*Day 1, Panel 2: Enhancing the Contribution of Earth Observation and Artificial Intelligence for Emergency Platforms*

"Earth Observation: digital product delivery to intended users at pace, scale, and accuracy"

*Lee Schwartz, The Geographer*

OFFICE OF THE GEOGRAPHER
AND GLOBAL ISSUES
UNITED STATES DEPARTMENT OF STATE

# 100 years of Geography at the US Department of State

**1922**
Office of The Geographer
Paris Peace Conference

**1941**
Cartography
during WWII

**1949**
Joins Bureau of
Intelligence &
Research

**1960**
New countries,
boundary authority

**1970**
UN Law of the
Seas

**1980-90s**
Global Issues;
Boundary
Verification

**2003**
Humanitarian Information Unit (HIU);
Sustainable Development; Open Data;
Human Geography; Participatory GIS;
Commercial Satellite Imagery
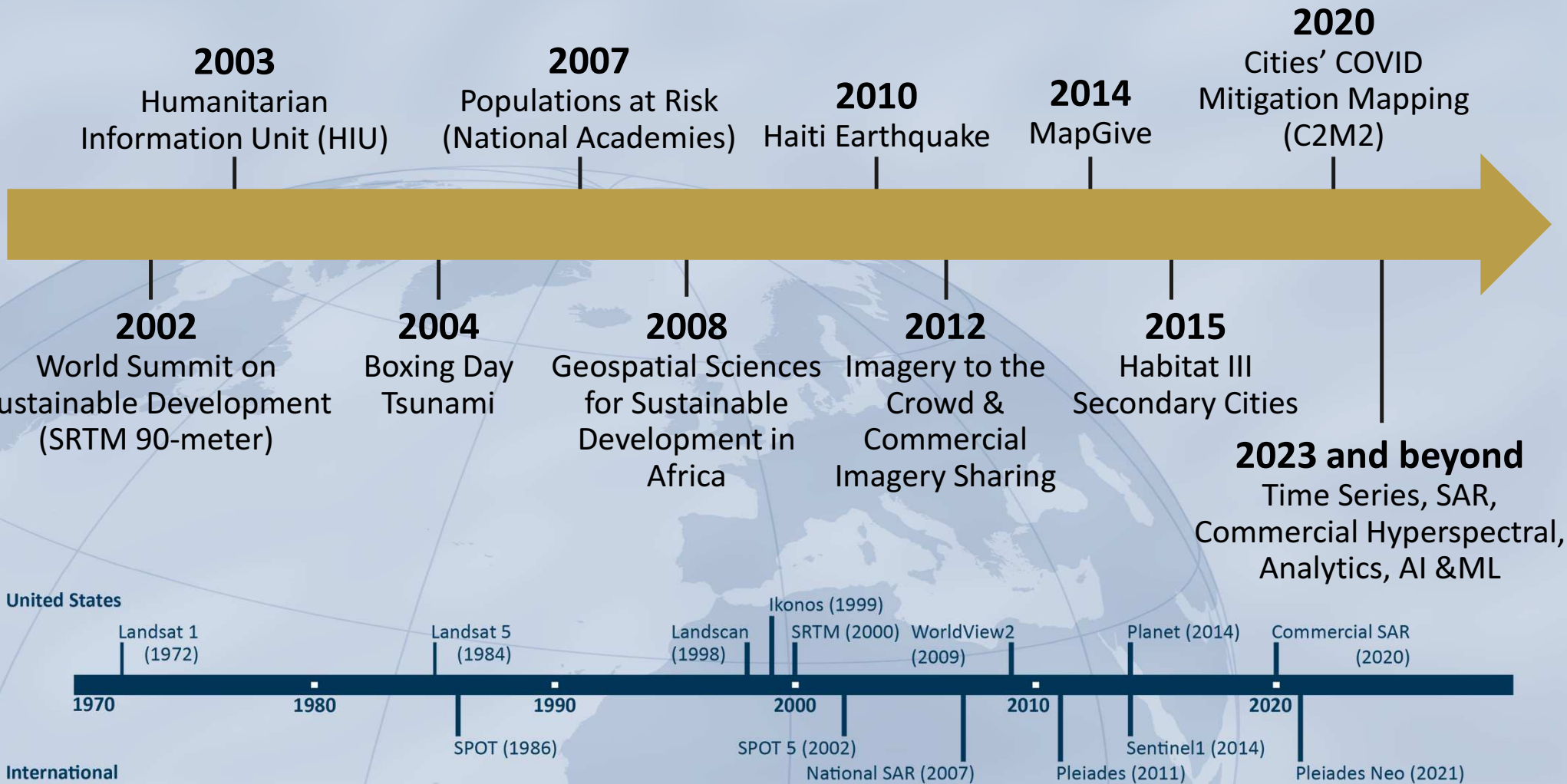
**2023**
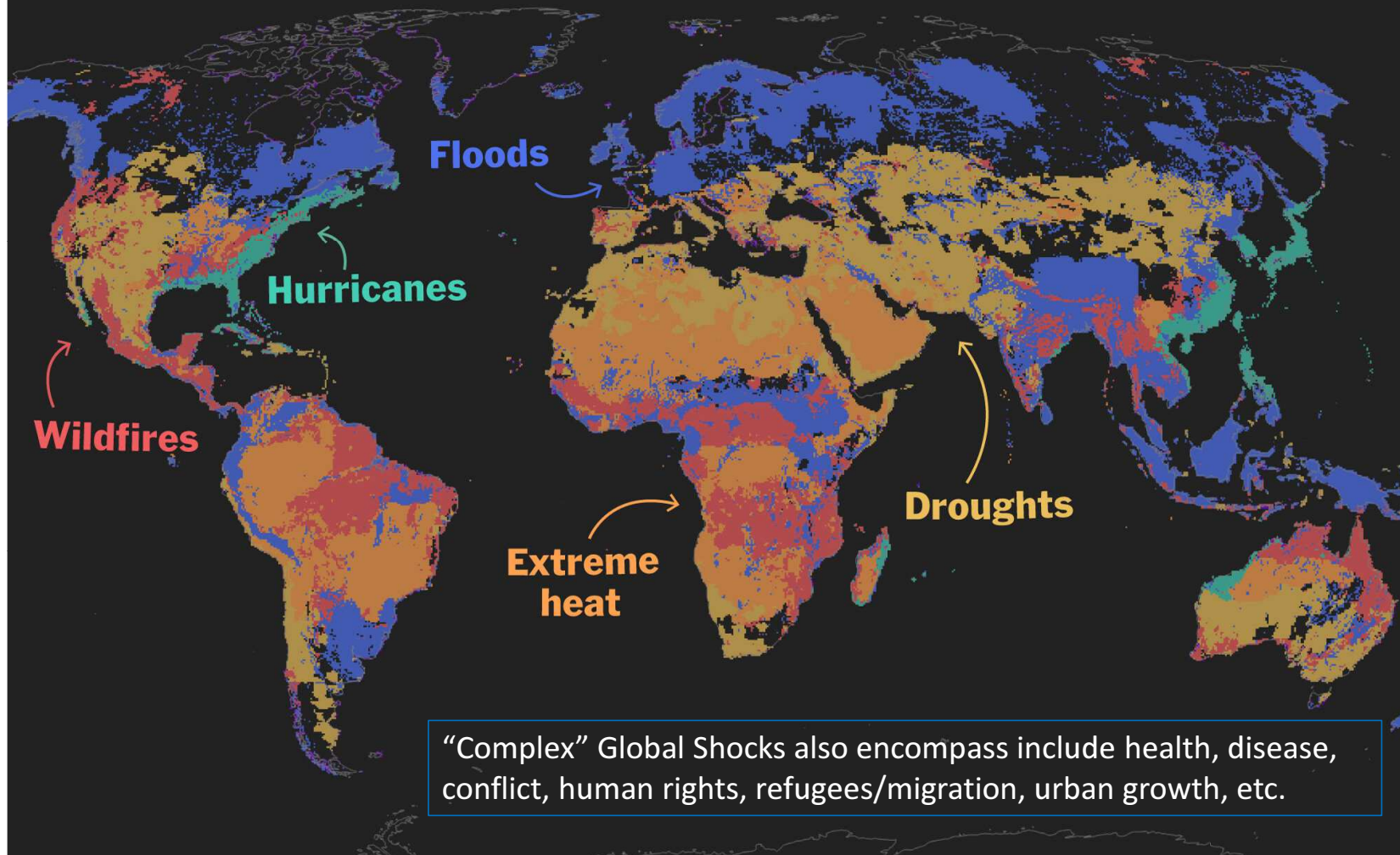Science & Technology;
Big Data Processing;
Democratization of Data

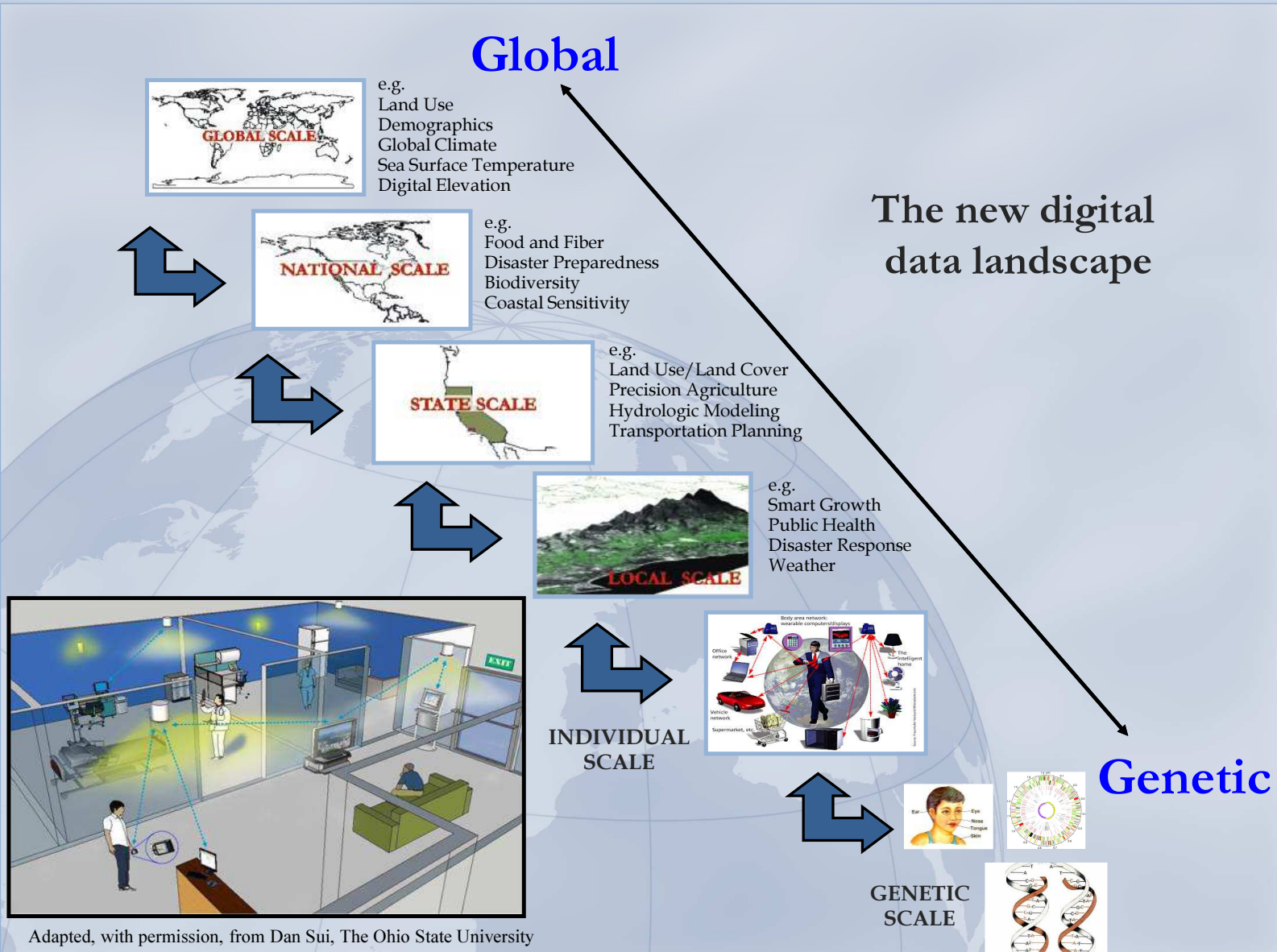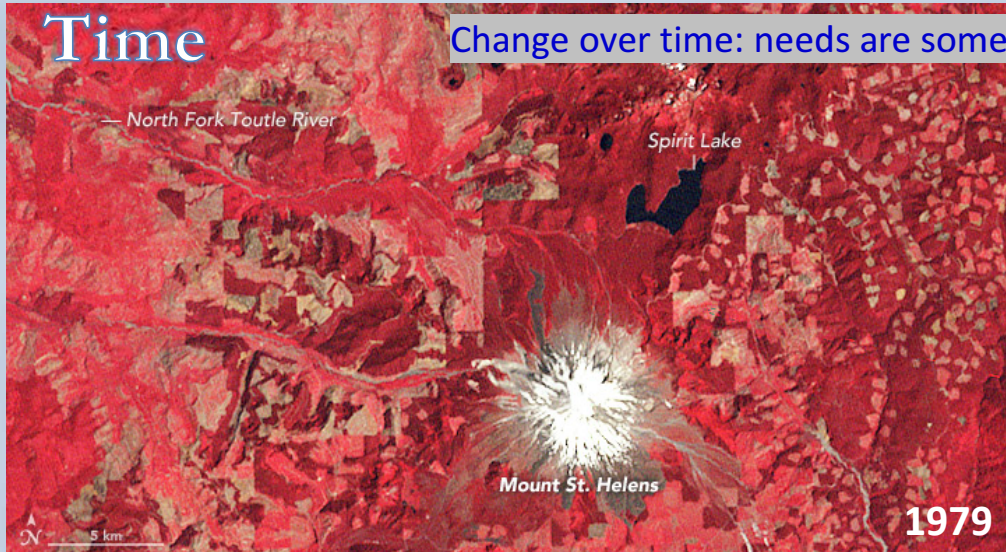# Earth Observation and the Office of the Geographer, U.S. Dept. of State

**2003**
Humanitarian Information Unit (HIU)

**2007**
Populations at Risk (National Academies)

**2010**
Haiti Earthquake

**2014**
MapGive

**2020**
Cities' COVID Mitigation Mapping (C2M2)

**2002**
World Summit on Sustainable Development (SRTM 90-meter)

**2004**
Boxing Day Tsunami

**2008**
Geospatial Sciences for Sustainable Development in Africa

**2012**
Imagery to the Crowd & Commercial Imagery Sharing

**2015**
Habitat III Secondary Cities

**2023 and beyond**
Time Series, SAR, Commercial Hyperspectral, Analytics, AI &ML

**United States**

Landsat 1 (1972)

Landsat 5 (1984)

Landscan (1998)

Ikonos (1999)

SRTM (2000)

WorldView2 (2009)

Planet (2014)

Commercial SAR (2020)

1970    1980    1990    2000    2010    2020

SPOT (1986)

SPOT 5 (2002)

National SAR (2007)

Pleiades (2011)

Sentinel1 (2014)

Pleiades Neo (2021)

**International**

Global Shocks

Floods

Hurricanes

Wildfires

Extreme heat

Droughts

"Complex" Global Shocks also encompass include health, disease, conflict, human rights, refugees/migration, urban growth, etc.

https://www.nytimes.com/interactive/2021/01/28/opinion/climate-change-risks-by-country.html

# Scale

**Global**

The new digital
data landscape

e.g.
Land Use
Demographics
Global Climate
Sea Surface Temperature
Digital Elevation

e.g.
Food and Fiber
Disaster Preparedness
Biodiversity
Coastal Sensitivity

e.g.
Land Use/Land Cover
Precision Agriculture
Hydrologic Modeling
Transportation Planning

e.g.
Smart Growth
Public Health
Disaster Response
Weather

**INDIVIDUAL
SCALE**

**Genetic**

**GENETIC
SCALE**

Adapted, with permission, from Dan Sui, The Ohio State University

Time

Change over time: needs are sometimes rapid and sometimes long-term

https://earthobservatory.nasa.gov/world-of-change/StHelens
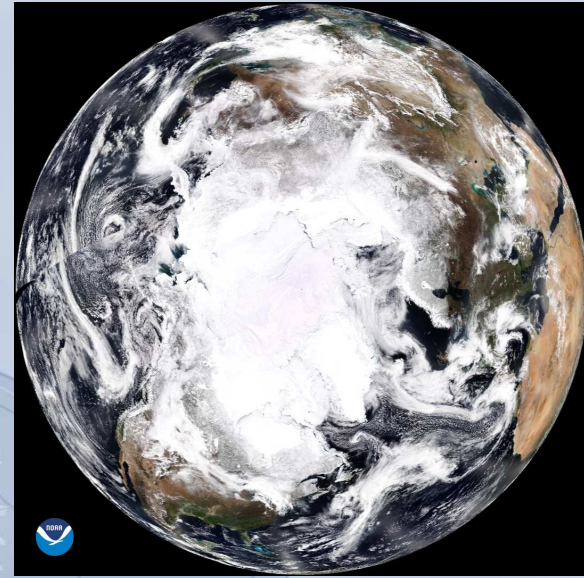
*Source: NASA Earth Observatory*
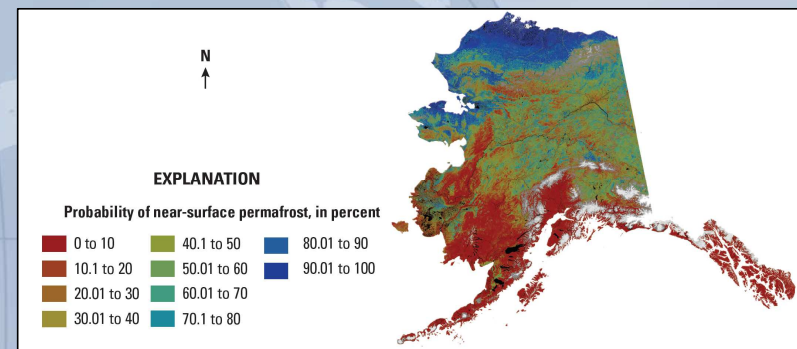
# Monitoring a Changing Arctic

- New sea routes opening - but with less predictable ice

- Changing ecosystems and food sources

- Erosion, permafrost thaw threaten coastal communities

- Monitoring GHG emissions



Composite image of Earth from the North Pole taken from NOAA-20 polar-orbiting satellite (2018)



A polar bear walking on an ice floe (U.S. Coast Guard photo)



EXPLANATION

Probability of near-surface permafrost, in percent

- 0 to 10
- 10.1 to 20
- 20.01 to 30
- 30.01 to 40
- 40.1 to 50
- 50.01 to 60
- 60.01 to 70
- 70.1 to 80
- 80.01 to 90
- 90.01 to 100

Map of Alaskan permafrost created using USGS satellite data

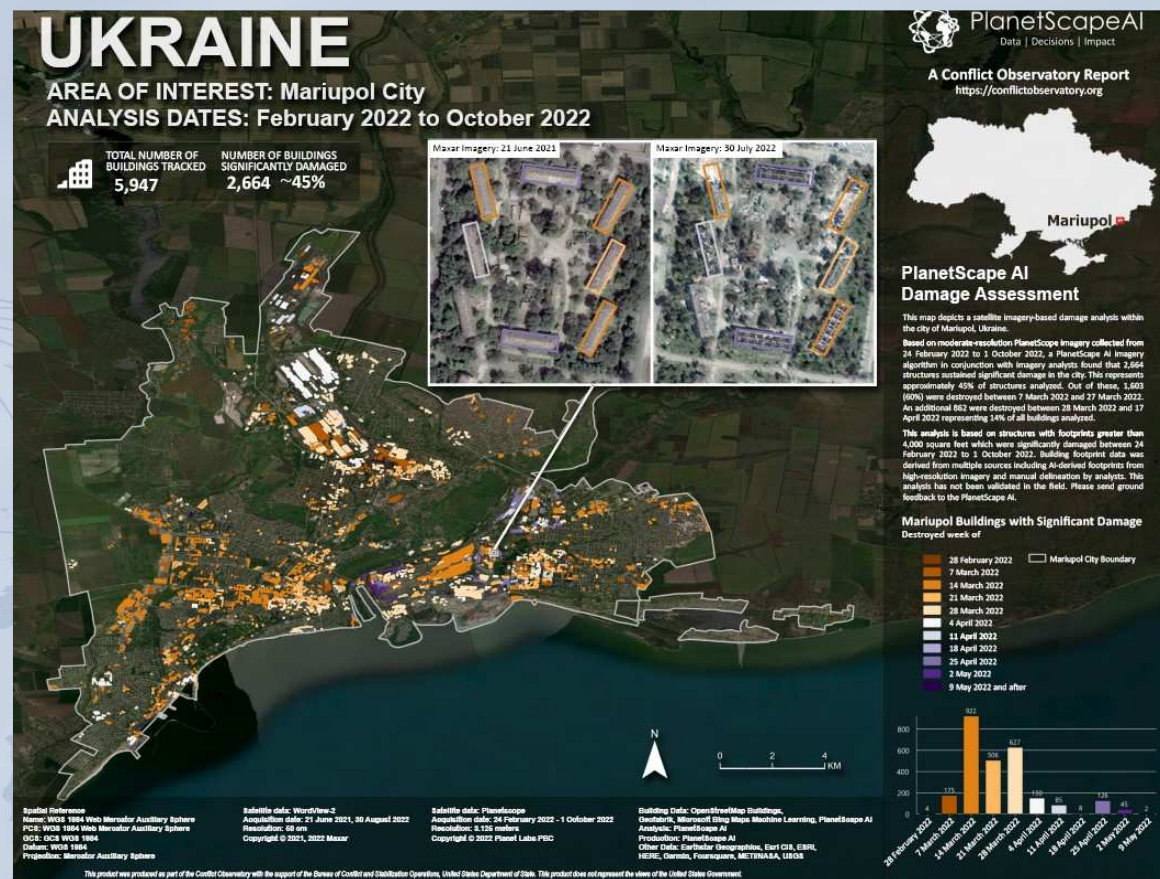## The Conflict Observatory uses

### Geospatial Information
- Satellite imagery, artificial intelligence/machine learning, and other geospatial information

### Open-Source Investigation Techniques
- Exploitation and geolocation of social media, websites, and news articles

## To Document

- Children's camps involved in forcible transfers and deportations
- Filtration Operations
- Mass graves
- Executions
- Forcible displacement, transfers, deportations
- Attacks on civilians
- Destruction of civilian infrastructure
- Destruction/theft of cultural heritage
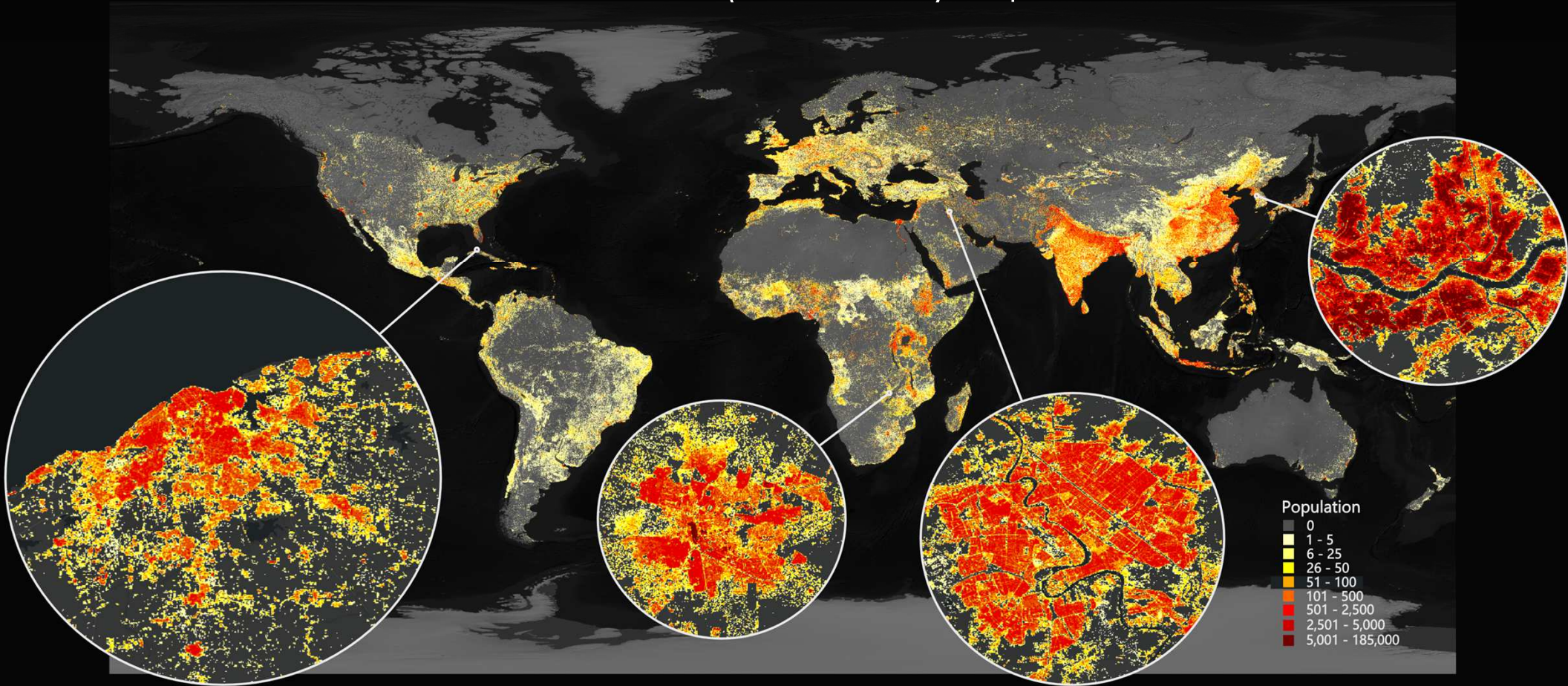- Damage to critical infrastructure



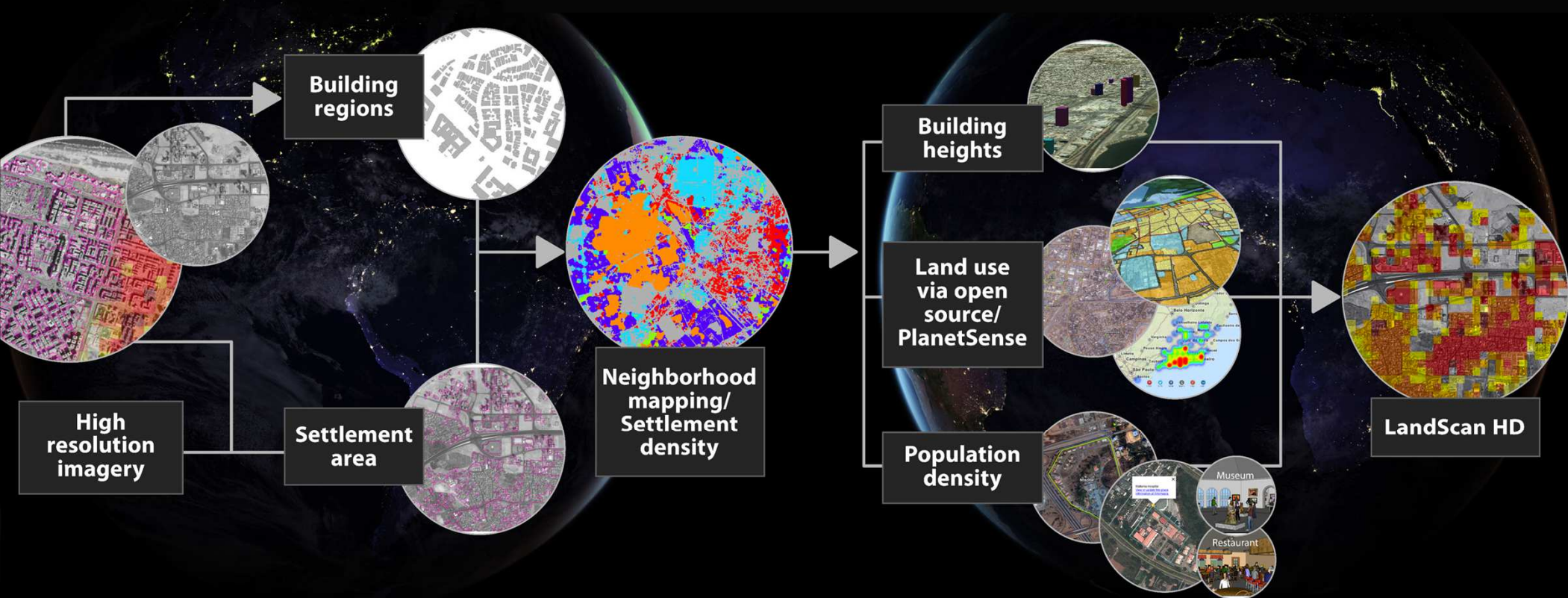Source: Conflict Observatory public report, available here: LINK

UNCLASSIFIED

# LandScan Program
Developing Global Gridded Population Datasets
of an "Ambient" (Unwarned) Populations

Population
0
1 - 5
6 - 25
26 - 50
51 - 100
101 - 500
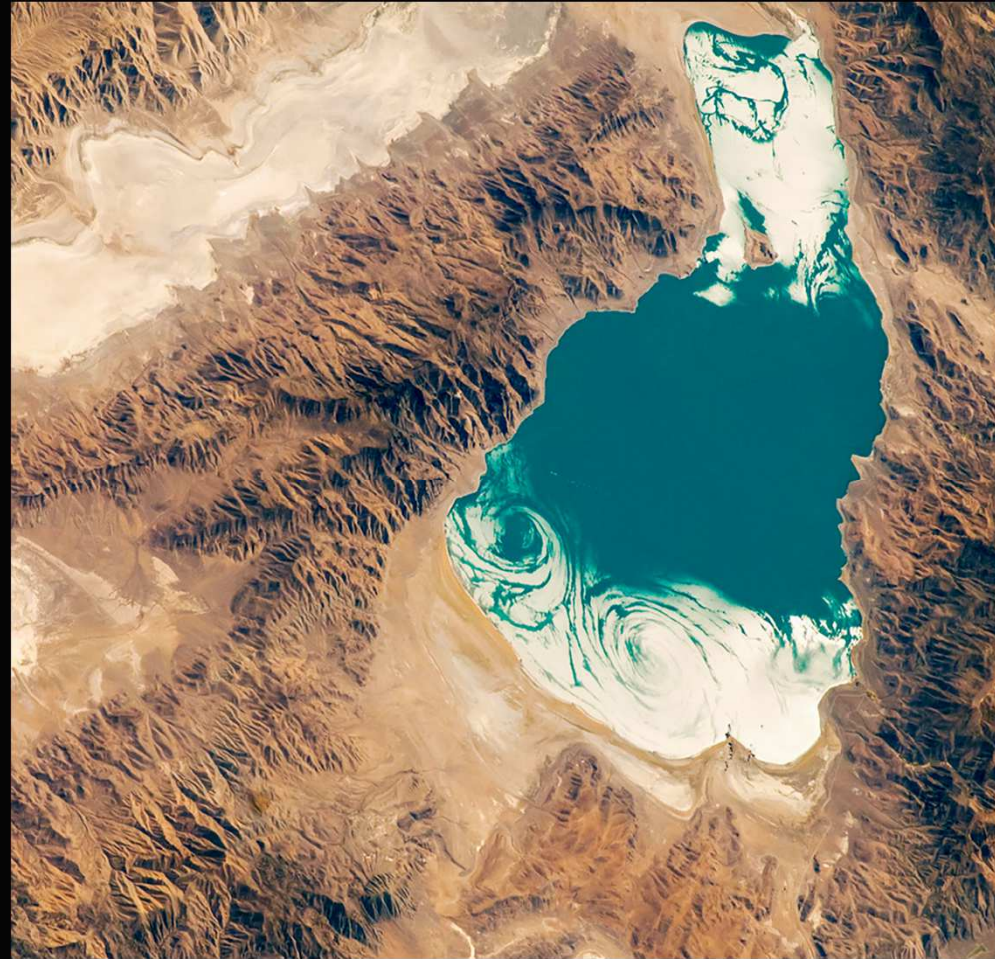501 - 2,500
2,501 - 5,000
5,001 - 185,000

# HydroScan
## Global Water Inventory, Persistently Monitored

The future "HydroScan" project will seek to capture and continuously monitor - through remote sensing, AI and image processing, and data science - Earth's surface and ground water resources.
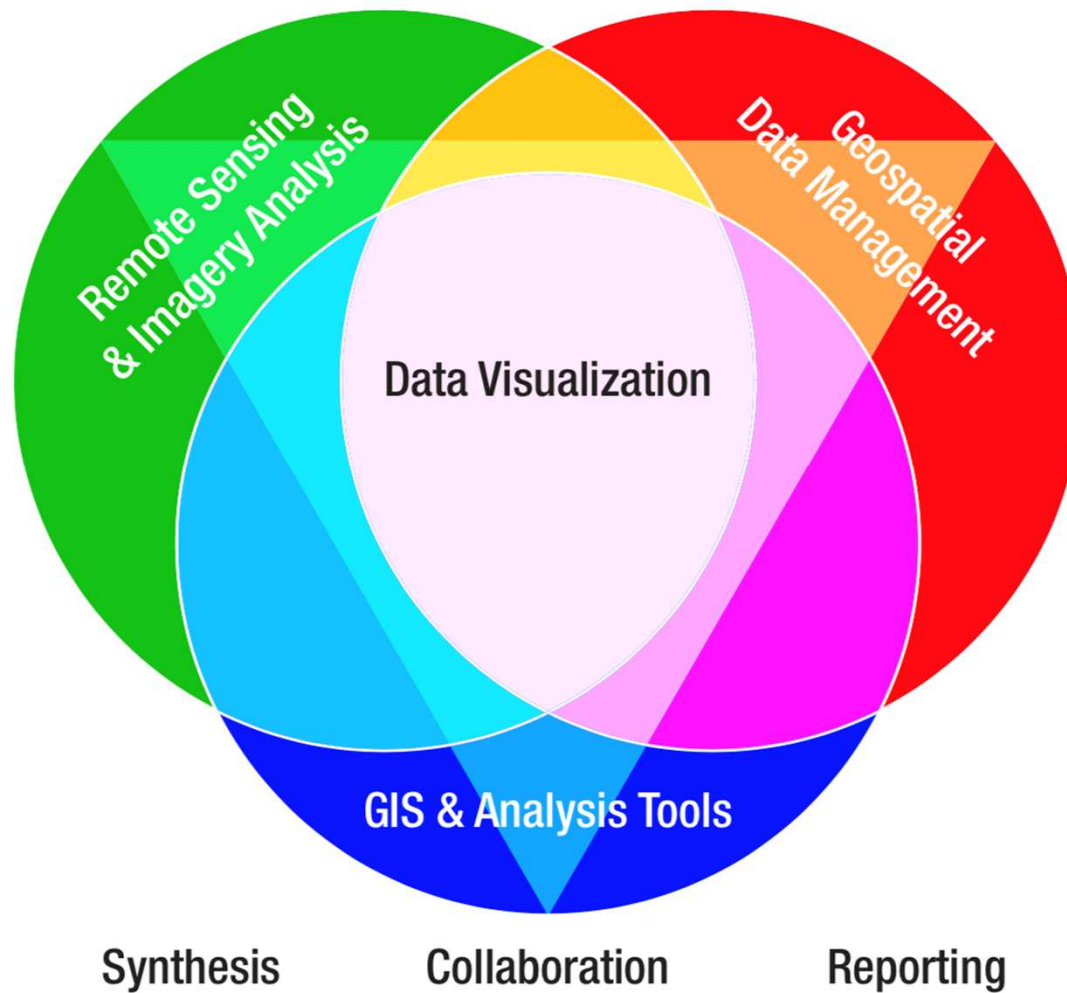
Rather than today's pixel-based snapshots of water presence, HydroScan will catalog and monitor water's atomic spatial units – the ponds, lakes, reservoirs, rivers, and aquifers – at fine spatial and temporal scales.

HydroScan will provide both an accurate inventory of surface and ground water, as well as an understanding seasonal variability baselines, to more effectively measure and monitor water risk and security.

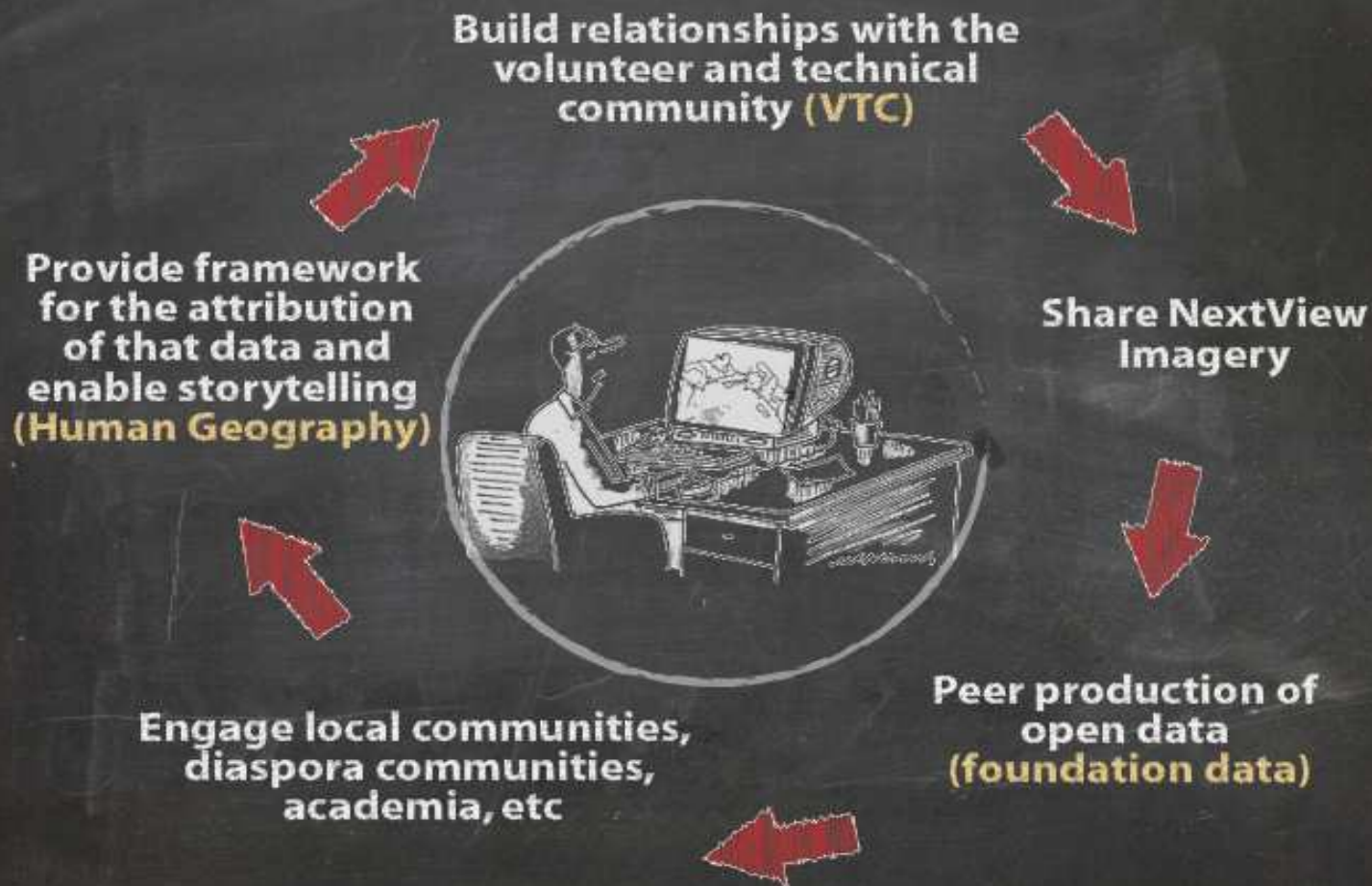GEOINT Essential Body of Knowledge

Remote Sensing & Imagery Analysis

Geospatial Data Management

Data Visualization

GIS & Analysis Tools

Synthesis    Collaboration    Reporting

https://gistbok.ucgis.org/bok-topics/geospatial-intelligence-and-national-security

# Imagery-driven Participatory Mapping

Build relationships with the volunteer and technical community (VTC)

Provide framework for the attribution of that data and enable storytelling (Human Geography)

Share NextView Imagery

Engage local communities, diaspora communities, academia, etc

Peer production of open data (foundation data)

**Open Data**

GeoSHAPE

High resolution satellite imagery

Imagery to the Crowd

Secondary **CITIES** OFFICE OF THE GEOGRAPHER

*100's data layers 50+ community activities*

Collaborative Processes (Remote Mapping)

**OpenStreetMap**

Remote volunteers trace satellite imagery

Field Data Collection

Community volunteers add local detail such as neighborhoods, street names, and evacuation centers

Humanitarian organizations use mapped information to plan risk reduction and disaster response activities that save lives

**MapGive Mapathons**

Participatory Mapping
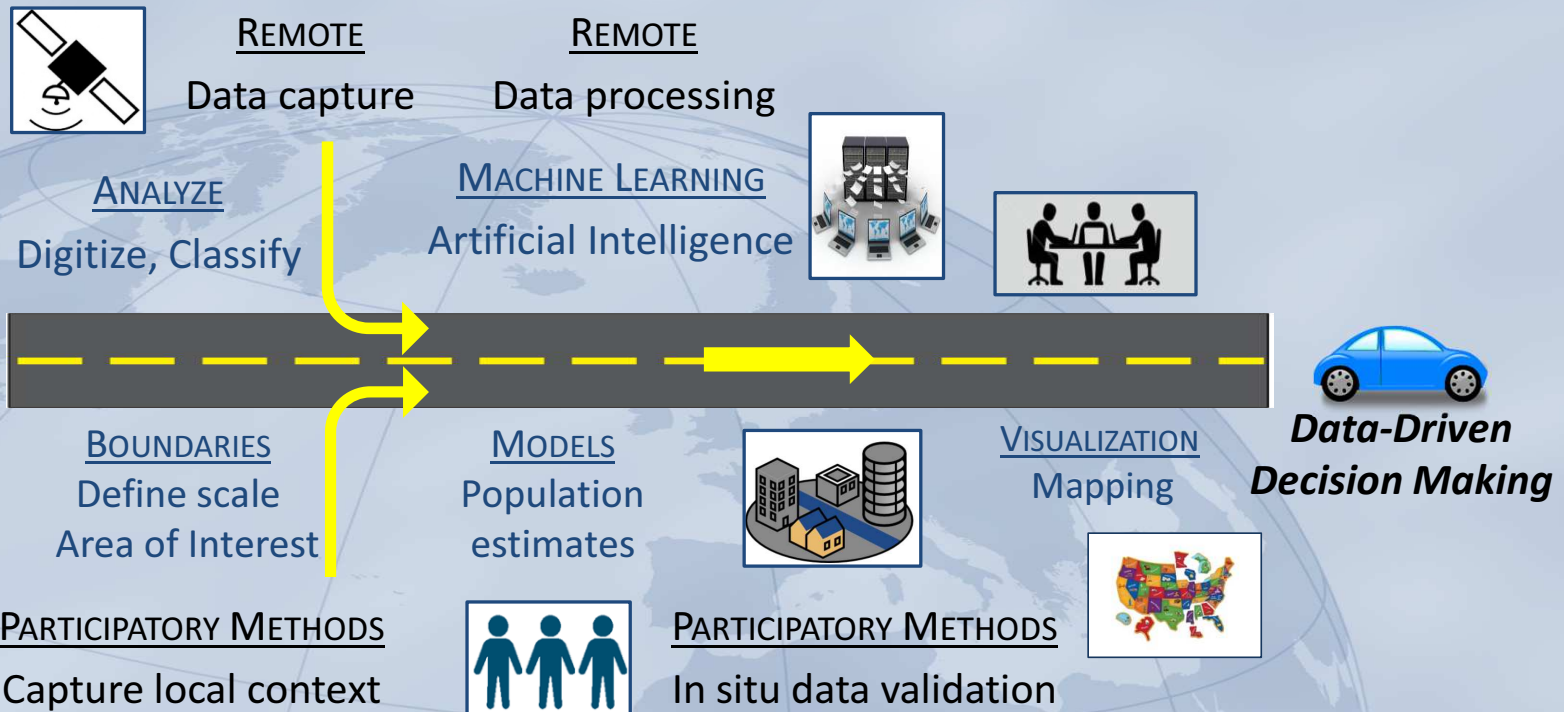
GeoNode   **StoryMap**

Sharing

**BOTTOM UP  vs.  TOP DOWN**

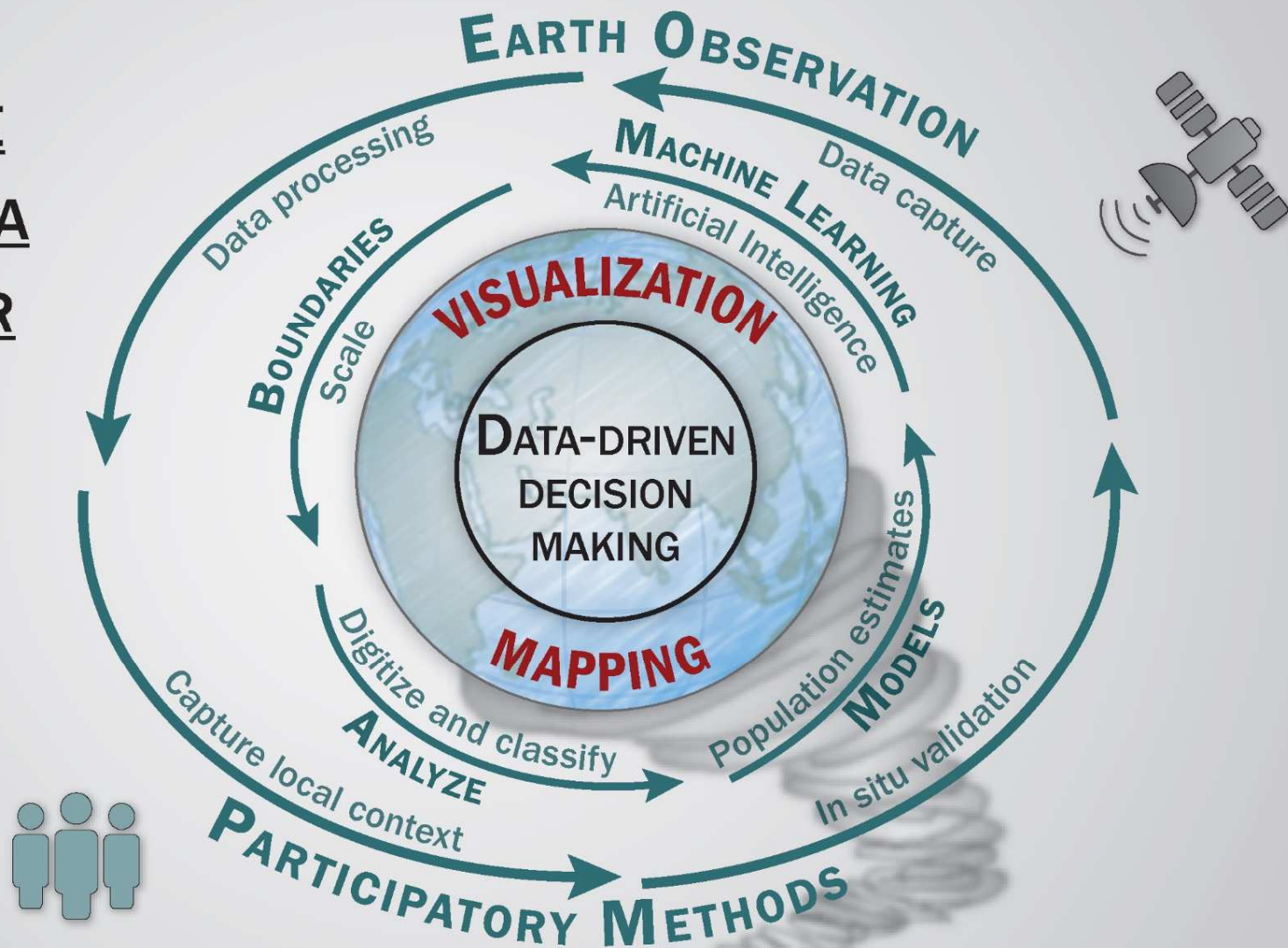**User defined:** Standards; Platform and Software agnostic; Bias.
**Partnerships:** participatory, community-based, local knowledge.
**Access:** ownership, democratization, empowerment, equity.

EARTH OBSERVATION + GROUNDTRUTH MAPPING HELP DRIVE DECISIONS

THE REMOTE & FIELD DATA CYCLONE FOR HUMAN GEOGRAPHY

EARTH OBSERVATION

Data capture

MACHINE LEARNING

Data processing

Artificial Intelligence

BOUNDARIES

Scale

VISUALIZATION

DATA-DRIVEN DECISION MAKING

MAPPING

Population estimates

MODELS

In situ validation

Digitize and classify

ANALYZE

Capture local context

PARTICIPATORY METHODS

BUILDING A "SATELLITE" TO COLLECT HUMAN GEOGRAPHY DATA