INTRODUCTION
No matter whether you are a GIS-newbie or a seasoned professional, there will come a time when you search through the hundreds of GIS tools in whatever GIS software you are using, whether it is one of the Esri packages, QGIS, GlobalMapper, etc., and just not find the right tool to do what you need done. Of course, if you are a newbie it might just be that you don’t know the name of the tool to enter into your search engine, but sometimes, the tool is simply not available. So… what to do? Believe it or not, you have options.

Three options come to mind:

**Option 1 – Buy the tool from a commercial off the shelf (COTS) ready-made GIS package, or**

**Option 2 – Find the tool in an open-source (or shareware) toolkit; don’t forget… GOOGLE knows everything, and**

**Option 3 – Make it yourself.**

So, your finances and/or programming skillset are the limiting factors to getting the GIS tool.

This month’s tip provides some details on these options. *(The tools identified below are not to be taken as endorsements, personal recommendations, or even a complete listing of those available.)*

So… here are a few starting places when you need a GIS tool:

**OPTION 1 – BUY THE TOOL**
If you are an Esri ArcGIS Desktop or ArcGIS Pro user, you have already purchase over 25 Toolboxes; the Spatial Analyst toolbox alone contains over 200 tools. So, it may be a daunting task just to know what tool is located where, even with the Geoprocessing “Search” in Desktop and the Find Tools in ArcGIS Pro that I discussed in the April 2022 column. If you still want more help finding the tools that you already own, there are “Cheat Sheets” available for free (http://s3.amazonaws.com/arena-attachments/1483540/1e582e391e6e24ae34754e349754e36210b034.pdf?1512435403) that may provide some clues. Also, there are additional toolsets that are available for purchase from the Esri MarketPlace (https://www.esri.com/arcgis-blog/products/arcgis-pro-net/announcements/arcgis-pro-add-ins-on-the-arcgis-marketplace/).

Probably the most popular COTS toolkit, XTools (https://xtools.pro/), is available for both ArcGIS Desktop and ArcGIS Pro. Licensing is available in both “you own it” and “annual subscription” modes. This package is advertised as a “Productivity Package” with over 100 additional tools for ArcGIS users. A listing of the tools and their functions is available on the website.

Then, of course, there are multiple COTS GIS software packages. Here is a raking of the top 30 GIS software packages (https://gisgeography.com/best-gis-software/) with links to their websites. Most of the COTS options include a “try before you buy” option, so you can “try” the tool, albeit with limited functionality, to see if it is the right one for you.

**OPTION 2 – FIND THE TOOL**
If you are looking for a “Free” or “ShareWare” option, a good start would be to search through the Wikipedia listing of GIS packages (https://en.wikipedia.org/wiki/List_of.spatial_analysis.software). While this listing is not all-inclusive, it does contain the major options, availability, and their dependencies. Many tools are “free” but require ArcGIS (not free), so this is a case of user-beware.

While discussing ShareWare and OpenSource, do not forget that the entire GRASS and SAGA toolsets are included with the QGIS distributions along with options for over 1100 additional tools. You may need to activate/manage the tools/plugins using the Plugins Manager (Figure 1) in QGIS. Warnings: (1) With over 1100 plugins available, you can install one, select multiples, or there is an option to install all of them, so be careful, (2) some plugins are identified as “experimental” as in Figure 1, so you may get unexpected results, and (3) I have found that some combinations of tools...
result in interference, cause the software to crash and will require a complete re-installation without the plugins. A complete list of all QGIS plugins can be viewed and downloaded at the QGIS Python Plugins Repository (https://plugins.qgis.org/plugins). This repository contains all previous and new plugins, as in this example in Figure 2 below which was uploaded just recently as of this writing. There are several toolkits that come as pre-packaged Esri Toolboxes and stand-alone tools. The WhiteBox Geospatial Analysis tools (https://www.whiteboxgeo.com/) from the University of Guelph’s Geomorphometry and Hydrogeomatics Research Group are an open-source platform containing over 500 tools. The tools can be downloaded (user contribution encouraged but not required) as a basic or extended (donation required) toolset. The ready-packaged ArcGIS toolbox is found at Github (https://github.com/giswqs/WhiteboxTools-ArcGIS) and a similar toolbox for QGIS versions 3 and above is found at the Plugins Repository (https://plugins.qgis.org/plugins/wbt_for_qgis/) sited above.

**OPTION 3 - MAKE THE TOOL**

Depending on your programming skills, constructing the tool yourself may be an option. For Esri users, if your need is a workflow-tool, you may be able to use ModelBuilder in either Desktop or Pro to construct a custom workflow using Toolbox components. Jupyter Notebooks, (https://www.dataquest.io/blog/jupyter-notebook-tutorial/) used for developing and presenting data science projects, have also proven valuable for GIS workflows and data development. Jupyter Notebooks can make use of exposed Esri, GRASS and SAGA tools and there are several Guides, Tutorials and YouTube videos available. Just use GOOGLE!

When all else fails, there are multiple programming languages available to build your own tool, but Python and R are probably the most popular, especially as they work well in combination with Jupyter Notebooks.

**Python:** There are several spatially compatible programming tools available for those proficient in programming. Perhaps the most readily available library for Python. Python GIS Libraries can be found at: https://gisgeography.com/python-libraries-gis-mapping/ and of course, a wealth of information for Esri ArcPy at: https://www.esri.com/en-us/arcgis/products/arcgis-python-libraries/overview. Hint: Included with the “Help” for each Esri tool, you can find the Python code that you can copy/paste for your use. There are lots of Python tutorials on the web, just GOOGLE “Python GIS Tutorial” to find them.

**R:** Another spatially aware programming packages are the “R” and “RStudio” libraries. As with Python, these libraries are opensource, robust and come with lots of web support (https://gisgeography.com/r-programming-gis/) and tutorials. R contains an expansive list of over 45 packages for spatial analysis (https://www.gislounge.com/r-packages-for-spatial-analysis/) and, like Python, works well in Jupyter Notebooks and has robust support, tutorials and YouTube videos.

These tips are just starters and are not meant to be inclusive. But when you need a tool and don’t know where to start, these are all good places.

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Send your questions, comments, and tips to GISTT@ASPRS.org.

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