Geoprocessing and georeferencing raster data
Raster conversion tools

Geoprocessing tools

ArcCatalog tools

- Copy
- Delete
- Rename
- Create Layer...
- Load
- Export
- Build Pyramids...
- Calculate Statistics...
- Properties...

ESRI Grid
GDB Raster
- Raster Dataset
- Raster Catalog
Erdas IMAGINE
TIFF
ArcMap - raster projection options

- **Best situation - all inputs have same spatial reference**
- **Simple or robust algorithm choice**
- **Applies projection on the fly**
  - Projection of data frame or first layer
- **Export option - data frame or original projection**
  - Various export formats
Geoprocessing - raster projection

- **Data Management Tools - Projections**
  - Best raster projection tool
  - Use resample method
    - Nearest neighbor
    - Bilinear interpolation
    - Cubic convolution
  - Option to specify registration points
    - Origin point for anchoring output cells

- **Geoprocessing environment**
  - General settings for geoprocessing
  - Applied to all output rasters
Conversion on the fly

- Many functions accept feature or raster data as input
  - Feature data automatically converted when necessary

- Non-grid rasters converted to grid for analysis
  - Consider converting compressed data before processing
Geoprocessing - raster tools

- Flip raster along horizontal axis.
- Flip raster along vertical axis.
- Converts between two coordinate systems.
- Scale by the specified x and y.
- Rotate around a specified point by a specified angle.
- Shift by specified x and y shift.
- Transform using links.
Conversion: polygon to raster

- Convert using string or numeric field
  - Unique attributes assigned value in the output raster
  - Conversion field added to VAT

- May results in:
  - Loss of detail
    - Smaller cell size — better representation
    - Larger cell size — more generalization
  - Loss of topological relationships
Conversion: line to raster

- Identifies raster cell crossed by the line
  - Codes cells with the attribute value associated with line
  - if more than one value for a cell
    - longest arc used

- Cell size should be
  - Average width of the linear features
Conversion: Point to raster

- **Method:**
  - Cell with center closest to point xy - coded with attribute of point
- **NoData assigned if no point available.**
- **Cell size — overriding factor**
- **Note:**
  - Most often interpolate z values for points, not convert
  - Seldom can original points be retrieved from converted raster without loss
Conversion: Raster to feature

- **Raster to polygon**
  - Regions vector polygons
  - Cell size controls “blockiness”
  - Deploy raster generalization to reduce “stair-step” effect

- **Raster to lines**
  - Stream to feature tool

- **Raster to Point**
  - Center of cell
  - Defines point feature XV
Georeferencing a raster

Image: Not georeferenced

Vector Data
Georeferencing steps

1. Add Georeferencing toolbar
2. Add Layers
3. Establish Links
4. Assess Accuracy
5. Save Transformation
   Update georeferencing
   Rectify
Georeferencing toolbar

- Component of ArcGIS deployed in ArcMap.
- Does not require ArcGIS Spatial Analyst

![Georeferencing toolbar screenshot with options for Rotate and Shift]
Establishing links

- Links used to tie unreferenced raster to georeferenced source data

- Requires:
  - At least three links
  - Evenly distributed over the entire raster

- Choose Link features that will not change position with time
Assessing accuracy of links

- The Link Table
  - Shows accuracy of transformation
  - Reports residual error of each link and RMS error for whole image

- RMS error depends on
  - Raster cell size
  - Accuracy in adding links

\[
RMS = \sqrt{\frac{E_1^2 + E_2^2 + \ldots + e_n^2}{n}}
\]
Initiating transformation

- Final stage of alignment
  - Two choices

- Update Georeferencing
  - Transformation information stored with raster and used when displayed or analyzed
  - No resampling of original data

- Rectify
  - Raster is resampled
  - New output created
Transformation process

- **Applies polynomial equation to unreferenced raster**
  - Source coordinates converted to rectified coordinates
  - Transformation complexity determined by:
    - polynomial order number of links and distortion of source raster

![Diagram of transformation process]

- Original Image
- 1st order: Linear Transformation
- Change of scale
- Change of skew
- Rotation
- 2nd order or higher: Polynomial Transformation
- In X
- In Y
The Rectification process

- Creates output raster from link positions
- Resamples source raster
- Fits source raster to output raster