FOUR ARCGIS RASTER CASE STUDIES

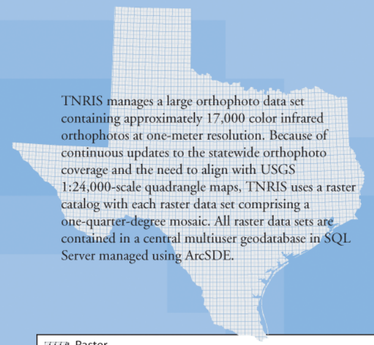
orthophotos

Texas Natural Resources Information System

The state of Texas manages a strategic GIS database with comprehensive coverage for key topographic map layers. One of the primary layers is a digital color orthophoto base for the entire state at one-meter resolution. Two key requirements are to support basemapping for natural resource management and provide public access and download for portions of the database, including the orthophoto layers.

Raster catalog or data set?	Catalog
Mosaic?	Yes
Compression	Lossy (JPEG25)
Pyramids	Cubic
Layer display	RGB

For image pyramid generation, bilinear interpolation and cubic convolution are the recommended resampling algorithms for continuous data, such as satellite imagery and aerial photography. TNRIS chose the cubic convolution resampling method for building pyramids because the results were sharper looking.



TNRIS manages a large orthophoto data set containing approximately 17,000 color infrared orthophotos at one-meter resolution. Because of continuous updates to the statewide orthophoto coverage and the need to align with USGS 1:24,000-scale quadrangle maps, TNRIS uses a raster catalog with each raster data set comprising a one-quarter-degree mosaic. All raster data sets are contained in a central multiuser geodatabase in SQL Server managed using ArcSDE.

The target compression level was determined based on the one-meter data resolution and the intended map scales. Generally, the expected map scales for presentation would not exceed 1:10,000. By inspecting test images, JPEG25 compression was judged acceptable.

Raster
[Raster catalog in ArcSDE for TNRIS]

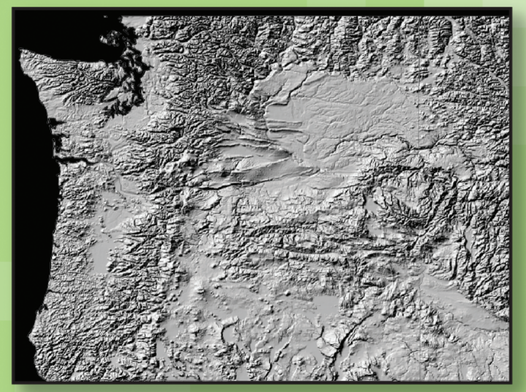
Field name	Data type	Allow nulls	Default value	Domain	Length	De-scrip-tion	Spatial reference	Geometry type	Avg Num Pts	Grid 1	Grid 2	Grid 3	Contains z values	Contains m values	Default shape field	Pre-ci-sion	Scale
NAME	Text	Yes															
RASTER	Raster						NAD 1927 UTM Zone 14N										
FOOTPRINT	Geometry	Yes					NAD 1927 UTM Zone 14N	Polygon	0	536870911.25			No	No	Yes		
OID	Object ID																
METADATA	BLOB	Yes															
FOOTPRINT.AREA	Double	No														0	0
FOOTPRINT.LEN	Double	No														0	0

elevation model

USGS National Elevation Dataset

The United States Geological Survey provides elevation data in a seamless format with a consistent projection, resolution, elevation units, and horizontal and vertical datums. This data set was mainly built from digital elevation models (DEMs) at a scale of 1:24,000 over the conterminous United States and islands and a scale of 1:63,360 for Alaska. These quadrangle-based DEMs were mosaicked into a single, continuous national raster data set.

Raster catalog or data set?	Data set
Mosaic?	Yes
Compression	Lossless (LZ77)
Pyramids	Cubic or bilinear
Layer display	Hillshaded relief



The 54,000 quadrangles of DEMs for the United States, including Alaska and Hawaii, are mosaicked into a single raster data set 60 GB in size, forming one GIS layer.

The NED is managed as a single raster data set.

A lossless compression, such as LZ77, is required to preserve elevation values for analysis.

DEM data is continuous; therefore, cubic convolution should be chosen to build the pyramids because it displays with a smooth and crisp appearance. Bilinear interpolation can be alternately considered when a smoother appearance is desired.

An automated system for updating NED is employed to make data corrections that minimize artifacts, perform edgematching, and fill sliver areas with missing data. These are incremental updates to the raster data set, including pyramids.

Data is stored in Oracle and accessed using ArcSDE. The NED is served over the Web using ArcIMS.

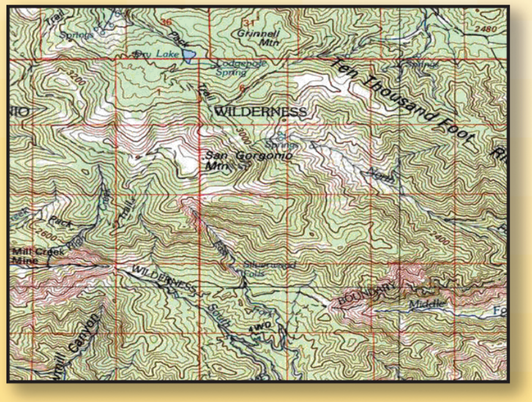
The original final resolution of the NED was one arc-second (approximately 30 meters) for most of the United States and two arc-seconds for Alaska. The NED is being continually updated with 10-meter and three-meter sources, gradually migrating the nationwide DEM to these finer resolutions. As of December 2003, 43 percent of the conterminous United States were available in 10-meter resolution.

scanned maps

National Geographic TOPO!

The National Geographic Society scanned all of the 1:24,000-scale USGS topographic maps for the entire United States. First, the set of maps for a state were mosaicked together into a raster data set. Next, a raster catalog was created with one raster comprising the mosaicked set of maps for a state. This enormous data set is distributed as the National Geographic TOPO! series.

Raster catalog or data set?	Catalog
Mosaic?	Yes
Compression	Lossy (JPEG50)
Pyramids	Bilinear
Layer display	Color maps



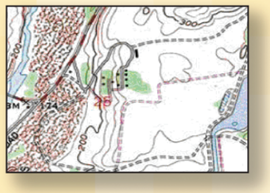
The project goal for this case study was to mosaic scanned topographic maps together for each state and deliver them as a raster catalog of mosaicked images to be used as background for mapping.

Because of the size of the mosaics, a raster catalog of mosaicked maps for each state was used to organize all the individual states into a single countrywide database using ArcSDE.

JPEG compression was used to store the raster data sets with a quality setting of 50. It was determined through prototyping that this still provided an adequate level of detail at the intended map scale while reducing the overall raster data set file size.

Pyramids were created to speed up the raster display. Although cubic convolution is often chosen for continuous data, in this case prototyping revealed that bilinear interpolation gave the high display quality.

The National Geographic TOPO! data sets were also reprojected to a geographic coordinate system (latitude–longitude). Because the original USGS topographic maps were projected to Universal Transverse Mercator (UTM), text symbology did not appear straight and a seamless image could not be built to cross UTM zones. Using a geographic coordinate system overcomes these two problems. Subsequently, they were converted to geographic latitude–longitude coordinates using the NAD83 datum.



time series

NOAA—Hurricane Mitch

A raster catalog can be used to manage a time series of raster data sets. This generally refers to raster data collected as observations at different times at a single location. Examples include collecting satellite imagery over a short period of time to monitor natural disasters, such as flooding or fires, or over longer periods of time to show the patterns of urban sprawl or the changes in a forested area because of cutting and regrowth.

Raster catalog or data set?	Catalog
Mosaic?	No
Compression	Lossless (LZ77)
Pyramids	Nearest neighbor
Layer display	Movie, wire frame off

This case study is based on a data set of satellite imagery collected over 17 days using a Geostationary Operational Environmental Satellite to capture the movements of Hurricane Mitch in 1998.

Loading this data into a raster catalog to use in ArcGIS was straightforward. By loading each data set into a raster catalog, the data could be managed together. New observations can be appended at any time, and the data set can be viewed as an animation to show the movement of the hurricane over time.

LZ77 compression was chosen to store the raster data sets because it is a lossless compression. Storage size was not a primary issue, and a lossless compression makes for high image quality.

Nearest neighbor was chosen for pyramid resampling because it makes the best display.

Displaying the raster catalog as a movie is a simple process. There is a setting in ArcMap on the raster catalog's layer properties dialog box users can specify to automatically display each raster data set in the raster catalog in a time sequence.

Raster
[Raster catalog in ArcSDE for Hurricane Mitch]

Field name	Data type	Allow nulls	Default value	Domain	Length	Description	Spatial reference	Geometry type	Avg Num Pts	Grid 1	Grid 2	Grid 3	Contains z values	Contains m values	Default shape field	Pre-ci-sion	Scale
OBJECTID	Object ID																
NAME	Text	Yes			255												
METADATA	BLOB	Yes			0												
DATA_TIME	Date	Yes															
SHAPE	Geometry	Yes					GCS WGS 1984	Polygon	0	2147			No	No	Yes		
RASTER	Raster					Raster Column	Unknown									0	0
SHAPE.AREA	Double	No														0	0
SHAPE.LEN	Double	No														0	0