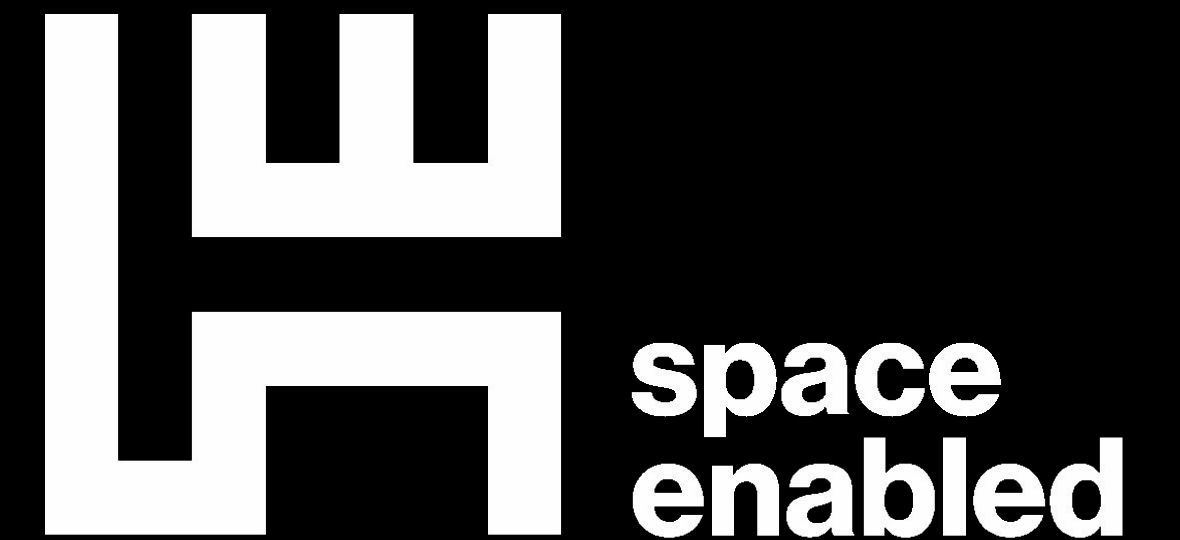


General Exam - Oral Component

Jack Reid



Introductions



Danielle Wood
MIT

Media Lab & Aero Astro



David Lagomasino
East Carolina University
Department of Coastal Studies



Sarah Williams
MIT

Technology & Urban Planning



Outline

A. Sustainable Development, Complex Systems, & Pressing Needs

B. Contextual Exam Area

- a. Theories of Development, Technocracy
- b. GIS

C. Technical Exam Area

- a. Remote Observation Systems
- b. Remote Observation Data Products

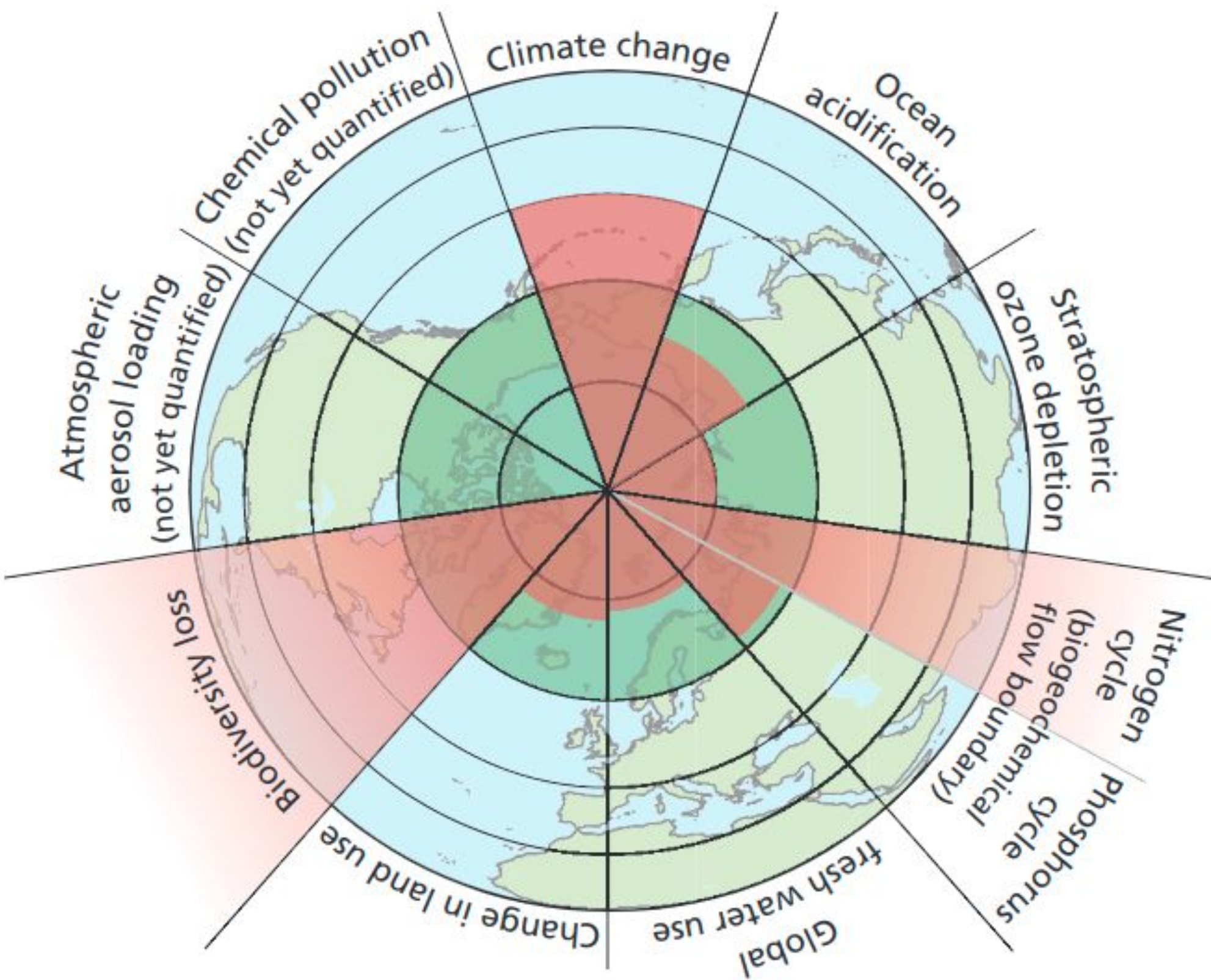
D. Primary Exam Area / Synthesis

- a. EVDT
- b. Stakeholder Involvement

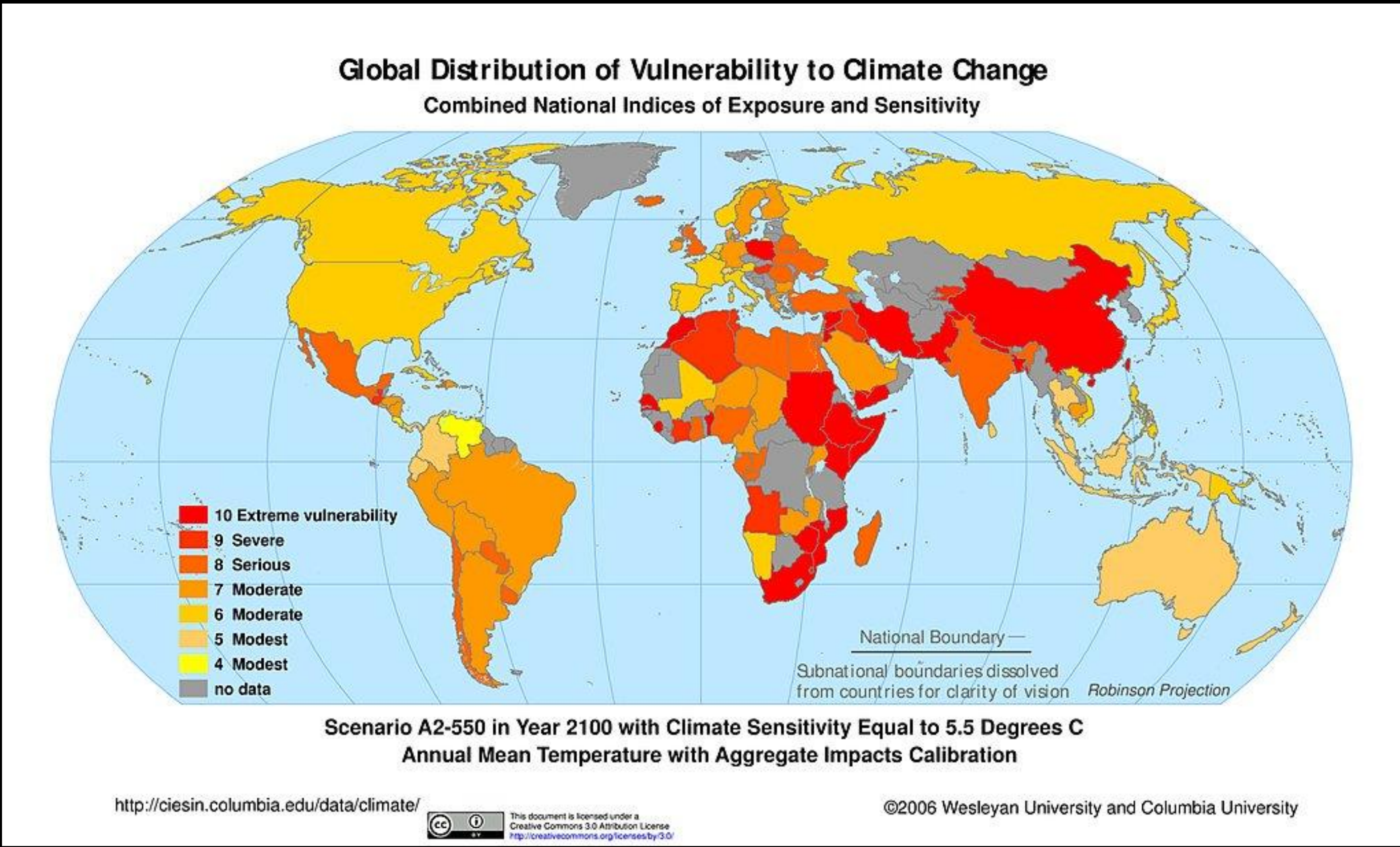
E. Opportunities



A: Cause for Concern



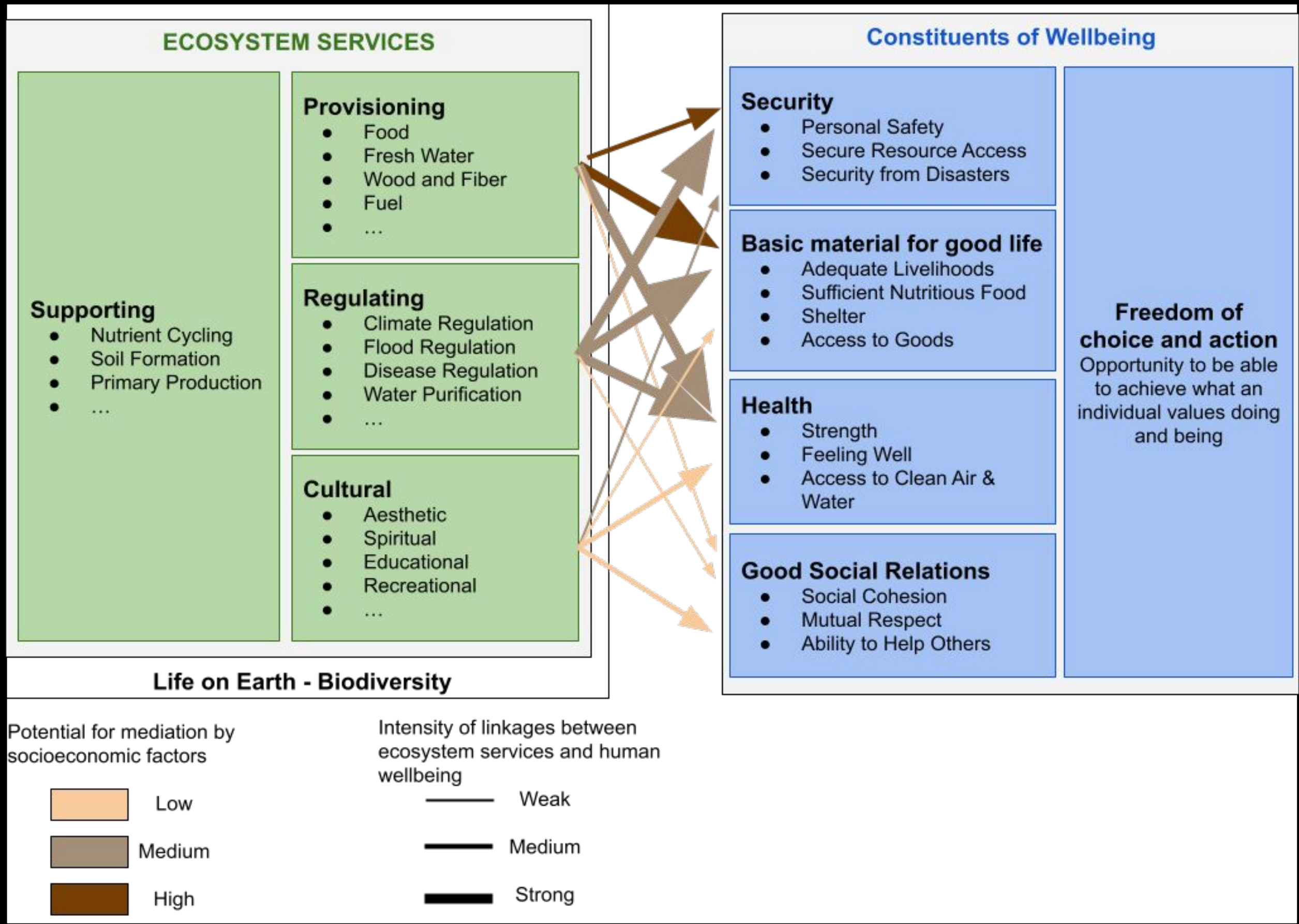
Rockström, Johan, et al. "A Safe Operating Space for Humanity." *Nature*, vol. 461, no. 7263, Sept. 2009, pp. 472–75



Yohe, Gary W., et al. "Global Distributions of Vulnerability to Climate Change." *Integrated Assessment*, vol. 6, no. 3, 3, July 2006



A: Concept of Sustainable Development

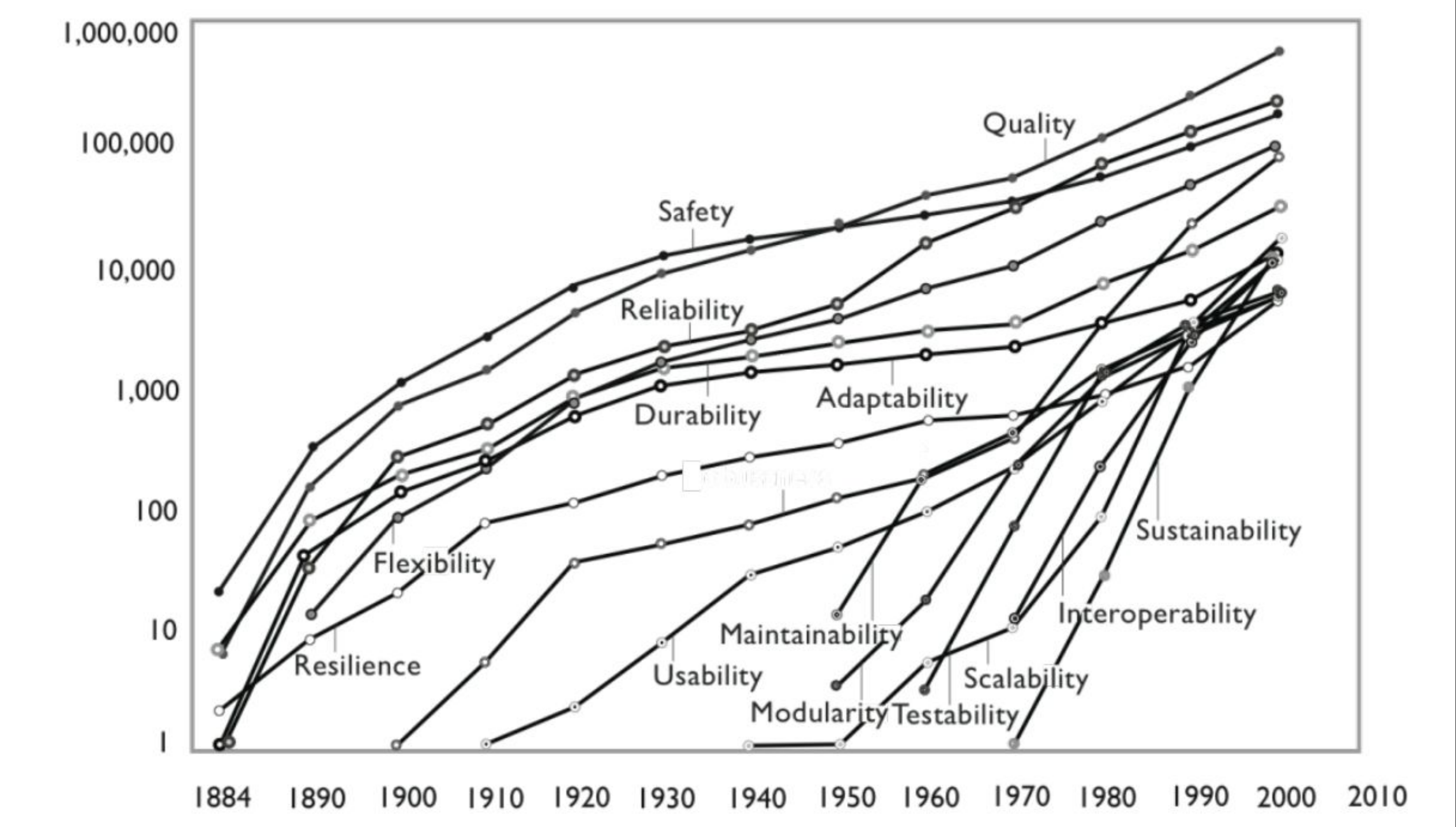


Campbell, Scott. "Green Cities, Growing Cities, Just Cities? Urban Planning and the Contradictions of Sustainable Development." *Readings in Planning Theory*, edited by Susan Fainstein and James DeFilippis, 4th ed., Wiley-Blackwell, 2016

Reid, W. V., et al. *Ecosystems and Human Well-Being - Synthesis: A Report of the Millennium Ecosystem Assessment*. Island Press, 2005.



A: Rise of Sustainable Development



de Weck, Olivier L., et al. Investigating Relationships and Semantic Sets amongst System Lifecycle Properties (Ilities). Working Paper, Massachusetts Institute of Technology. Engineering Systems Division, Mar. 2012. dspace.mit.edu, <https://dspace.mit.edu/handle/1721.1/102927>.



A: Sustainable Development Goals



A: What's Next?

- Increasing need for sustainability
- Increasing recognition of interconnectedness & complexity
- Increasing attention to the perspectives of the oppressed
- Increasing capabilities of data collection & processing



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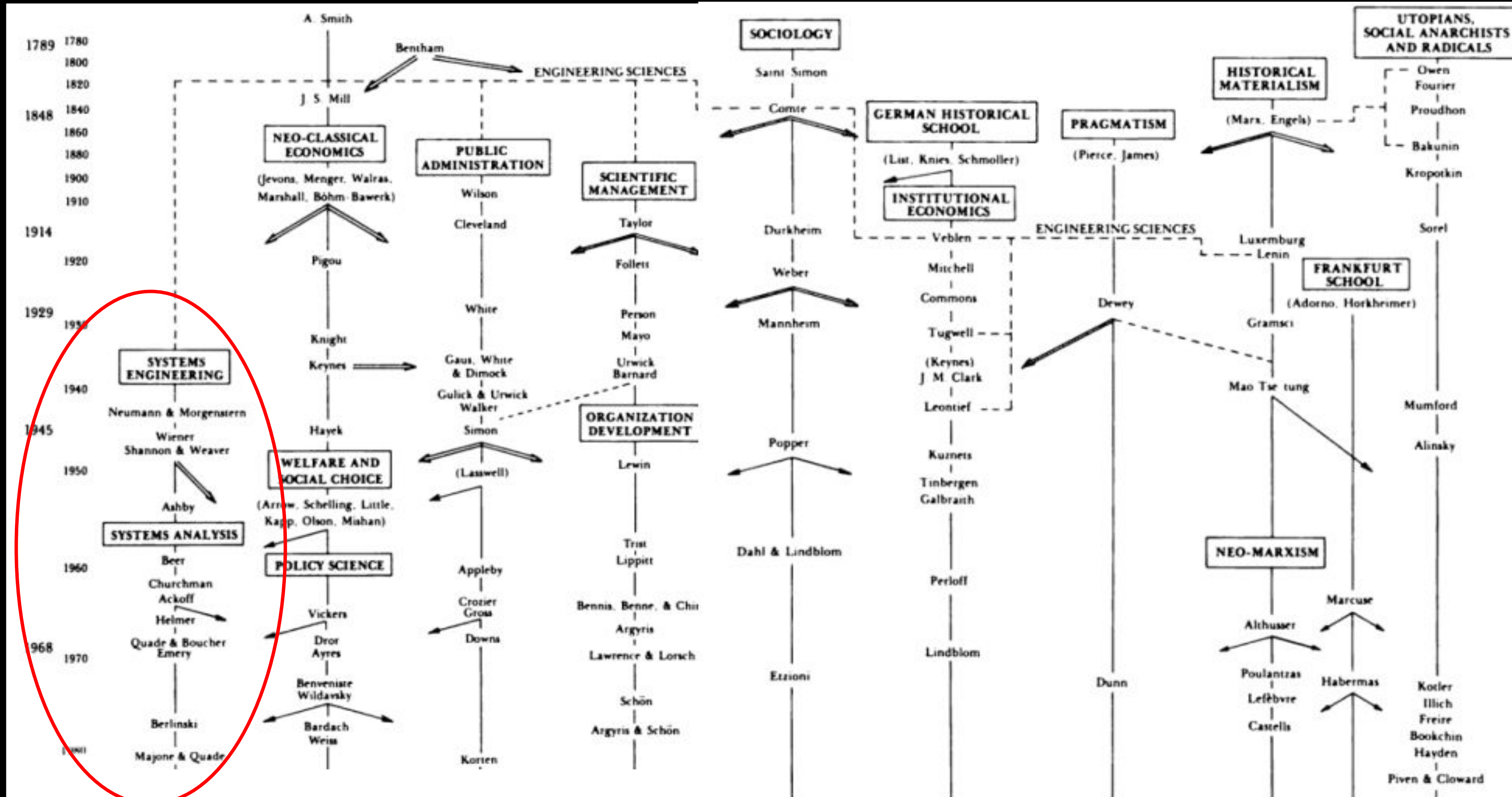


B: Development Schools of Thought

Conservative/Technical

Social Reformist

Utopian/Anarchistic

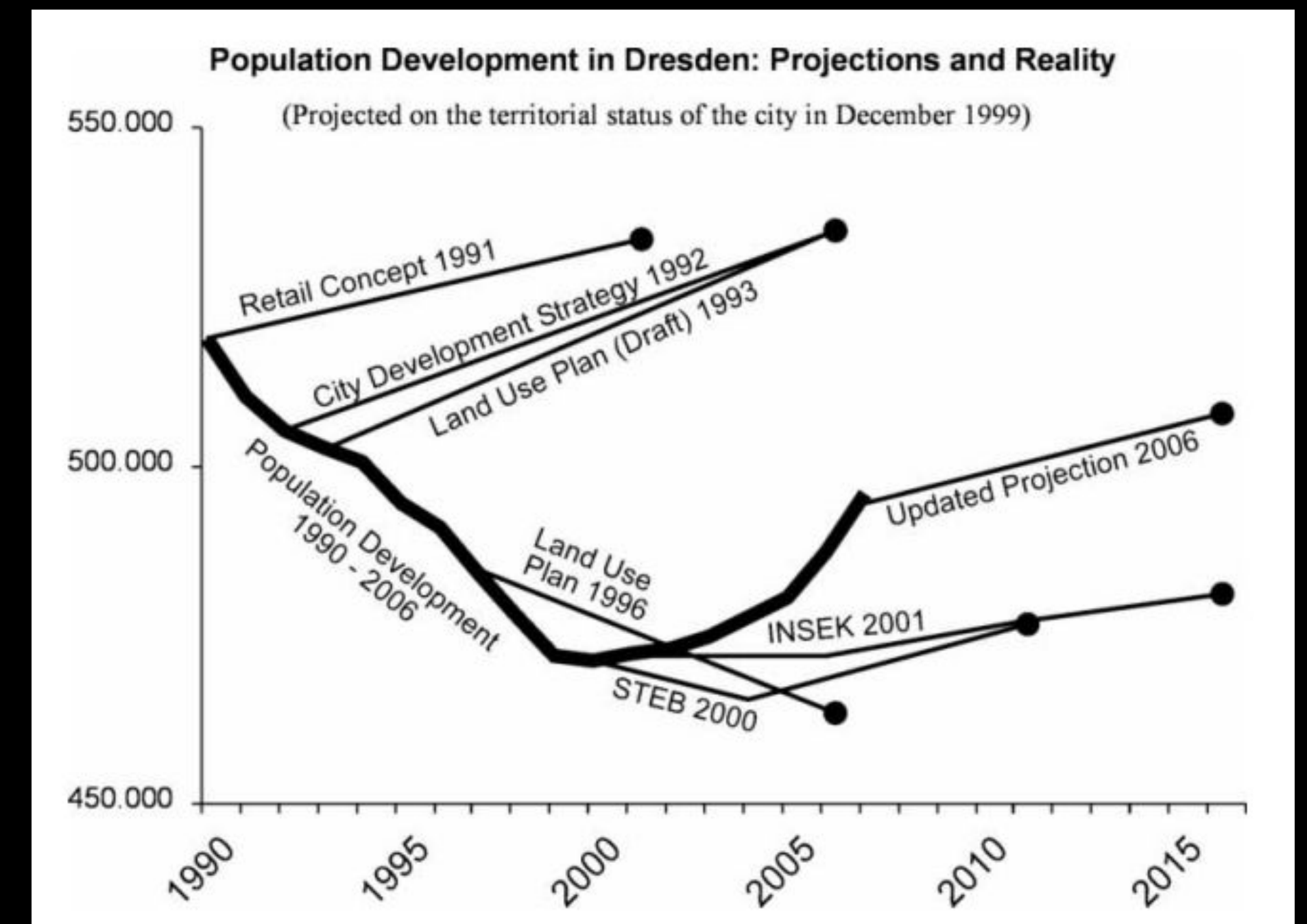


Friedmann, John. "Two Centuries of Planning: An Overview." *Explorations in Planning Theory*, edited by Seymour Mandelbaum et al., Routledge, 2017, pp. 10–29.



B: The Technocratic Problem

- Uphold existing systems of power and oppression (Friedmann, Eubanks, Robinson)
- Inevitably expand top-down control & surveillance (Scott)
- Fundamentally did not work (Jacobs, Light, Easterly, Lee Jr., etc)
 - Insufficient data for models
 - Lack of detailed causal understanding
 - Blank state / universality assumptions
 - Implementation tends to alienate
 - Overprioritization of easy to quantify metrics



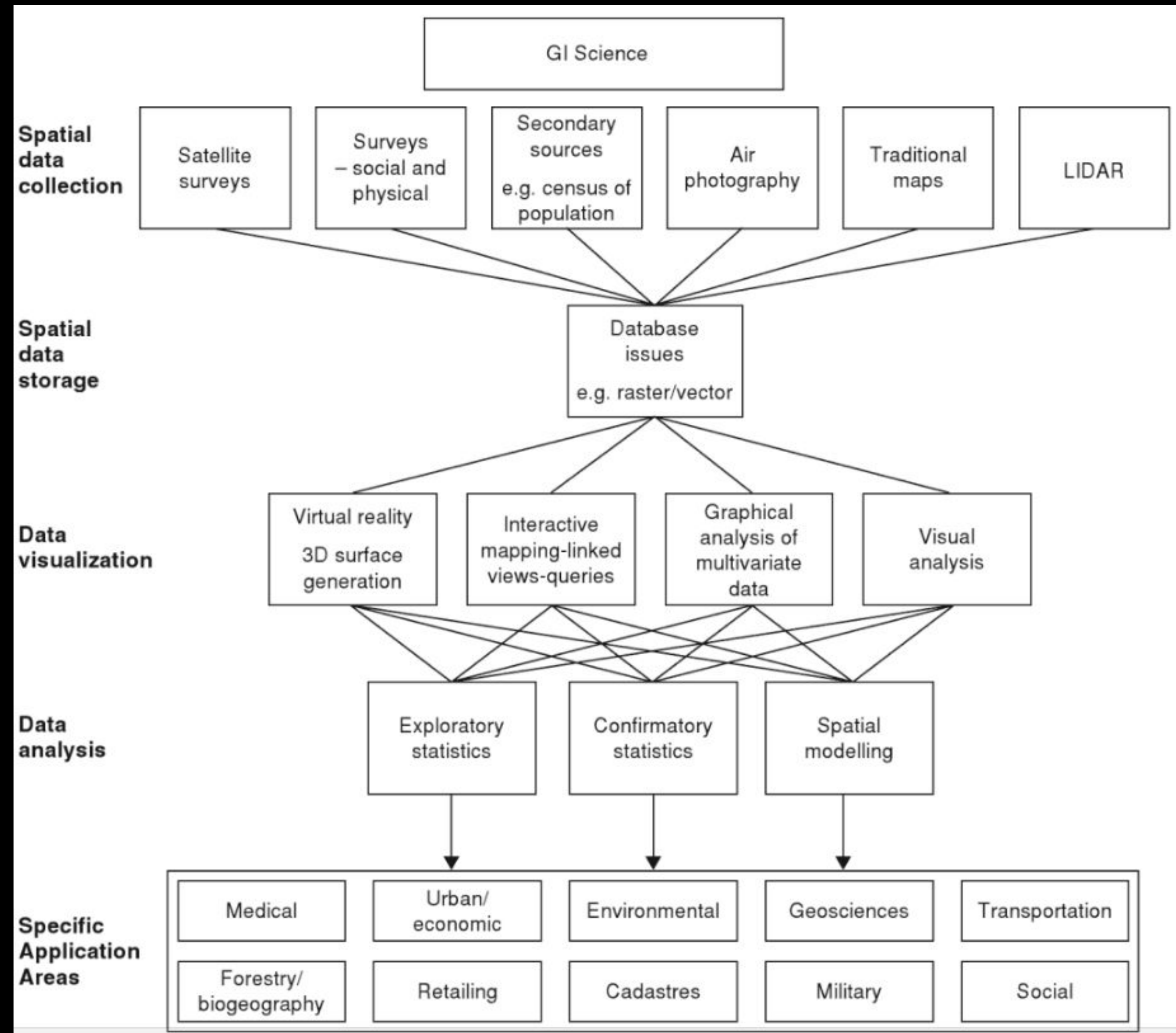
Wiechmann, Dr Thorsten. "Errors Expected — Aligning Urban Strategy with Demographic Uncertainty in Shrinking Cities." *International Planning Studies*, vol. 13, no. 4, Nov. 2008, pp. 431–46.

B: A Technocratic Response?

- Increased humility and a widened definition of value (in some circles)
 - Less emphasis on singular, monolithic solutions, more interest in flexibility
 - In engineering (de Neufville) and in economics (Sachs)
- New models of planning, mapping, & systems engineering
 - Participatory Frameworks (PPGIS, Arnstein's Ladder, Stakeholder Analysis)
 - Critical Perspectives (Critical Cartography, Multistakeholder Decision-Making)
- Increased need
- More data, better models
 - GIS
 - Remote Sensing
 - Machine Learning
 - Telecommunications



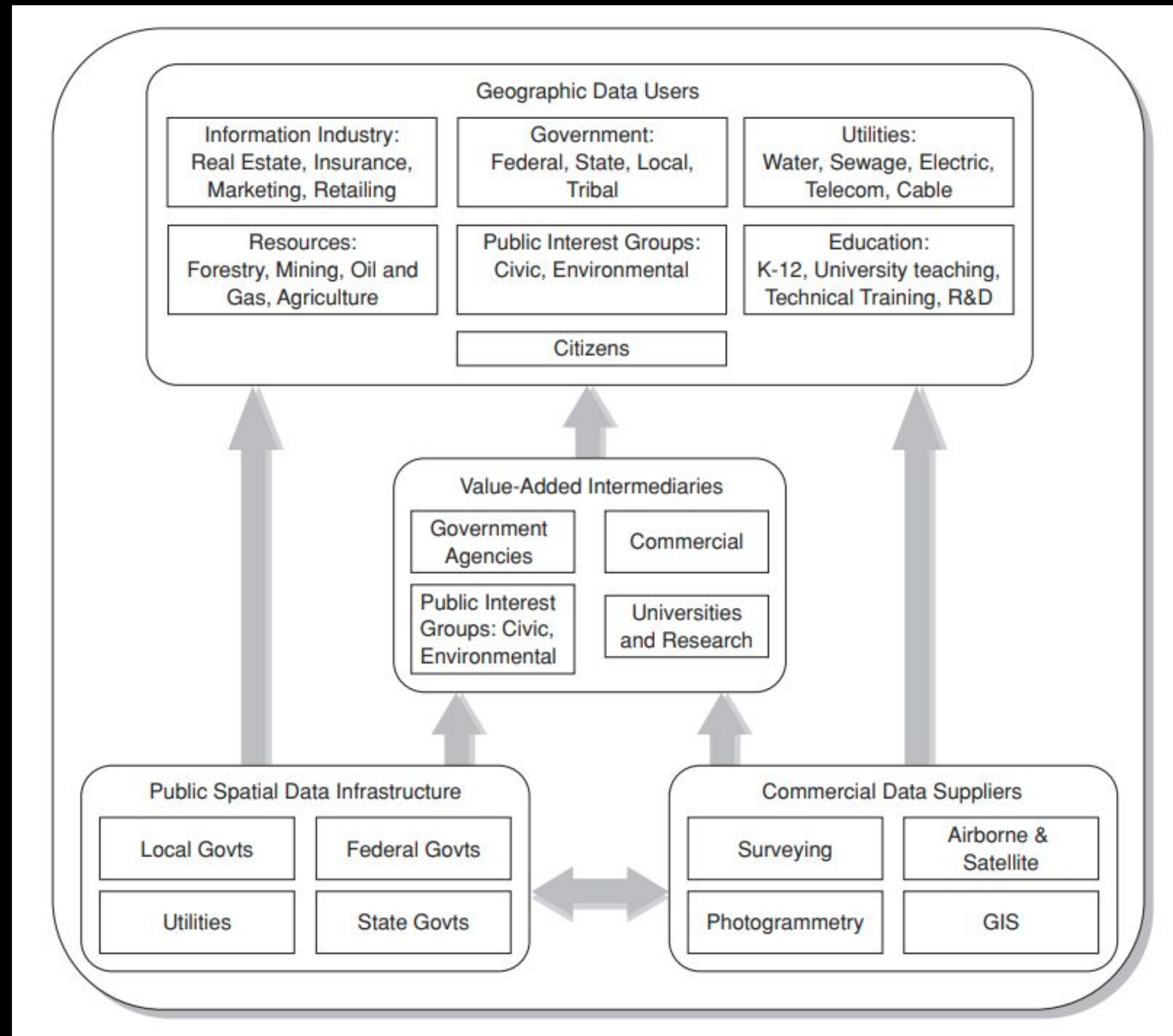
B: What is GIS?



Fotheringham, A. Stewart, and John P. Wilson. "Geographic Information Science: An Introduction." *The Handbook of Geographic Information Science*, John Wiley & Sons, Ltd, 2007, pp. 1–7.



B: GIS Ecosystem

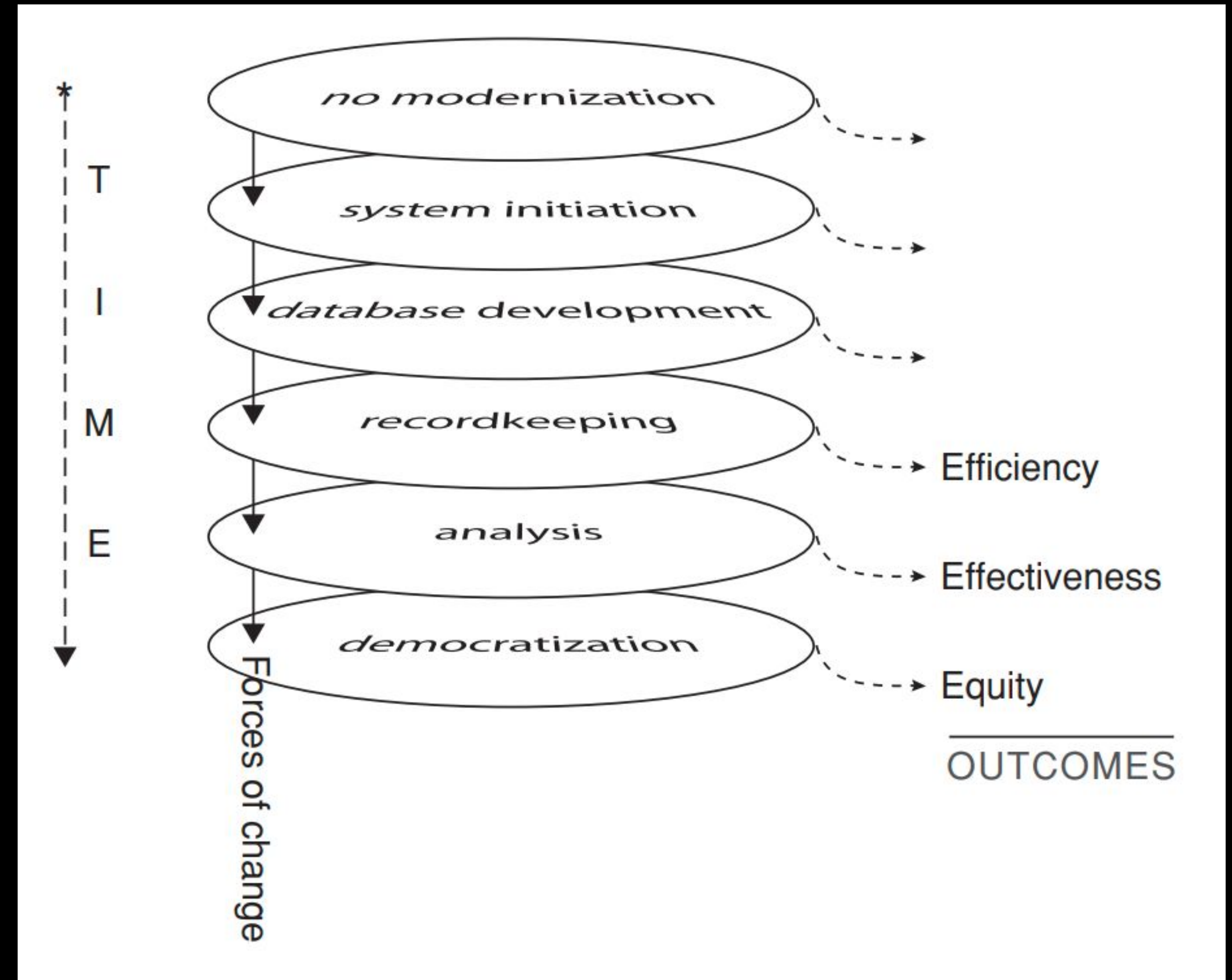


Cowen, David J. "The Availability of Geographic Data: The Current Technical and Institutional Environment." *The Handbook of Geographic Information Science*, John Wiley & Sons, Ltd, 2007, pp. 11–34.



B: GIS Problems & Responses

- Cartography as colonialist
- PPGIS
- Critical Cartography
- Maps are propositions



Tulloch, David L. "Theoretical Model of Multipurpose Land Information Systems Development." *Transactions in GIS*, vol. 3, no. 3, 1999, pp. 259–83.



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C: Rise of Remote Sensing Systems

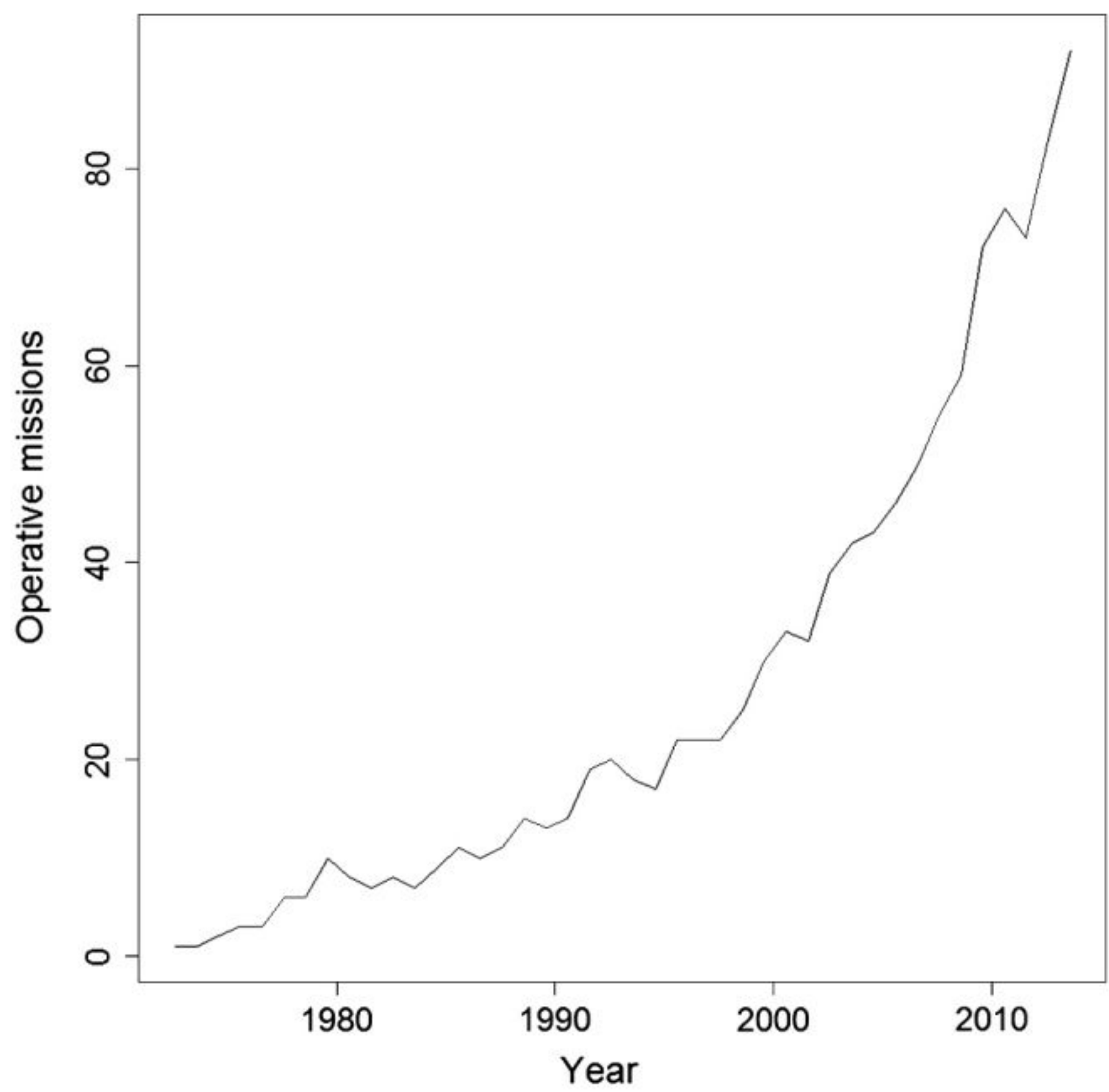
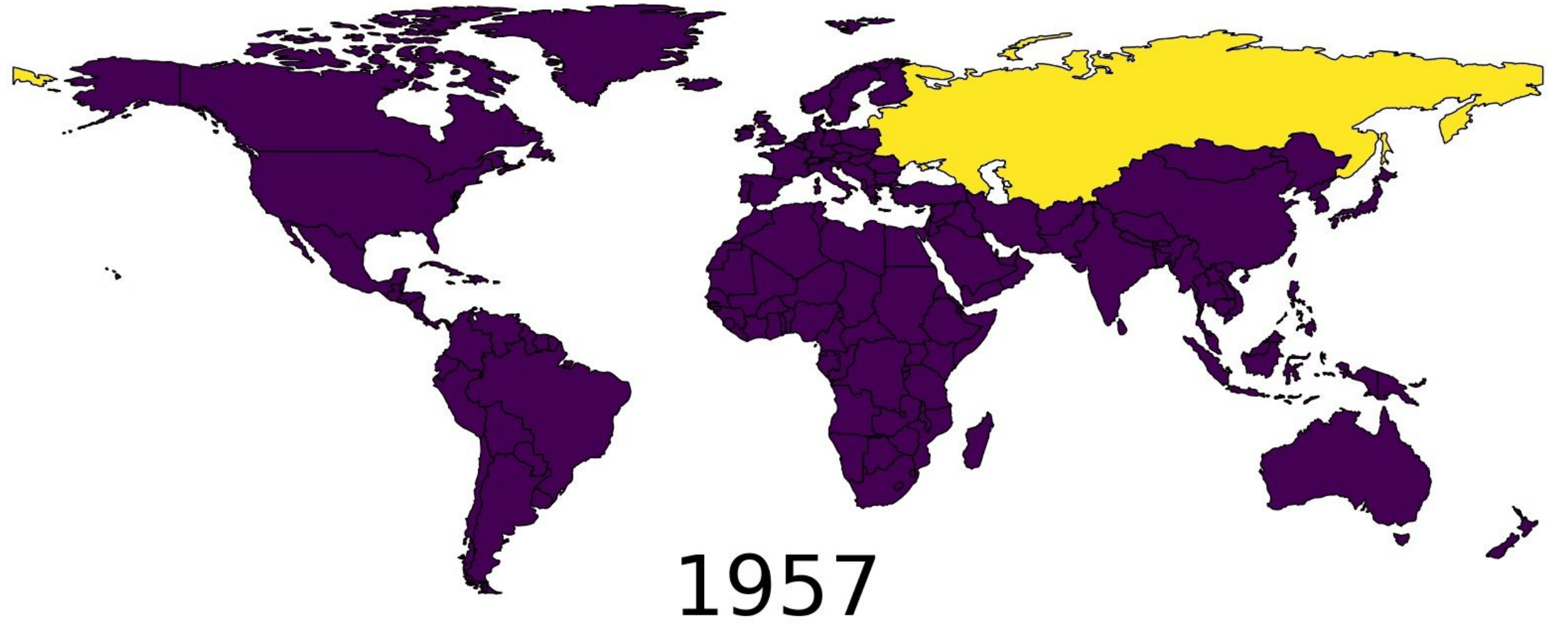


Fig. 2. The number of near-polar orbiting, land imaging civilian satellites operational as of 1st August 1972 to 2013.

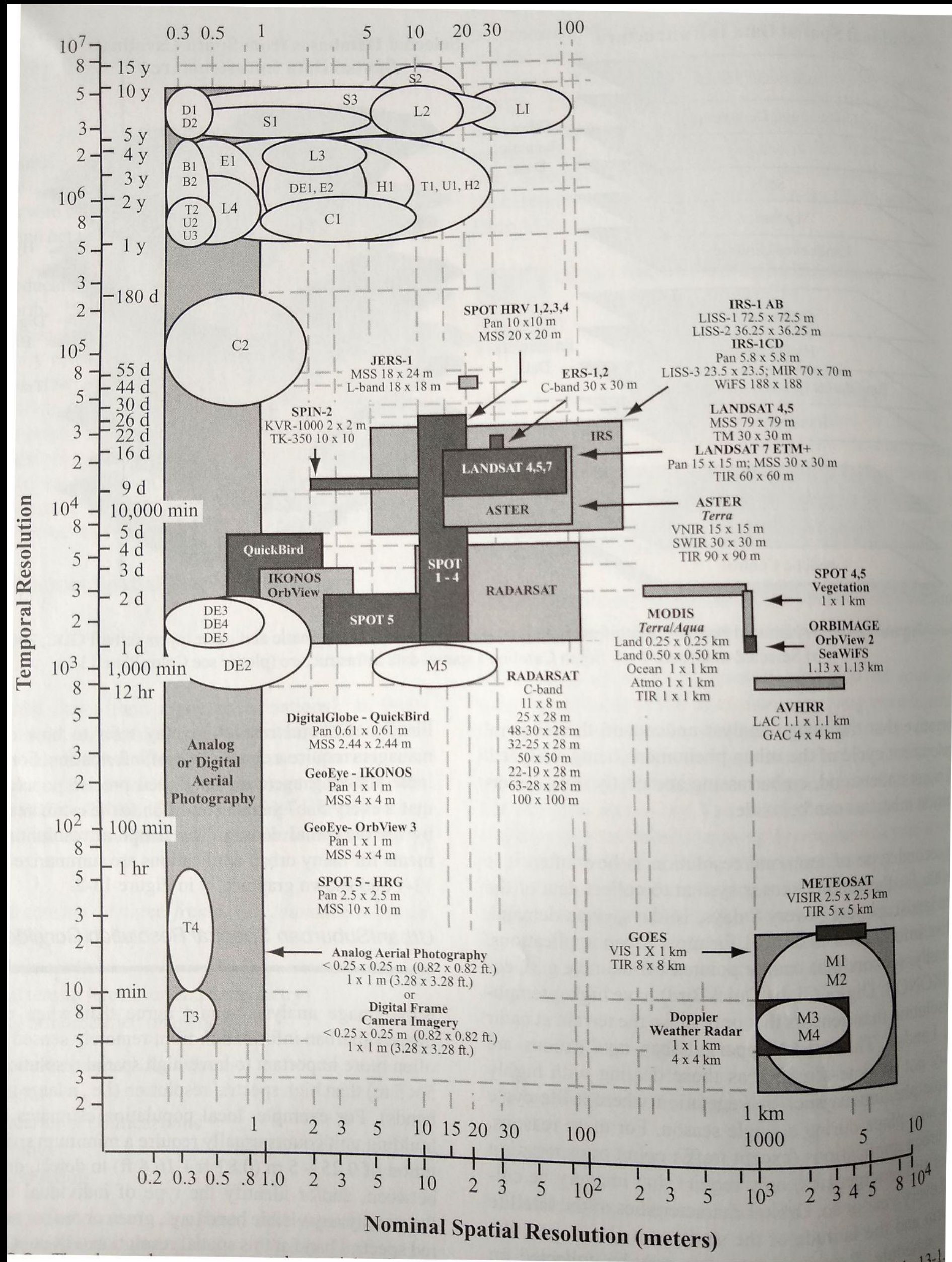
Countries with operational spacecraft: 1



← Belward, Alan S., and Jon O. Skøien. "Who Launched What, When and Why; Trends in Global Land-Cover Observation Capacity from Civilian Earth Observation Satellites." *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 103, Elsevier, May 2015, pp. 115–28, <https://doi.org/10.1016/j.isprsjprs.2014.03.009>.



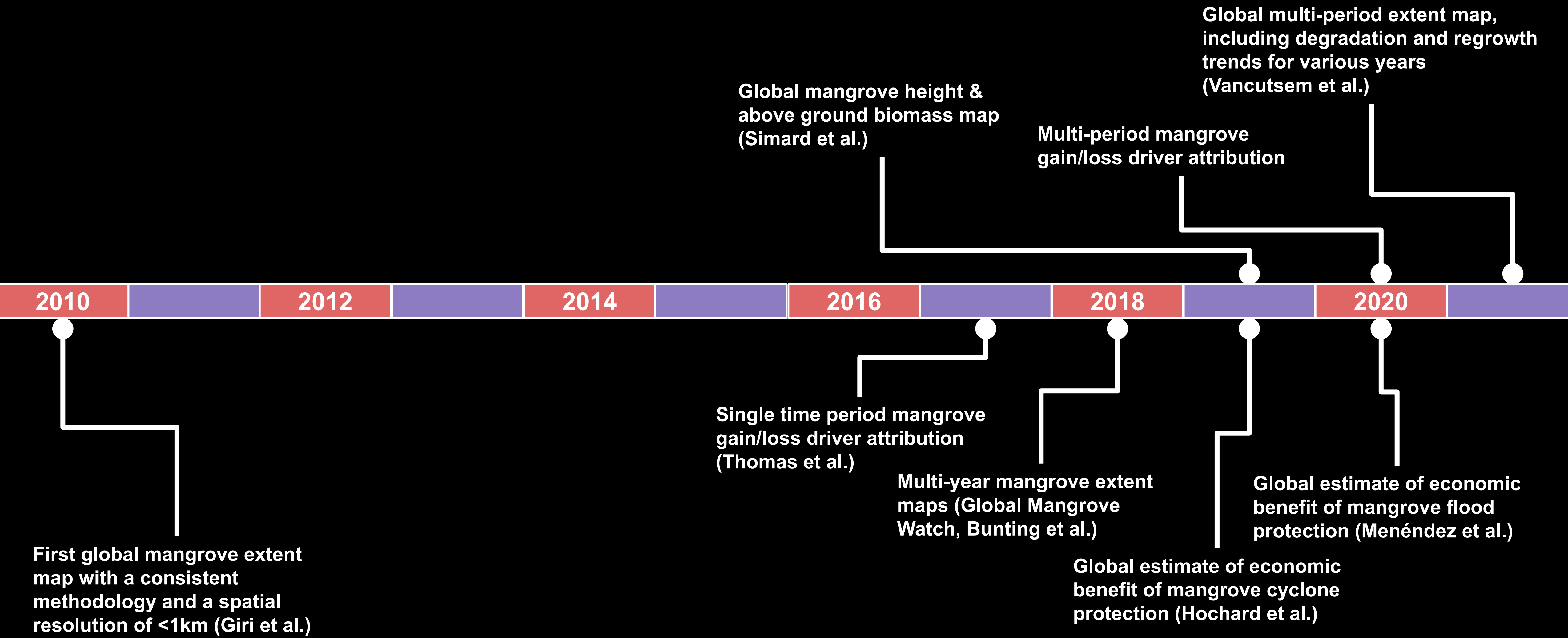
C: Remote Sensing Data & Techniques



- Improved resolutions (spatial, spectral, radiometric, temporal)
- More refined indices
- New Data Types
 - SAR
 - LIDAR
 - Gravitational Field Anomalies
- Supervised & Unsupervised Classification
- Cloud-based access and computation

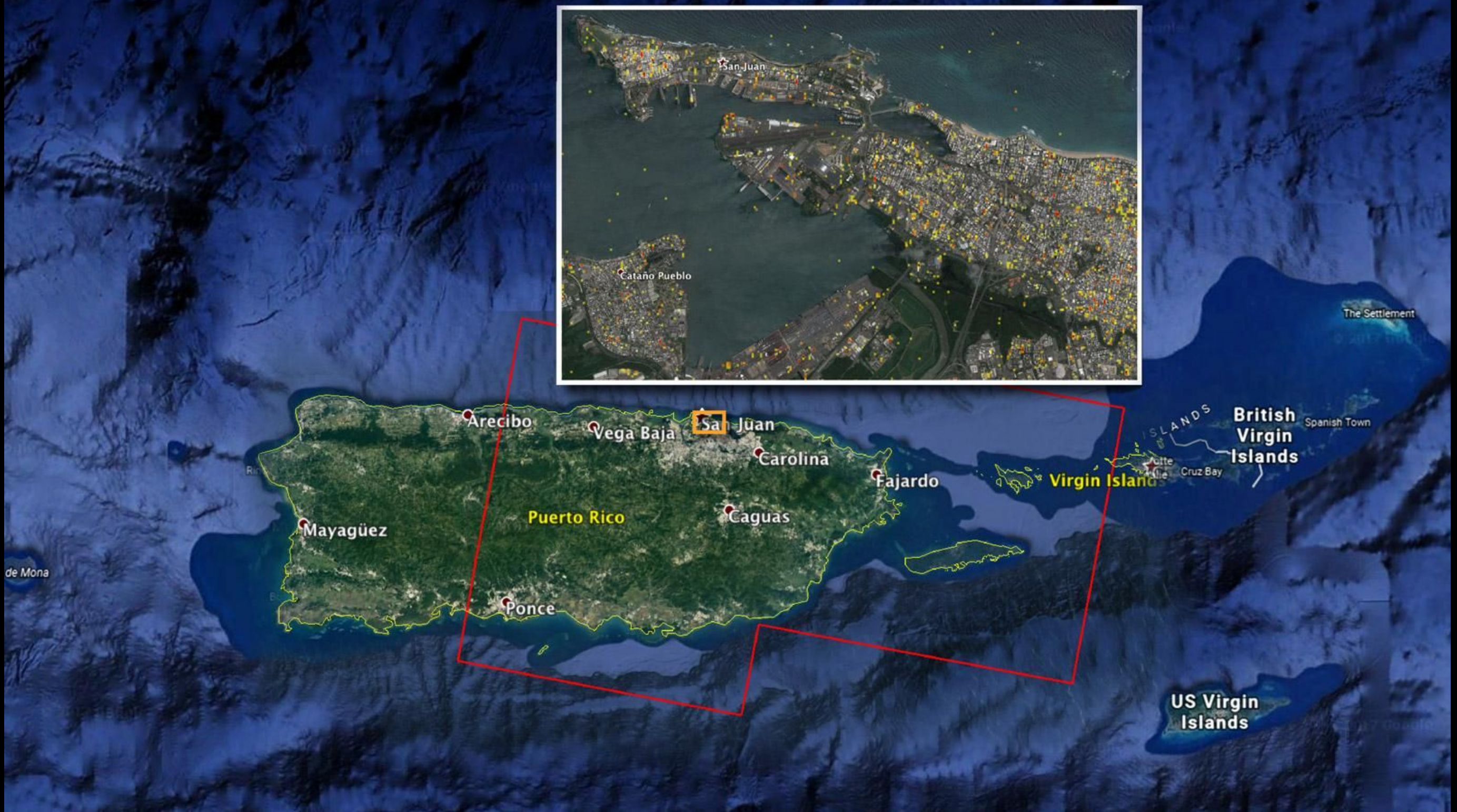
Jensen, John. *Remote Sensing of the Environment: An Earth Resource Perspective*. 2nd edition. Upper Saddle River, NJ: Pearson, 2006.

C: Remote Sensing Application Trends - Mangroves



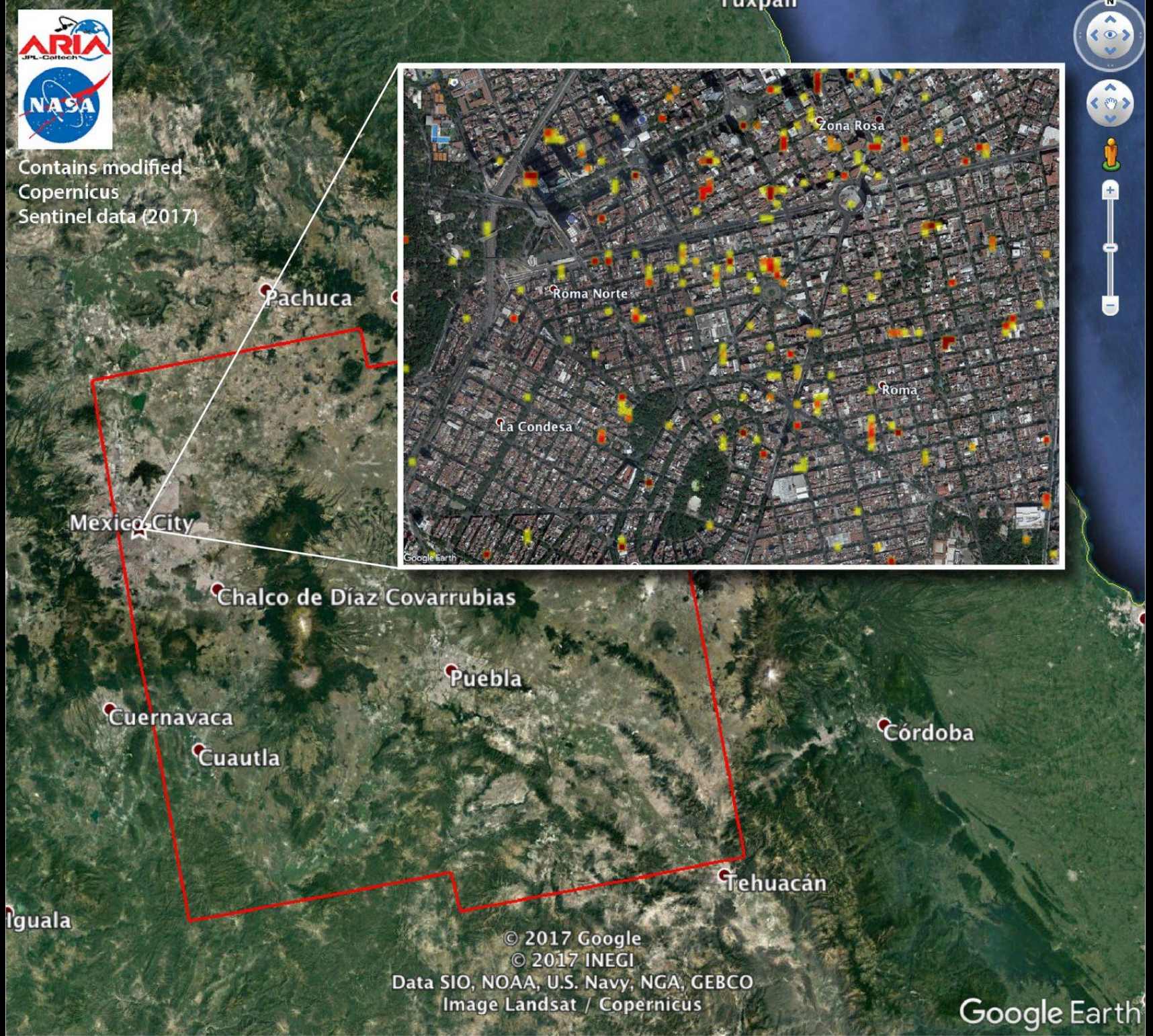
C: Remote Sensing Application Trends - Disaster Response

Puerto Rico



Hurricane Maria makes landfall on Sep 20, 2017.
NASA supplies damage maps on Sep 22, 2017

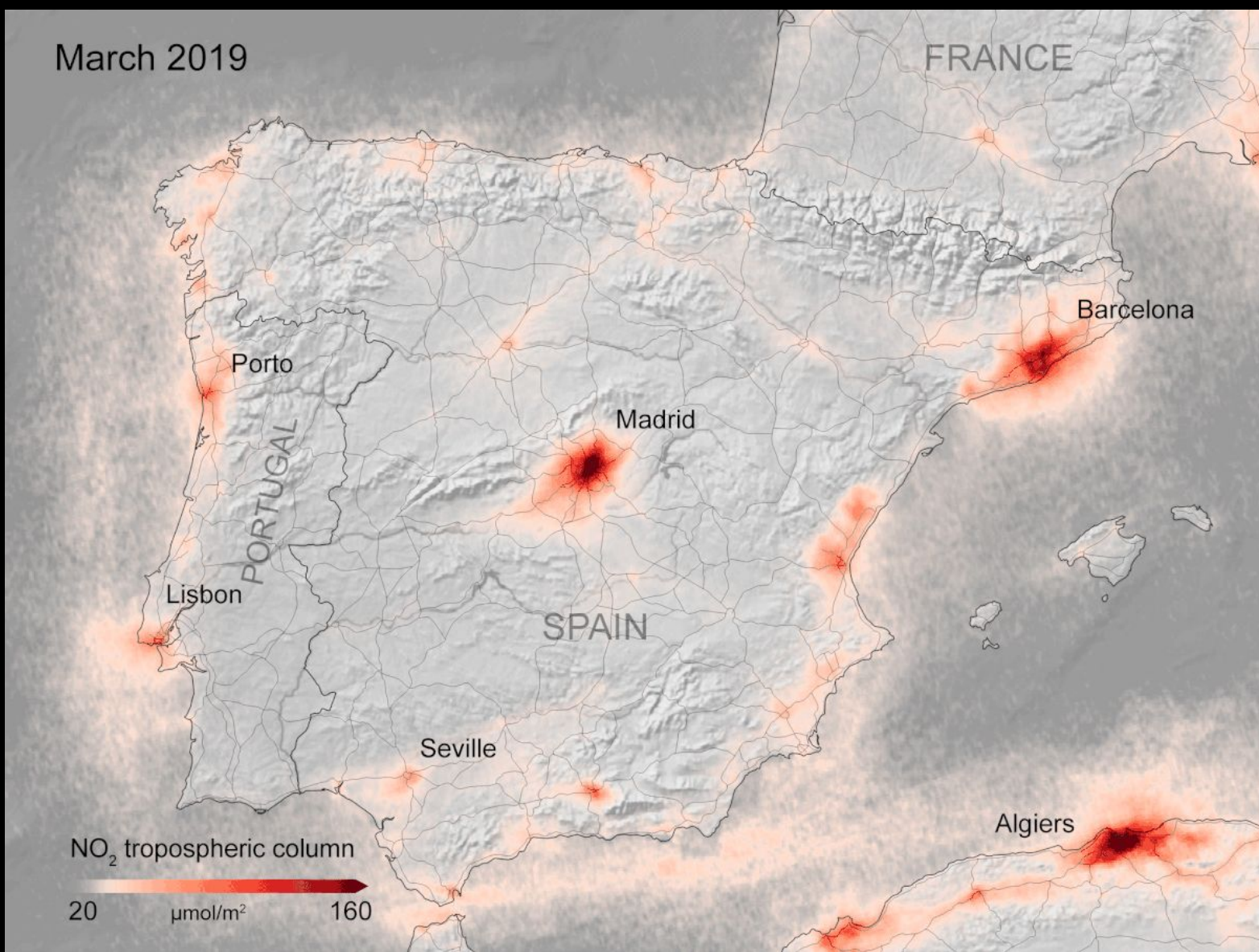
Mexico City



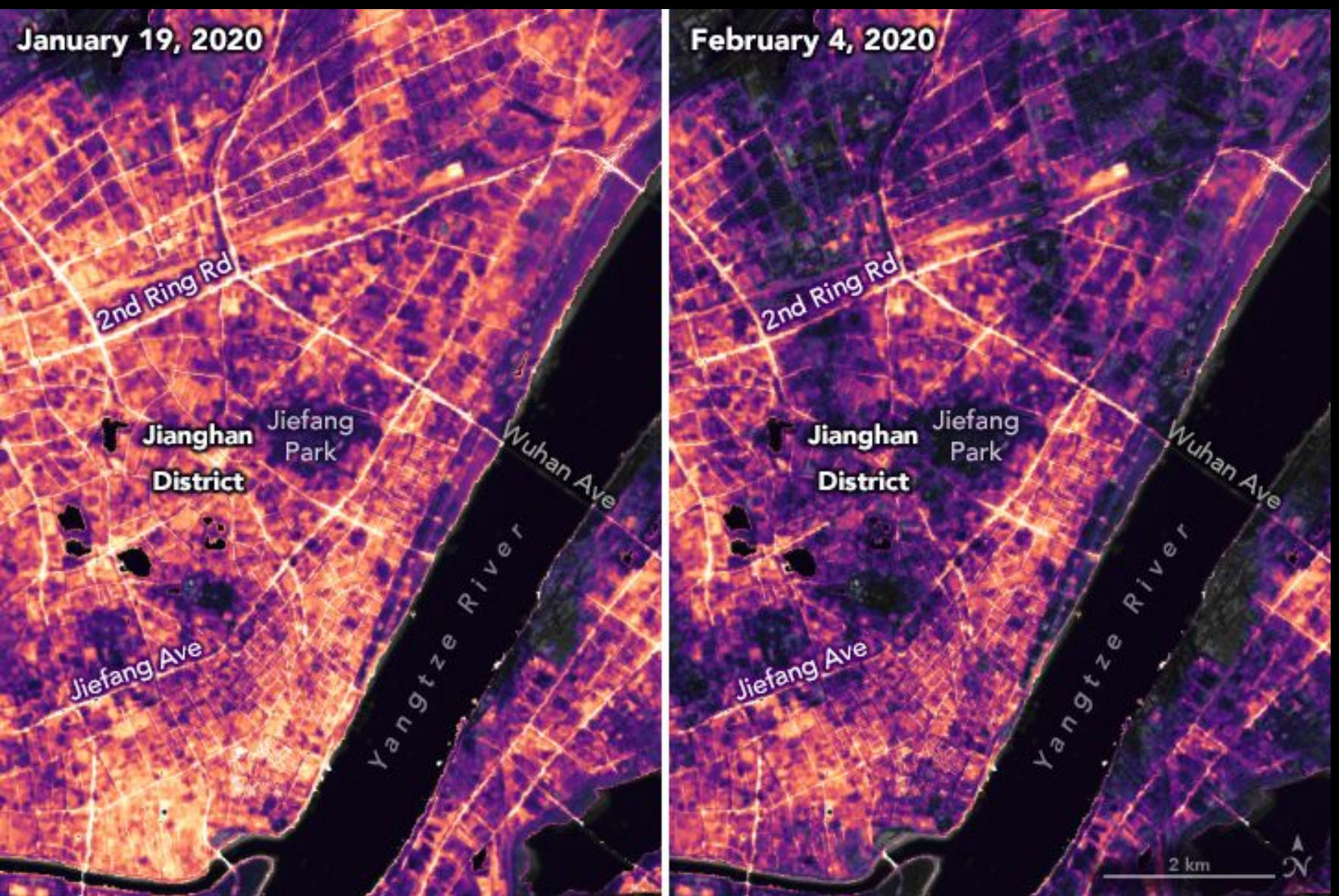
Earthquake occurs on Sep 19, 2017
NASA supplies damage maps on Sep 20, 2017



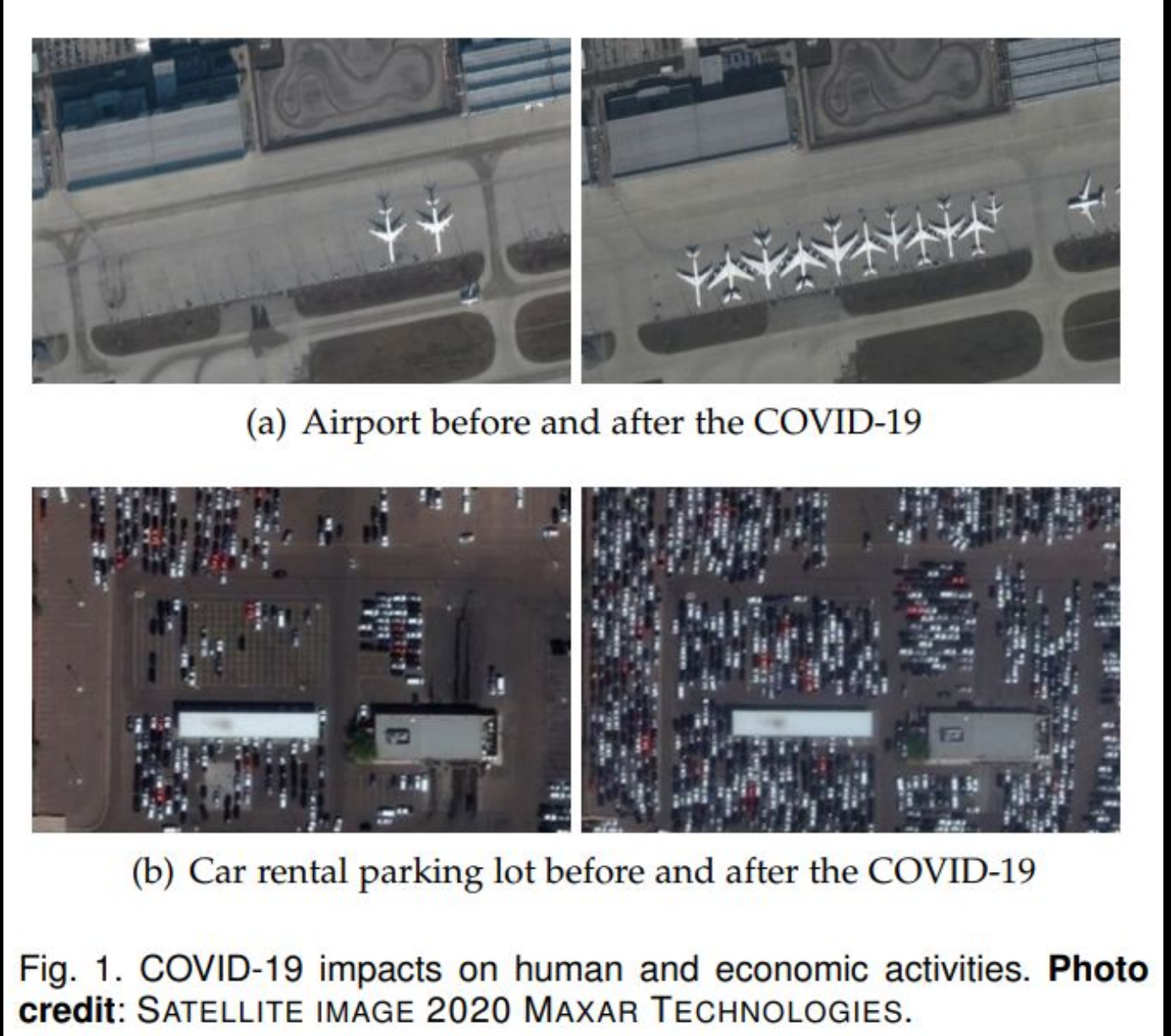
C: Remote Sensing Application Trends - COVID-19



Emissions



Nightlights



Traffic



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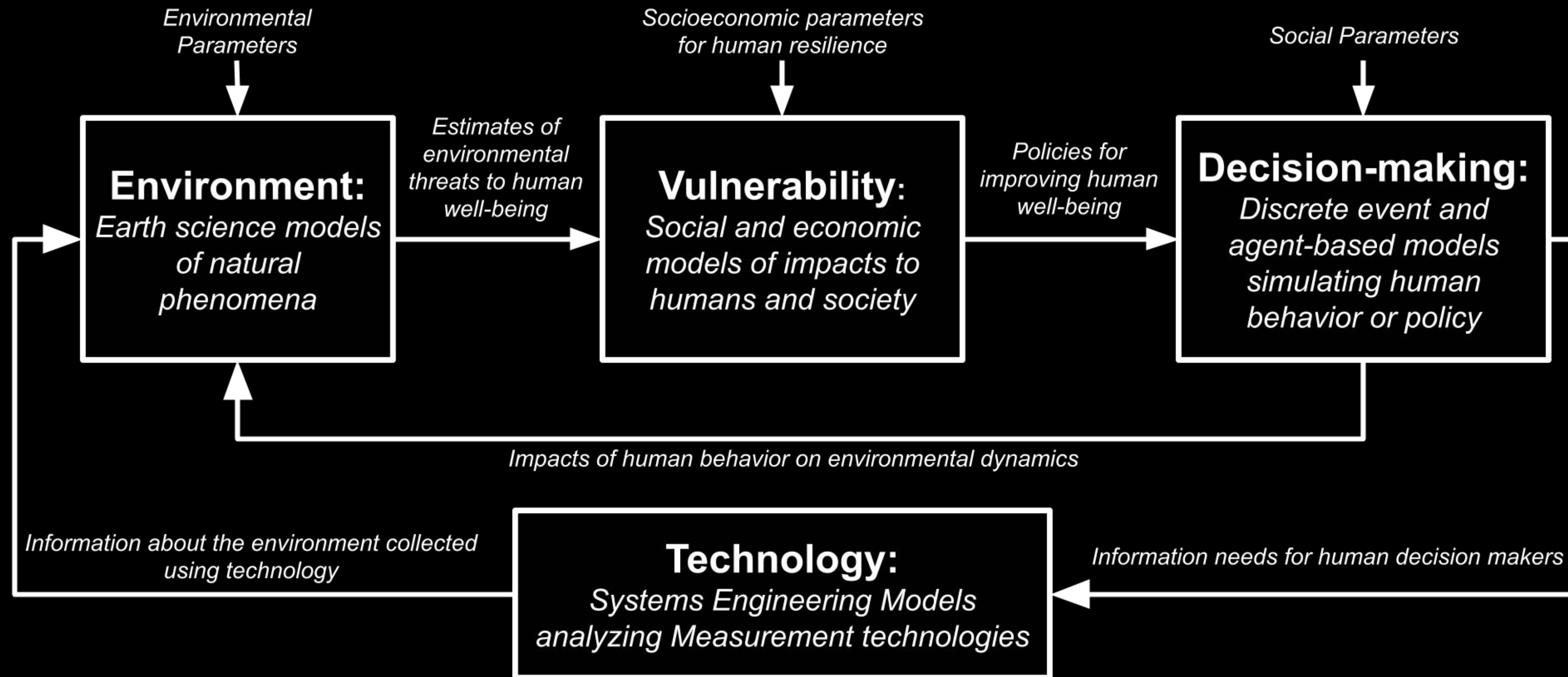
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E. Opportunities



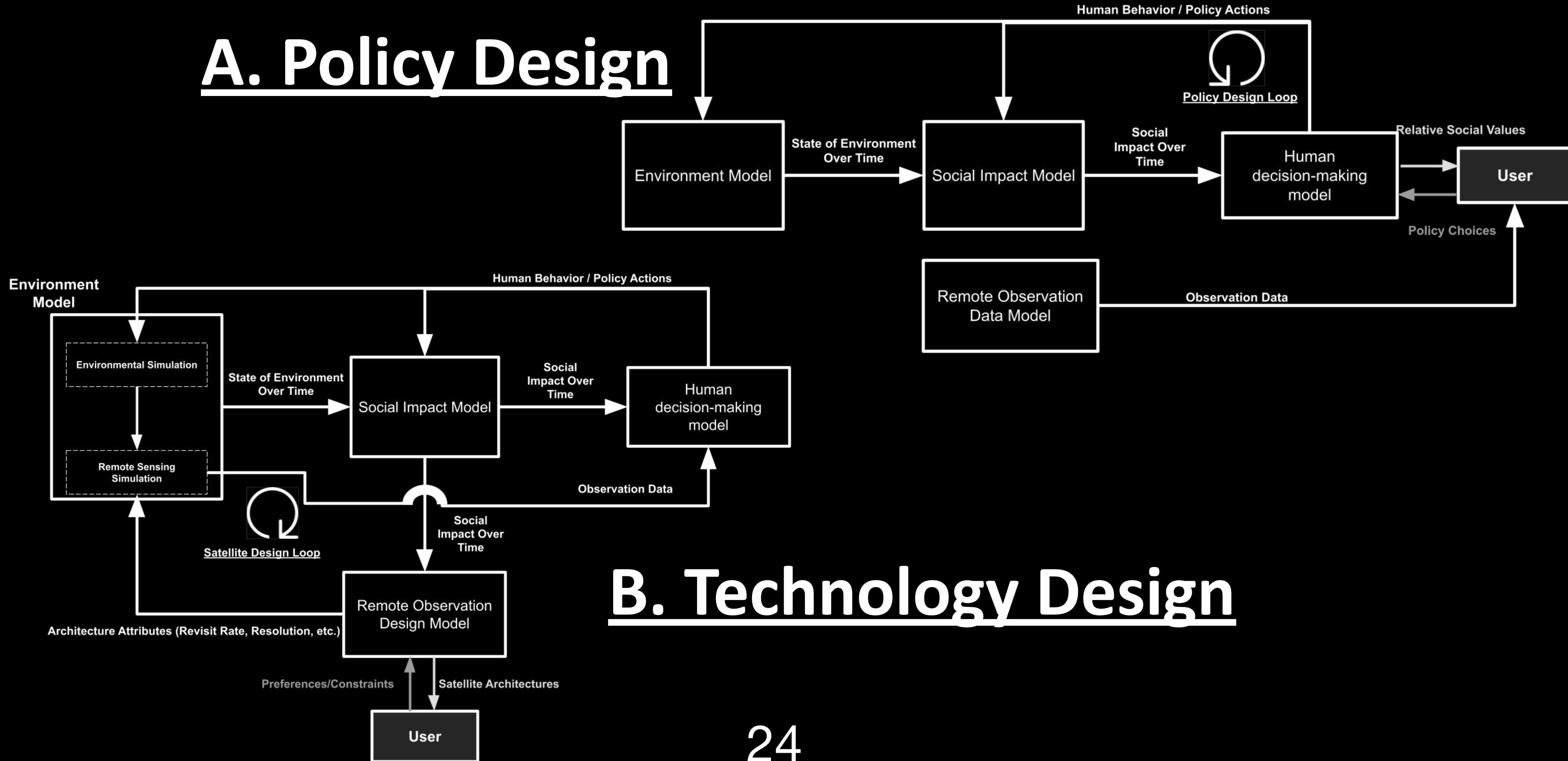
D: EVDT Framework



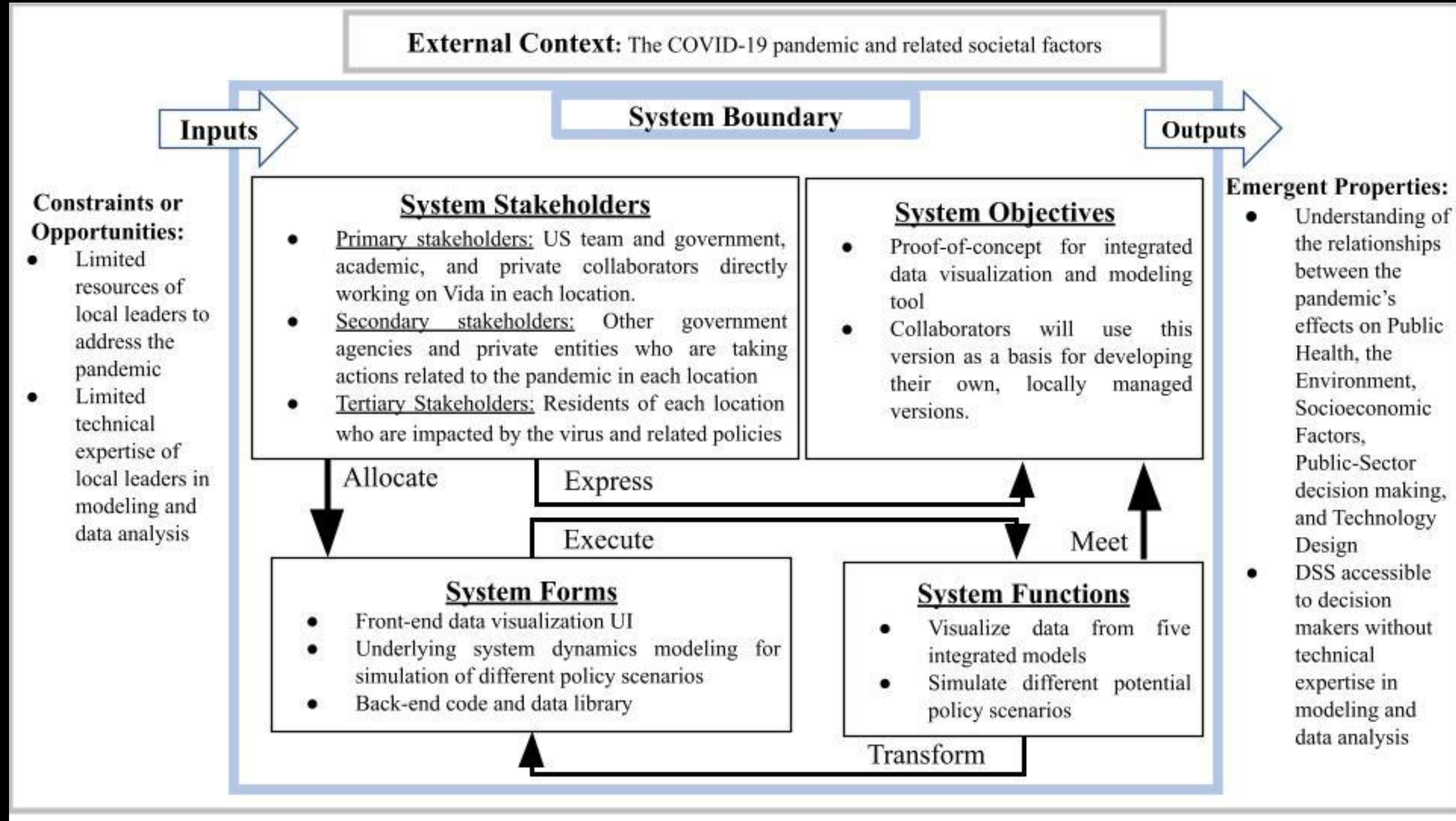
- What is happening in **the natural environment**?
- How will **humans be impacted** by what is happening in the natural environment?
- What **decisions are humans making** in response to environmental factors and why?
- What **technology system** can be designed to provide high quality information that supports human decision making?

D: EVDT Arrangements

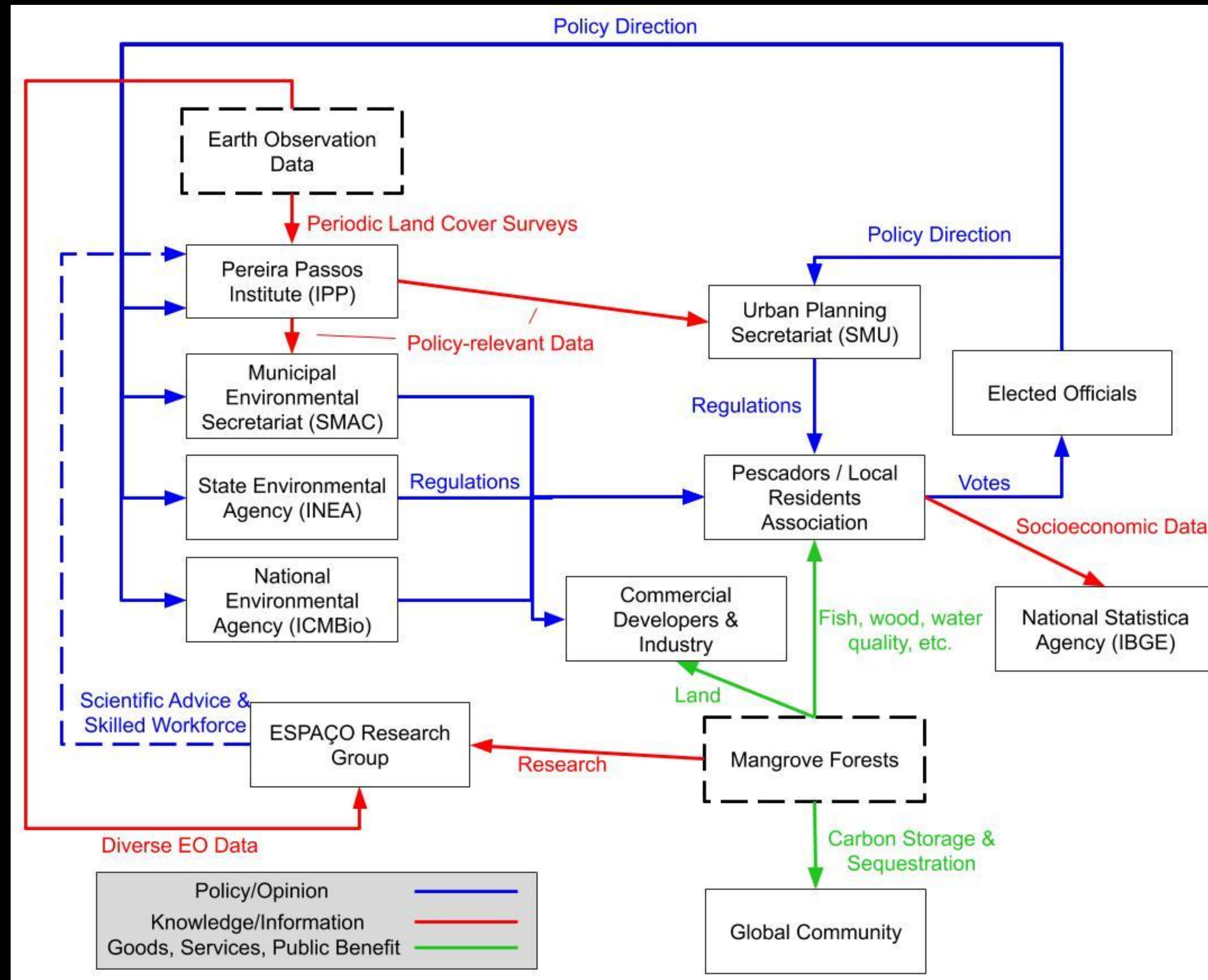
A. Policy Design



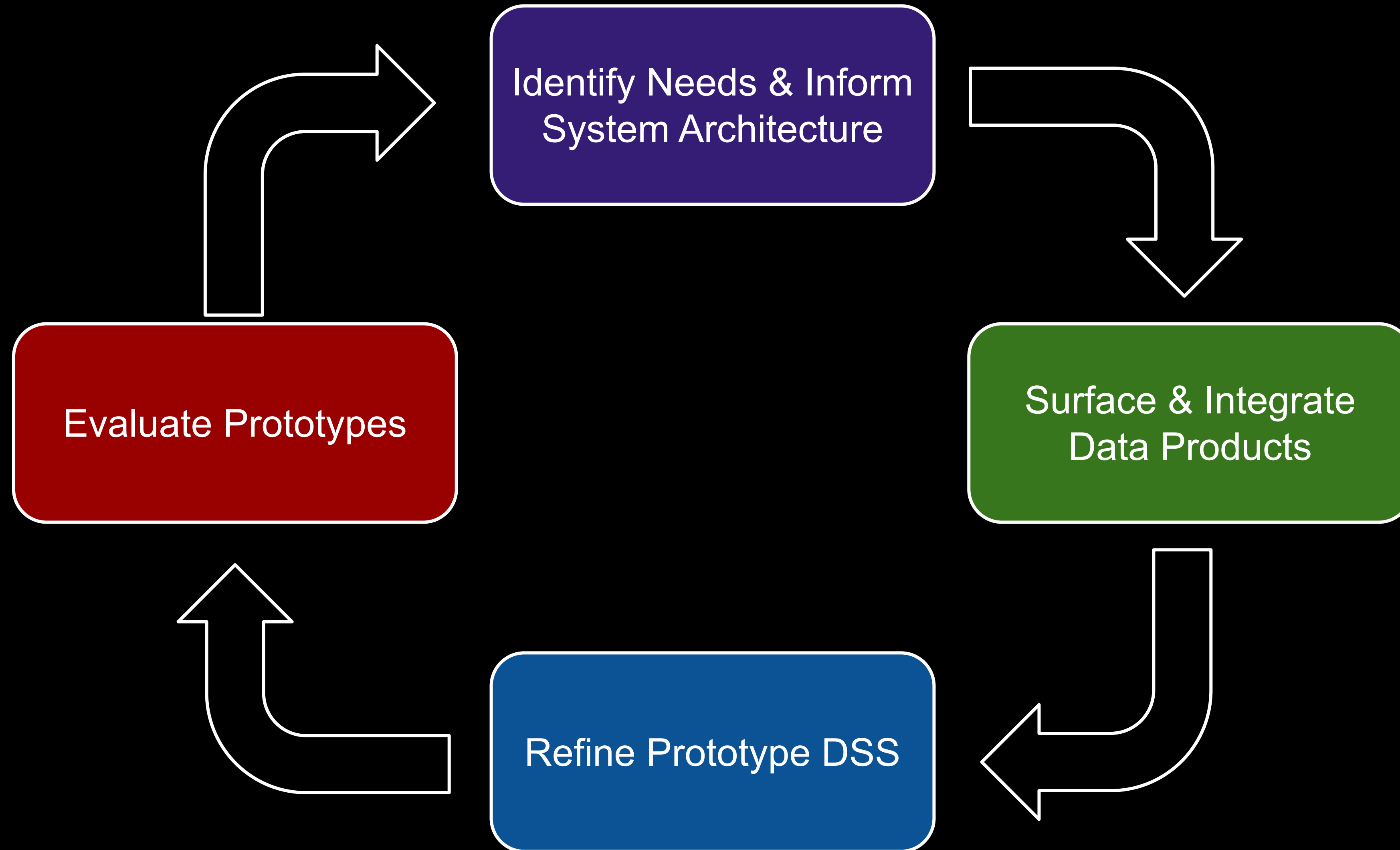
D: Systems Architecture



D: Stakeholder Mapping



D: Stakeholder Involvement



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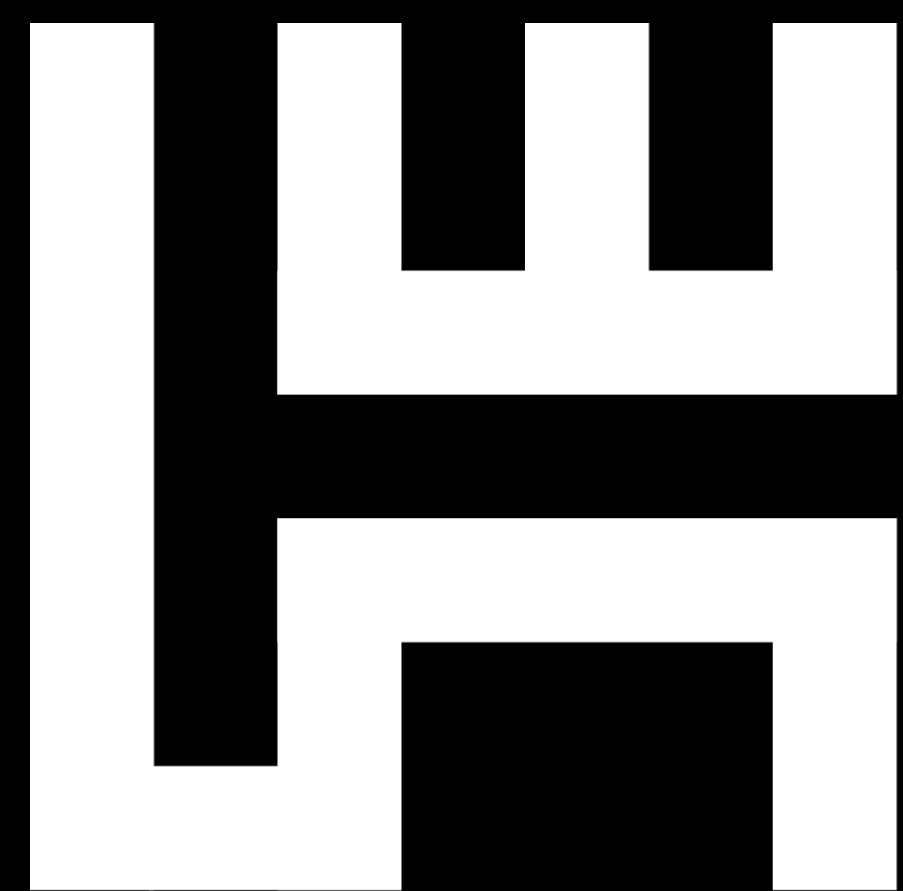
E. Opportunities



E: Opportunities

- Participatory multi-disciplinary decision support
 - Integrating GIS & remote sensing
 - Scenario planning
- Developing a framework for modular re-use and adaptation of simulation components
- “Closing the loop” - using sustainable development applications to inform the design of remote observation systems





**space
enabled**