Take Advantage of Python Expressions and Code Blocks

Modify the Calculate Field and Calculate Value tools

By Jason Pardy, ESRI Product Engineer

The geoprocessing framework in ArcGIS 9.2 supplies enhancements in terms of tools and the use of scripts to automate tasks. These enhancements include additional functionality in the Calculate Field tool and a new tool, Calculate Value. Although ArcGIS 9 includes scripting support for many of today's most popular scripting environments, such as VBScript, JScript, and Perl, Python comes with ArcGIS 9 and scripting examples are written in this popular and well-supported scripting language.

Calculate Field

The Calculate Field tool now offers more sophisticated expressions to compute and assign values to a specified field of the input table. With Python expressions and the new Code Block parameter, a user can
- Use any Python function in the expression.
- Access properties of feature geometry.
- Access the new random value operator.
- Reclassify values using if-then-else logic.

Figures 1, 2, and 3 show how Calculate Field is used.

Calculate Value

With the release of 9.2, ArcGIS has a new tool called Calculate Value that includes Python as an expression type and a Code Block parameter. Users can employ new modeling techniques and generate values and data in new ways. This tool returns a value based on a user-specified Python expression that can be used to
- Evaluate mathematical operations.
- Access the random value operator.
- Create a model with the flexibility of a script.

Using the Calculate Value tool, a user can control the flow of processing in ModelBuilder, also known as branching. In the example shown in Figure 4, the Calculate Value tool is used in ModelBuilder to check for the existence of a field. In the Code Block for Calculate Value, the geoprocessor is created providing access to ListFields. This method is passed to the input table and the field name. The field name is used as a wild card to limit the result of ListFields to one value. The value returned from Calculate Value is a Boolean type where 0 is false and 1 is true.

For more information and examples using the Calculate Field and Calculate Value tools with Python expressions and Code Blocks, visit the ArcGIS Desktop 9.2 Online Help at webhelp.esri.com.
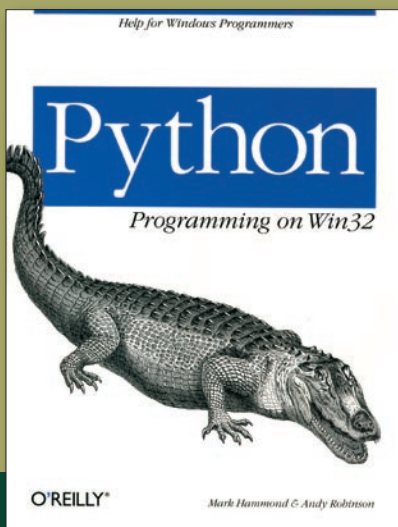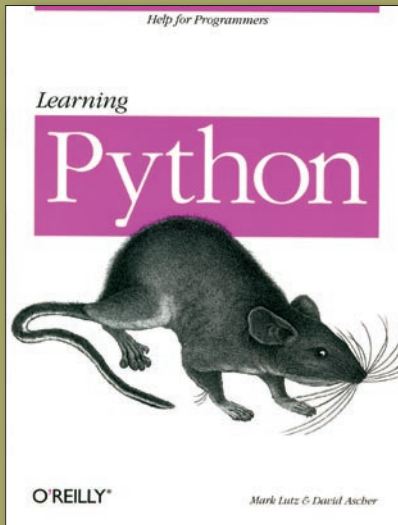
In addition to the classes and seminars available from ESRI listed at the end of this section, several books are available including *Learning Python* and *Python: Programming on Win32,* both available from O'Reilly.

Use Scripting with Tools and Models

Python can increase tool productivity

Geoprocessing tasks can be time intensive because they are often performed on many different datasets or large datasets. In ArcGIS 9, scripting can be used to automate geoprocessing tasks. Scripting allows the execution of simple processes that employ a single tool or complex processes involving piggybacked, multitool tasks with validation. In addition, scripts are recyclable. Because they can be data nonspecific, they can be reused.

ArcGIS comes with Python and provides many scripting examples using Python. ESRI supports Python for scripting because
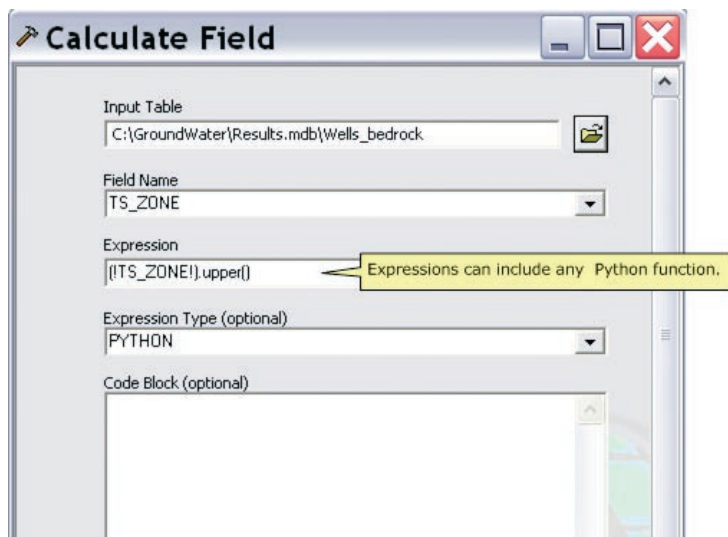
Figure 1: Expressions can include any Python function. In this example, the Python function (!TS_ZONE!).upper() is used in an expression to convert field values to uppercase.
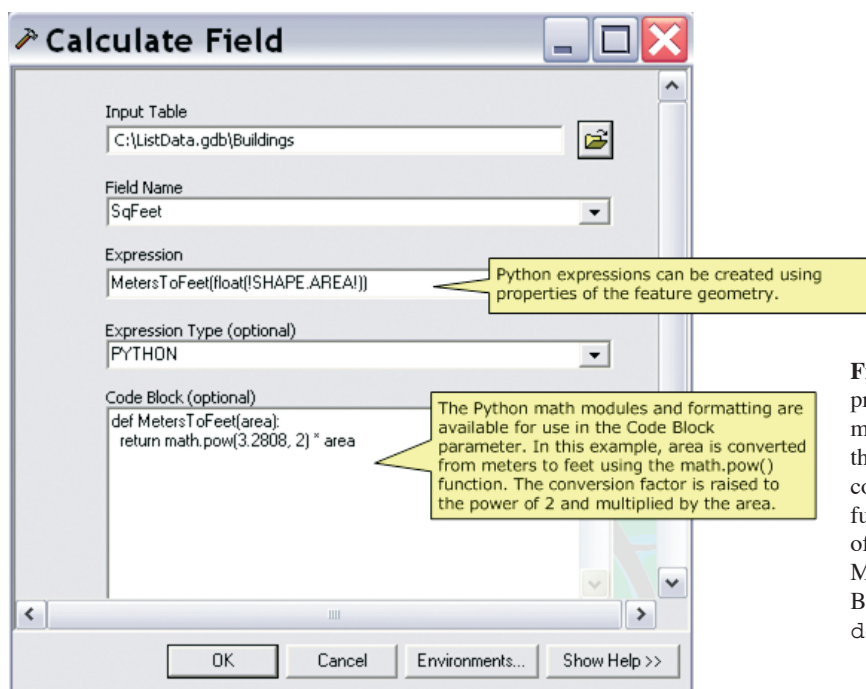

Figure 2: Python expresions can be created using properties of the feature geometry. Python math modules and formatting are available for use in the Code Block parameter. In this example, area is converted from meters to feet using the math.pow() function. The conversion factor is raised to the power of 2 and multiplied by the area. The expression used is MetersToFeet(float(!SHAPE.AREA!)) and the Code Block is
```
def MetersToFeet(area):
    return math.pow(3.2808, 2) * area
```

- Python's clean syntax and simple, clear concepts make it easy to learn.
- Documenting Python is easy because it has readable code.
- Complicated data structures are straightforward to work with in Python.
- Python can be seamlessly integrated with other programming languages.
- Python can be downloaded at no cost from the Web and has a strong user community.

Previously, ArcGIS required the PythonWin add-on for Windows. ArcGIS 9.2 uses a new Python module called arcgisscripting and no longer requires the win32com module provided by PythonWin. This allows Python geoprocessing scripts to run on all supported platforms (Windows, Linux, and Solaris UNIX). However, Python scripts developed for ArcGIS 9 and 9.1 will just run. The installation for PythonWin is included with the ArcGIS install media. For more information about Python, visit **www.python.org**.

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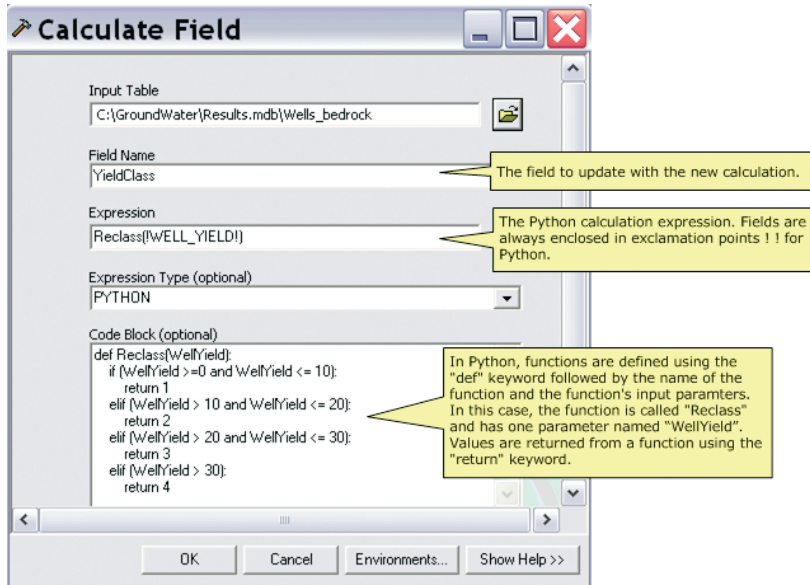
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Figure 3: Field Name is the field to update with the new calculation. Python calculation expression fields are always enclosed with exclamation points (!!) and functions are defined using the "def" keyword followed by the name of the function and the function's input parameters. In this case, the function is called "Reclass" and one parameter is named "WellYield." In this example, the expression is `Reclass(!WELL_YIELD!)` and the Code Block is:

```
def Reclass(WellYield):
  if (WellYield >= 0 and WellYield <=
10):
    return 1
  elif (WellYield >10 and WellYield <=
20):
    return 2
  elif (WellYield >20 and WellYield <=
30):
    return 3
  elif (WellYield > 30):
    return 4
```
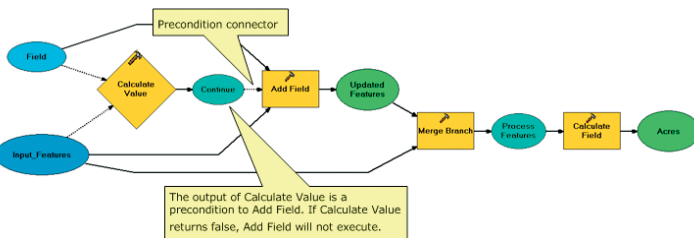

Figure 5: Model variables must be passed to the Code Block from the expression. This is achieved by creating a definition in the expression. The parameter "in_Field" is used as a wild card to limit the result of ListFields to one value.

Figure 4: The Calculate Value tool can be used to control the flow of processing in ModelBuilder. The Python expression CheckField(r"%input_features%", "%field%") and the Code Block:

```
import arcgisscripting
gp = arcgisscripting.create()

def CheckField(in_Table, in_Field):
    fields = gp.ListFields(in_Table, in_Field)
    if fields.Next():
        return 0
    return 1
are used in the Calculate Value tool to check
the existence of a field.
```
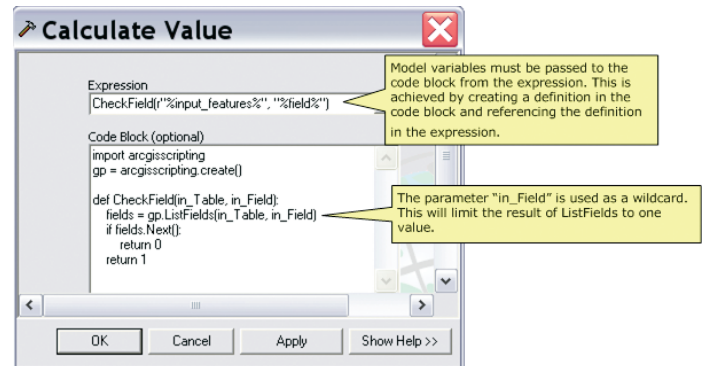
ESRI Resources: Learn how to use Python

Training
Self-Study Virtual Campus Courses
Geoprocessing with ArcGIS Desktop
Geoprocessing Using ModelBuilder
Getting Started with Scripting in ArcGIS 9

Instructor-Led Classroom Courses
Introduction to Geoprocessing Scripts Using Python
Writing Advanced Geoprocessing Scripts Using Python
Advanced Analysis with ArcGIS

Documentation
Writing Geoprocessing Scripts with ArcGIS
Geoprocessing Programming Guide
Geoprocessing Quick Reference
PowerPoint and Scripts
Advanced Python Demos and Slides Toolbox at support.esri.com