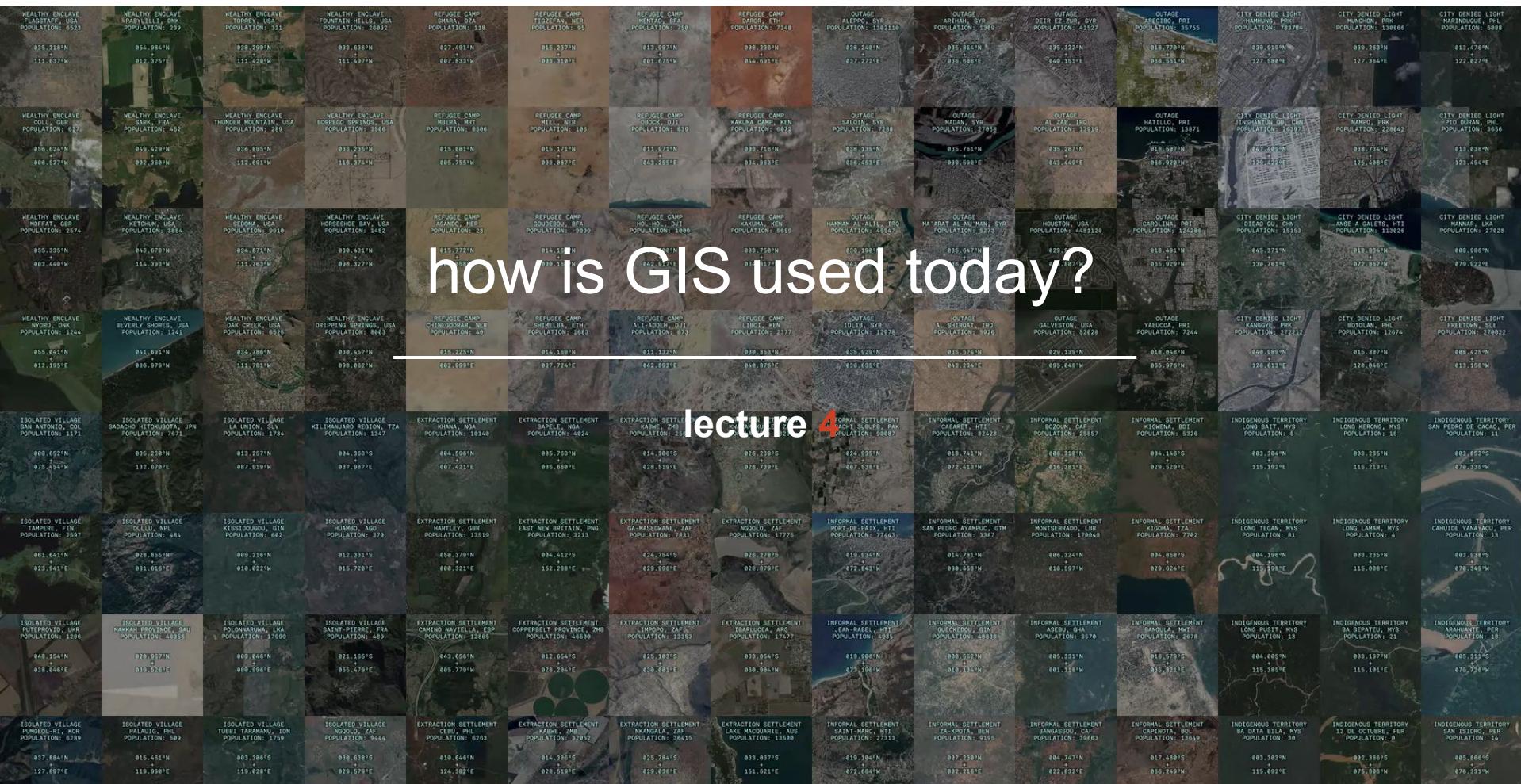


# how is GIS used today?

## lecture 4



## overview

**some applications of GIS today in various fields, discussion of remote sensing technologies and implications**

1. **public sector (governments)**
2. **public sector (NGOs / universities)**
  
3. **private sector (remote sensing)**
4. **private sector (software developers)**
5. **private sector (designers)**
6. **private sector (journalism)**

**“...while many maintain that the development and use of GIS constitute a scientific pursuit capable of producing objective knowledge of the world, others criticize GIS for inadequate representation of space and subjectivity, its positivist epistemology, its instrumental rationality, its technique-driven and data-led methods, and its role as surveillance or military technology deployed by the state.”**

- Mei-Po Kwan (2002: 645), quoted in “Mapping the Digital Empire”, Jason Farman (2010)

**“We are entering the age of the infinite examination and of compulsory objectification.... Visibility is a trap.”**

- Michel Foucault, Discipline and Punish: The Birth of the Prison (1975)

# applications of GIS today

(not a comprehensive list)

---

1. public sector (governments)
2. public sector (NGOs / universities)
  
3. private sector (remote sensing)
4. private sector (software developers)
5. private sector (designers)
6. private sector (journalism)

## 1. public sector (governments)

- land and population management
- every city has GIS website
- example: USGS

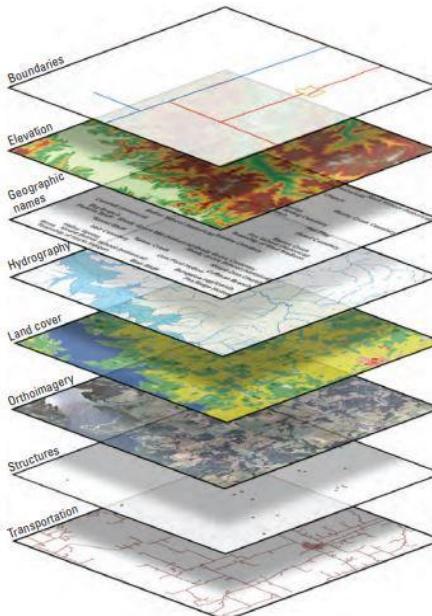
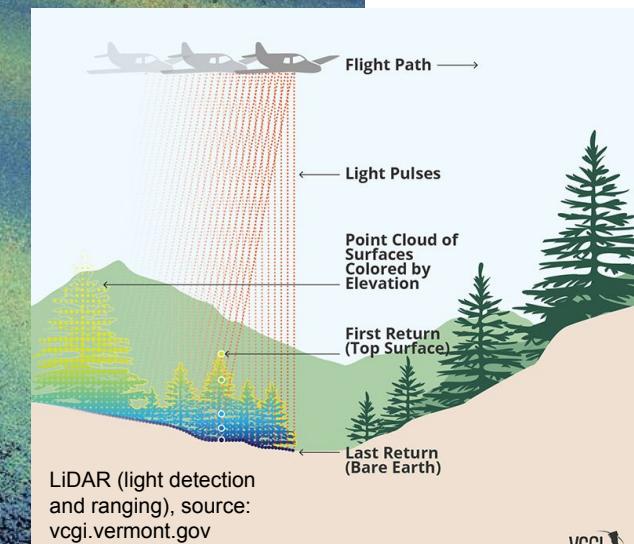
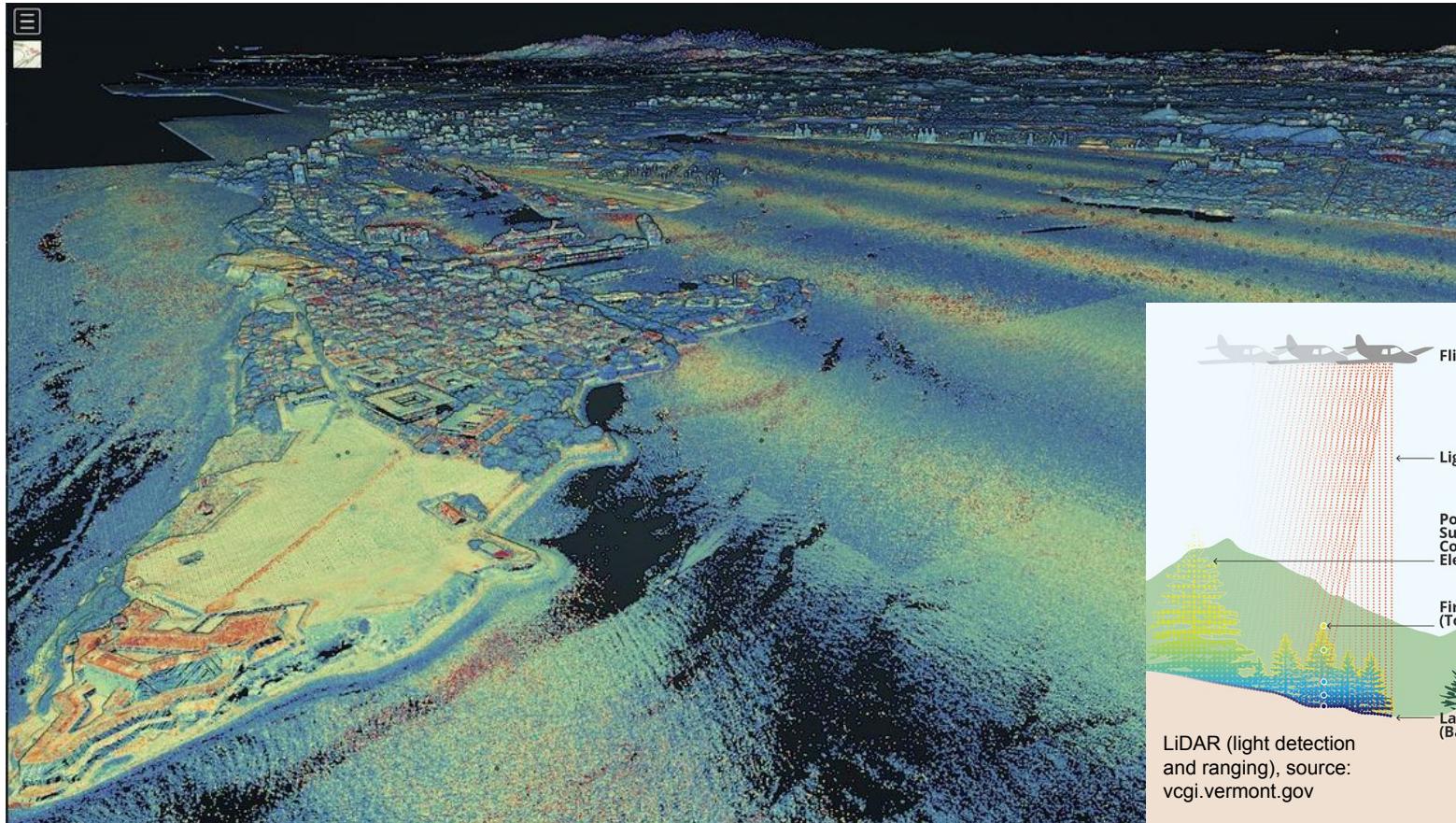


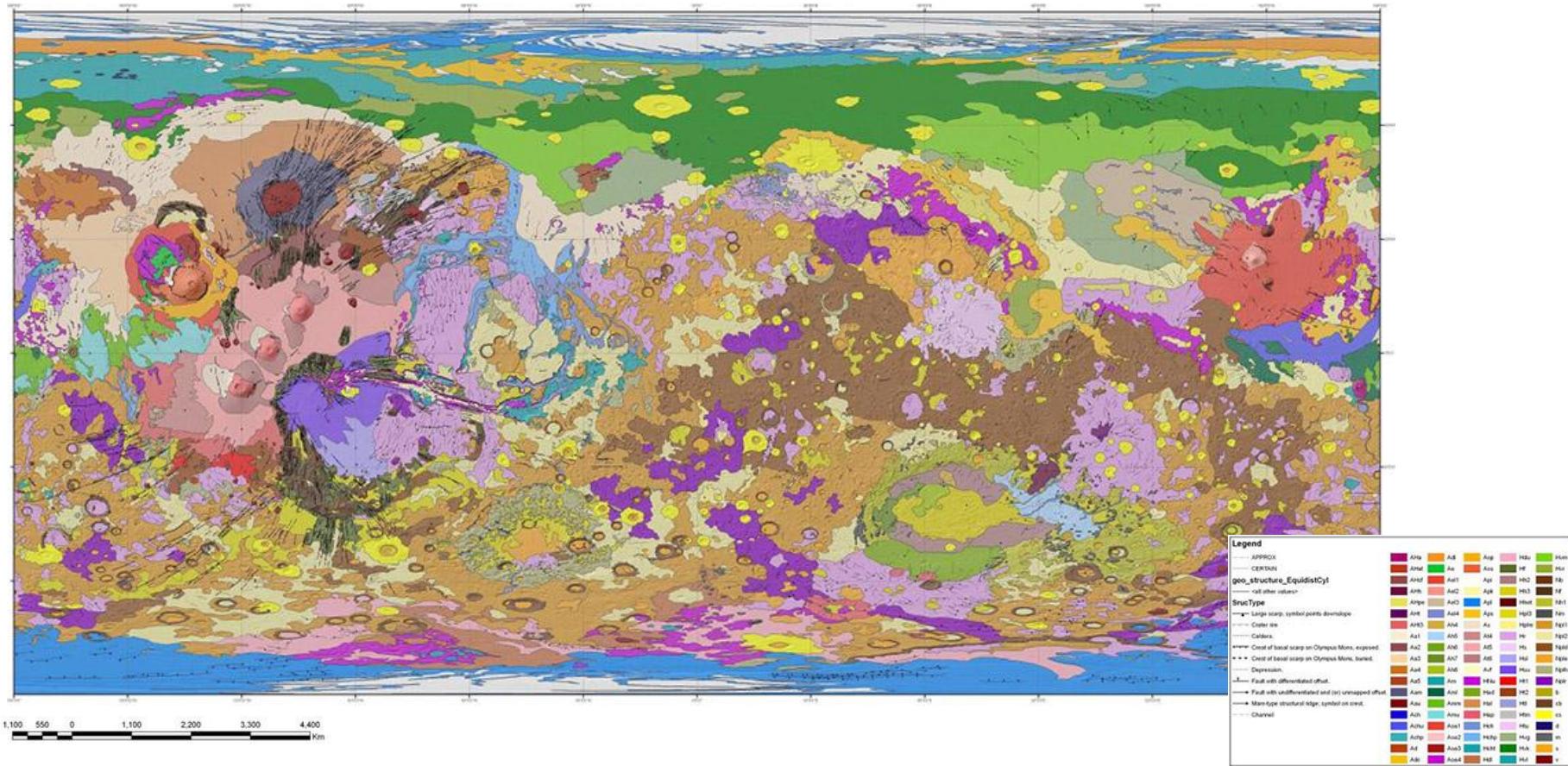
Figure 1. Eight base layers of *The National Map*.

“Traditionally, power was what was seen, what was shown, and what was manifested... Disciplinary power, on the other hand, is exercised through its invisibility; at the same time it imposes on those whom it subjects a principle of compulsory visibility. In discipline, it is the subjects who have to be seen. Their visibility assures the hold of the power that is exercised over them.”

- Michel Foucault, *Discipline and Punish: The Birth of the Prison*

**USGS 3DEP LiDAR point cloud data; source: USGS**



**USGS** geologic map of Mars, source: astrogeology.usgs.gov

## City of Blacksburg GIS platform, source: webgis.net/va/Blacksburg/

The screenshot shows a web-based GIS application for the Town of Blacksburg, VA. The interface includes a top navigation bar with a back/forward button, refresh, search, and other controls. Below the navigation is a toolbar with icons for zoom, search, and layers.

The main area features a map of Blacksburg with orange outlines representing parcels. Numerous street names are labeled in black text, such as GILBERT ST, COLLEGE CT, TURNER ST NW, STANGER ST, OTEY ST NW, W ROANOKE ST, JACKSON ST NE, E ROANOKE ST, WHARTON ST SE, PENN ST SE, MDTOWN WAY, E HEARST SE, KENT ST, CLAY ST SW, MILLER ST, E HEARST SW, DRAPER RD SW, S MAIN ST, EAKIN ST SE, MOUNTAIN VIEW DR, HEMLOCK DR SE, UPLAND RD, REYNOLDS AVE, EVERGREEN WAY, and SUNSET DR. A green shaded area represents a buffer around a specific parcel.

A detailed property information overlay is displayed on the left side of the map. It includes:

- Details** (hide)
- Identify Adjoining Parcels**
- Select Features by Buffer**
- Parcels** (with buttons: Zoom To, Unhighlight, Highlight, Clear, Export to KML, Export to SHP)
- Parcel ID: 001370
- Map Number: 256-6SEC 5 4,5
- Owner: ELSA B ROOP REV LIVING TRUST C/O ALLYN GUDHEIM TURNER
- Address: 1427 QUARRIER ST, CHARLESTON WV 25301
- Subdivision: ALEXANDER BLACK ADDITION
- Subdivision Lot: 4,5
- Deed Book: 2009
- Deed Page: 005030
- Legal Desc: ALEXANDER BLACK ADD
- Legal Desc 2: LOTS 4,5 SEC 5
- Land Value: \$117,000.00
- Building Value: \$328,100.00
- Land Use Value: \$0.00
- Total Assessed Value: \$445,100.00
- Sale Date: 19-MAY-09
- Year Built: 1914
- Jurisdiction: BLACKSBURG
- Tax District: BP
- Zoning: OTR
- Neighborhood: BR230100
- [View Property Record](#)
- [Print Property Record](#)
- Physical Address: 205 OTEY ST, BLACKSBURG
- Stories: 2
- Rooms: 10
- Bedrooms: 5
- Full baths: 2
- MGFA: 1398
- SFLA: 3120
- [Multiple Lots](#)

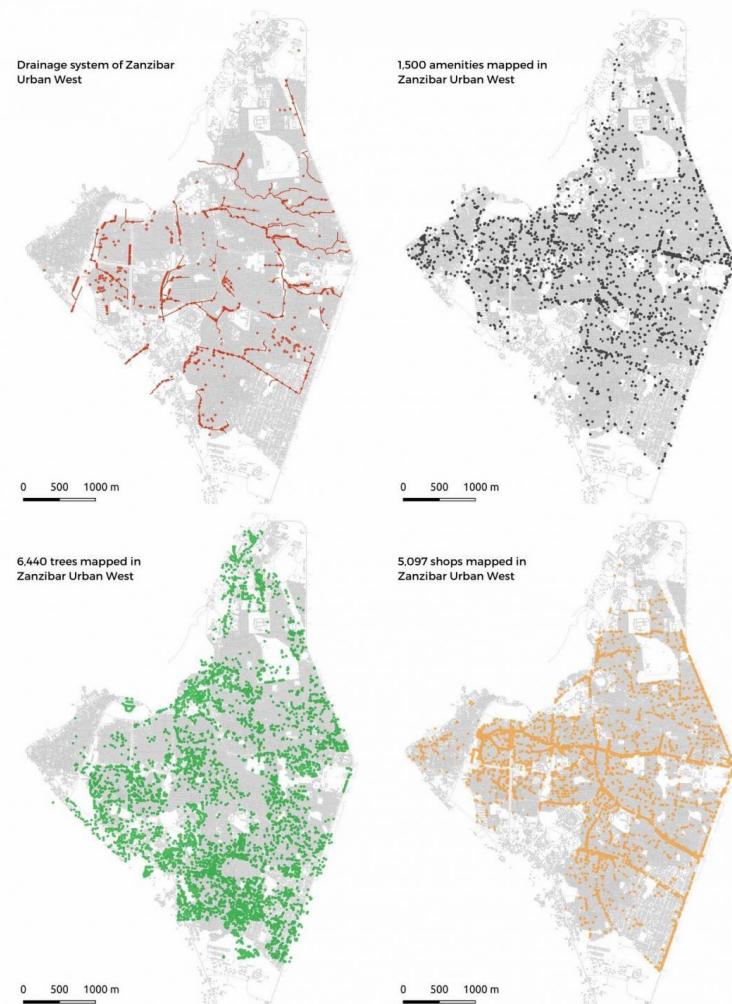
At the bottom of the page, there are links for "About", "Layers", "Legend", "Related Links" (Town of Blacksburg Website, Download GIS Data, Blacksburg Census Dashboard), "Email: WebGIS Support", "Webpage: WebGIS.net", "Developed by: Hurt & Proffitt, Inc.", "Site Last Updated February 2022", and "Help".

## Spatial Collective GIS consulting company based in Nairobi

- hired to train and support community organizations to map remote and informal areas in Africa, collect field data, contribute geographical information and shapes, and collect and map survey information on households, infrastructure, and so on
- right: [blog entry](#) on infrastructure and buildings mapped in Zanzibar
- below: [blog entry](#) on mapping half a million buildings in Tanzania and making them available on OpenStreetMap (collaboration with students at the University of Tanzania, data owned by Commission for Lands)



Half a Million Buildings Mapped



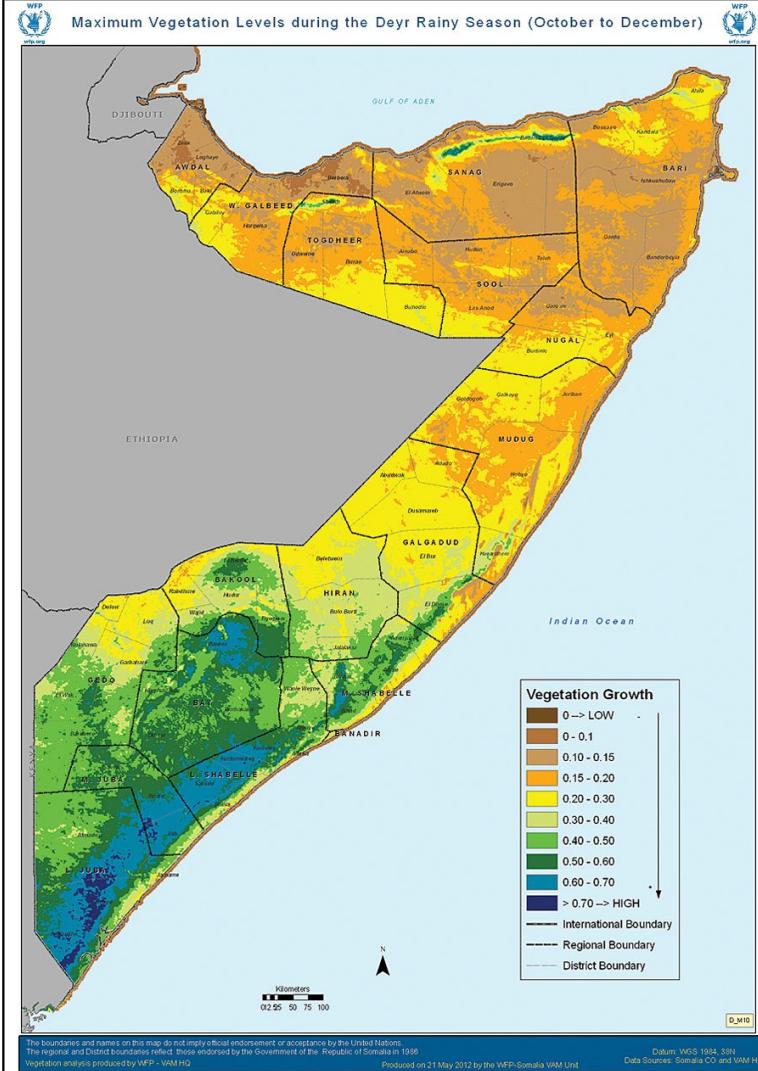
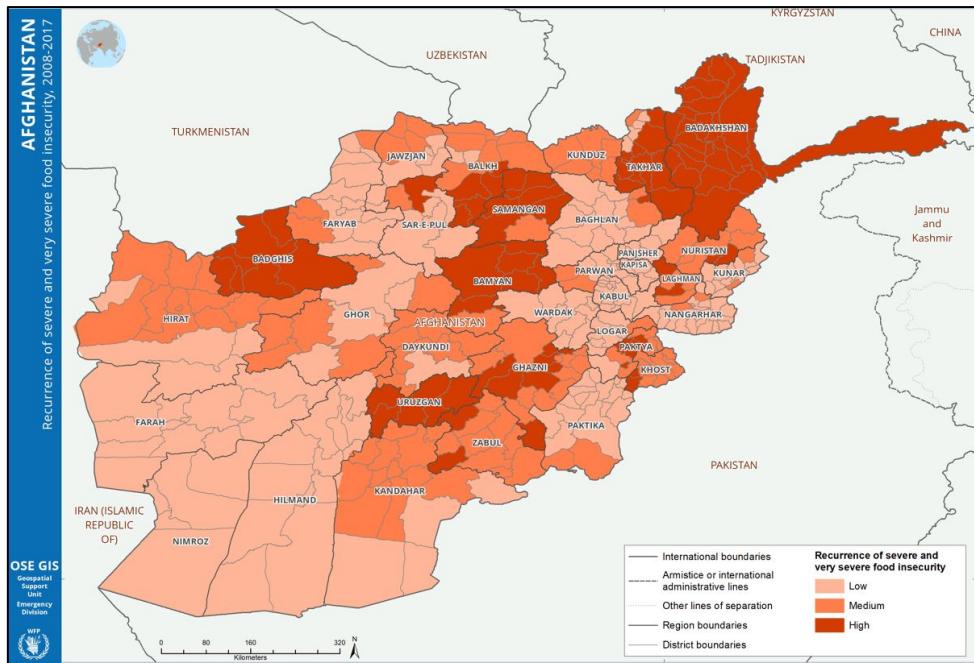
## 2. public sector (universities / NGOs)

### World Food Program (WFP)

- disaster relief examples of GIS use: supply chain management and event monitoring (eg weather event)

below: food insecurity in Afghanistan

right: vegetation levels in Somalia



## Center for Spatial Research Columbia University GSAPP

- urban research on social and humanitarian issues
- collaborative labs with student researchers, supported by research classes like "Conflict Urbanism" series
- project examples:
  - "[Million Dollar Blocks](#)": cost of prisoners visualized per block they came from
  - "[Conflict Urbanism: Aleppo](#)" (right) - using satellite data and AI to analyze bomb rubble and other evidence of conflict
  - "[In Plain Sight](#)": analysis of dark and bright spots of the world at night, which don't always correspond to population
  - "[Mapping the New Politics of Care](#)": interactive map of USA showing different health risk measurements such as health care enrollment, COVID-19 case rate, unemployment, and years of potential life lost



## Center for Spatial Research

["Million Dollar Blocks"](#): cost of prisoners visualized per block they came from

- above: cost of incarceration per block in Brooklyn
- below: close-up with person count and incarceration cost

**"It cost \$11,839,665 to  
incarcerate people from these  
11 blocks in 2003. We call  
these Million Dollar Blocks."**

- c4sr



## Center for Spatial Research

["In Plain Sight"](#): skeptical take on images of the world at night, which have been used as evidence of population concentration

- above right: bright places that are not populated
- below right: dark places that are populated
- below left: detailed analysis of one dark/light scenario



## Forensic Architecture Goldsmiths, University of London

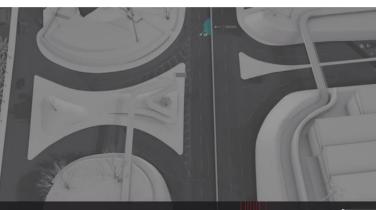
- applies architectural / spatial skills to international humanitarian crimes
- creates evidence for reports, exhibitions, and criminal prosecution
- collaborative labs with student researchers
- project examples:
  - [Black Boxes of Disappearance](#) (Bogota, Colombia): tracks captured individuals from 1985 using remote sensing, 3D visualization, video footage, and testimony; charges the Colombian military with abduction, torture, and murder
  - [Digital Violence](#) (global): tracks Israeli group NSO's use of Pegasus hacking software to "infect the phones of activists, journalists, and human rights defenders" (forensic-architecture) around the world
  - [Environmental Racism in Death Alley, Louisiana](#) (Louisiana, USA): mapping health consequences for mostly black communities living downwind from Petrochemical facilities

176 DISPOSSESSION AND THE MEMORY OF THE EARTH: LAND DISPOSSESSION IN NUEVA COLONIA



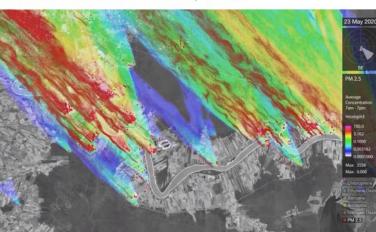
DATE OF INCIDENT	1960s to the present day	LOCATION	Nueva Colonia, Urabá Antioquia, Colombia	FORUMS	Legal Process, Exhibition, Human Rights Report, Truth Commission, Web Platform
<b>COMMISSIONED BY</b>					
	This investigation shows how the dispossession of campesino farmers in the Urabá Antioquia region of Nueva Colonia was achieved by a combination of physical violence, environmental transformations and legal means.				

177 THE MURDER OF LUCAS VILLA



DATE OF INCIDENT	05.05.2021	LOCATION	Pereira, Colombia	FORUMS	Media
<b>IN PARTNERSHIP WITH</b>					
	Bellingcat, Cosentencia, Baudó Agencia Pública				

178 ENVIRONMENTAL RACISM IN DEATH ALLEY, LOUISIANA



DATE OF INCIDENT	17/18 - Ongoing	LOCATION	'Death Alley', Louisiana, USA	FORUMS	Legal Process, United Nations, Exhibition, Media, Web Platform
<b>IN PARTNERSHIP WITH</b>					
	RISE St. James				

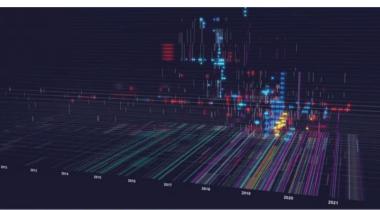
A stretch of the Mississippi River between Port Fourchon and its mouth in the Gulf of Mexico is known to those who live near its toxic air as 'Death Alley'. Using advanced techniques in cartography and fluid mechanics, we worked to support local demands for accountability and reparations.

179 THE BLACK BOXES OF DISAPPEARANCE: ENFORCED DISAPPEARANCE IN THE SIEGE OF THE PALACE OF JUSTICE



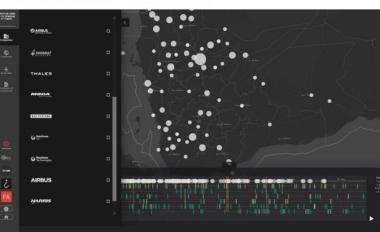
DATE OF INCIDENT	06.11.1985 - 07.11.1985	LOCATION	Bogotá, Colombia	FORUMS	Legal Process, Exhibition, Media, Truth Commission, Web Platform
<b>COMMISSIONED BY</b>					
	The Committee for the Clarification of Truth, Coexistence and Non-Repetition of Colombia				

179 DIGITAL VIOLENCE: HOW THE NSO GROUP ENABLES STATE TERROR



DATE OF INCIDENT	2015 - Ongoing	LOCATION	At least 49 countries worldwide	FORUMS	Legal Process, Exhibition, Media, Web Platform
<b>COMMISSIONED BY</b>					
	Self-Initiated				

179 EUROPEAN ARMS IN THE BOMBING OF YEMEN

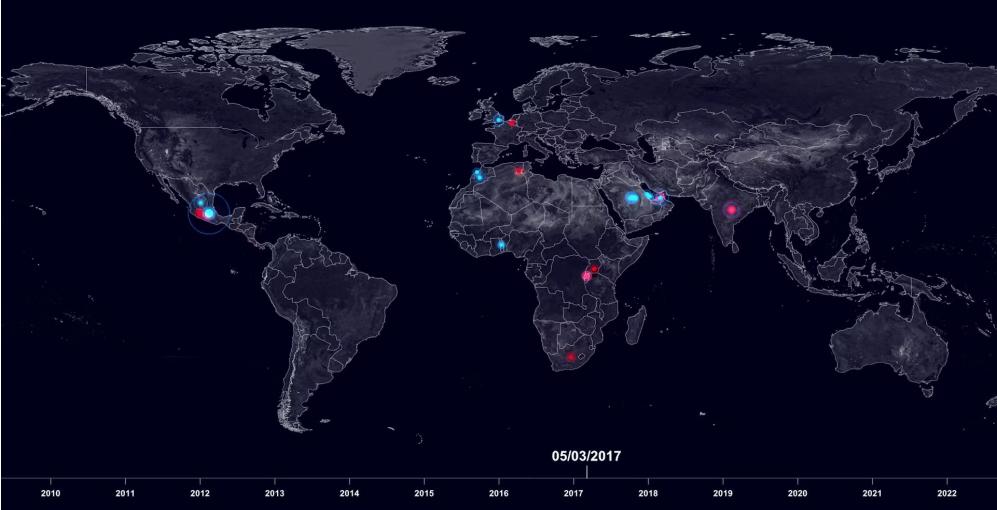
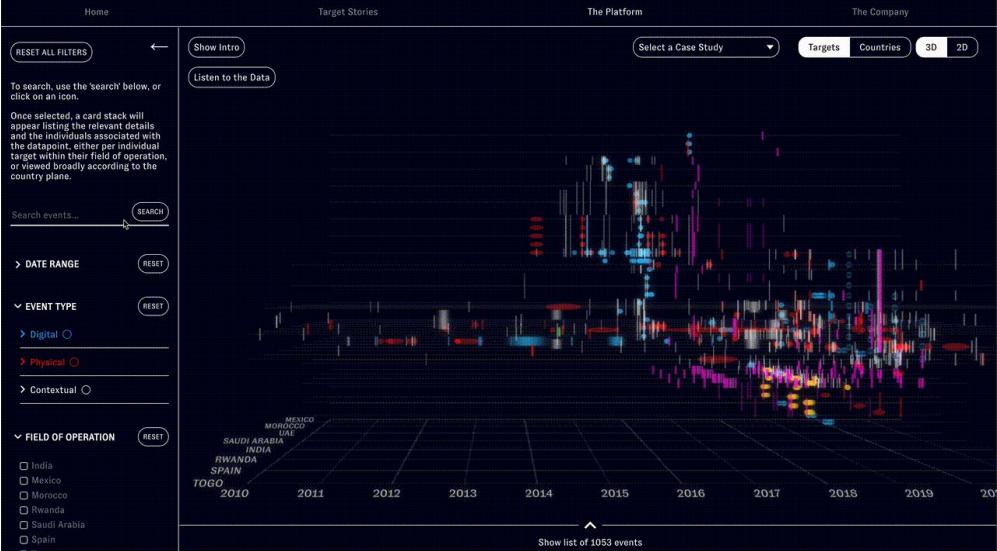


DATE OF INCIDENT	26.03.2015 - Ongoing	LOCATION	Yemen	FORUMS	Legal Process, Exhibition, Human Rights Report, Web Platform
<b>COMMISSIONED BY</b>					
	European Center for Constitutional and Human Rights (ECCR)				

Since 2015, airstrikes by the Saudi-led coalition in Yemen have caused grave human rights violations. Partnering with the investigative group developed by interactive media to reveal the extent to which arms producers and governments in Europe continue to profit from arms exports despite evidence of their substantial contribution to the military operations of the Saudi-led coalition in Yemen.

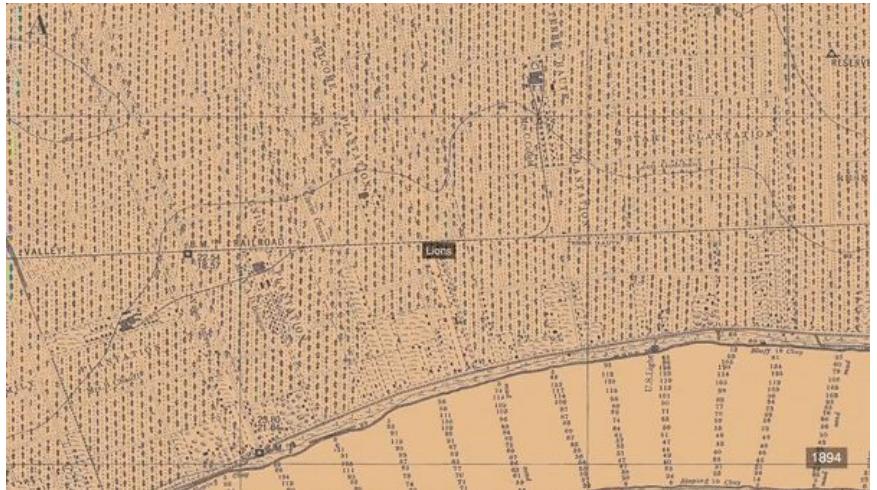
## Forensic Architecture

- “Digital Violence”: tracks Israeli group NSO’s use of Pegasus hacking software to “infect the phones of activists, journalists, and human rights defenders” (forensic- architecture) around the world
- upper right: interactive platform to view interrelated graphs of Pegasus hacks, real-world violence, political changes, and journalistic / human rights activities
- lower right: global map of ISO incidents
- lower left: another visualization of the data



## Forensic Architecture

- “[Environmental Racism in Death Alley, Louisiana](#)” (Louisiana, USA): mapping health consequences for mostly black communities living downwind from Petrochemical facilities
- upper right: land sell-off along Mississippi River
- lower right: concentration of chemicals
- lower left: cartographic regression - analysis of Lions residential and petrochemical development over time



### 3. private sector (remote sensing)

- **satellite imagery**: tracking movement and change over time, from small-scale (individual animals and machines) to large-scale (geologic shifts)
- **LiDAR / photogrammetry** (airplane or drone): 3-D physical environment, from urban situations to hidden land features
- **other digitized information** such as consumer behavior, preferences, physical and web tracking, purchases; records;
- satellites collect sophisticated info on: ecological change, urbanization, minerals, weather
- used in physical industries including: logistics (eg transportation, commerce), energy (oil, renewables), mining, land management, real estate development, military operations
- and intangible industries including: consumer analysis, economics, political behavior



## SkyWatch

- platform to source and analyze high-resolution satellite imagery
- API (coding platform)
- high-quality satellite imagery subscription



Pleiades

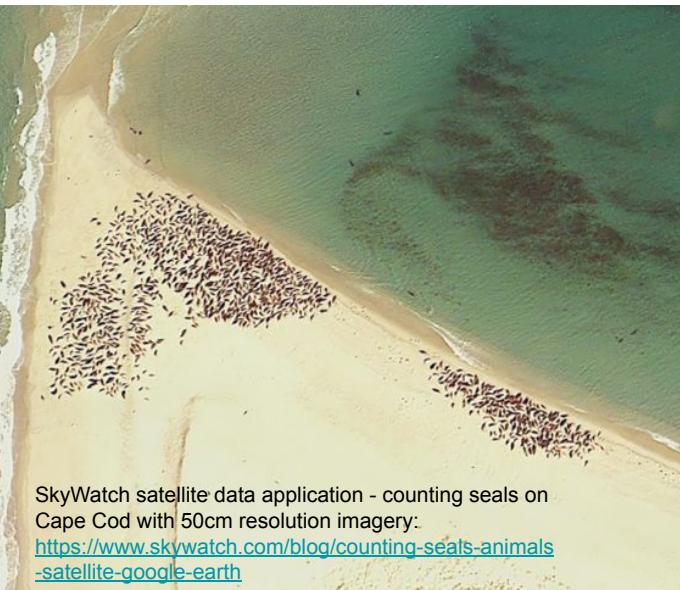
Provider: Airbus / Resolution: 50cm



SkySat

Provider: Planet / Resolution: 50cm / [Specs](#)

TripleSat Constellation

Provider: 21AT / Resolution: 80cm / [Specs](#)

KOMPSAT-3A

Provider: SIIS / Resolution: 40cm / [Specs](#)

KOMPSAT-3

Provider: SIIS / Resolution: 50cm / [Specs](#)

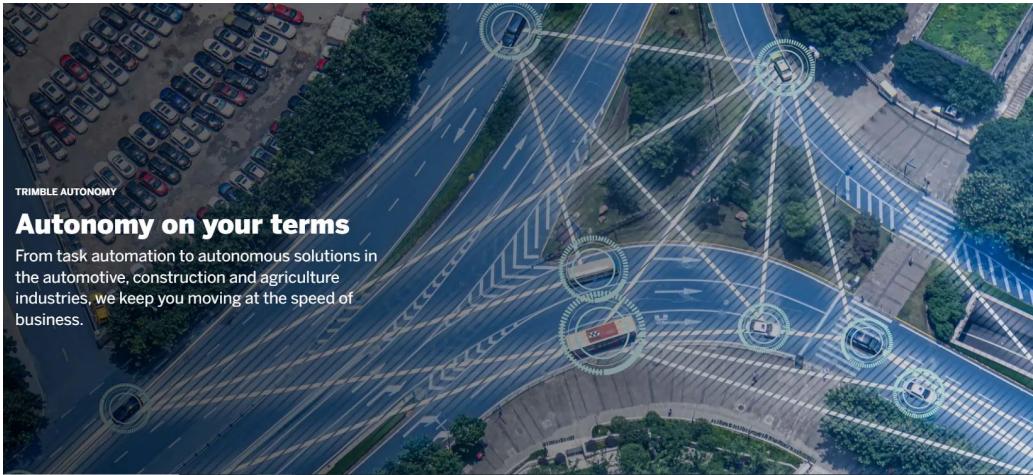
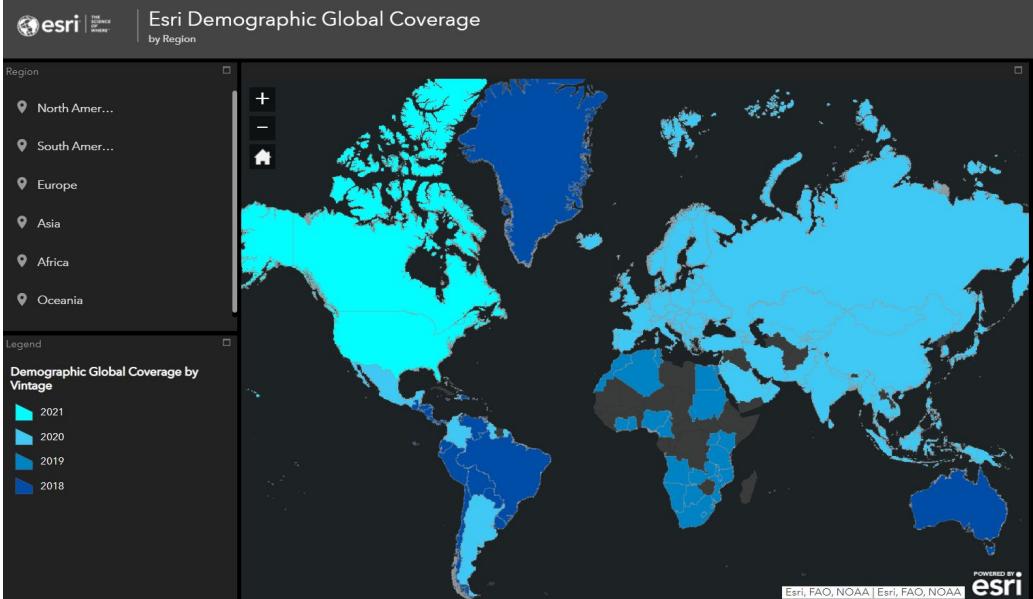
KOMPSAT-2

Provider: SIIS / Resolution: 1m / [Specs](#)SkyWatch high-resolution satellite sources: <https://www.skywatch.com/data>

SkyWatch satellite data application - counting seals on Cape Cod with 50cm resolution imagery:  
<https://www.skywatch.com/blog/counting-seals-animals-satellite-google-earth>

## 4. private sector (software developers)

- **ESRI** (above)
- **Trimble** (below)



## 5. private sector (designers)

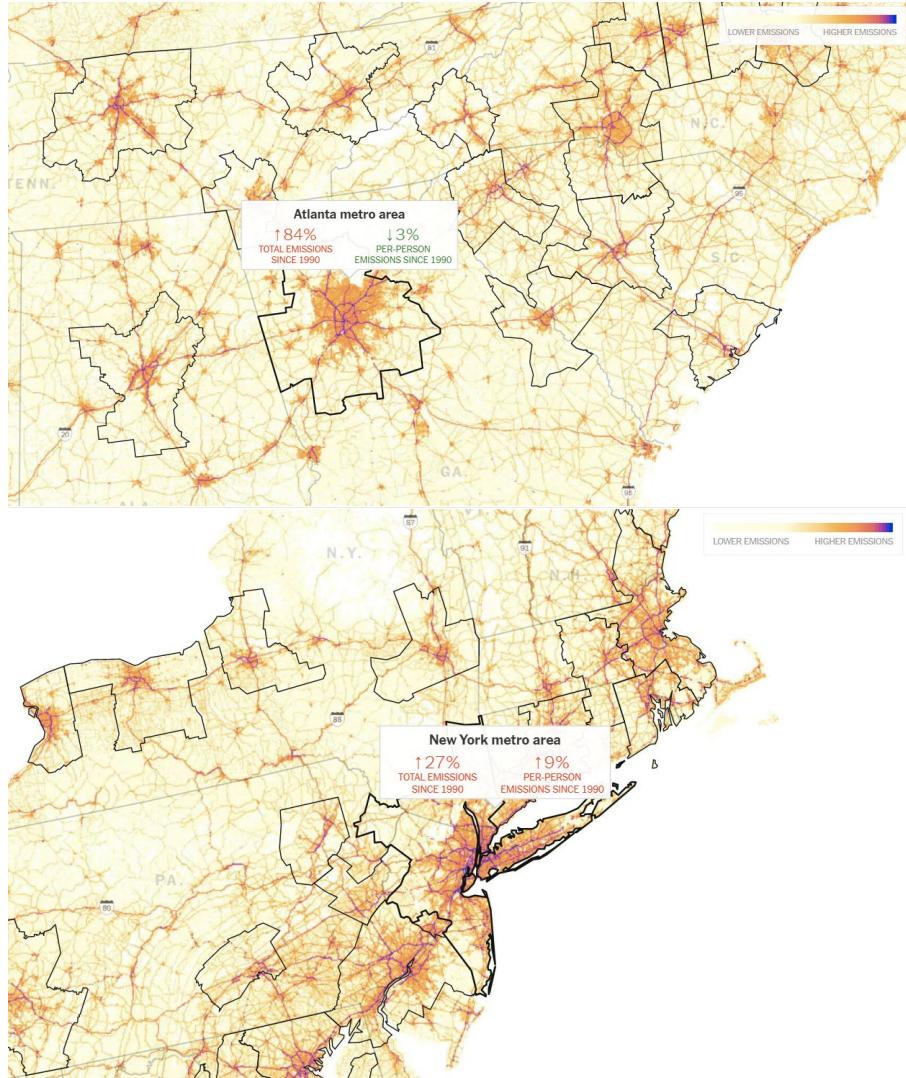
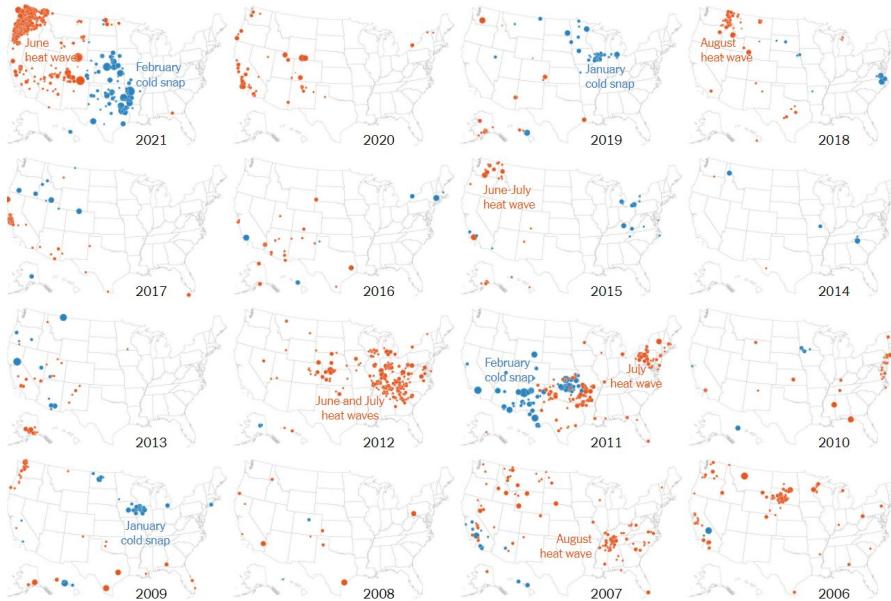
- apply design skills, refined aesthetics to data visualization, often combined with programming and GIS expertise to create beautiful maps and apps for companies
- example: Stamen
  - upper right: San Francisco break-ins
  - lower right: California crop parcels
  - lower left: raptor migration tracking
  - link: [Facebook flowers](#)



## 6. private sector (journalism)

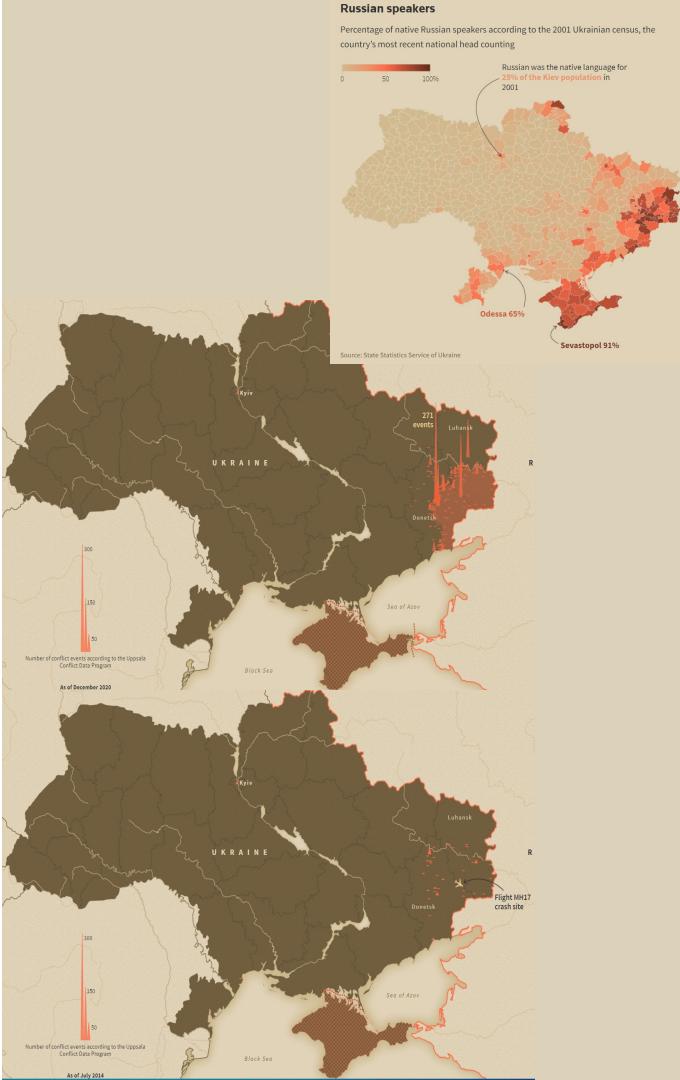
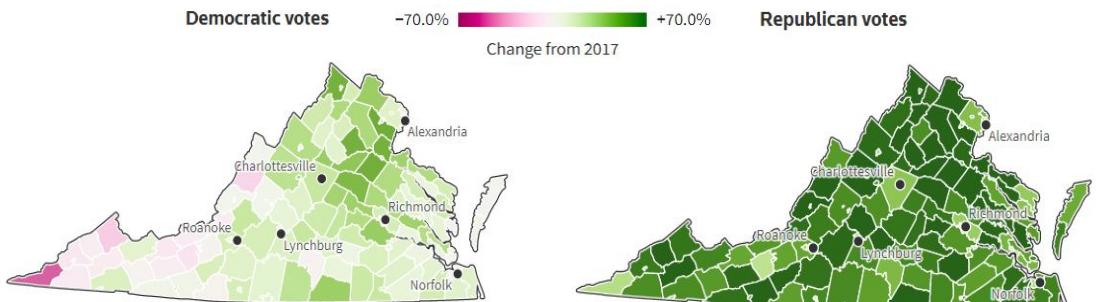
### New York Times

- right: "[Map of Auto Emissions in the US](#)" (2019)
- below: "[Temperature Records in the US](#)" (2022)



## Reuters

- right: “[On the Edge of War](#)” (2022) scrollymap and data visualization report on Russian troop presence on border with Ukraine
- below: “[Virginia Governor’s Race](#)” (2021) voter behavior analysis of Virginia election



**“The fact that we cannot eliminate the cultural baggage inherent in any human artifact does not give us a license to ignore the practical consequences of our decisions in designing that artifact...”**

– “Mapping the Digital Empire”, Jason Farman (2010)

## Additional References

“The Master’s Tools Will Never Dismantle the Master’s House”, Audrey Lorde, essay:  
[https://collectiveliberation.org/wp-content/uploads/2013/01/Lorde\\_The\\_Masters\\_Tools.pdf](https://collectiveliberation.org/wp-content/uploads/2013/01/Lorde_The_Masters_Tools.pdf)

Center for Spatial Research, Columbia University-based data/GIS lab with a focus on mapping ongoing humanitarian crises:  
<https://c4sr.columbia.edu/#>

Forensic Architecture, University of London-based data/GIS lab with a focus on visualizing international human rights violations for use in NGO reports and criminal persecution:  
<https://forensic-architecture.org/>

Spatial Collective, Nairobi-based GIS consultants:  
<http://spatialcollective.com/>

Flowers made from Facebook connections by design company Stamen:  
<https://stamen.com/work/facebook-flowers/>