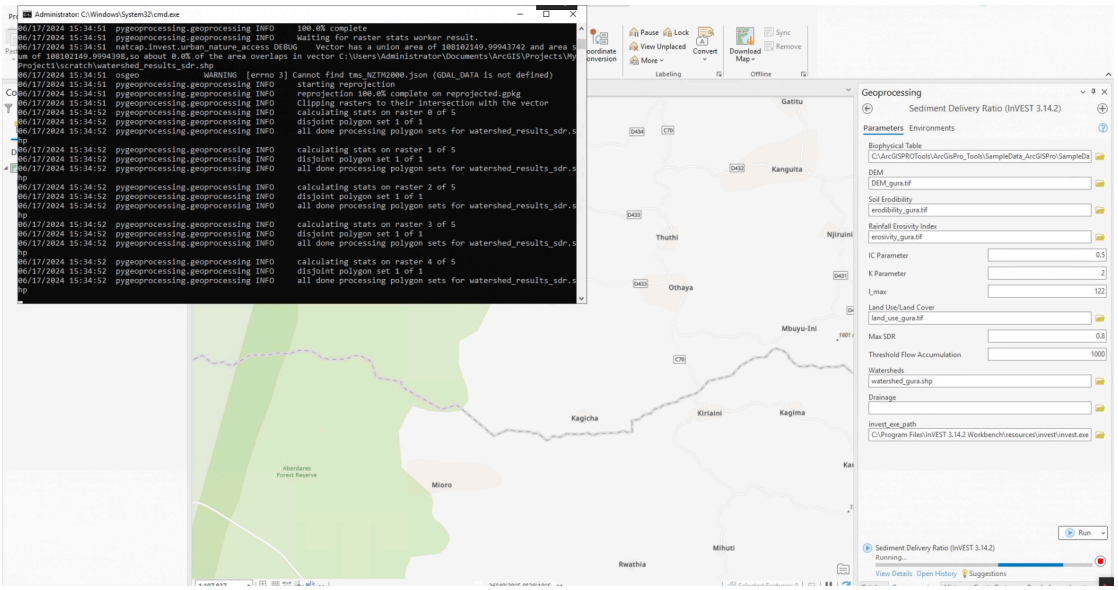
- Click  and select the “Biophysical Table”. In this example, we will use the file of “biophysical_table_Gura.csv” in the path of “\Environmental Analysis\SDR”.
- For the “DEM”, select “DEM_gura.tif” from the path of “\Environmental Analysis\SDR”.
- For the “Soil Erodibility”, select “erodibility_gura.tif” from the path of “\Environmental Analysis\SDR”.
- For the “Rainfall Erosivity Index”, select “erosivity_gura.tif” from the path of “\Environmental Analysis\SDR”.
- For the “Land Use/Land Cover”, select “land_use_gura.tif” from the path of “\Environmental Analysis\SDR”.
- For the “Watersheds”, select “watershed_gura.shp” from the path of “\Environmental Analysis\SDR”.
- Set “l_max” as 122.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the

pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.

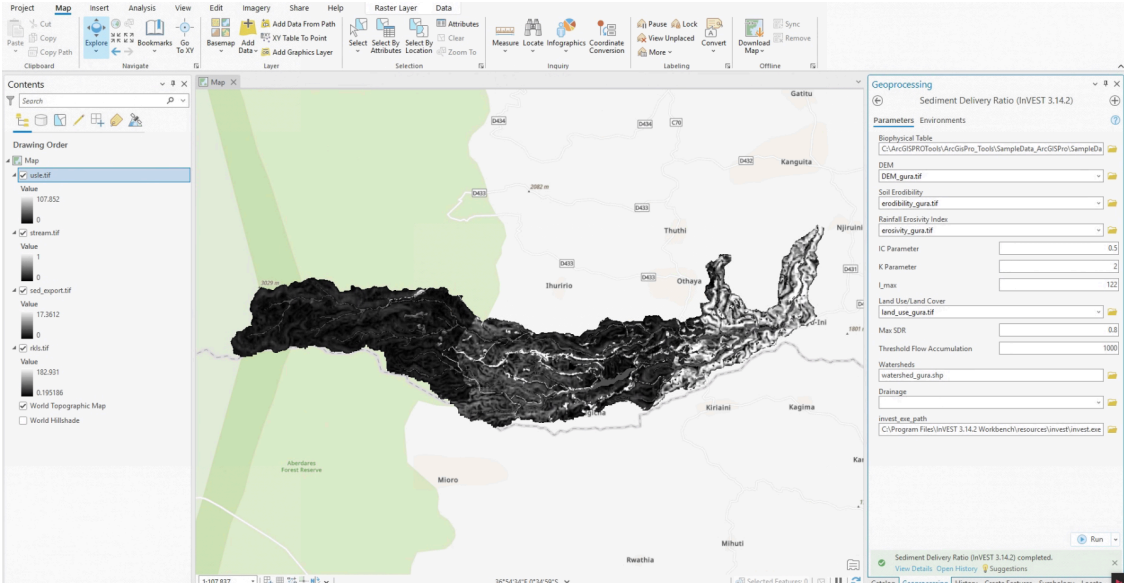
- Keep other parameters as default. And the all parameters are shown like:



- Then, click Run and an additional CMD window will show and that means the InVEST is running now.

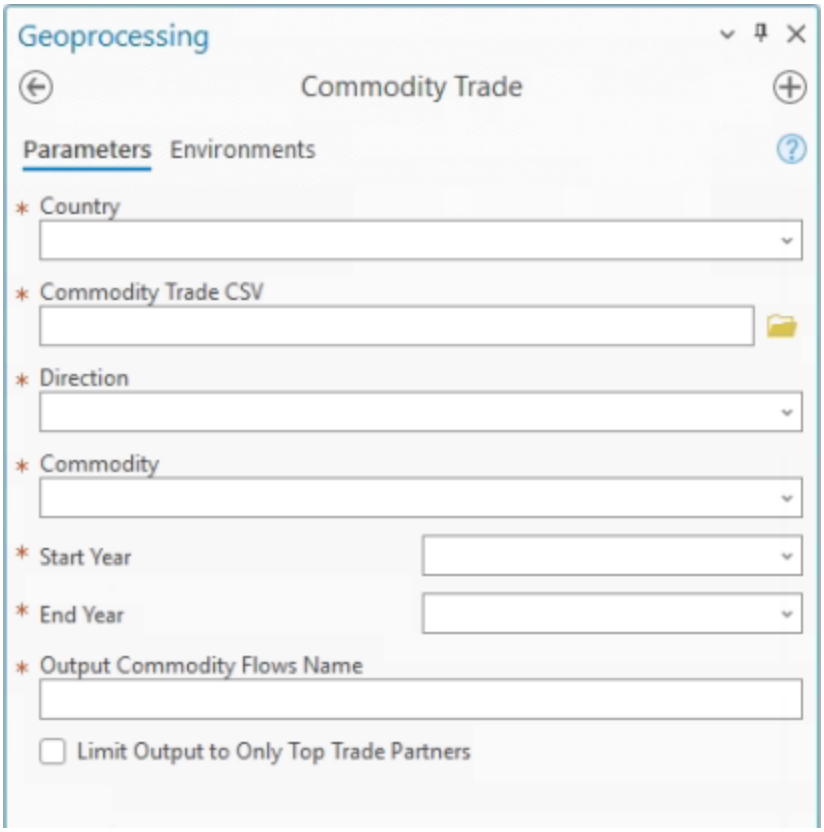


- When running is completed, the result shows like:



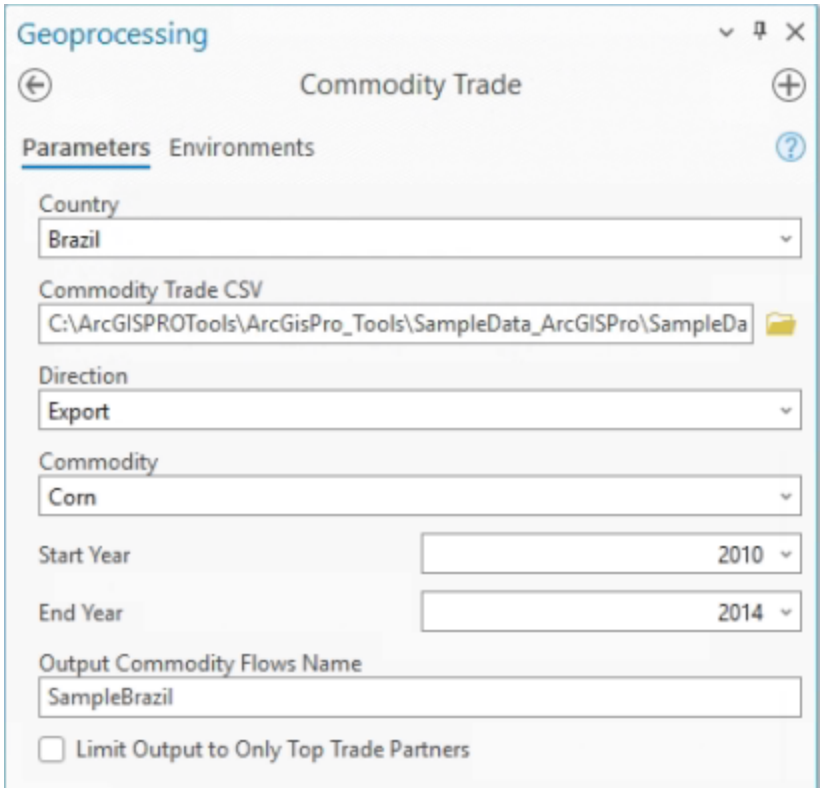
3.5 Flows

3.5.1 Commodity Trade

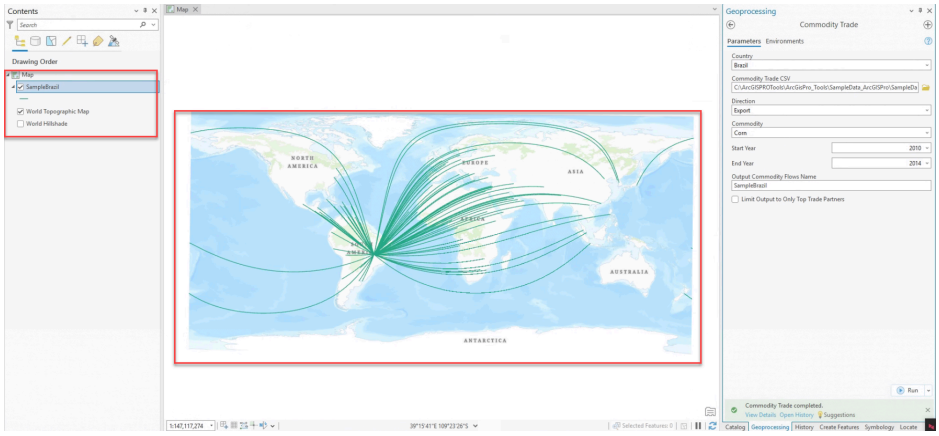


Right click the script and open it

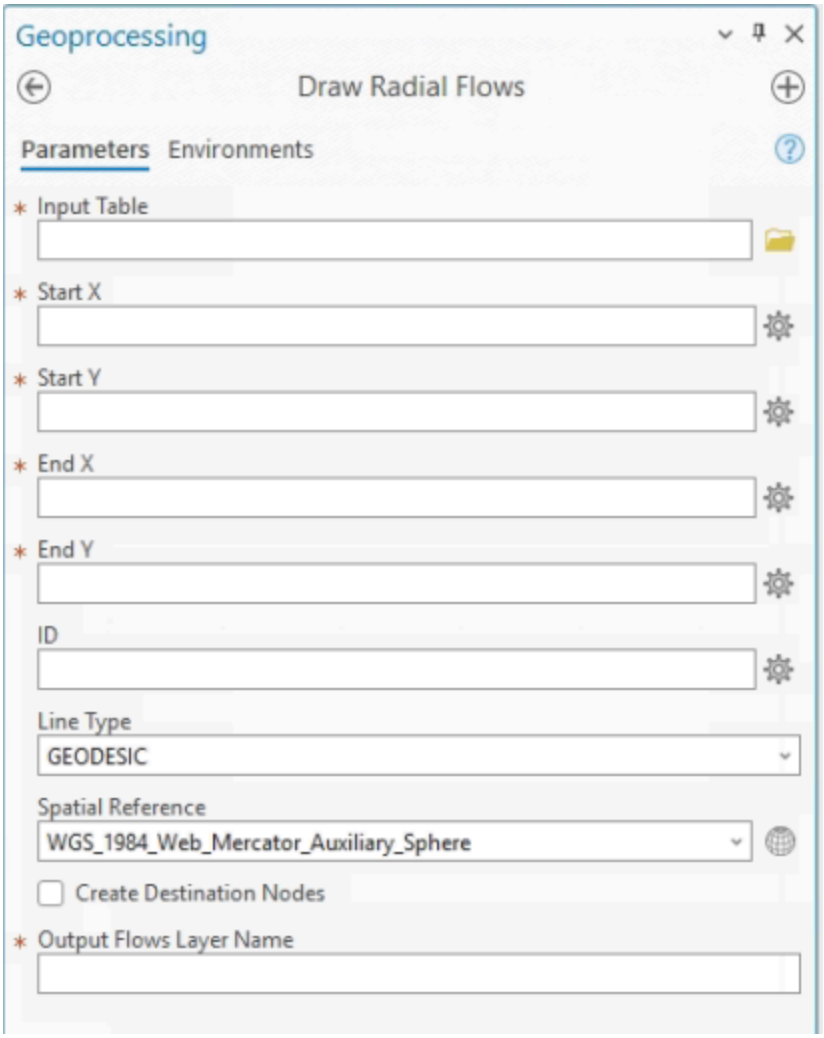
- Set “Country” as “Brazil” from the droplist
- For the “Commodity Trade CSV”, select the file of “comm_trade.csv” from the folder of “\Flows\Commodity Trade”.
- Set “Direction” as “Export” from the droplist
- Set “Commodity” as “Corn” from the droplist
- Set “Start Year” as 2010 from the droplist
- Set “End Year” as 2014 from the droplist
- Set “Output Commodity Flows Name” as “SampleBrazil”
- Keep other parameters as default:



- Click RUN button to execute the script and get the result:



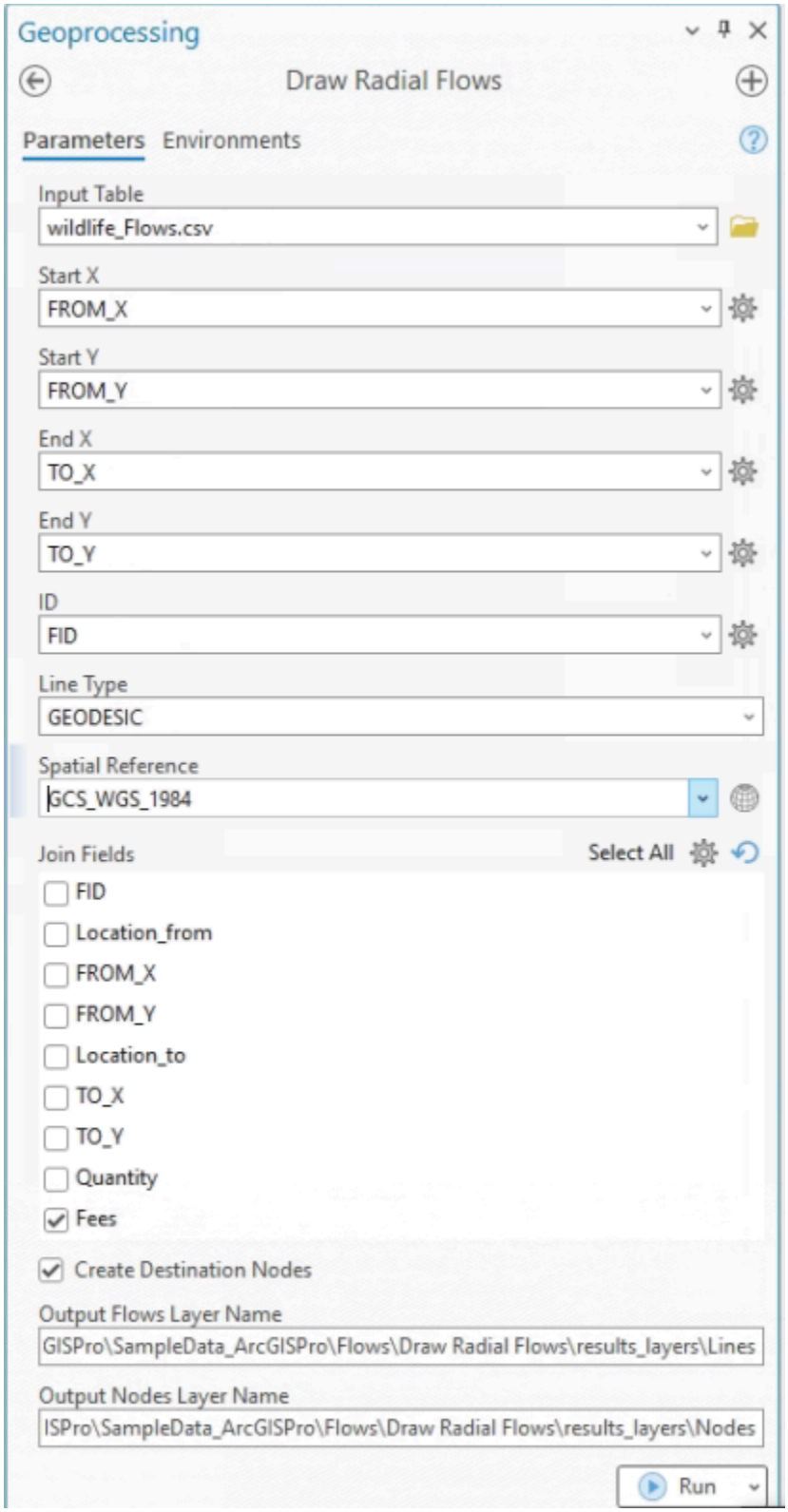
3.5.2 Draw Radial Flows



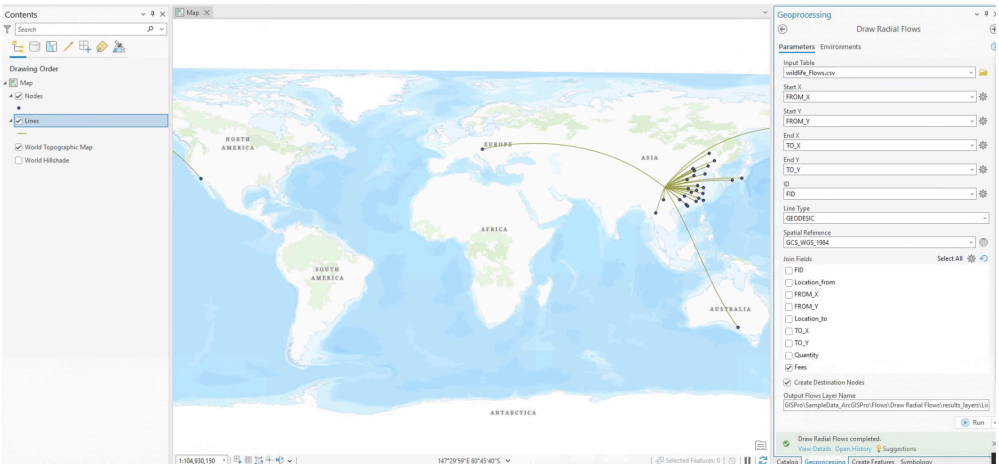
Right click the script and open it

- Click  and select the “Input Table”. In this example, we will use the file of “wildlife_Flows.csv” from the folder of “\Flows\Draw Radial Flows”.
- Set “Start X”, “Start Y”, “End X” and “End Y” as “FROM_X”, “FROM_Y”, “TO_X” and “TO_Y” from the droplists respectively.
- Set “ID” as “FID” from the droplist.
- Select “Fees” as the “Join Fields”
- Click “Create Destination Nodes” option.
- Set the path “\Flows\Draw Radial Flows\results_layers\Lines” in “Output Flows Layer Name”
- Set the path “\Flows\Draw Radial Flows\results_layers\Nodes” in “Output Nodes Layer Name”

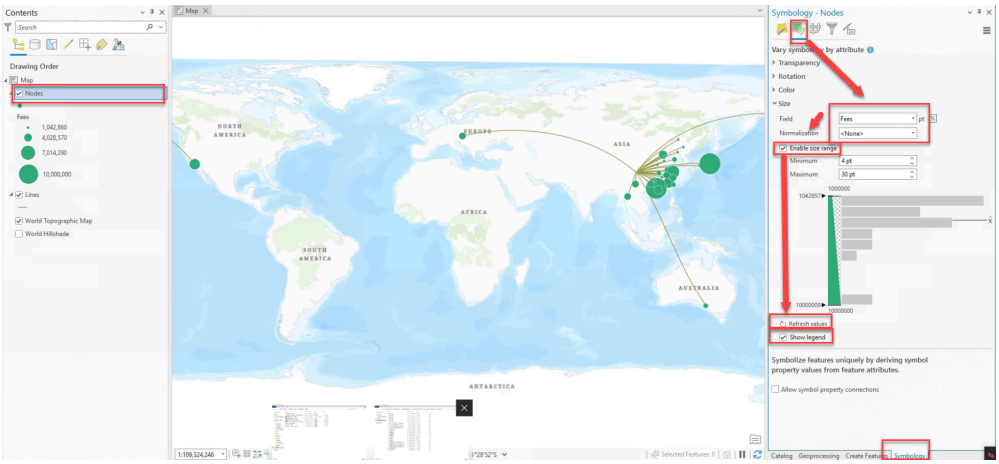
- Set “Spatial Reference” as “Current Map” and finally, it looks like:



- Click Run to execute the script and get the result:



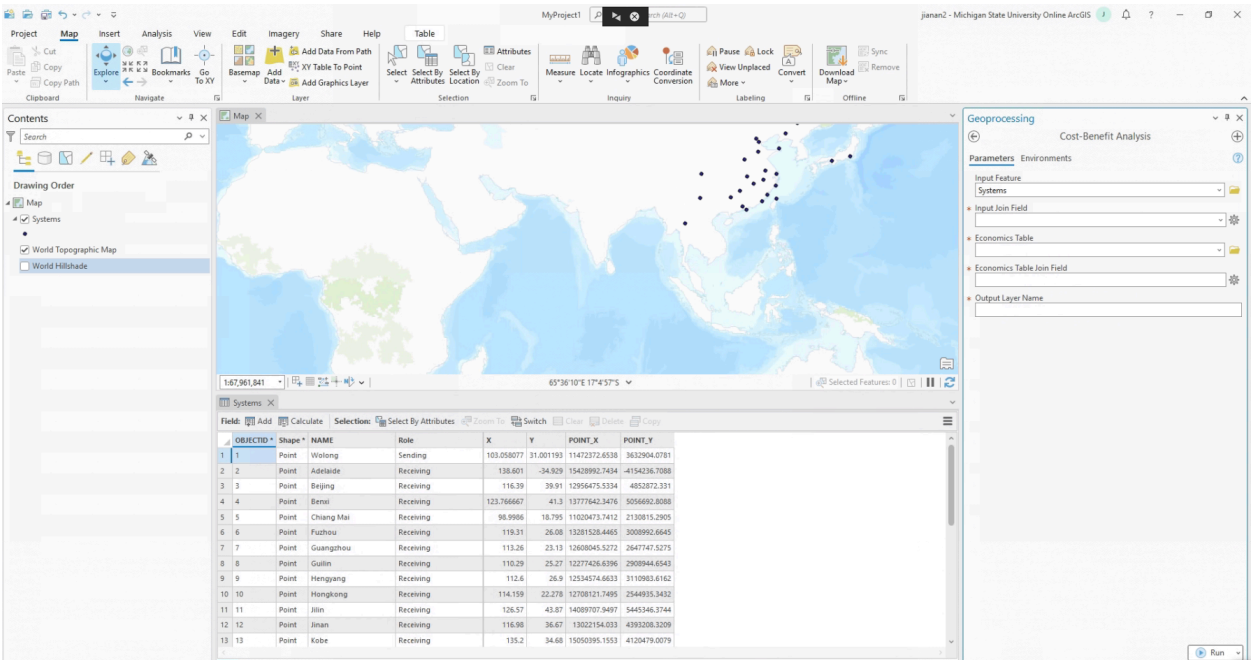
- You can select the “Nodes” layer and set the “Symbology” property as follows to vary the point size related to the fees number:



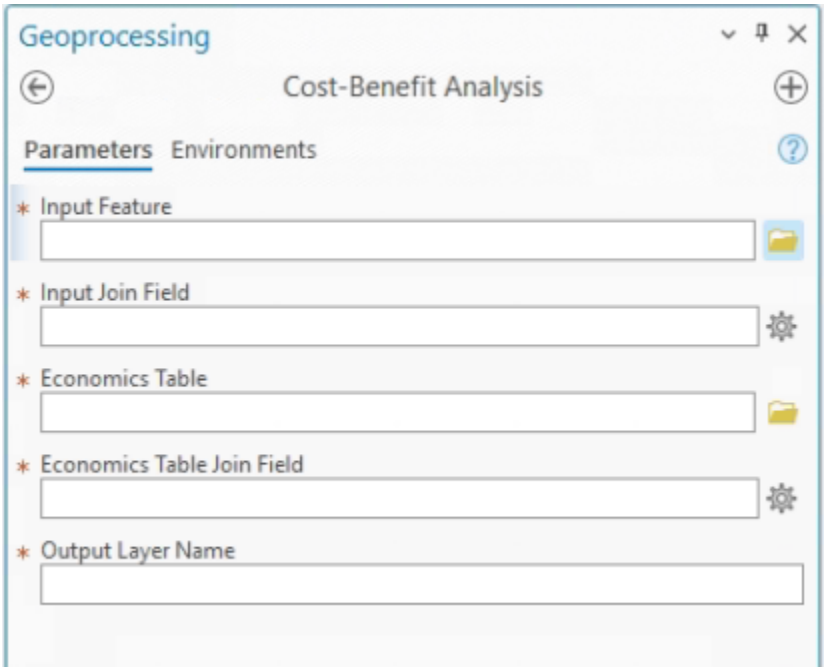
3.6 Socioeconomic Analysis

3.6.1 Cost-Benefit Analysis

Note: You need to run “3.7.2 Draw Systems from Table” to generate the feature layer in the map to get the result like below at first!!



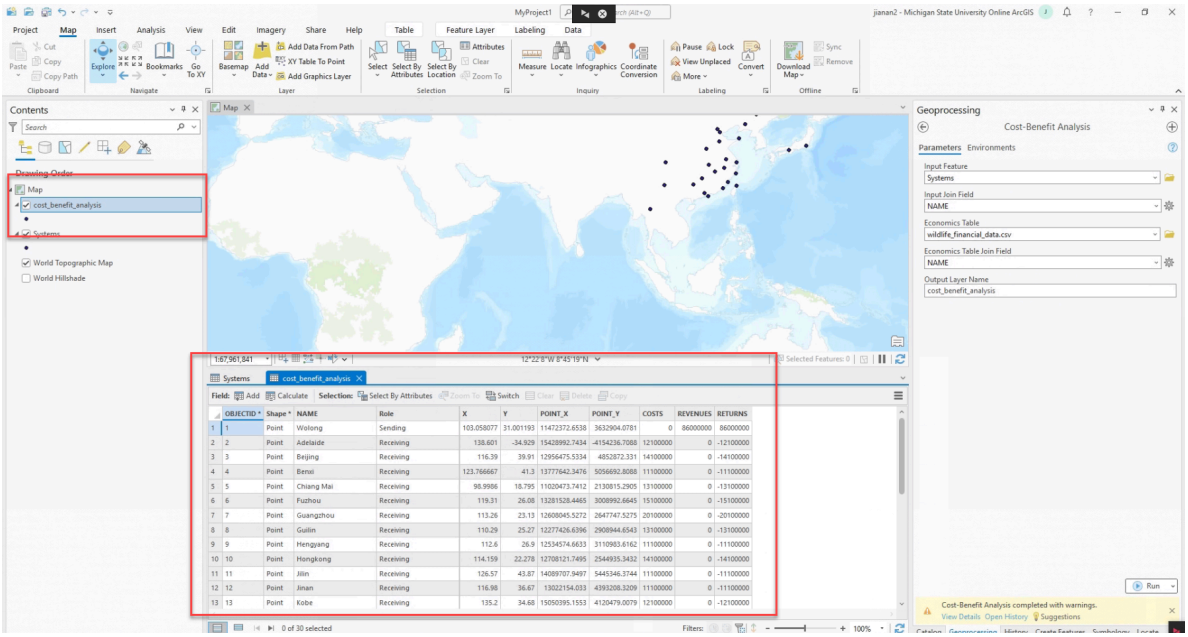
Then it is ready to use “Cost-Benefit Analysis”



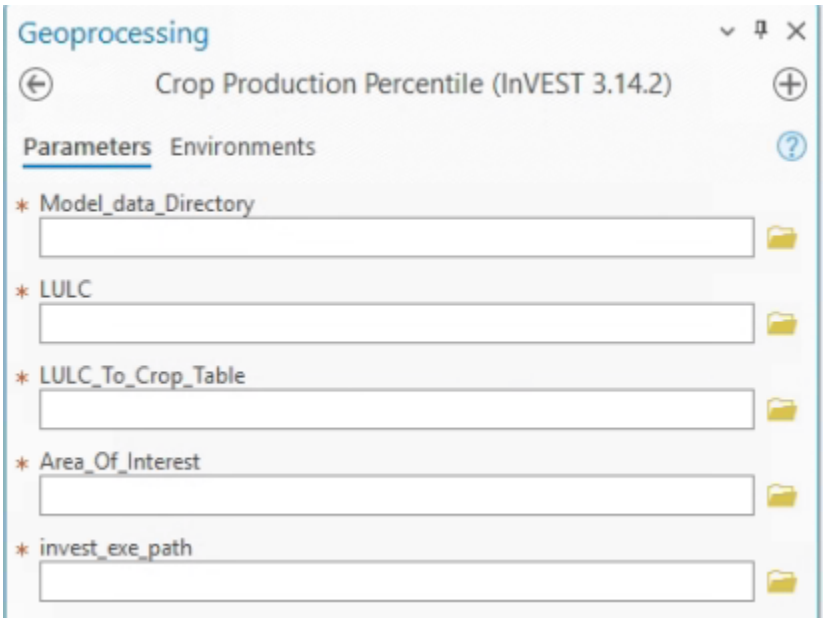
Right click the script and open it

- Click  and select the “Input Feature”. Select “Systems”
- Set “Input Join Field” as “NAME” from droplist.
- For the “Economics Table”, select “wildlife_financial_data.csv” from “\Socioeconomic Analysis\Cost-Benefit Analysis”.

- Set “Economics Table Join Field” as “NAME” as well.
- Set “Output Layer Name” as “cost_benefit_analysis”
- Run the script by clicking “Run” and get the result as:

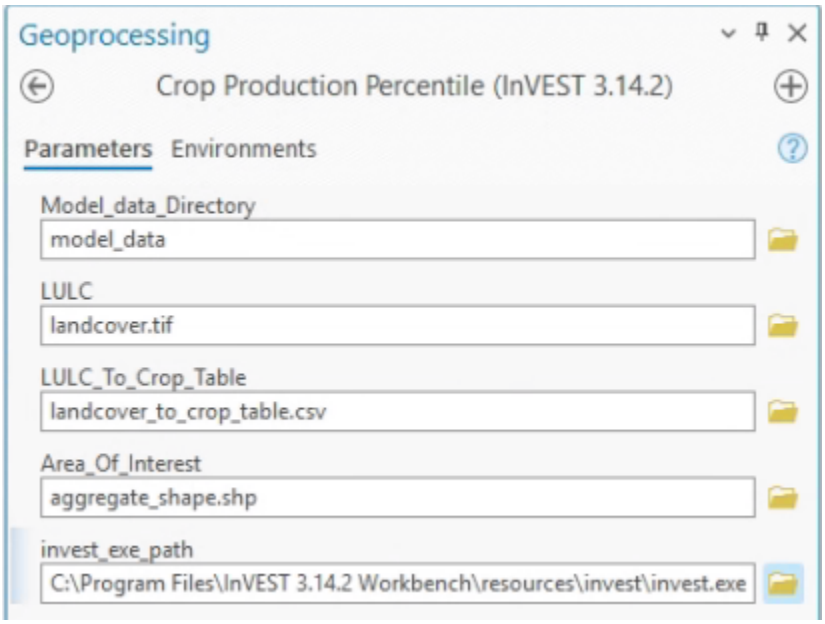


3.6.2 Crop Production Percentile (InVEST 3.14.2)

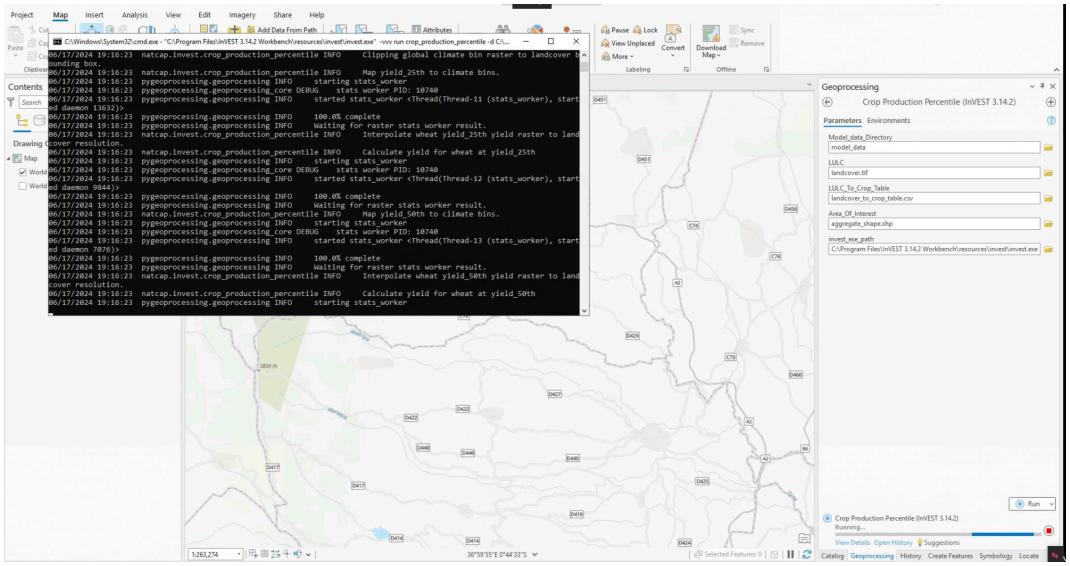


Right click the script and open it

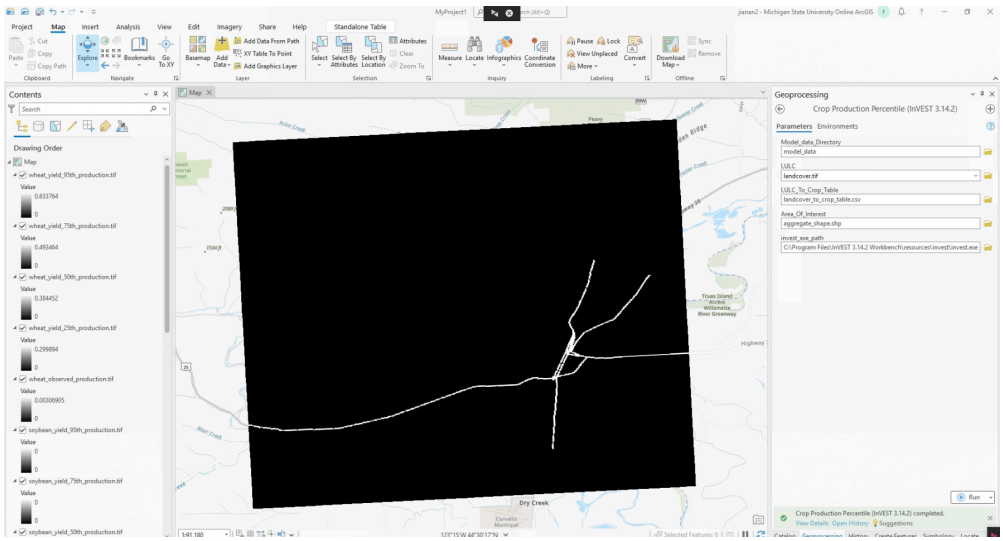
- Click  and select the “Model_data_Directory”. In this example, we will use the model data folder as “\Socioeconomic Analysis\CropProductionPercentile\model_data”.
- For the “LULC”, it is set as “landcover.tif” from “\Socioeconomic Analysis\CropProductionPercentile\sample_user_data”.
- For the “LULC_To_Crop_Table”, it is set as “landcover_to_crop_table.csv” from “\Socioeconomic Analysis\CropProductionPercentile\sample_user_data”.
- For the “Area_Of_Interest”, it is set as “aggregate_shape.shp” from “\Socioeconomic Analysis\CropProductionPercentile\sample_user_data”.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Keep other parameters as default. And the all parameters are shown like:



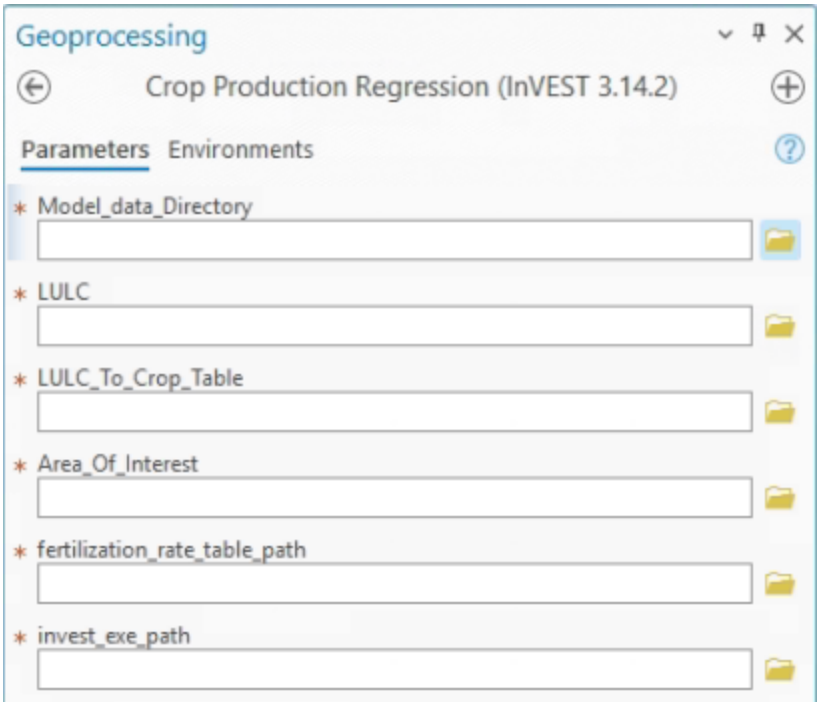
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:

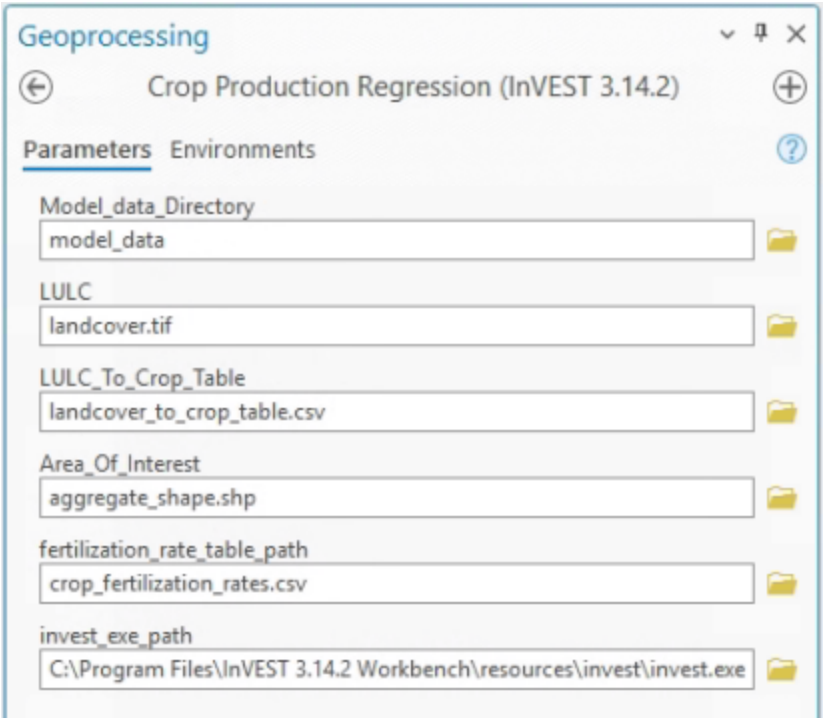


3.6.3 Crop Production Regression (InVEST 3.14.2)

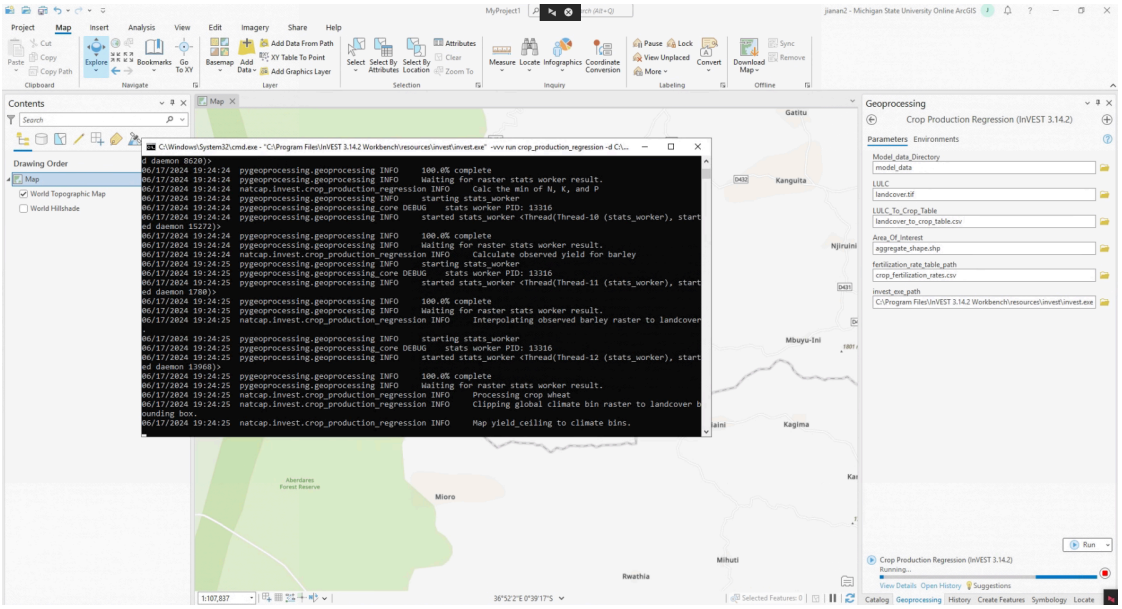


Right click the script and open it

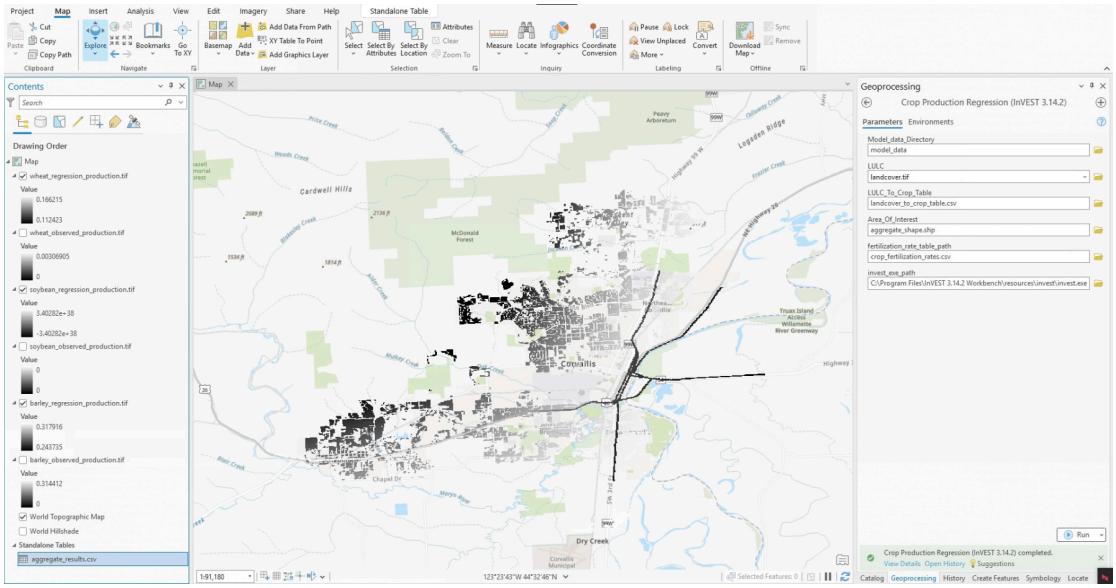
- Click  and select the “Model_data_Directory”. In this example, we will use the model data folder as “\Socioeconomic Analysis\CropProductionRegression\model_data”.
- For the “LULC”, it is set as “landcover.tif” from “\Socioeconomic Analysis\CropProductionRegression\sample_user_data”.
- For the “LULC_To_Crop_Table”, it is set as “landcover_to_crop_table.csv” from “\Socioeconomic Analysis\CropProductionRegression\sample_user_data”.
- For the “Area_Of_Interest”, it is set as “aggregate_shape.shp” from “\Socioeconomic Analysis\CropProductionRegression\sample_user_data”.
- For the “fertilization_rate_table_path”, it is set as “crop_fertilization_rates.csv” from “\Socioeconomic Analysis\CropProductionRegression\sample_user_data”.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Keep other parameters as default. And the all parameters are shown like:



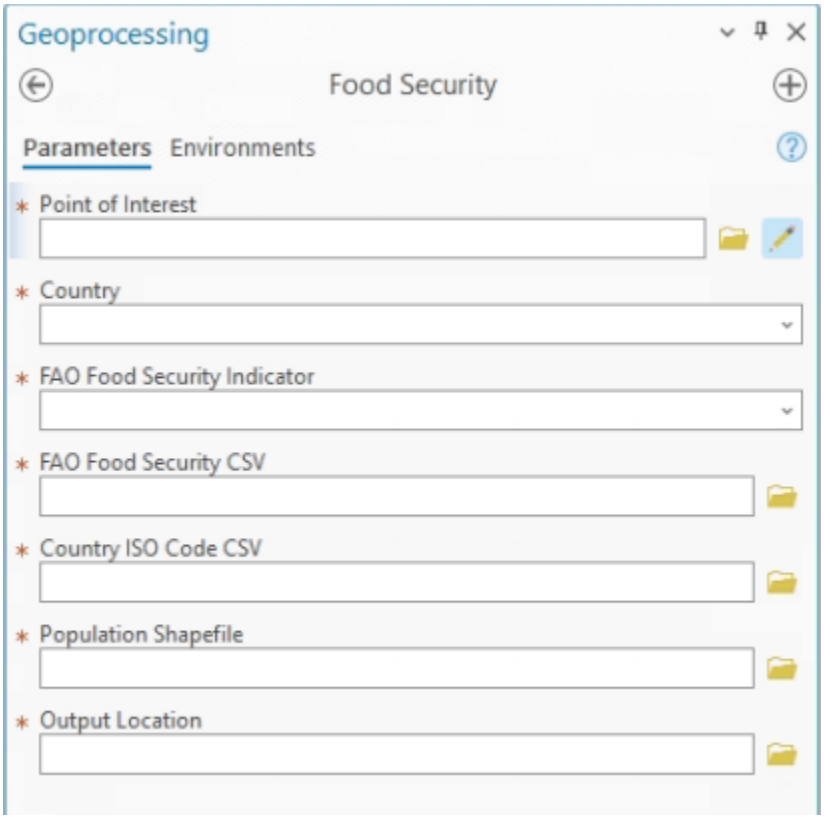
- Then, click Run and an additional CMD window will show and that means the InVEST is running now.



- When running is completed, the result shows like:



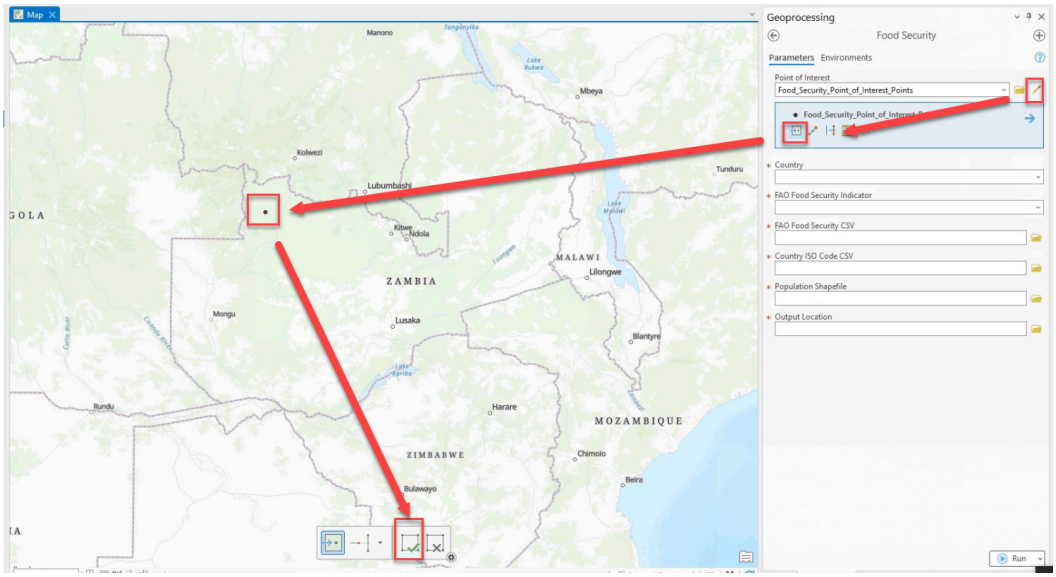
3.6.4 Food Security



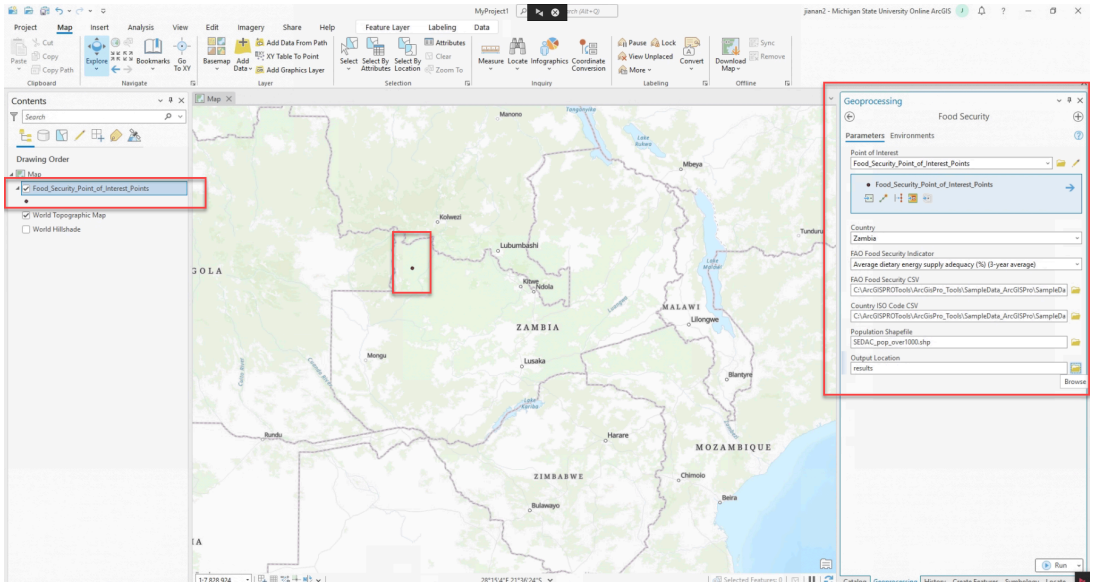
Right click the script and open it

- To run the Food Security tool, you will need to populate the interface with some

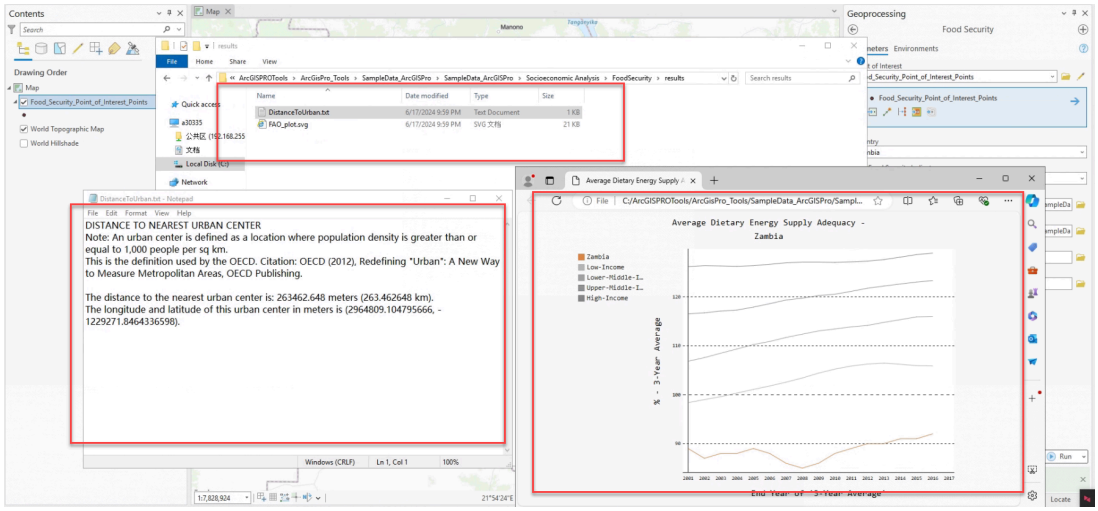
information. First, you will want to place the Point of Interest within the map viewer. Below, the Point of Interest has been placed in the northern part of Zambia's NorthWestern province.



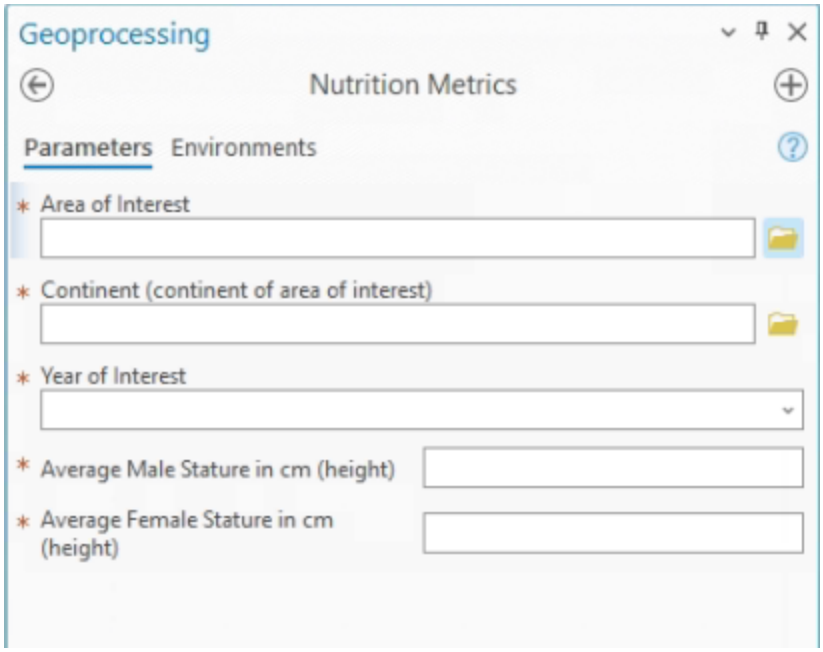
- Set "Country" as "Zambia"
- Set "FAO Food Security Indicator" as "Average dietary energy supply adequacy (%) (3-year average)" from the droplist.
- For "FAO Food Security CSV", select "fao.csv" from the folder of "\Socioeconomic Analysis\FoodSecurity"
- For "Country ISO Code CSV", select "iso_codes.csv" from the folder of "\Socioeconomic Analysis\FoodSecurity"
- For "Population Shapefile", select "SEDAV_pop_over1000.shp" from the folder of "\Socioeconomic Analysis\FoodSecurity"
- For "Output Location", select "\Socioeconomic Analysis\FoodSecurity\results"
- All parameters are set like below:



- Then, click Run and get results in the output folder, here it is “\Socioeconomic Analysis\FoodSecurity\results”

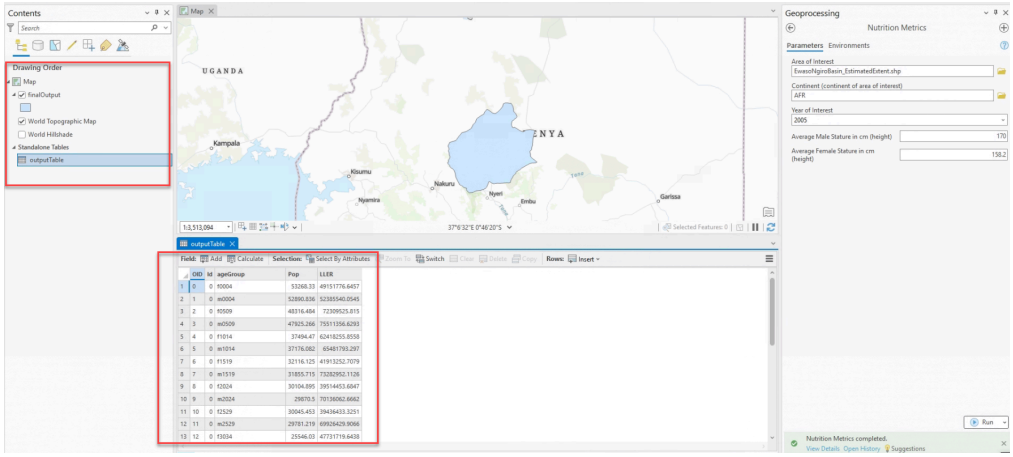


3.6.5 Nutrition Metrics

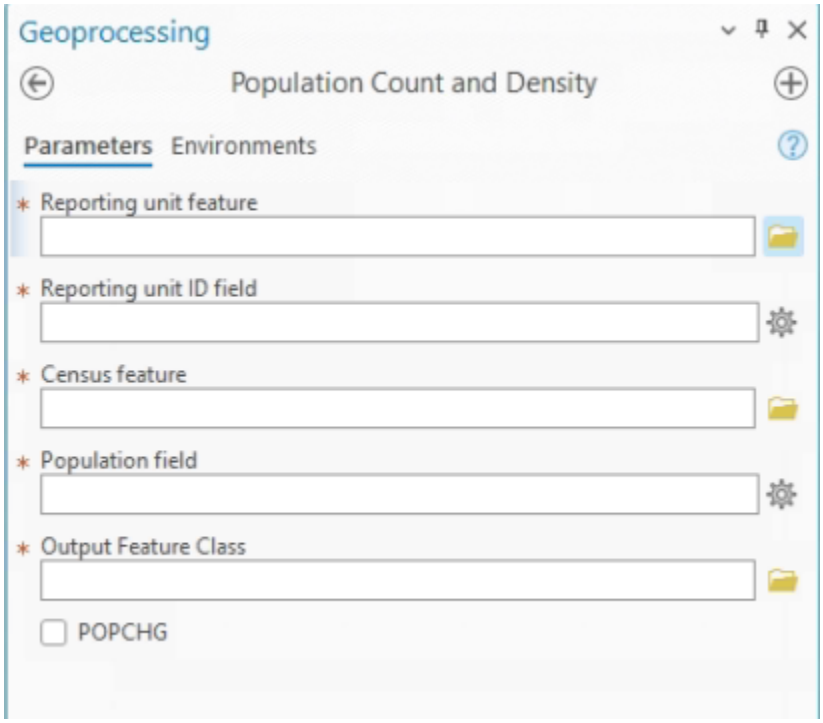


Right click the script and open it

- Click  and select the “Area of Interest”. In this example, we will use the file of “EwasoNgiroBasin_EstimatedExtent.shp” from the folder “\Socioeconomic Analysis\Nutrition Metrics”
- For the Continent (continent of area of interest), select the folder “\Socioeconomic Analysis\Nutrition Metrics\AFR”
- Set “Year of Interest” as 2005 from the droplist.
- Set “Average Male Stature in cm (height)” as 170
- Set “Average Female Stature in cm (height)” as 158.2
- Then click Run to get the result:

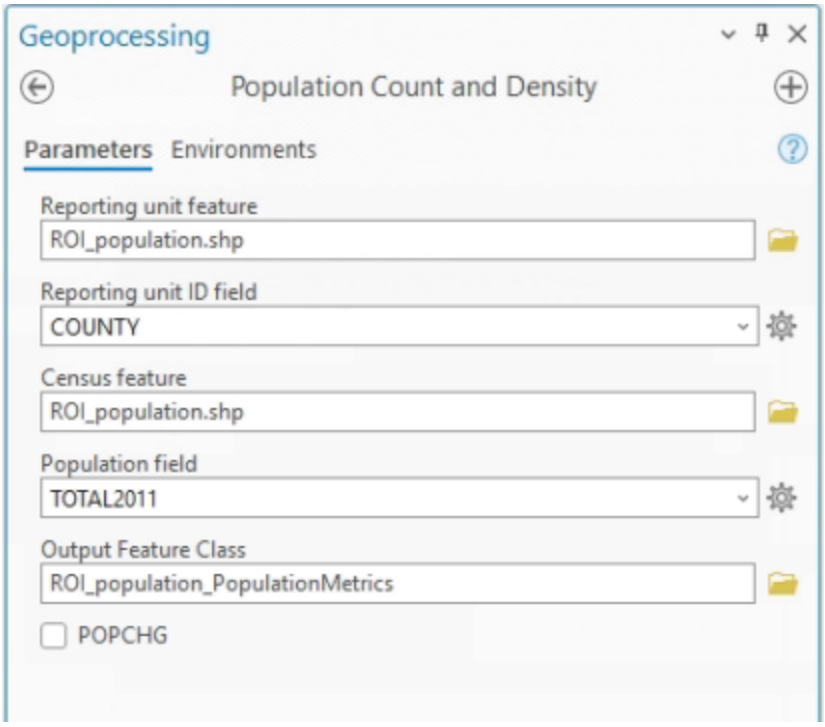


3.6.6 Population Count and Density

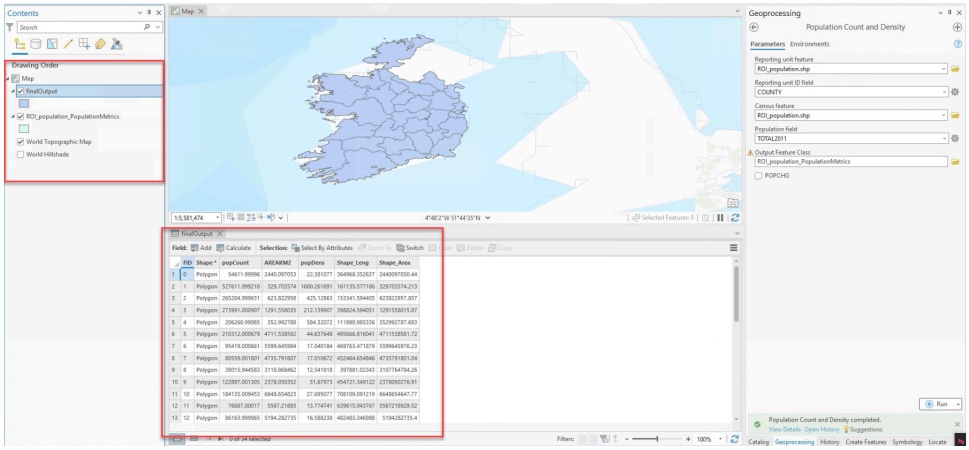


Right click the script and open it

- Click  and select the “Reporting unit feature”. In this example, we will use the file of “ROI_population.shp” from the folder “\Socioeconomic Analysis\Population Count and Density”
- Set “Reporting unit ID field” as “COUNTRY” from the droplist.
- Click  and select the “Census feature”. In this example, we will use the file of “ROI_population.shp” from the folder “\Socioeconomic Analysis\Population Count and Density”
- Set “Reporting unit ID field” as “TOTAL2011” from the droplist.
- Keep other parameters as default

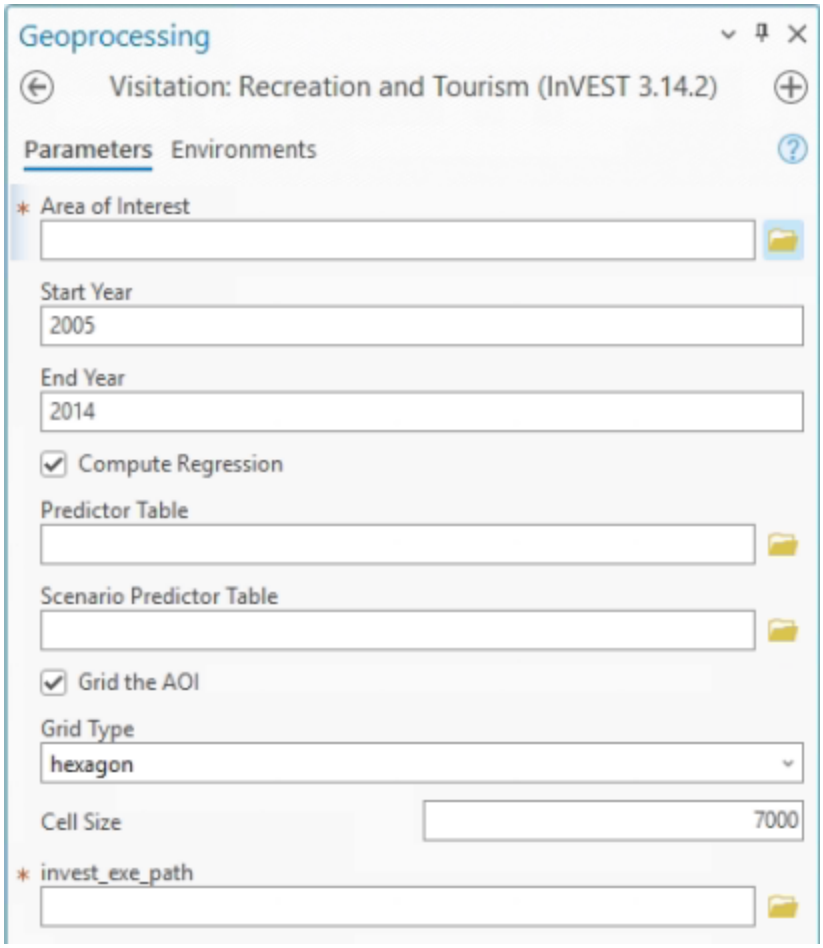


- Run the script to get the result:



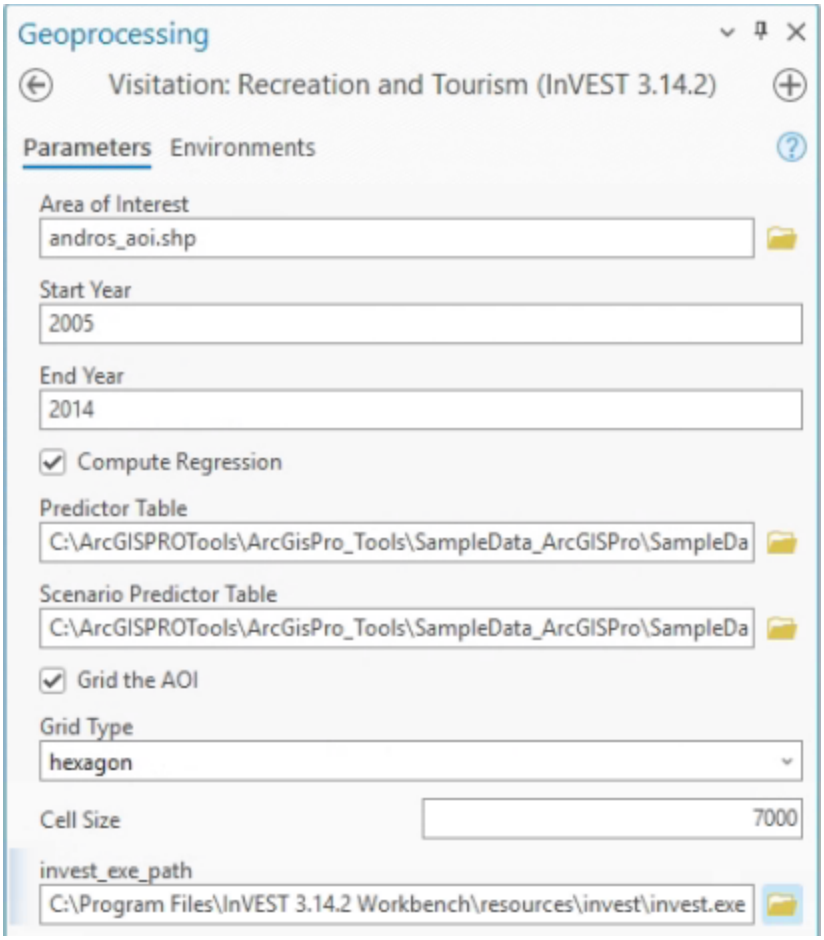
3.6.7 Visitation: Recreation and Tourism (InVEST 3.14.2)

Note: This script needs an internet connection.

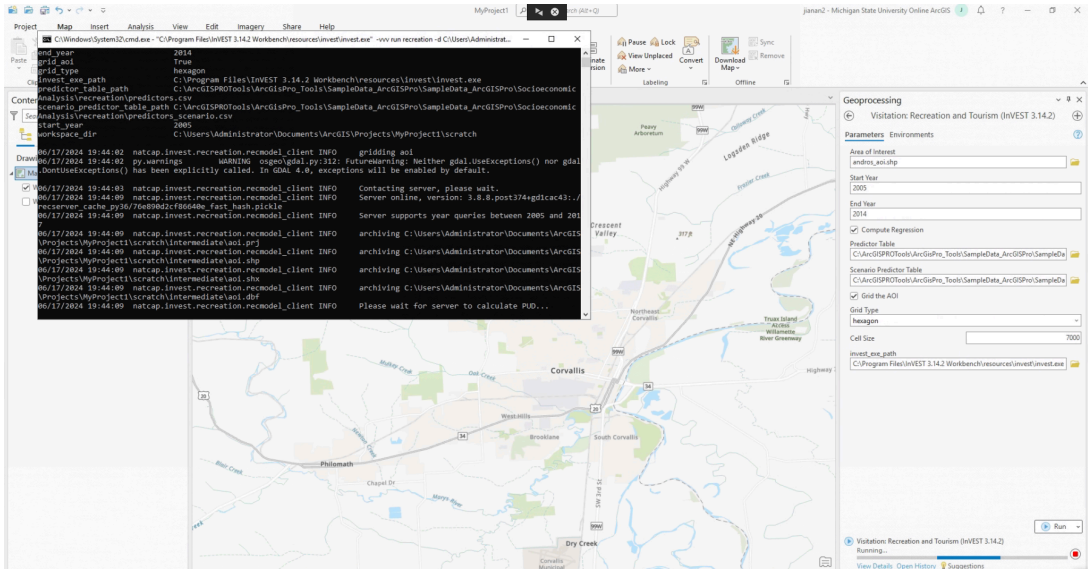


Right click the script and open it

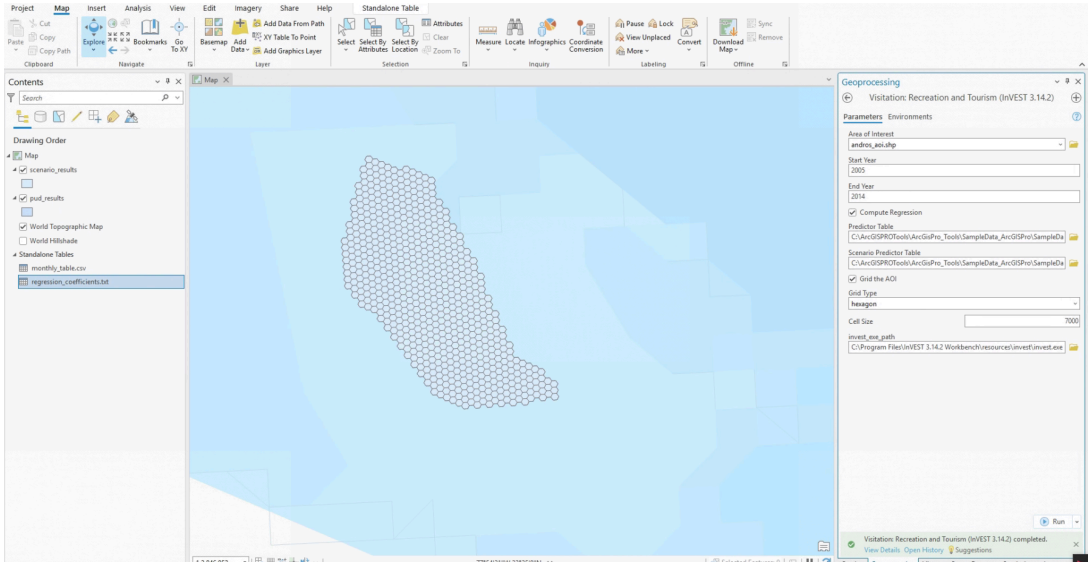
- Click  and select the “Area of Interest”. In this example, we will use the file “andros_aoi.shp” from the folder “\Socioeconomic Analysis\recreation”.
- For “Predictor Table”, it is set as “predictors.csv” from the folder “\Socioeconomic Analysis\recreation”.
- For “Scenario Predictor Table”, it is set as “predictors_scenario.csv” from the folder “\Socioeconomic Analysis\recreation”.
- Due to we need to use InVEST CLI model, we need to set the InVEST PATH into the parameter of “invest_exe_path”. Because, currently, the InVEST was installed in the pathe of “C:\Program Files\InVEST 3.14.2 Workbench”, we can input the path of “C:\Program Files\InVEST 3.14.2 Workbench\resources\invest\invest.exe” here.
- Keep other parameters as default. And the all parameters are shown like:



- Then, click Run and an additional CMD window will show and that means the InVEST is running now.

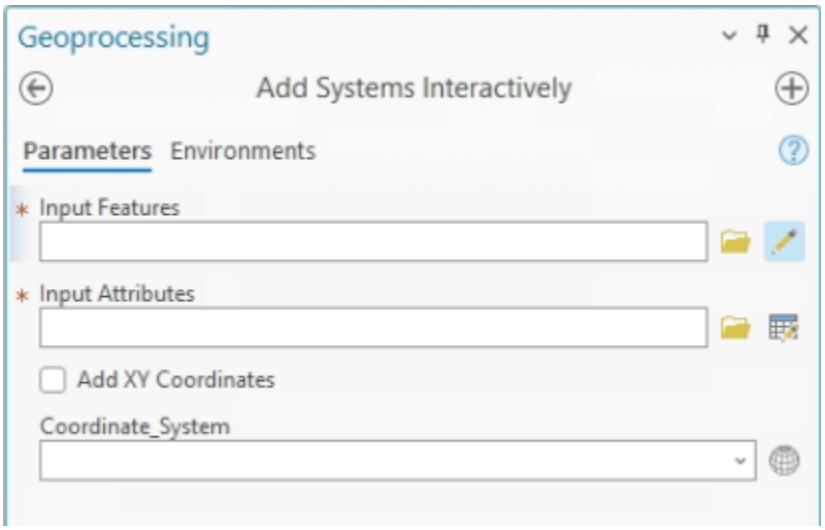


- When running is completed, the result shows like:



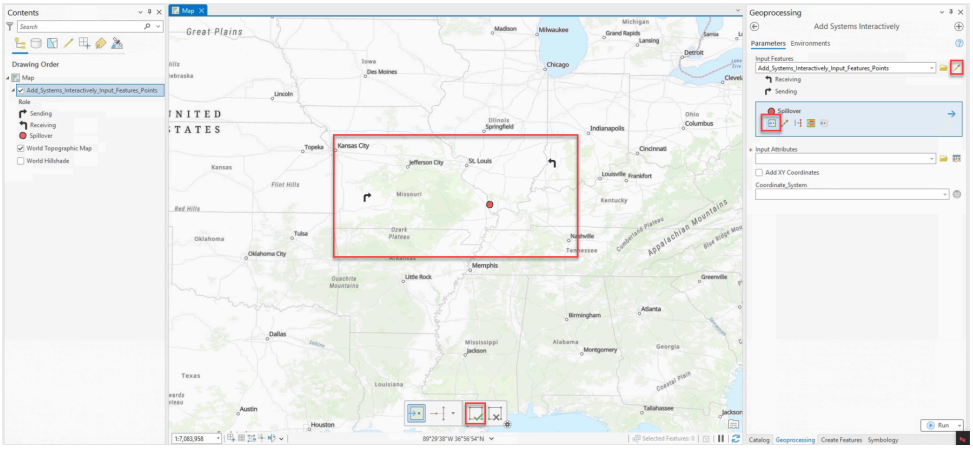
3.7 Systems

3.7.1 Add Systems Interactively

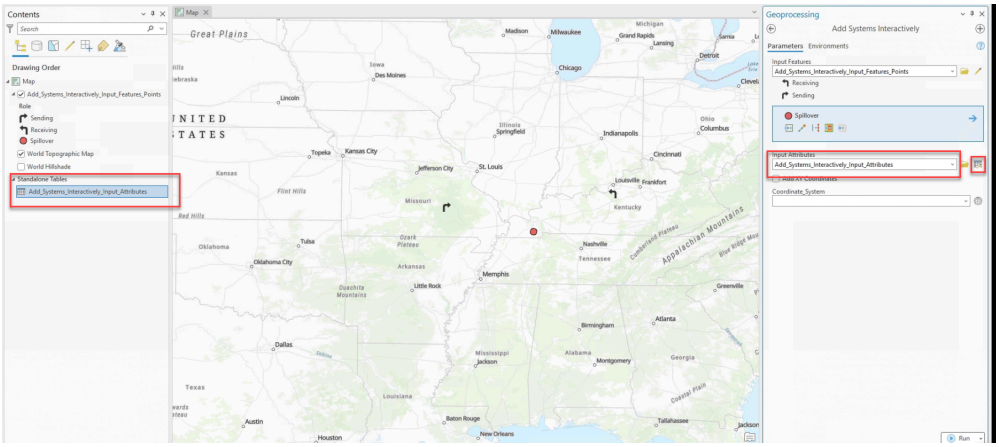


Right click the script and open it

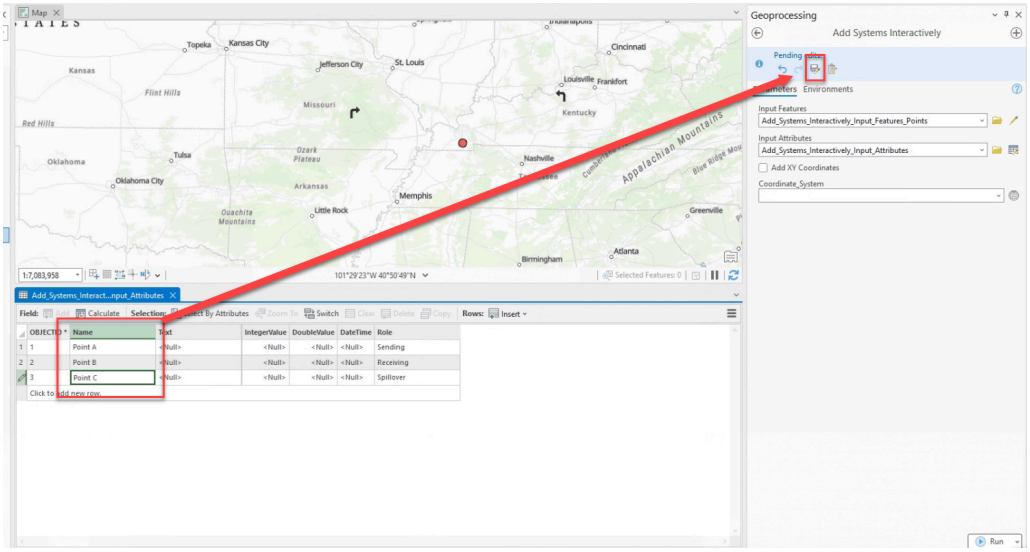
- Click  to create new features in the current map to use as input
- Select “Points” and Move the mouse cursor over the map and you should see points ready to be placed.
- Then, click on the map to mark the position your down and click the “Finish”.



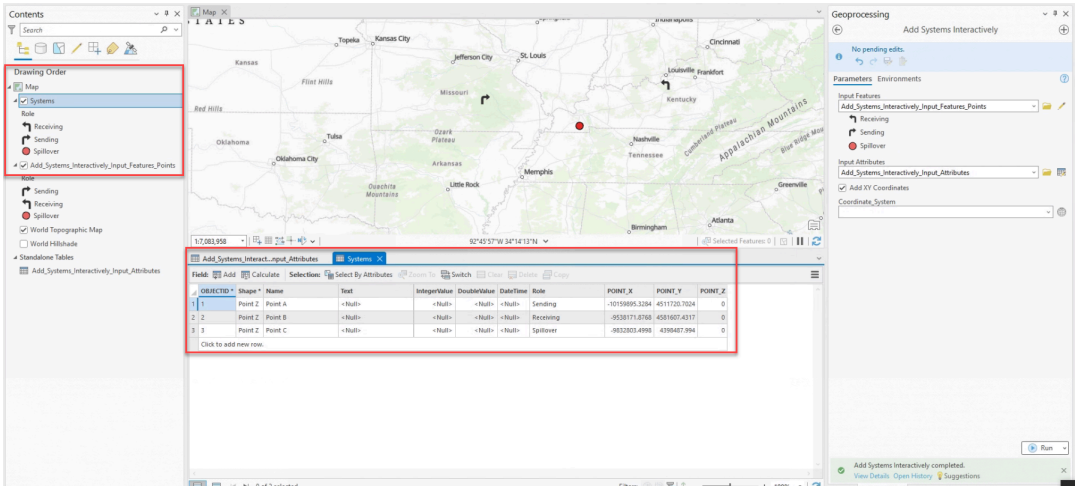
- Select the feature layer and Click  to create an attribute table



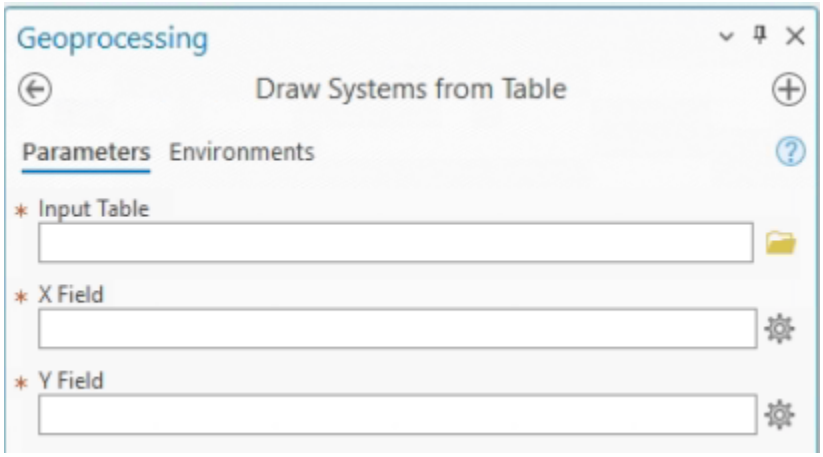
- You will get a table in the “Contents” tab and need to open it by right click and select “Open”
- Then, input the description in the “Name” colum and then click “save”



- You can check “Add XY Coordinates” and keep other parameters as default, then click RUN to execute the script.
- For the result, you can check the “Systems” layer in the Contents, and right click it to open the attribution table, you will see the data there.

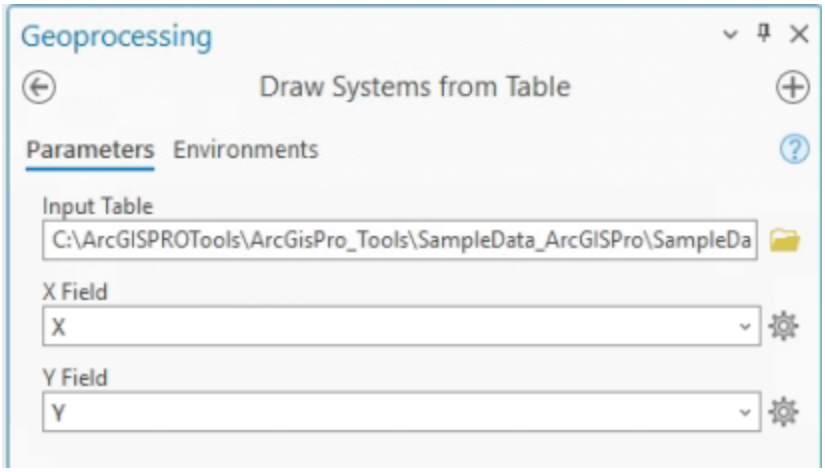


3.7.2 Draw Systems from Table

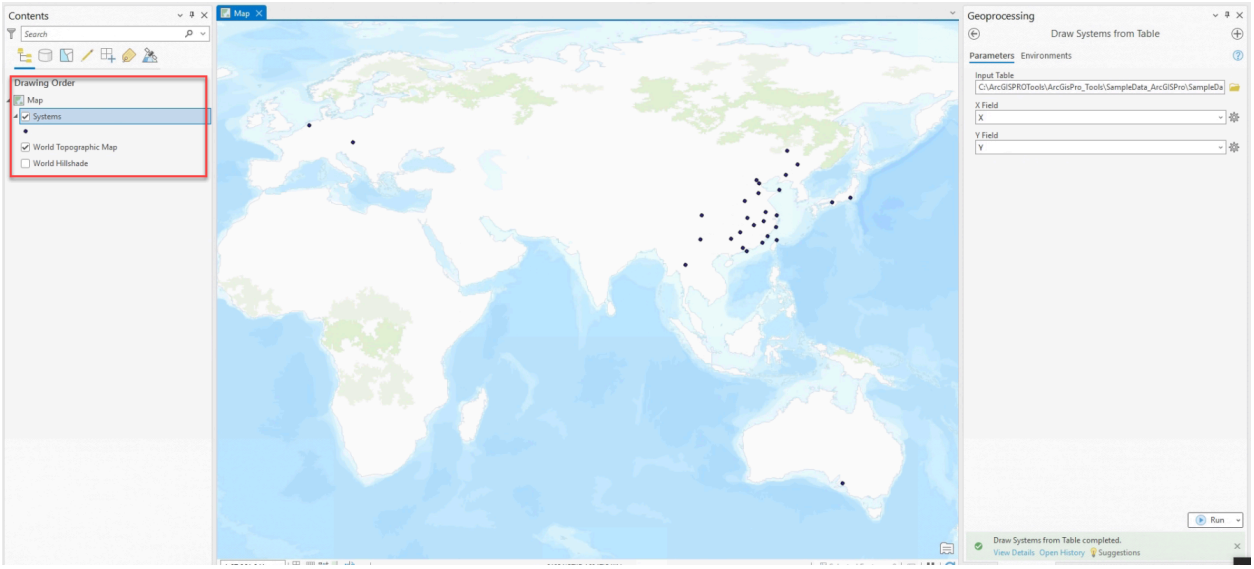


Right click the script and open it

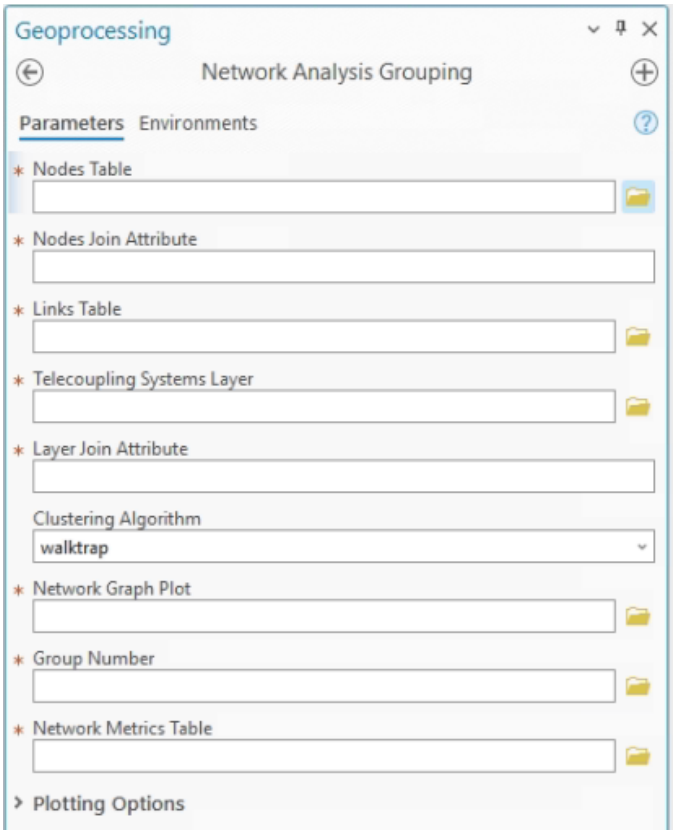
- Click  and select the “Input Table”. In this example, we will use the file “wildlife_Systems.csv” from the folder “\Systems\Draw Systems from Table”.
- Set “X Field” as “X” and “Y Field” as “Y” from the droplist.
- All parameters are set like:



- Then, click “Run” and the results shows like:



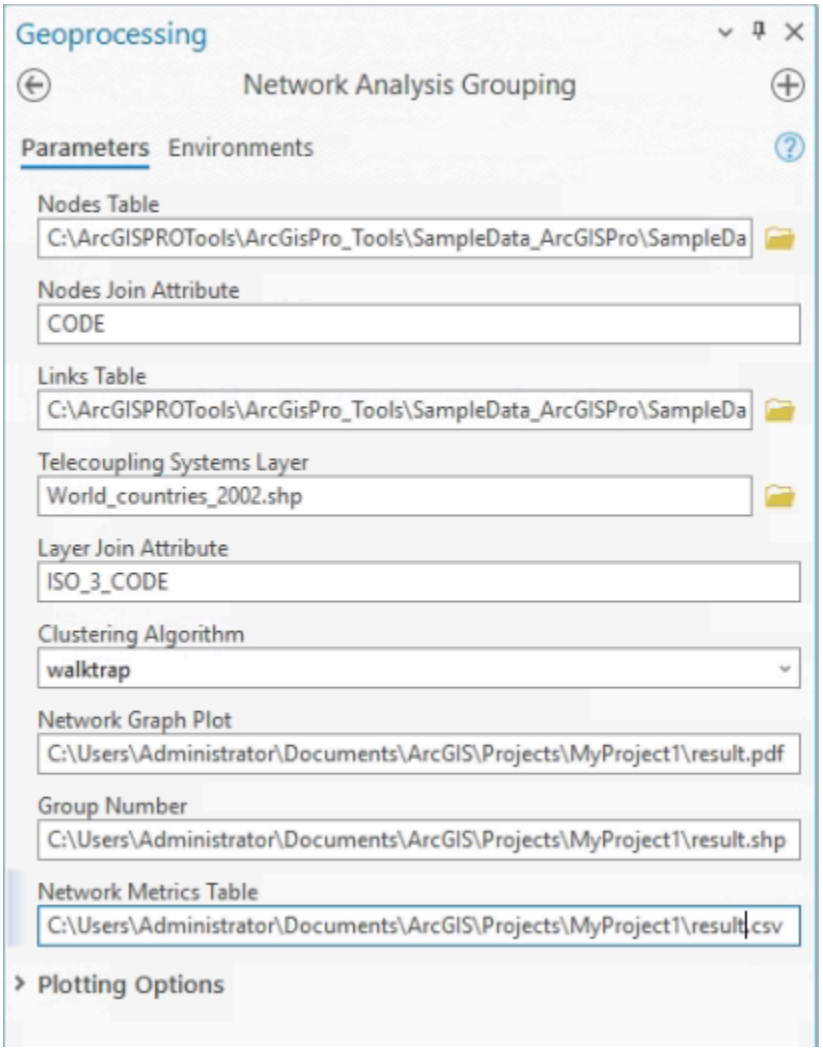
3.7.3 Network Analysis Grouping



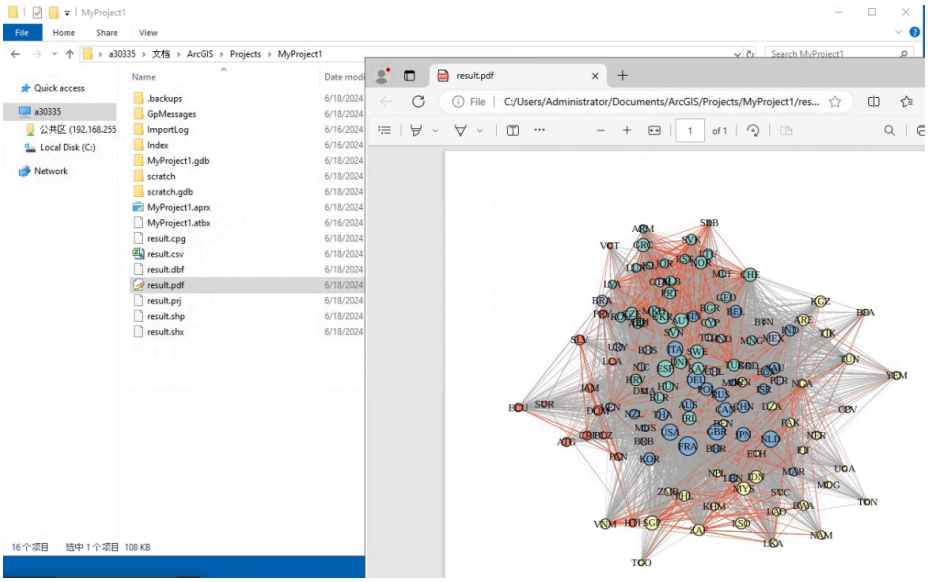
Right click the script and open it

- Click  and select the “Nodes Table”. In this example, we will use the file “nodes.csv” from the folder “\Systems\Network Analysis Grouping”.
- Set “Nodes Join Attribute” as “CODE”
- Click  and select the “Links Table”. In this example, we will use the file “links.csv” from the folder “\Systems\Network Analysis Grouping”.
- For the “Telecoupling Systems Layer”, select “World_countries_2002.shp” from the folder “\Systems\Network Analysis Grouping”.
- Set “Layer Join Attribute” as “ISO_3_CODE”
- Set “Network Graph Plot” as “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\result.pdf”
- Set “Group Number” as “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\result.shp”

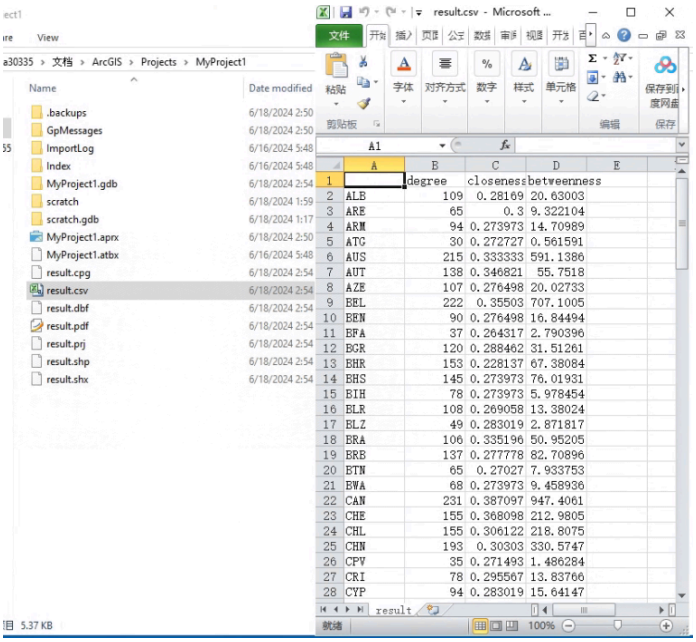
- Set “Network Metrics Table” as “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\result.csv”
- The parameters are set as below:



- You can check the pdf from “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\result.pdf” as below:



- You can check the csv from “C:\Users\Administrator\Documents\ArcGIS\Projects\MyProject1\result.csv ” as below:



	degree	closeness	betweenness
ALB	109	0.28169	20.63003
ARE	65	0.3	9.322104
ARM	94	0.273973	14.70989
ATG	30	0.272727	0.561591
AUS	215	0.333333	591.1386
AUT	138	0.346821	55.7518
AZE	107	0.276498	20.02733
BEL	222	0.35503	707.1005
BEN	90	0.276498	16.84494
BFA	37	0.264317	2.790396
BGR	120	0.288462	31.51261
BHR	153	0.228137	67.38084
BHS	145	0.273973	76.01931
BIH	78	0.273973	5.978454
BLR	108	0.269058	13.38024
BLZ	49	0.283019	2.871817
BRA	106	0.335196	50.95205
BRB	137	0.277778	82.70896
BTN	65	0.27027	7.933753
BWA	68	0.273973	9.458936
CAN	231	0.387097	947.4061
CHE	155	0.368098	212.9805
CHL	155	0.306122	218.8075
CHN	193	0.30303	330.5747
CPV	35	0.271493	1.486284
CRI	78	0.295567	13.83766
CYP	94	0.283019	15.64147