

PRACTICAL LECTURE

Python and Proprietary GIS

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Python and Proprietary GIS

Most GIS and remote sensing software systems now have bindings to Python

To combine Python GIS scripting between different software systems is a challenge

Example of desktop software systems available for Python scripting:

- ESRI ArcGIS Pro
- ESRI ArcGIS Desktop 10.8 (Supported until 2026, no 10.9 planned)
- Safe FME Desktop
- ENVI/IDL

Python and Safe FME

Not tested by teacher but the use of Python transformers (e.g. PythonCaller) are available.

FME Python API Documentation:

<http://docs.safe.com/fme/html/fmepython/index.html>

Tutorial:

<https://community.safe.com/s/article/python-and-fme-basics>

PythonCaller:

https://docs.safe.com/fme/html/FME_Desktop_Documentation/FME_Transformers/Transformers/pythoncaller.htm

Python and ArcGIS Pro

As with **osgeo**-related products you must point to the correct Python installation linked to ArcGIS on your computer.

Accessing Python for ArcGIS Pro:

1. Use the installed IDE or Notebook from the Start menu (Windows)
2. Access via VSCode similar as with osgeo-products (live example later)

Investigate what Python that are used and what environment path settings that are used by exploiting the built in sys module:

Import sys

sys.executable

sys.path

Python and ArcGIS

Tool in ArcGIS is available via the **arcpy** Python module

Running a tool:

```
import arcpy  
arcpy.analysis.Buffer("c:/temp/dronephotos.shp", "c:/  
temp/dronephotos_buffer500.shp ", "500 METERS")
```

Getting results from a tool:

When a geoprocessing tool is executed, the results of the tool are returned in a Result object. Typically, this object is the path to the output dataset produced or updated by the tool. In other cases, it may contain other value types.

```
result = arcpy. analysis.Buffer("rivers", "riverBuf", "50 METERS")  
print result  
C:\Portland\Portland_OR.gdb\riverBuf
```

Python and ArcGIS

Using environment settings:

Geoprocessing environment settings can be thought of as additional parameters that affect a tool's results. They differ from normal tool parameters in that they are set separately from the tool and are interrogated and used by tools when they are run.

```
arcpy.env.workspace = "c:/data/Portland.gdb"
```

Using functions:

ArcPy exposes a number of functions to better support geoprocessing workflows. Functions can be used to list certain datasets, retrieve a dataset's properties, check for existence of data, validate a table name before adding it to a geodatabase, or perform many other useful scripting tasks.

```
print(arcpy.Exists("c:/data/Portland.gdb/streets"))
```

```
False
```

Python and ArcGIS

Using classes:

ArcPy classes, such as the `SpatialReference` and `Extent` classes, are often used as shortcuts to complete geoprocessing tool parameters that would otherwise have a more complicated string equivalent.

```
spatial_ref = arcpy.SpatialReference("Hawaii Albers Equal Area Conic")
```

Working with modules:

ArcPy includes modules covering other areas of ArcGIS. ArcPy is supported by a series of modules, including a data access module (`arcpy.da`), a mapping module (`arcpy.mapping`), an ArcGIS Spatial Analyst module (`arcpy.sa`), and an ArcGIS Network Analyst module (`arcpy.na`).

For example, the tools of the `arcpy.sa` module use tools in the Spatial Analyst toolbox but are configured to support Map Algebra. Thus, executing `arcpy.sa.Slope` is the same as executing the Slope tool from the Spatial Analyst toolbox.

```
arcpy.sa.Slope("c:/data/Portland.gdb/streets")
```

arcpy – loop example

Copy a large number of shape files into a geodatabase

```
import os
```

```
import arcpy
```

```
# Set the workspace for ListFeatureClasses
```

```
arcpy.env.workspace = "c:/base"
```

```
# Use the ListFeatureClasses function to return a list of shapefiles.
```

```
featureclasses = arcpy.ListFeatureClasses()
```

```
# Copy shapefiles to a file geodatabase
```

```
for fc in featureclasses:
```

```
    arcpy.CopyFeatures_management(fc, os.path.join("c:/base/output.gdb",  
                                                    os.path.splitext(fc)[0]))
```

Another loop example to run the clipping tool over multiple shapefiles

<https://www.youtube.com/watch?v=M1BPbGRS2JQ> (ArcGIS 10.x)

VSCode and ArcGIS

- Start ArcGIS Python Command Prompt from the start menu in Windows
- Locate Code.exe and execute
- Start a new project and choose the interpreter based on your ArcGIS installation:
 - ArcMap 10.x – C:\Python27\ArcGIS10.3\python.exe
 - ArcGIS Pro – c:\Program Files\ArcGIS\Pro\bin\Python\envs\arcgispro-py3\python.exe
- Ready to start coding
- Sometimes the ArcGIS 10.x python version have an issue with code completion using arcpy. This is solved by running one simple script using arcpy function, e.g.:

```
Import arcpy
```

```
grid = arcpy._RasterToNumPyArray('c:/temp/DSM_LondonCity_1m.tif')
```