

# Leveraging Remotely Sensed Data for International Projects

What's out there, what's free, and how can I use it?

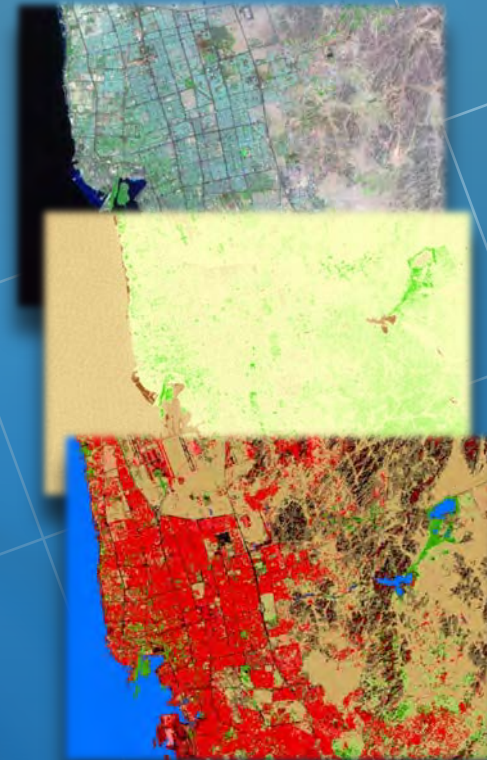
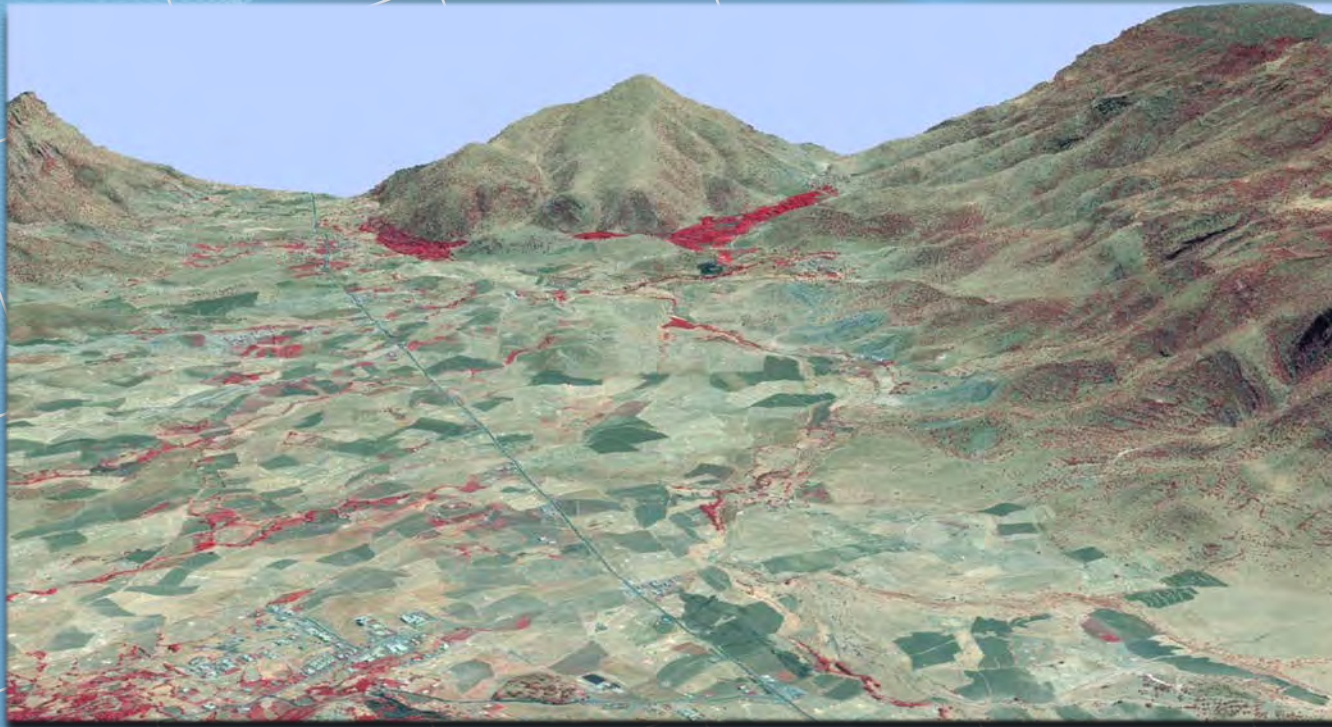
Jared Newell

GIS Specialist

CDM Smith – Latham, NY

Spring NEArc

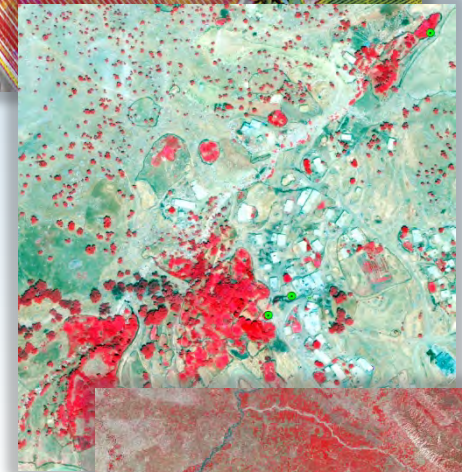
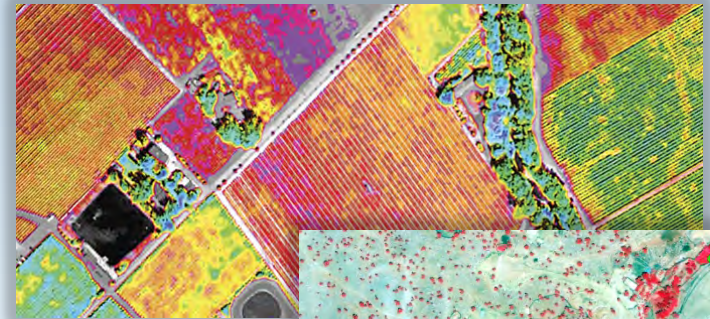
5/14/2013



**CDM  
Smith**

# Outline

- International GIS – What's out there?
- Remotely sensed data options
- Where can I get this stuff?
- Overview of sensors. Landsat, ASTER.
- Case studies, custom toolsets, and products
- High resolution imagery
- High res imagery for environmental assessment
- What the future holds... Concluding remarks





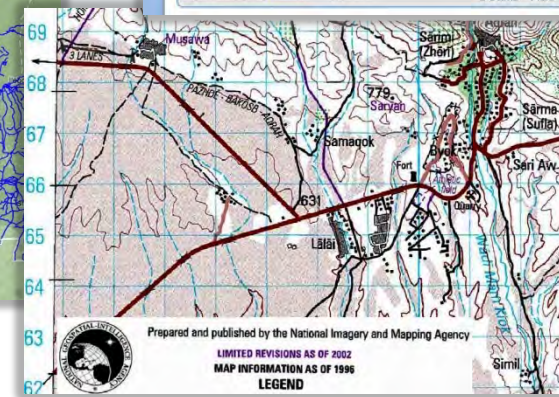
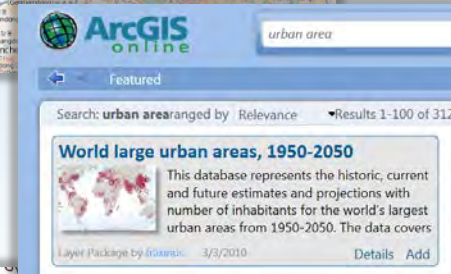
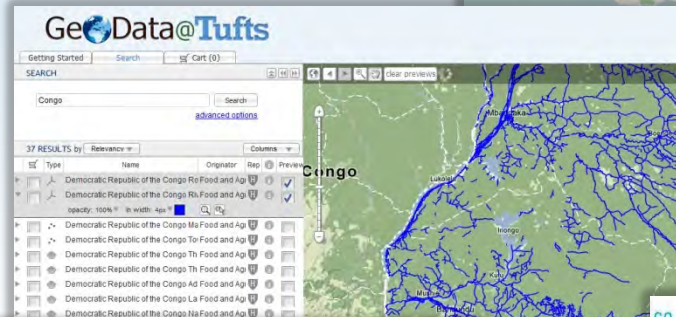
# What's Out There?

- Open Databases, Govt, private
- OSM, Crowdsourced
- Education, Non-Profits
- ArcGIS Online
- Military, Top Secret
- Reach out locally
- Extract your own info

# Imagery!

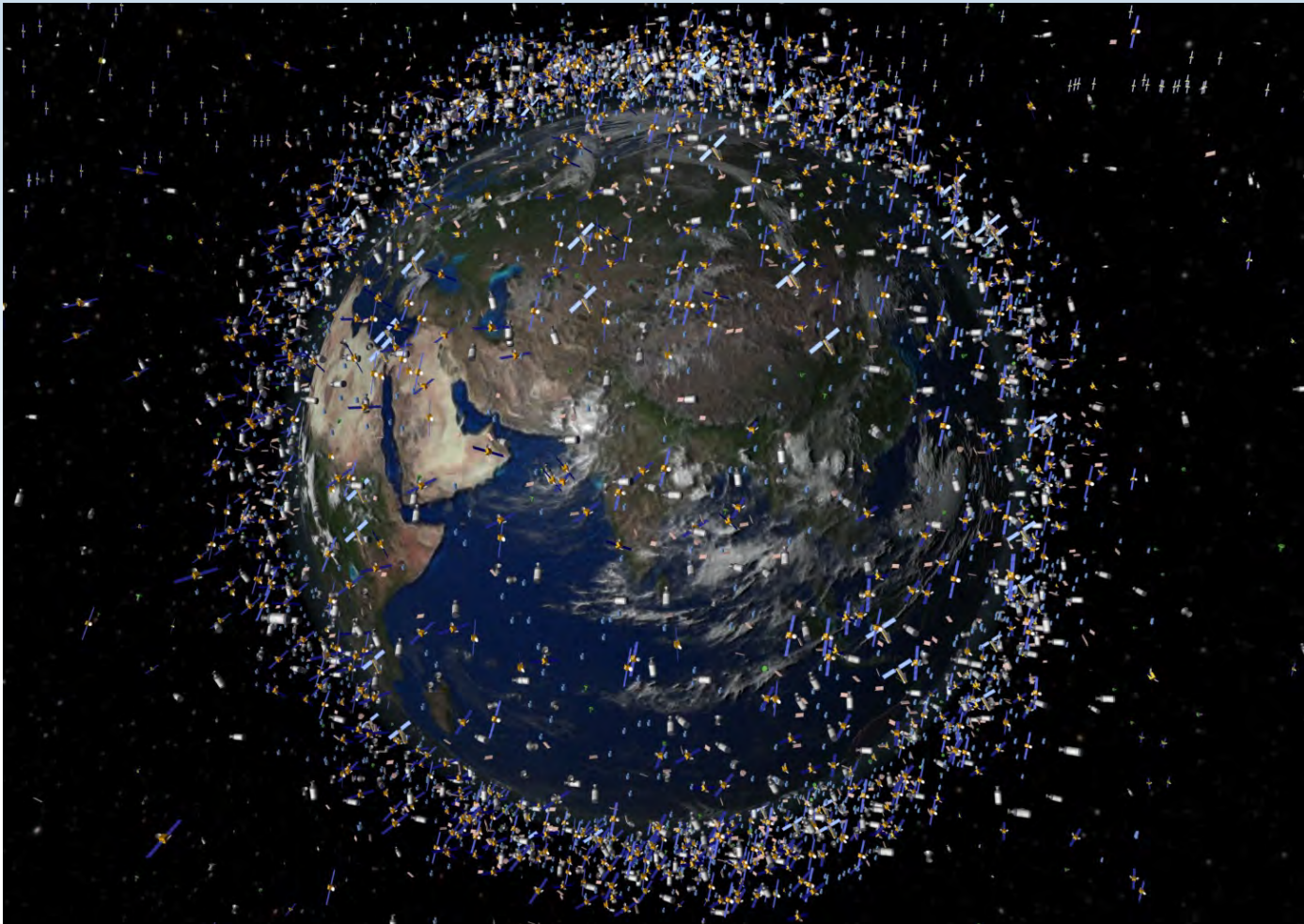


ArcGIS Editor for OpenStreetMap



# Satellite Data

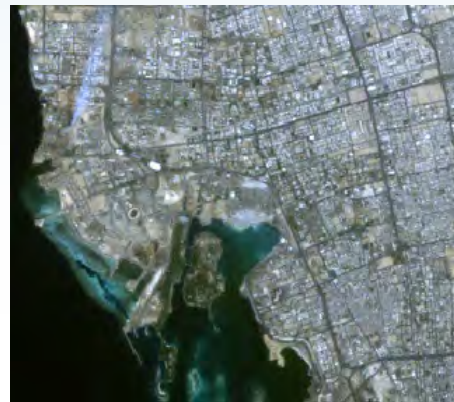
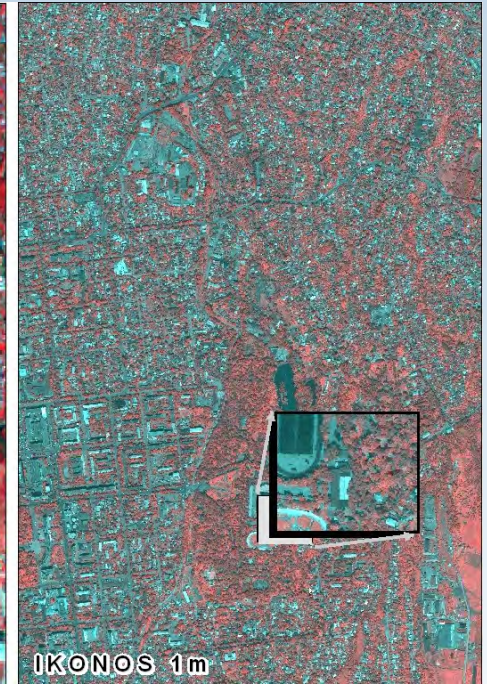
- Amazing amount of remote sensing data out there
- With the right knowledge and tools, an extremely powerful resource.






# What's out there?

- Take your pick. 40cm to 5km.
- One band to dozens.
- Consider Scale and Extent!  
Often times 'Less is More'
- Sensor Characteristics:  
Spatial and spectral  
resolution, frequency, swath.
- You can't have it all!





# Where can I get it?



science for a changing world

## EarthExplorer

Home 2 New System Messages






Search Criteria Data Sets Additional Criteria Results

### 2. Select Your Data Set(s)

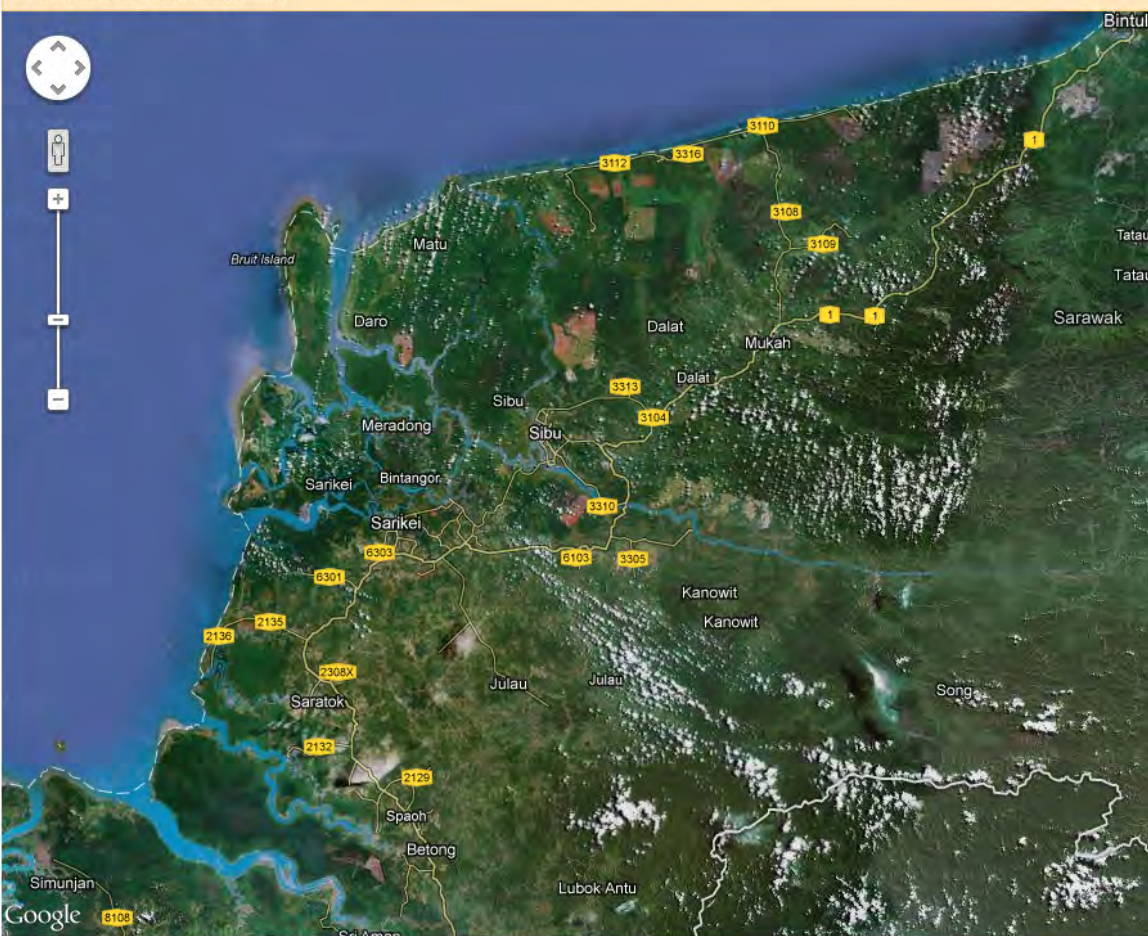
Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the *Additional Criteria* or *Results* buttons below. Click the plus sign next to the category name to show a list of data sets.

☐ Use Data Set Prefilter ([What's This?](#))

Data Set Search:

- ☐ Aerial Imagery
- ☐ AVHRR
- ☐ Cal/Val Reference Sites
- ☐ Commercial
- ☐ Declassified Data
- ☐ Digital Elevation 
- ☐ Digital Line Graphs 
- ☐ Digital Maps 
- ☐ EO-1
- ☐ Forest Carbon Sites
- ☐ Global Fiducials
- ☐ Global Land Survey
- ☐ HCMM
- ☐ JECAM Sites
- ☐ Land Cover
- ☐ Landsat Archive 
- ☐ Landsat CDR 
- ☐ Landsat Legacy
- ☐ Landsat MRLC
- ☐ LIDAR
- ☐ NASA LPDAAC Collections
- ☐ Orbview-3
- ☐ Radar
- ☐ Vegetation Monitoring

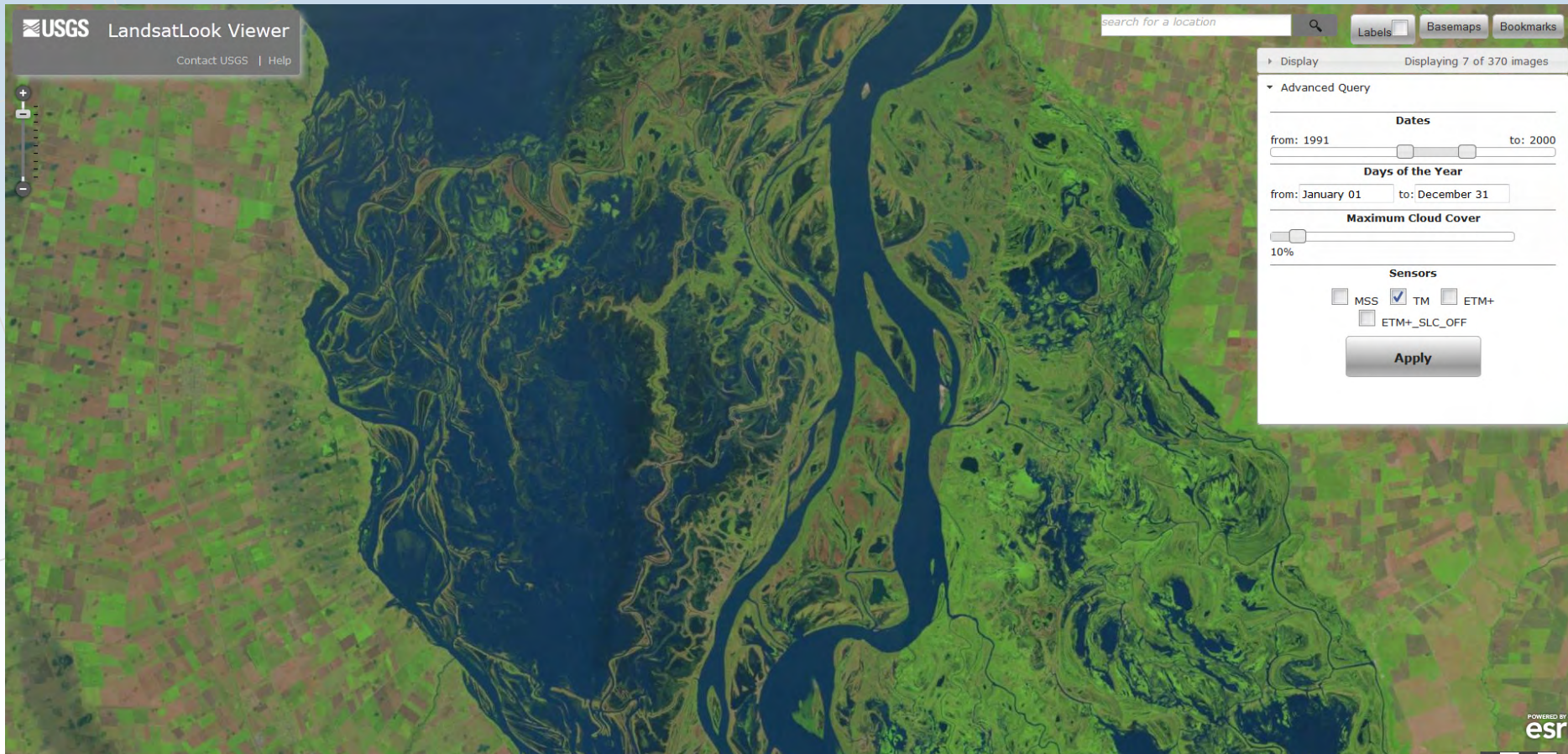
### Search Criteria Summary (Show)



The up-to-date Google map is not for purchase or for download; it is to be used as a guide for reference and search purposes only.



# Where can I get it?



# Where can I get it?

**USGS**  
science for a changing world  
Earth Resources Observation and Science Center (EROS)

USGS Home  
Contact USGS  
Search USGS

USGS Global Visualization Viewer   System Notices (2), 1 New, 1 Critical

Collection   Resolution   Map Layers   Tools   File   Help

**Downloadable**

WRS-2 Path / Row: 146 40   Go  
Lat/Long: 28.9 77.9   Go  
Max Cloud: 20%   ← ↑ ↓ →

Scene Information:  
ID: LE71460402003130ASN00  
CC: 0%   Date: 2003/5/10  
Qty: 9   Product: ETM+ L1T  
May 2003   Go  
Prev Scene   Next Scene  
L7 SLC-on (1999-2003) List

Map showing locations in Northern India and surrounding regions. Key locations labeled include: Fatehpur, Faisalabad, Shorkot Road, Amritsar, Bara Bangahol, Kibar, Ssu-ma-ssu, Chitkal, Daba, Gaundat, Rishikesh, RADAUR, Ratanpuri, Gannja, Bagha, Hujra, Bahli Dilawar, Alipur, Berwala, Lakhasar, Rori, Bhanin, Mahaim, Binjasar, Kanasar, Panchur, Jasrapura, New Delhi, DHANAURA, REORIA HUSAINPUR, Suni, Sobala, Tolisain, KHERI, Pay, KANSUA, Pinalhat, Sir Mathura, Toda Rai Singh, Betu, Chitalwana, Ramsar, Shergarh, Phalodi, Devikot, Sadhan, KHAN, Kardh, Mekhtar, Langar Sarai, Chulam Aliwala, Jaoon, and Bara. A yellow box highlights the area around New Delhi.

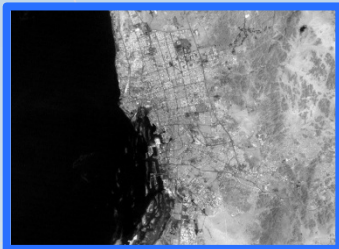


# Landsat

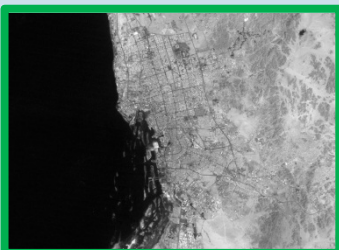
- 1972 – Present
- 8 band
- 15-60m pixel resolution
- 16 day repeat
- Excellent Compromise on spatial, temporal, and spectral resolution.



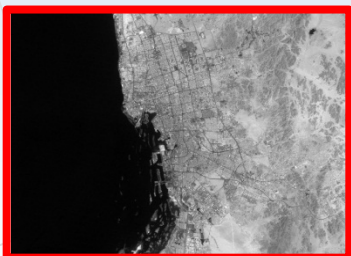
# Landsat



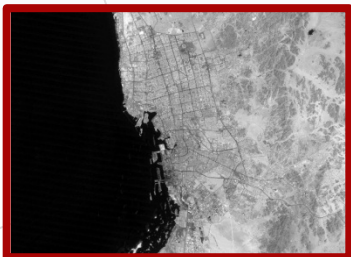
Band 1 (0.45-0.52  $\mu\text{m}$ , blue-green).  
Aquatic, Sediment,  
noisy.



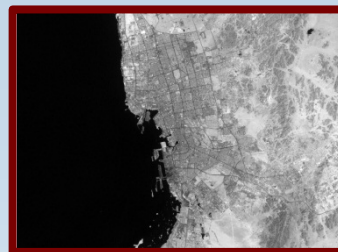
Band 2 (0.52-0.60  $\mu\text{m}$ , green).



Band 3 (0.63-0.69  $\mu\text{m}$ , red). Diff.  
between soil and  
veg.



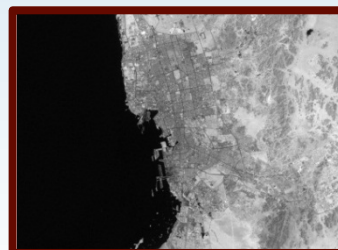
Band 4 (0.76-0.90  $\mu\text{m}$ , NIR). Veg.  
Water/Land.



Band 5 (1.55-1.75  $\mu\text{m}$ , Mid-IR).  
Moisture Veg and  
Soil.



Band 6 (10.40-12.50  $\mu\text{m}$ , Thermal-IR).  
Surface Temp.



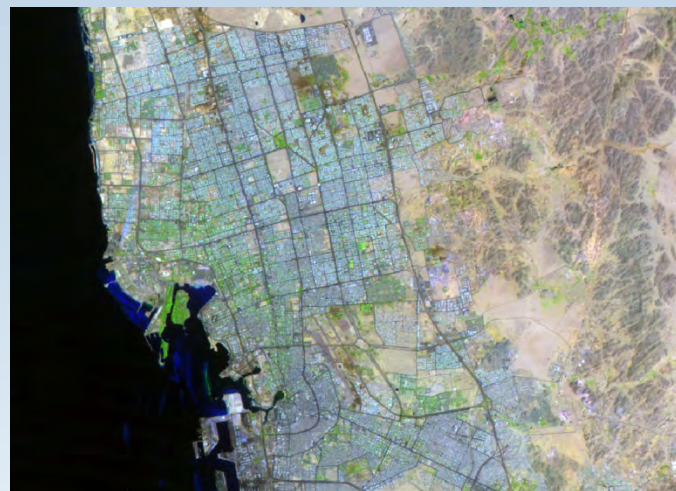
Band 7 (2.08-2.35  $\mu\text{m}$ , Mid-IR). Veg  
Moisture.  
Soil/Geology.



# Landsat



3,2,1. True Color



5,4,1. Agriculture. Irrigation. Geology.



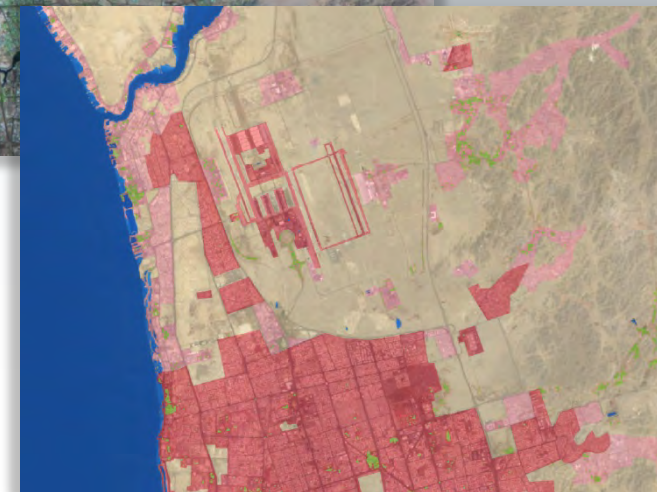
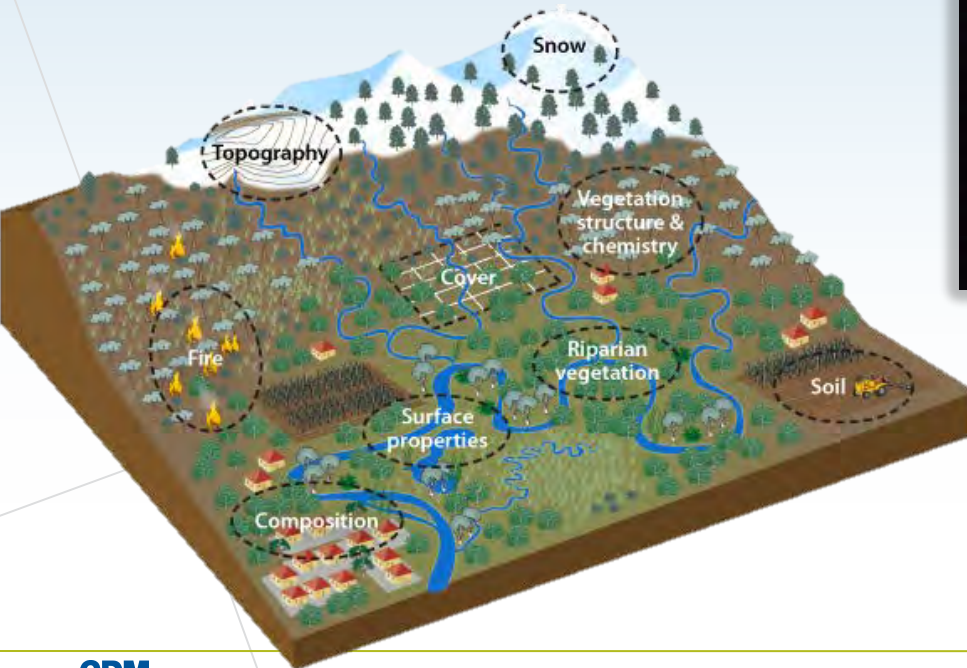
4,3,2. Water and veg enhancement



7,4,2. Veg differences. Geology.

# Applications and uses

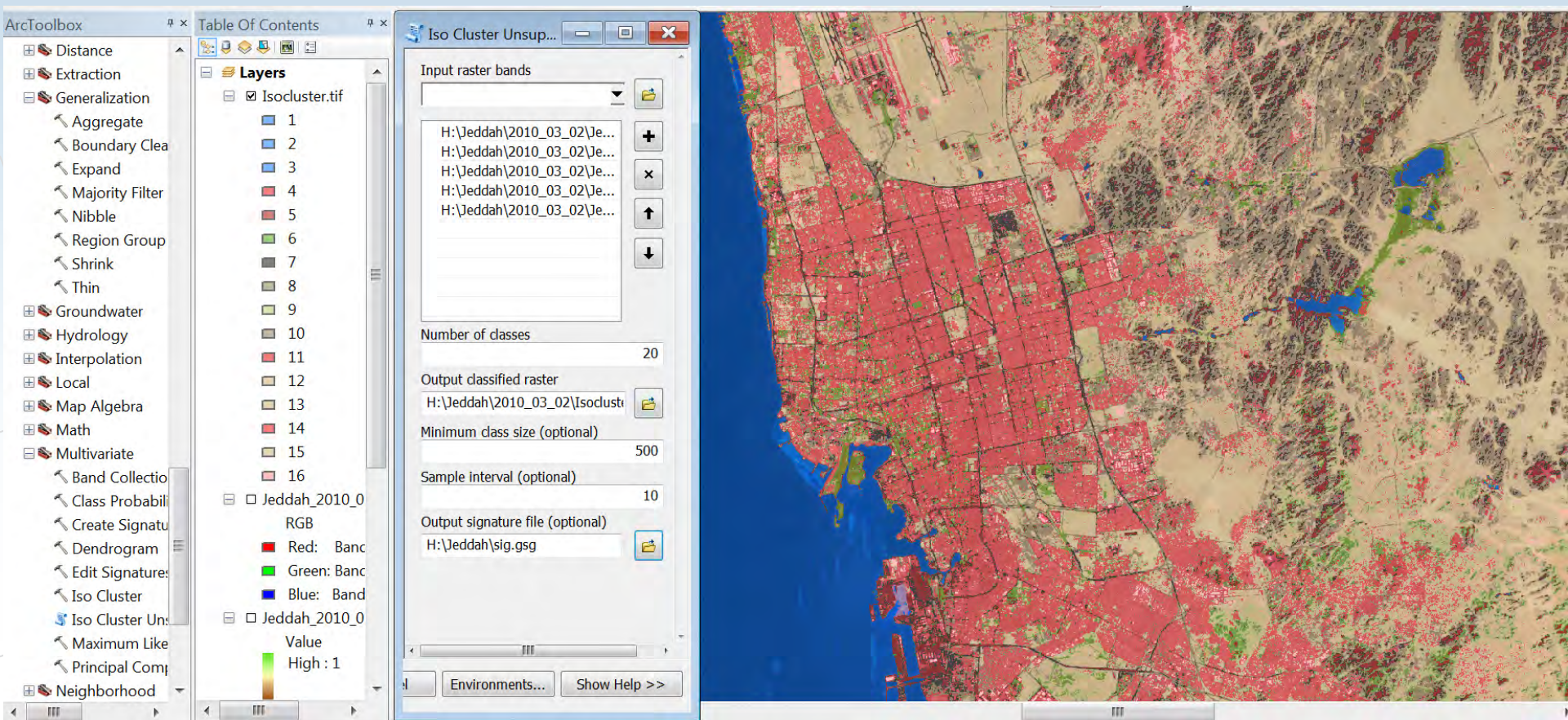
- Land Cover, Land Cover Change
- Analysis of vegetation, surficial hydrology, impervious surface
- Feature extraction
- General Base Mapping





# Toolsets

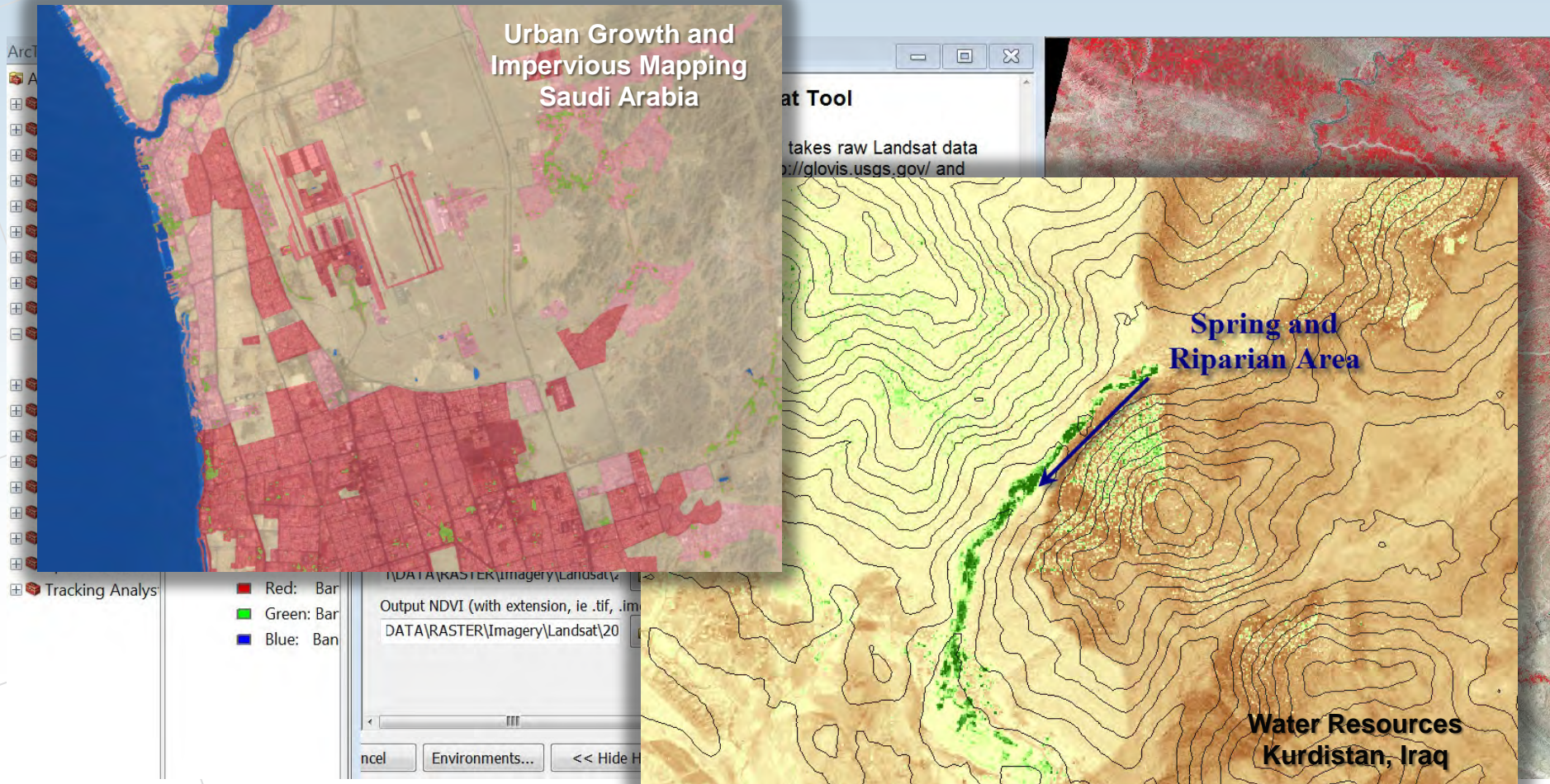
- Out of the box tools in ArcGIS's Spatial Analyst
- Combination of Multivariate toolset and Generalization.  
(Boundary Clean > Region Group > Nibble)





# Toolsets

- Custom Toolbox to process raw Landsat data from USGS.
- Composites Bands, exports 6 band raster, 4 band pan sharpened raster, NDVI.





# ASTER DEM for Hydro Tools

Identify

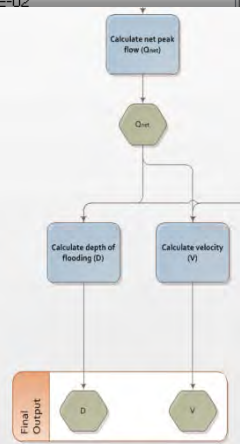
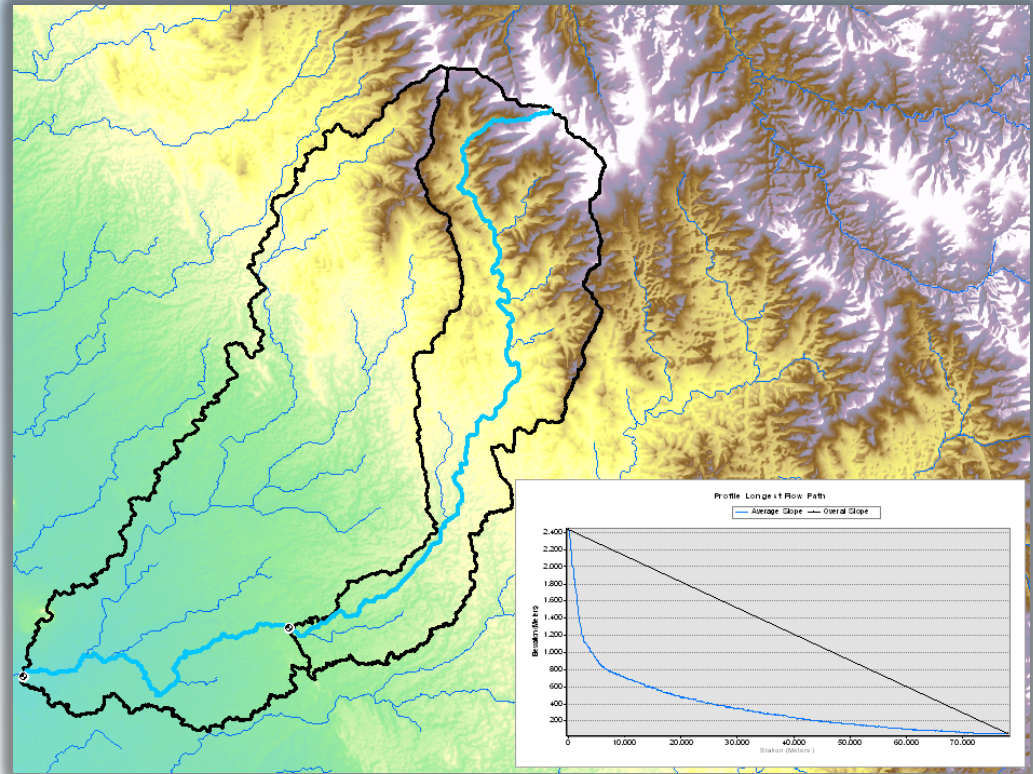
Identify from: **<Top-most layer>**

- Watershed10
  - Sabia\_3
    - Watershed10
      - 1
        - WatershedPoint10
          - Sabia\_3
  - Dam\_92
    - Watershed10
      - 2
        - WatershedPoint10

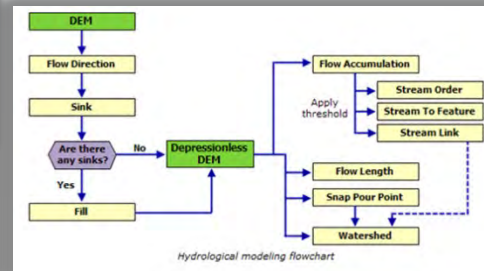
Location:

Field	Value
OBJECTID	1
HydroID	238465
Area	735202104.141271
Length	77940.5726796099
CN	70.1558786289446
S	108.050914283904
P	149.7
TC	23925.6829042091
ROVol	51081665.4670312
QPeak	665.641149488103
QLoss	529.37236963991
QNet	136.268779848193
FW	525.261655573296
Avg_Slope	6.88390854650496E-02
D	0.164679999999989
V	1.57535998784261
Int	0.25943028279774

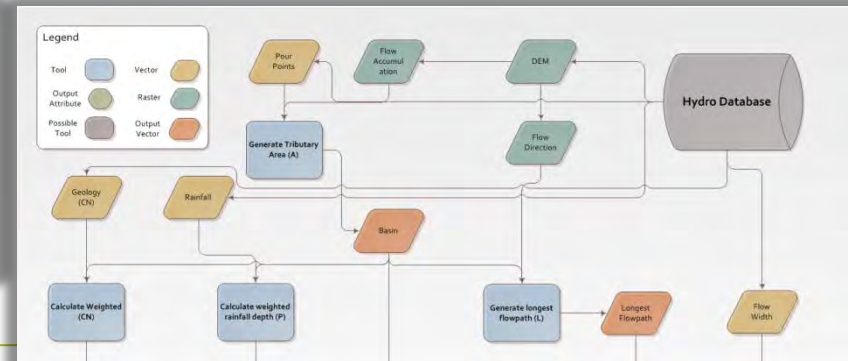
Identified 2 features



Typical Hydro

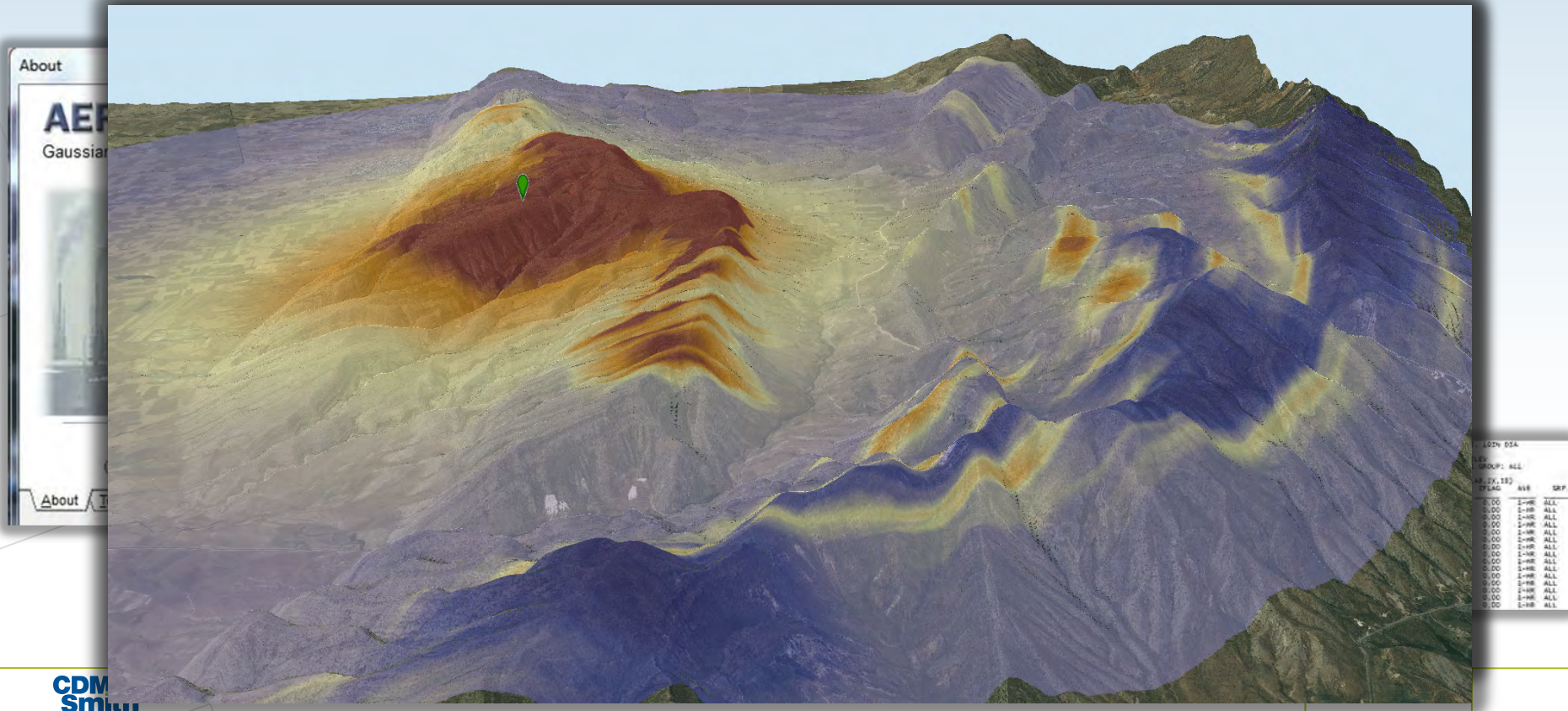


Custom Hydro



# ASTER DEM for Air Dispersion Modeling

- AERMOD – Atmospheric dispersion modeling system
- Models plumes and plume dispersion
- Used for many EPA regulatory projects
- FORTRAN based, pretty clunky, not visually appealing







# High Resolution Imagery

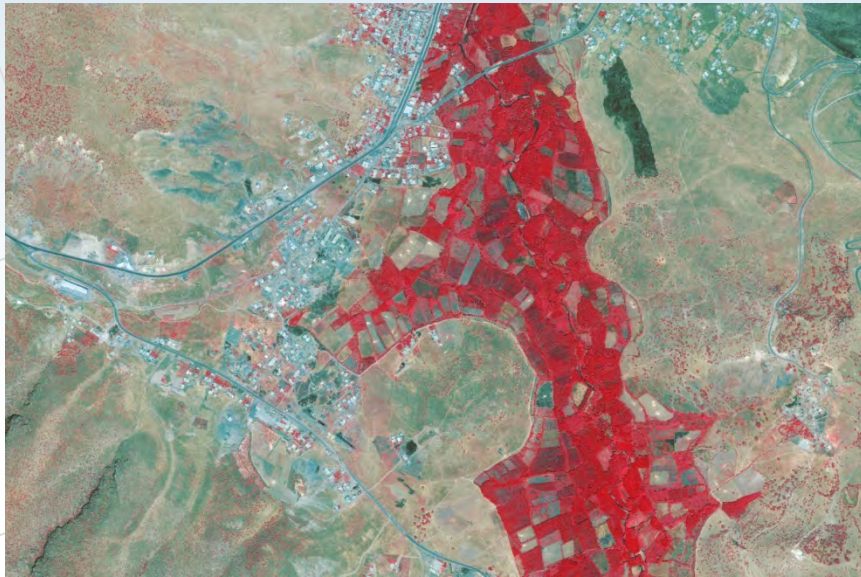
## This stuff's not free!

- Useful for site characterization, environmental assessments, base mapping, field activities, feature extraction.
- For many projects it's worth the \$\$\$

Platform		Sensor	Spatial Scales - extent - pixel size	Spectral Resolution and Range	Radiometric Resolution	Temporal Resolution - repeat frequency - time of acquisition	Source(s) for Data
high spatial resolution multi spectral	 	QuickBird 2 IKONOS GeoEye-1	Extremely fine (local)  Extent: 25sqkm+, 49sqkm+  GRE: 0.5-1m (pan) or 1.64-4m (multi)	> 100 nm Medium range: 400-920nm  # Bands: 4	High: 11 bit (2048 levels)	morning 3 days Programmable	Geoimage Quickbird www.digitalglobe.com IKONOS www.geoeeye.com GeoEye-1 www.geoeeye.com
		Rapid Eye	High: (local, province, region) Extent: 77km swath at nadir  GRE: 5m	> 100 nm Medium range: 440-850nm  #Bands: 5	Medium: 12bit	Derived product from SPOT5	RapidEye www.rapideye.de Geoimage www.geoimage.com.au AAMHatch www.aamhatch.com
		WorldView-1	Extremely fine (local)  Extent: 25sqkm+  GRE: 0.5m (pan)	> 100 nm Medium range: 400-900nm  # Bands: 1	High: 11 bit (2048 levels)	morning 3 days Programmable	Geoimage WorldView-1 www.digitalglobe.com
		WorldView-2	Extremely fine (local)  Extent: 25sqkm+  GRE: 0.5m (pan) or 1.84m (multi)	> 100 nm Medium range: 400-1050nm  # Bands: 8	High: 11 bit (2048 levels)	Not yet operational, launch scheduled for October 2009	Geoimage WorldView-2 www.digitalglobe.com

# Case Study: WV2 Imagery Kurdistan

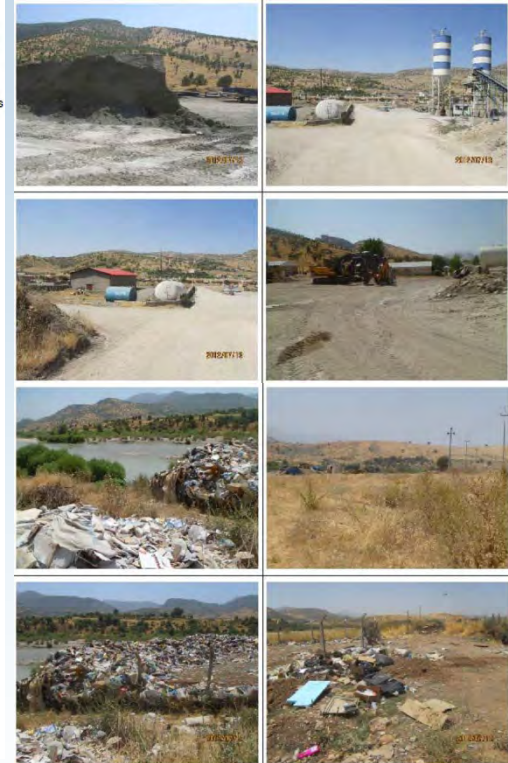
- Oil and Gas companies in the process of exploration. Working with local environmental agencies to document baseline conditions.
- Imagery initially purchased for base mapping. Now multiple products and applications.





# Case Study: WV2 Imagery Kurdistan

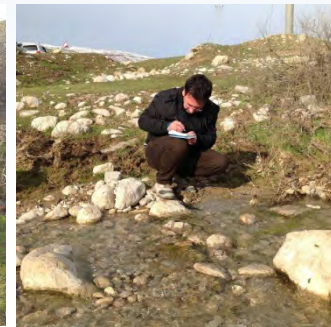
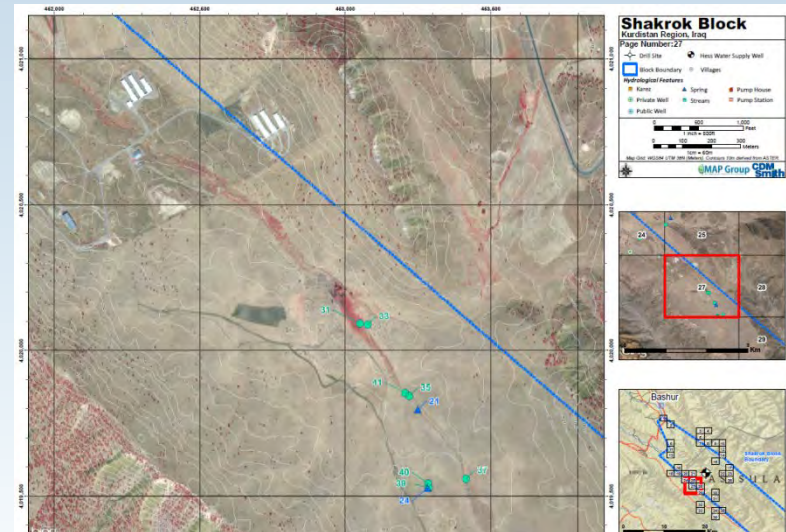
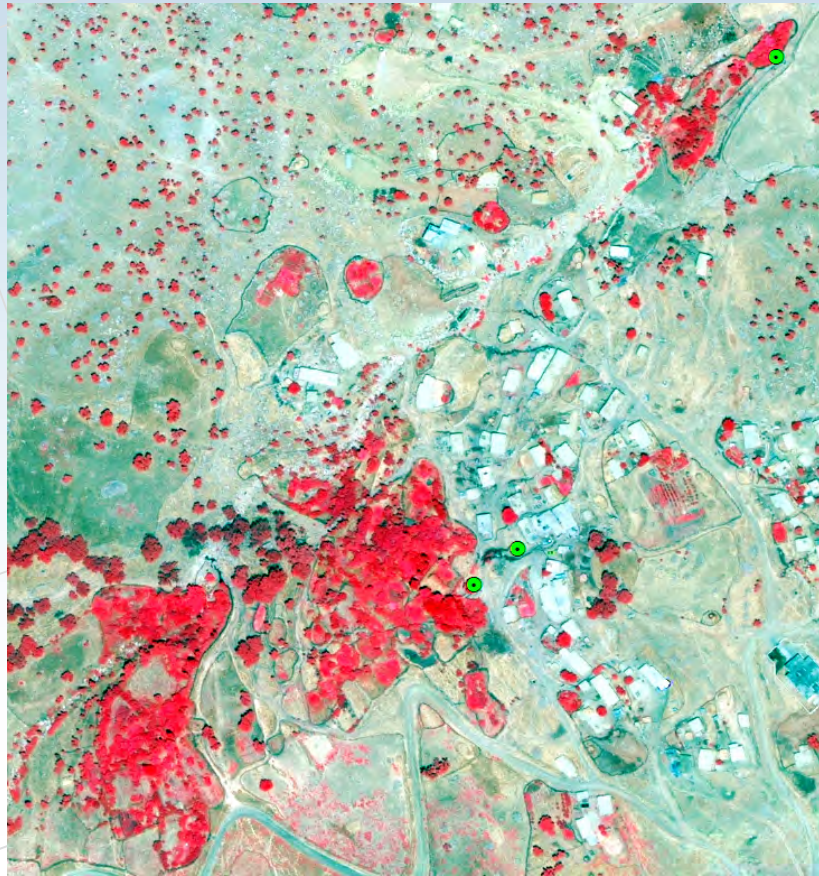
- Image screening for areas of concern. Baseline conditions.





# Case Study: WV2 Imagery Kurdistan

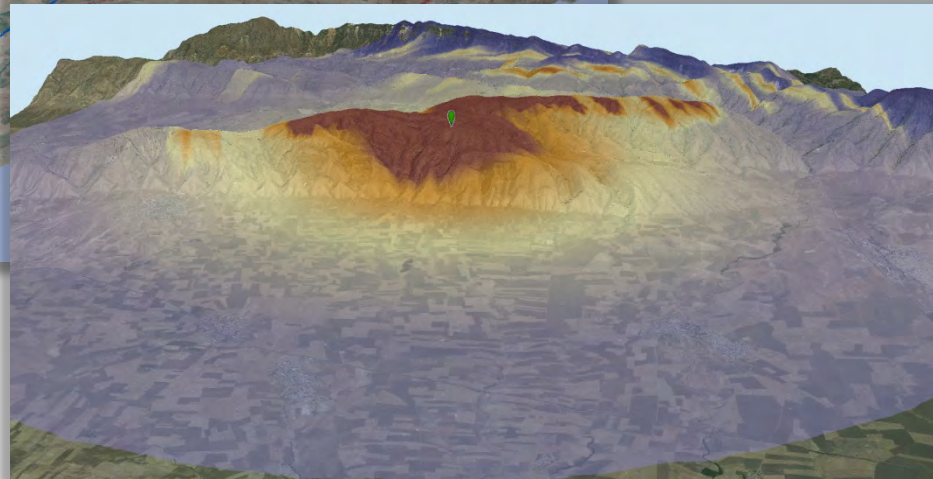
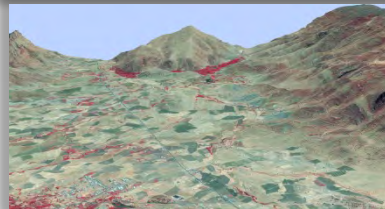
- Hydrological Assessment. Springs, surface water, riparian.
- NIR band extremely useful. Image Analysis Toolbar.





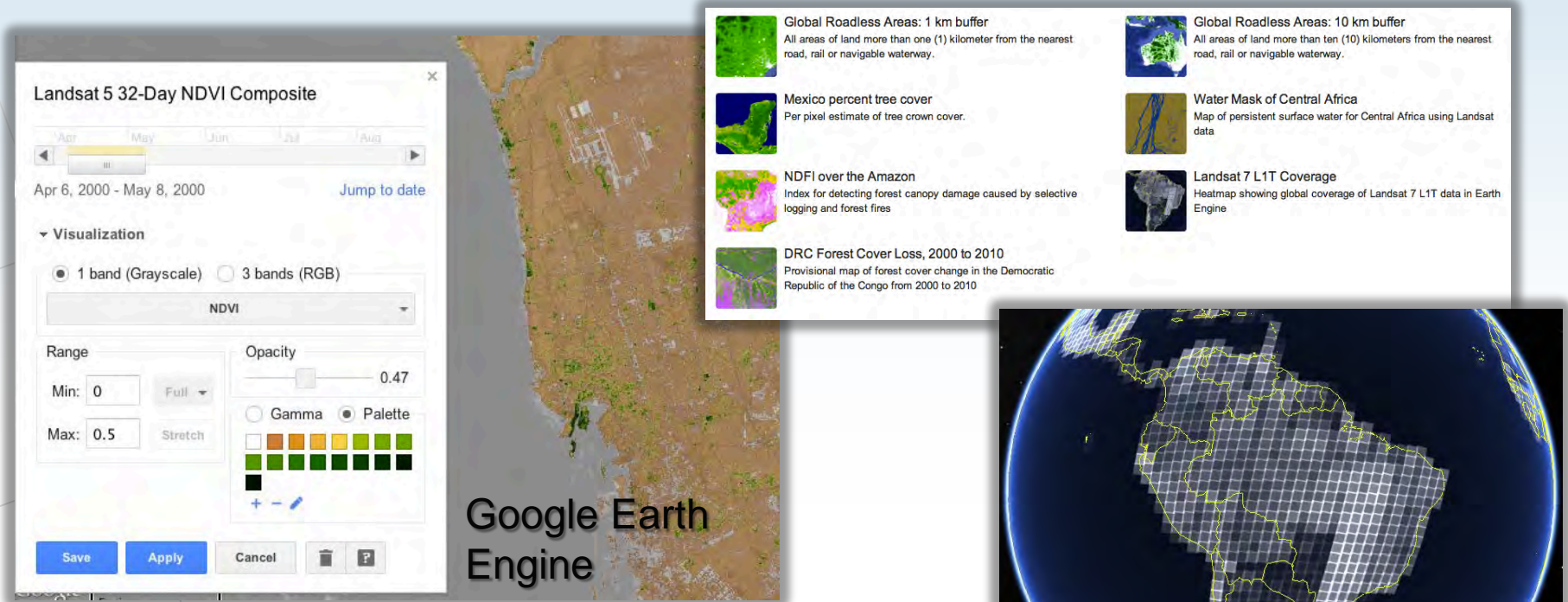
# Case Study: WV2 Imagery Kurdistan

- Visualization: Satellite view to 3D, a Greater display of information



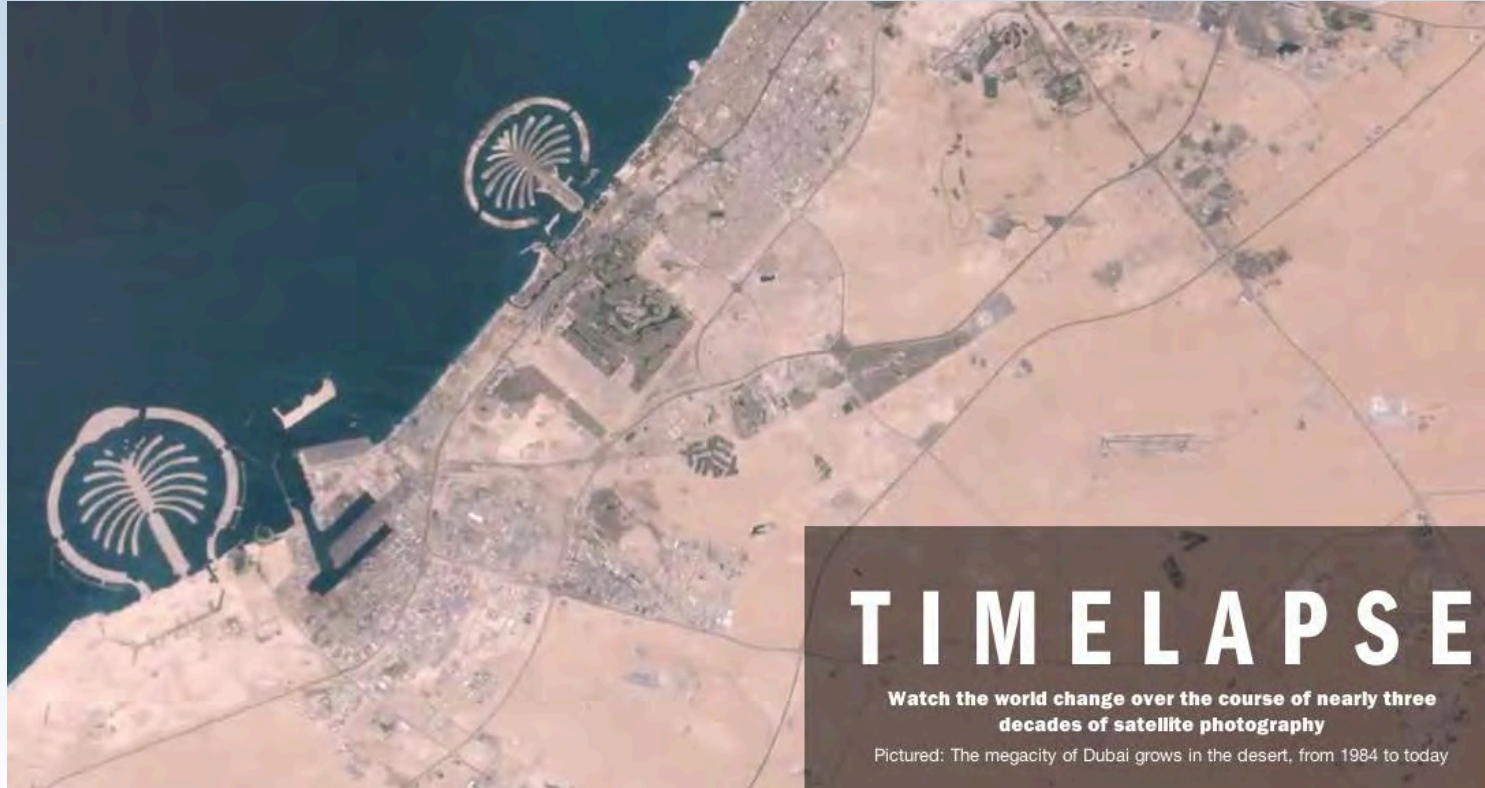
# What the Future Holds...

- More access to imagery (archives, govt, commercial)
- Web apps. On the fly processing, viewing, and downloads
- Remote Sensing for the GIS professional and GIS user
- Filling in data gaps in geospatial data (Raster > Vector)
- Greater understanding of our world





# What the Future Holds...



#### Growth of Las Vegas, Nevada

Interactive Landsat timelapse of urban expansion and water resources in the Nevada desert, 1984-2012.



#### Wyoming Coal Mining

Interactive Landsat timelapse of coal mining in Wyoming, 1984-2012.



#### Saudi Arabia Irrigation

Interactive Landsat timelapse of center-pivot irrigation sites (crop circles) in Saudi Arabia, 1984-2012.



#### Drying of Lake Urmia, Iran

Interactive Landsat timelapse of the drying of Lake Urmia, 1984-2012.



#### Amazon Deforestation, Brazil

Interactive Landsat timelapse of deforestation of the Amazon rainforest, 1984-2012.



#### Columbia Glacier Retreat, Alaska

Interactive Landsat timelapse of the retreat of the Columbia Glacier in Alaska, 1984-2012.



#### Dubai Coastal Expansion

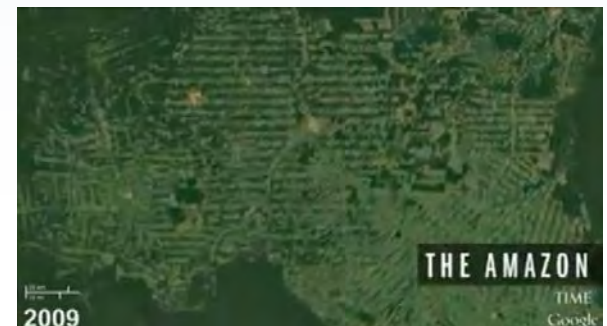
Interactive Landsat timelapse of the creation of the artificial Palm Islands off the coast of Dubai, 1984-2012.



#### Drying of the Aral Sea

Interactive Landsat timelapse of the drying of the Aral Sea, 1984-2012.

- [Dallas](#)
- [Vegas](#)



# Contact information and Resources

- **Jared Newell** - [newelljd@cdmsmith.com](mailto:newelljd@cdmsmith.com)

## Resources

- EarthExplorer: <http://earthexplorer.usgs.gov/>
- LandsatLook: <http://landsatlook.usgs.gov/>
- Glovis: <http://glovis.usgs.gov/>
- Geofabrik (OSM): <http://www.geofabrik.de/index.html>
- Google Earth Engine: <http://earthengine.google.org>
- Google Timelapse: <http://earthengine.google.org/#timelapse/>
- Wikimapia: <http://wikimapia.org>