# The Raster Stamp

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## Overview

The Raster Stamp is a tool has been developed using ESRI's front-end ArcGIS scripting library "arcpy" that enables the user to make modifications to raster datasets that follow customizable rules in relation to the geometry of input vector data. The vector data can be of point, polyline or polygon type. The input vector data is "stamped" onto the input raster, so that the raster cell values are modified by values are calculated by a user-designed distance function. The tool combines pre-existing ESRI tools to make a flexible new tool that can be used via an inutitive graphical user interface (GUI) or imported as a python function. The tool uses the ESRI Spatial Analyst Toolbox and therefore requires an ESRI Spatial Analyst Extension License.

## Use

The tool is modular and is ready for use in ESRI ArcGIS Desktop products, or can be called as a function in a larger script. To use the script in ArcGIS for Desktop, the user can download the script and ESRI ArcToolBox file and load the toolbox. From there, the user can run the script using the script GUI. To integrate the script as a function in a larger script, the user can download the script file and place it in the same directory as their own script, and import it using the command `from raster_stamp import raster_stamp`. From there, the parameters can be entered as they are described in the docstring accompanying the raster_stamp function.

To use the script, the user must have a raster dataset to act as a surface and some vector data to stamp onto it. The distance function must be specified, which takes the form of a valid python expression where the distance variable is represented as "d". This function represents the z-value with respect to distance from the input features. The user has access to the python "math" library (Python, 2016). The user then also specifies a list of discrete distances at which the function will be evaluated. The distances need not be at regular intervals. The user can also specify the staircase type, which determines if the distance function should be evaluated at the edge closer to the feature, the edge furthest from the feature, or the midpoint in between. The operation is also specified, indicating whether the z values should be added to, subtracted from, multiplied by or divided by the stamp's z values. There are also a number of other settings that can be specified by the user to tweak the final output, most of which control settings of the default ESRI tools used during the script.

## Steps

The process of the script is as follows, with a graphic representation shown in Fig. 1: 1. The input vector features and input surface raster are chosen by the user. 2. The input vector features are buffered using ESRI's "Multiple Ring Buffer" tool (ESRI 2017 (1)) to create a series of buffer features representing distances from the input vector features. 3. The buffer features are assigned a z attribute value according to the user-specified distance function and staircase type. 4. The buffer features are converted to a "stamp raster" using ESRI's "Polygon to Raster" (ESRI 2017 (2)) tool. The cell size and snap raster are automatically set to those of the input surface raster. 5. A new "stamped raster" is created by applying the stamp raster to the surface raster with the user-specified operation using ESRI's "Raster Calculator" (ESRI 2017 (3)) tool.

## Applications

The Raster Stamp tool is very abstract in nature and therefore lends itself to a great deal of potential applications. Some examples include precise physical modeling of landscape modification such as trench digging or hill building, probabilistic modeling of phenomenon occurrences as a result of proximity to discrete features, and optimizing industrial facility site selection by quantitatively modeling the degradation of suitable habitat for a species based on a priori knowledge of the degree of degradation with respect to the distance from said industrial facility.

In a general sense, the Raster Stamp tool functions as an effective method of seamlessly integrating discrete vector features into continuous surface data models at any scale and resolution. It allows the user to efficiently define any mathematical relationship between vector features and their effect on their local continuously-modeled environment. The modularity of the tool allows it tool allows it to be used by both users as a standalone geoprocessing task, and also by developers as an importable function in their own custom tools.

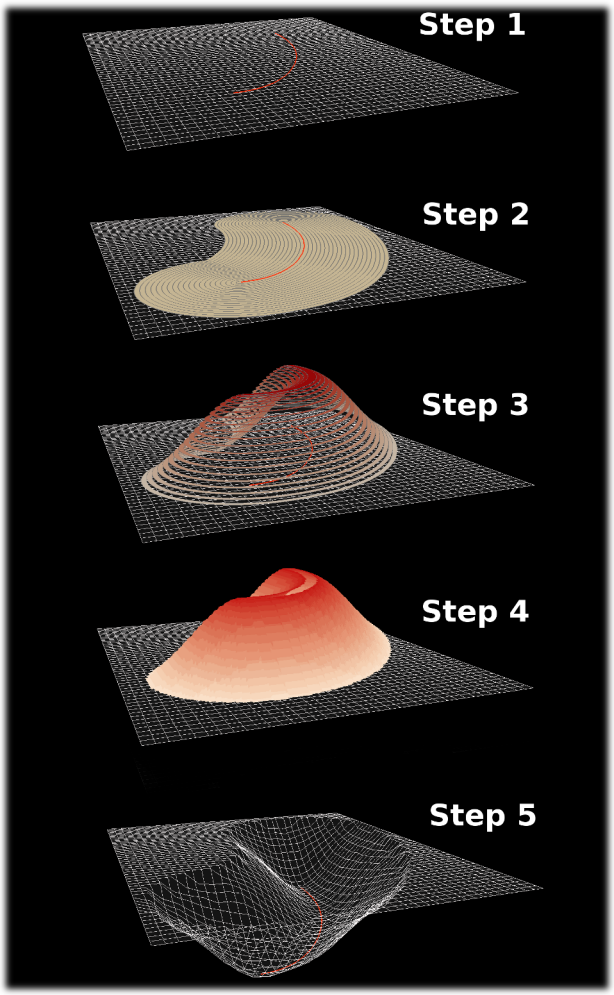


**Figure 1:** *Graphic representation of the process of the Raster Stamp Tool. This example shows a polyline feature being stamped onto a flat surface, using a normal distance function and a subtraction operation.*

## References

ESRI 2017 (1) – **ESRI ArcGIS Desktop Documentation** *"Multiple Ring Buffer"*. <http://desktop.arcgis.com/en/arcmap/10.4/tools/analysis-toolbox/multiple-ring-buffer.htm> Accessed on 16.02.2017.

ESRI 2017 (2) – **ESRI ArcGIS Desktop Documentation** *"Polygon to Raster"*. <http://desktop.arcgis.com/en/arcmap/10.4/tools/conversion-toolbox/polygon-to-raster.htm> Accessed on 16.02.2017.

ESRI 2017 (3) – **ESRI ArcGIS Desktop Documentation** *"Raster Calculator"*. <http://desktop.arcgis.com/en/arcmap/10.4/tools/spatial-analyst-toolbox/raster-calculator.htm> Accessed on 16.02.2017.

Python – **Python 2.17.3 Documentation** *"9.2.: math"*. <https://docs.python.org/2/library/math.html#module-math> Accessed on 16.02.2017.