The Afghanistan Hyperspectral Quadrangle Map Series

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Presentation Outline

- U.S. Geological Survey projects in Afghanistan
- Afghanistan hyperspectral data acquisition and processing
- Countrywide surface mineral data
- Afghanistan 1:250,000-scale quadrangle map series
- Software and Data layers
- Templates
- Exporting layers and cleanup
- Map assembly
- Symbology challenges
- Project tracking
- Examples
- Post mortem
- Sources and links
USGS Projects in Afghanistan

- Agro-Meteorology
- Airborne Geophysical Surveys
- Capacity and Institution Building
- Coal
- Earthquake Hazards
- Geospatial Infrastructure Development
- Hyperspectral Data
- Minerals and Information Packages
- Oil and Natural Gas
- Water
Spectra are used for direct identification of soils / minerals / vegetation
- Wavelength position and shape of absorption features
- 1-µm minerals: Spectral features in visible to near-infrared (VIS–NIR)
- 2-µm minerals: Spectral features in shortwave infrared (SWIR)
Spectra of unknown materials are calibrated, analyzed, compared against spectral library of known materials.

USGS maintains and updates the premier geoscience spectral library:
- Spectra of hundreds of natural and anthropogenic materials.
Afghanistan HyMap™ Data Acquisition

- HyMap™ (HyVista Corp.) imaging spectrometer
  - 450–2,500 nm
- WB–57 high altitude NASA aircraft
- August 22–October 2, 2007
  - 43 days, 28 flights
  - Constraints
- 218 flightlines
- Approximately 400,000 km²
  - (67% land area)
Afghanistan 1-µm Surface Materials Data: Iron-bearing Minerals

Kokaly and others, 2013a
Detail of Hyperspectral Data with True-color Landsat Image

Unpublished data
Afghanistan 1:250,000-scale Quadrangle Series

- Geology (Bohannon and Turner, 2005)
- Topography (Bohannon, 2005)
- Natural Color (Davis and Turner, 2005a)
- False Color (Davis and Turner, 2005b)
Quadrangles of Afghanistan

LOCATION MAP

HyMap™ imaging spectrometer data-coverage area shown in gray
USGS 1:250,000-scale hyperspectral quadrangles shown in black outline
USGS/AGS 1:250,000-scale quadrangle shown in red (Kabul)
Afghanistan 1:250,000-scale topographic series quadrangle shown in blue (Kabul)
Software

- ArcGIS 10.2
  - Data storage
  - Hyperspectral export
  - Shaded relief export
  - Most vector exports
- Adobe Illustrator CS5
  - Source and final templates
  - Static map items
  - Map assembly
  - Publication
- Microsoft Excel
  - Instructions and tracking
GIS Data for Map Layers

- 1-µm and 2-µm hyperspectral rasters
- Shaded relief from SRTM data
- Roads
- Settlements
- Graticule
- Boundaries
- Elevations
- Labels

USGS
Illustrator Source Templates

- Previous quad series
  - Natural-color Landsat
- Retain design
- Not enabled for MAPublisher extension
- Static map elements
  - Context map
  - Scale bars
  - Agency text, etc.
- Unique map elements
  - Coordinate labels
  - Elevations
Final Illustrator Templates

Single quad

Double quad

USGS
- Detailed procedures (84 steps)
- Clip unprojected data into quadrangle geodatabases
- Reproject data to UTM
  - WGS84, zone 41N or 42N
  - Central meridian set to center of map frame
- Hyperspectral map
  - Graticule clipped to quad extents
  - Symbology and labels
  - Pixel counts for legend
  - Rasters and vectors
- Shaded relief map
  - Province borders

### ArcGIS Exports

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Clip unprojected data into quadrangle geodatabases</td>
<td>Reproject data to UTM: WGS84, zone 41N or 42N, central meridian set to center of map frame.</td>
</tr>
<tr>
<td>2.</td>
<td>Hyperspectral map</td>
<td>Graticule clipped to quad extents, symbology and labels, pixel counts for legend.</td>
</tr>
<tr>
<td>3.</td>
<td>Shaded relief map</td>
<td>Province borders.</td>
</tr>
</tbody>
</table>

**USGS**
Export Cleanup

- Un-nest all groups into root layers
  - Simplicity, ease of use, greatly reduces logical file size
- Fix font issues
  - Adobe Legacy Text Bug
    - Workaround: Open file, select all (Ctrl-A), arrow up, arrow down
    - Forces software to re-code font sizes from 1-pt back to actual size
  - Reset all text back to appropriate font size, if different
- Raster
  - Stitch raster strips back into single contiguous layer
- Edit symbology
  - Line weights
  - Add missing labels
  - Set tics to appropriate stroke, color, delete extraneous
  - Set transparency and dashes
Map Assembly

- Pull collar items from Illustrator source templates
  - Delete unneeded layers (many)
  - Coordinate label font styles
  - Symbolize peaks and elevation labels
- Copy / paste layers from cleaned export files
- Adjust and align map item placement
  - Quads are different widths depending on latitude
- Update map collar
  - Titles, authorship, report numbers, pixel counts
- Adjust graticule colors
- Set context map to indicate correct quads

USGS
Symbology Challenges

- Many colors of varying tones, abrupt color changes
- Large swaths of bold color, or hash of many colors
- Graticule and tic color:
  - Black graticule would disappear against black areas
  - Light gray graticule would disappear against color areas
  - Two different medium grays chosen
- Settlement labels:
  - White with black halo on hyperspectral coverage areas
  - Black with no halo on white non-data backgrounds
- Elevation labels: Oblique white font with black drop shadow
- Settlement symbols: Transparent, to show local minerals
- Roads: Red that does not match red mineral classes
<table>
<thead>
<tr>
<th>Quadrangle Name</th>
<th>Map Title</th>
<th>Authorship</th>
<th>File Size</th>
<th>Full Map</th>
<th>Proj Status</th>
<th>Notes</th>
</tr>
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</tbody>
</table>

**Notes:**
- Proj Status: A = Available, NA = Not Available
- Notes: * = In progress, NA = Not Available
Hyperspectral Quadrangle 3468: Carbonates, Phyllosilicates, Sulfates, Altered Minerals

Kokaly and others, 2013b
Hyperspectral Quadrangle 3468: Iron-bearing minerals

King and others, 2013
Hyperspectral Quadrangle 3264: Carbonates, Phyllosilicates, Sulfates, Altered Minerals

Kokaly and others, 2013b
Hyperspectral Quadrangle 3264: Iron-bearing minerals
Hyperspectral Quadrangle 3262: Carbonates, Phyllosilicates, Sulfates, Altered Minerals

Kokaly and others, 2013b
Hyperspectral Quadrangle 3262: Iron-bearing minerals
Hyperspectral Quadrangle 3466: Carbonates, Phyllosilicates, Sulfates, Altered Minerals

Kokaly and others, 2013b
Hyperspectral Quadrangle 3466: Iron-bearing minerals
Post Mortem

- Multi-country and -agency publication tracking process
- Local spelling translations – many variants
- Export to Illustrator improvement suggestions
  - Text size and line weights
  - Nested layering
  - Raster export
  - Graticule tics
- MAPublisher extension for Adobe Illustrator
  - Expensive licensing and training, and not frequently used
  - Original source templates are Mac-based (compatible?)
- Job-tracking software?
Sources

Links

- AVIRIS spectrometer
  - aviris.jpl.nasa.gov
- HyMap spectrometer
  - www.hyvista.com
- USGS Spectral Library
- USGS projects in Afghanistan
  - afghanistan.cr.usgs.gov
- Airborne survey flight line planning and data collection
  - pubs.usgs.gov/of/2008/1235
- Surface material analysis data
  - pubs.usgs.gov/ds/787

- Countrywide surface material wall maps
  - pubs.usgs.gov/sim/3152/A
  - pubs.usgs.gov/sim/3152/B

- Hyperspectral quadrangle maps
  - Carbonates, Phyllosilicates, Sulfates, Altered Minerals, and Other Materials
    - pubs.usgs.gov/of/2013/1191/A through
    - pubs.usgs.gov/of/2013/1220/A
  - Iron-bearing Minerals and Other Materials
    - pubs.usgs.gov/of/2013/1191/B through
    - pubs.usgs.gov/of/2013/1220/B

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