Evaluating Merits and Applicability of Geospatial Technologies

Geospatial Technologies and Human Rights Project
Scientific Responsibility, Human Rights and Law Program
American Association for the Advancement of Science
Why is this important?

- Not a panacea
- Can be ambiguous
- Awareness of limitations critical
- Need to be informed consumer; recognize bad analysis
- Solid Basis for Fieldwork
Limitations of Remote Sensing

- Resolution
- Repeat Cycle
- Dwell Time
- Geometry
- Atmospheric Effects
Resolution

Tahrir Square
Repeat Cycle
Dwell Time
Geometry

Image A: DigitalGlobe, Image B: Astrium
What does this mean?

- Remote sensing powerful, but not omniscient
- Mostly still images; video limited to very short-duration
- “Enhance” function much less capable than portrayed by Hollywood
Limitations interact differently according to:

- Imaging Targets
- Data Products
- Analysis Methods
Imaging Targets: Cities

- Can be difficult to see down into narrow streets/alleyways
- High visual complexity; Analyst-intensive; takes a long time
- Durable; can be hard to damage; damage may be invisible from overhead

Imagery: DigitalGlobe
Imaging Targets: Villages & Rural Areas

- May not exist on maps
- Names may be ambiguous
- Often made of natural materials; hard to locate at low-resolution
Imaging Targets: Agriculture

- Takes a long time for changes to become apparent
- Can be hard to evaluate fallow fields (shifting cultivation)
- Burning may –or may not– be normal

Image: DigitalGlobe
Imaging Targets: Geographic Regions

- The tropics: Clouds / Rainy Season

- Mountainous Terrain:
  - Shadows
  - Topographic Distortion
  - Layover

Image: DigitalGlobe
Data Products: High-Resolution Imagery

QuickBird: 60 cm (multispectral)

Ikonos: 1 m (multispectral)

OrbView: 1 m (panchromatic)
Data Products: Low-Resolution Imagery

- **Pro:**
  - Low Cost
  - Wide area of coverage
  - Deep archives

- **Con:**
  - Poor Spatial Resolution
  - Scan-Line Error in Some Data

Imagery: NASA/USGS
Data Products: Airborne Imagery

- **Pro:**
  - Resolution extremely high
  - Only practical way to get certain data products in high-resolution

- **Con:**
  - Expensive
  - Overflight often requires permission of multiple jurisdictions/regulatory agencies
  - Easily disrupted due to maintenance issues, weather, temporary flight restrictions
  - Off-nadir angles often extreme
Data Products: Radar

- **Pro:**
  - Sees through clouds
  - Sees at night
  - Detects oil slicks, earth movements, etc.

- **Con:**
  - Usually Monochromatic
  - Requires skill to interpret; generally lower-resolution
  - Speckle makes analysis more difficult
  - Expensive

Image: European Space Agency
Data Products: Crowdsourced Mapping

- Often only available option
- Quality of information can vary
- Potential for manipulation exists
- Perceived as less trustworthy
- Must make the case for accuracy

Image: OpenStreetMap
When Things Get Ambiguous:
The Importance of Experienced, Independent Analysis
Oil Slick or Calm Sea?
Tanks...
...or Trees?
Shell Craters...
…or orchard management?
Ways to Avoid Misinterpretation

- Transparency
- Ground Truth
- Multiple Data Sources
- Peer Review
- Separate analysis from agenda
Things to Remember When Evaluating

• Need to place events in proper context

• Imagery alone seldom sufficient to get full picture of a situation

• Multiple interpretations can (and almost always do) exist
  • The one that seems the most likely can still be wrong

• Even experienced analysts make mistakes

• Sensor must be appropriate for the job
Be an informed consumer!

Ask:

• Is remote sensing appropriate for this application?
  - When did event occur?
  - What are the resolution requirements?
  - How large of an area is required?
  - What kind of data would be most useful?
  - Is the area accessible?
Be an informed consumer! (continued)

Ask:

• What is the question to be answered?
  • Can it be answered through other means?
  • What is the specific benefit of remote sensing?
  • What other information exists?

• Who will do the analysis? Are they:
  • Trustworthy?
  • Experienced?
  • Independent?
Questions?

#AAAS_GTHR