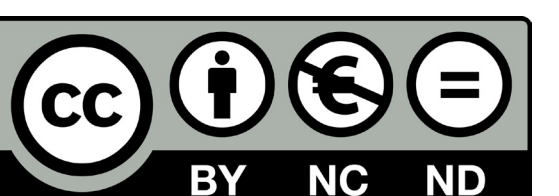


METROPOLITAN CARTOGRAPHY UP CLOSE FROM AFAR

ALESSANDRO MUSETTA, ANTONELLA CONTIN
POLITECNICO DI MILANO
SEVILLE, 2018-02-19



TELLme - TRAINING FOR EDUCATION, LEARNING, AND LEADERSHIP TOWARDS A NEW METROPOLITAN DISCIPLINE



“SUPER WICKED” PROBLEM

IS A PROBLEM THAT IS DIFFICULT OR IMPOSSIBLE TO SOLVE BECAUSE OF INCOMPLETE, CONTRADICTORY, AND CHANGING REQUIREMENTS THAT ARE OFTEN DIFFICULT TO RECOGNIZE

IN THE METROPOLITAN SYSTEM WE FACE MULTIPLE
“SUPER WICKED” (?)

“SUPER WICKED” characteristic (Kelly Levine)

- / TIME IS RANNING OUT
- / NO CENTRAL AUTHORITY
- / THOSE SEEKING TO SOLVE THE PROBLEM ARE ALSO CAUSING IT
- / POLICIES DISCOUNT THE FUTURE IRRATIONALITY

After Big Data: The Coming Age of “Big Indicators”

(TO MANAGE “SUPER WICKED” PROBLEMS)

JAN 2018
ANDREW ZOLLI

“BIG INDICATORS”

/ HIGHLY DETAILED

/ CONTINUOUSLY PRODUCED

/ TRACK CHANGE IN THE HEALTH OF THE EARTH’S MOST IMPORTANT
SYSTEMS, IN REAL TIME

THE ROLE OF INNOVATION

BIG DATA / collection and analysis

REMOTE SENSING / computer vision analysis

CLOUD COMPUTING / computational power

1977

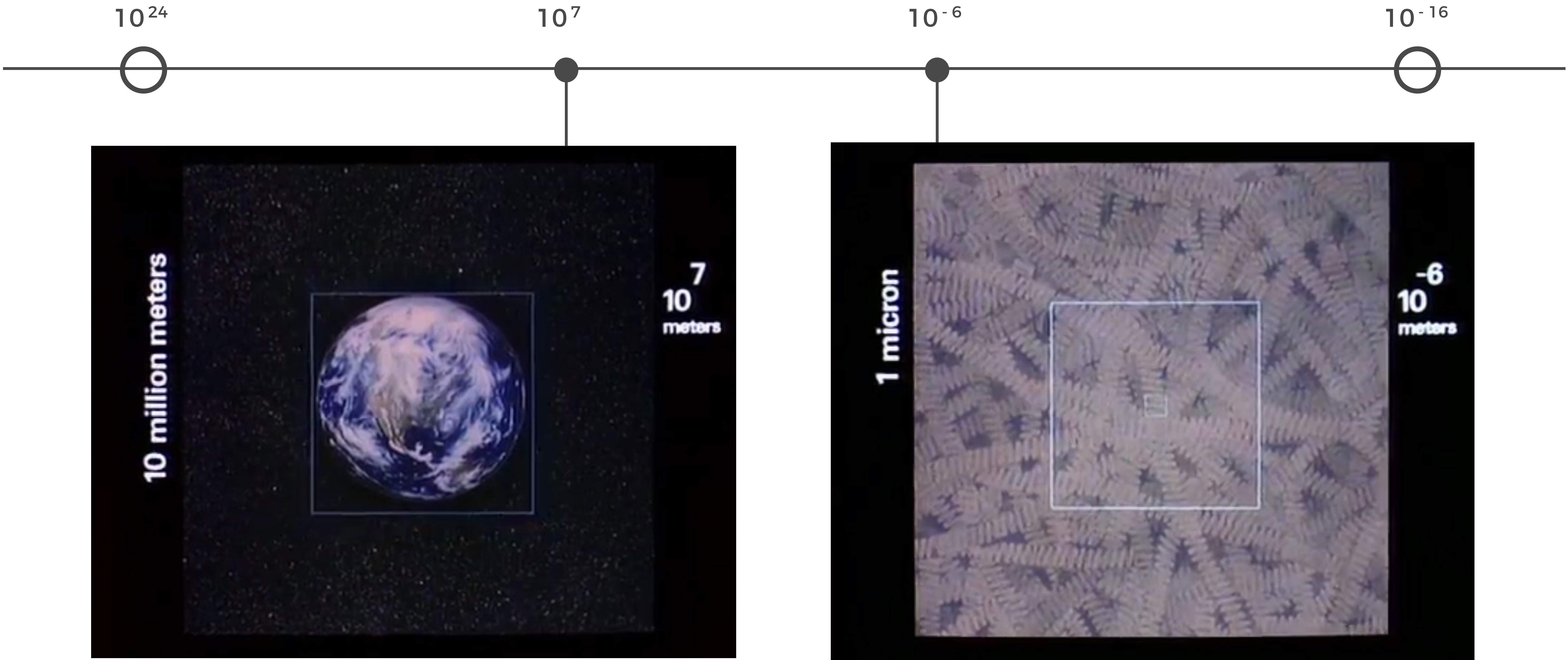
POWERS OF TEN

AND THE RELATIVE SIZE OF THINGS IN THE UNIVERSE

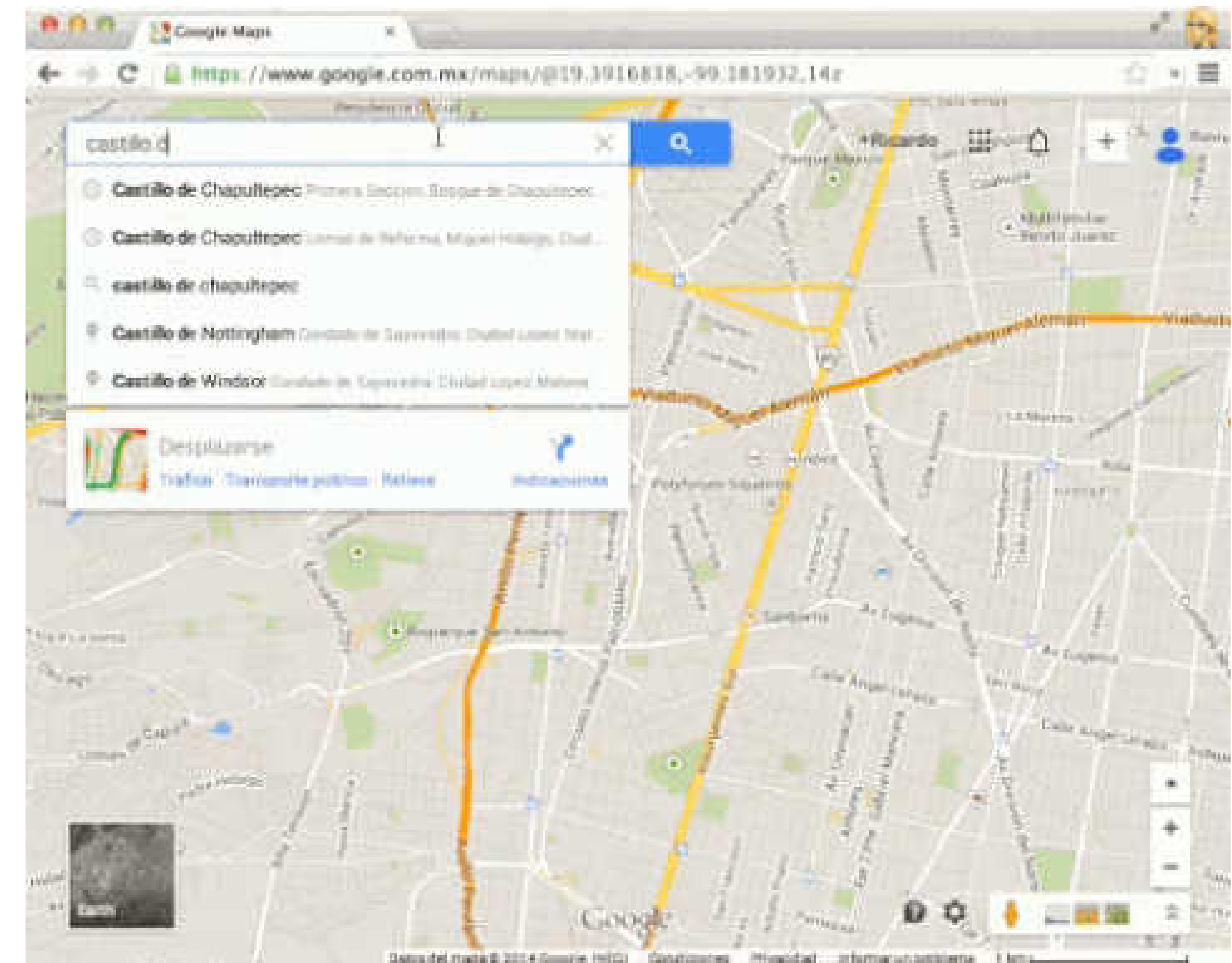
CHARLES AND RAY EAMES



POWERS OF TEN ILLUSTRATES THE UNIVERSE AS AN ARENA OF BOTH CONTINUITY AND CHANGE, OF EVERYDAY PICNICS AND COSMIC MYSTERY. IT BEGINS WITH A CLOSE-UP SHOT OF A MAN SLEEPING NEAR THE LAKESIDE IN CHICAGO, VIEWED FROM ONE METER AWAY. THE LANDSCAPE STEADILY MOVES OUT UNTIL IT REVEALS THE EDGE OF THE KNOWN UNIVERSE. THEN, AT A RATE OF 10-TO-THE-TENTH METERS PER SECOND, THE FILM TAKES US TOWARDS EARTH AGAIN, CONTINUING BACK TO THE SLEEPING MAN'S HAND AND EVENTUALLY DOWN TO THE LEVEL OF A CARBON ATOM.



GLOBAL SAFARI



“I don’t understand why people need to make maps anymore. They’ve got Google Maps !”

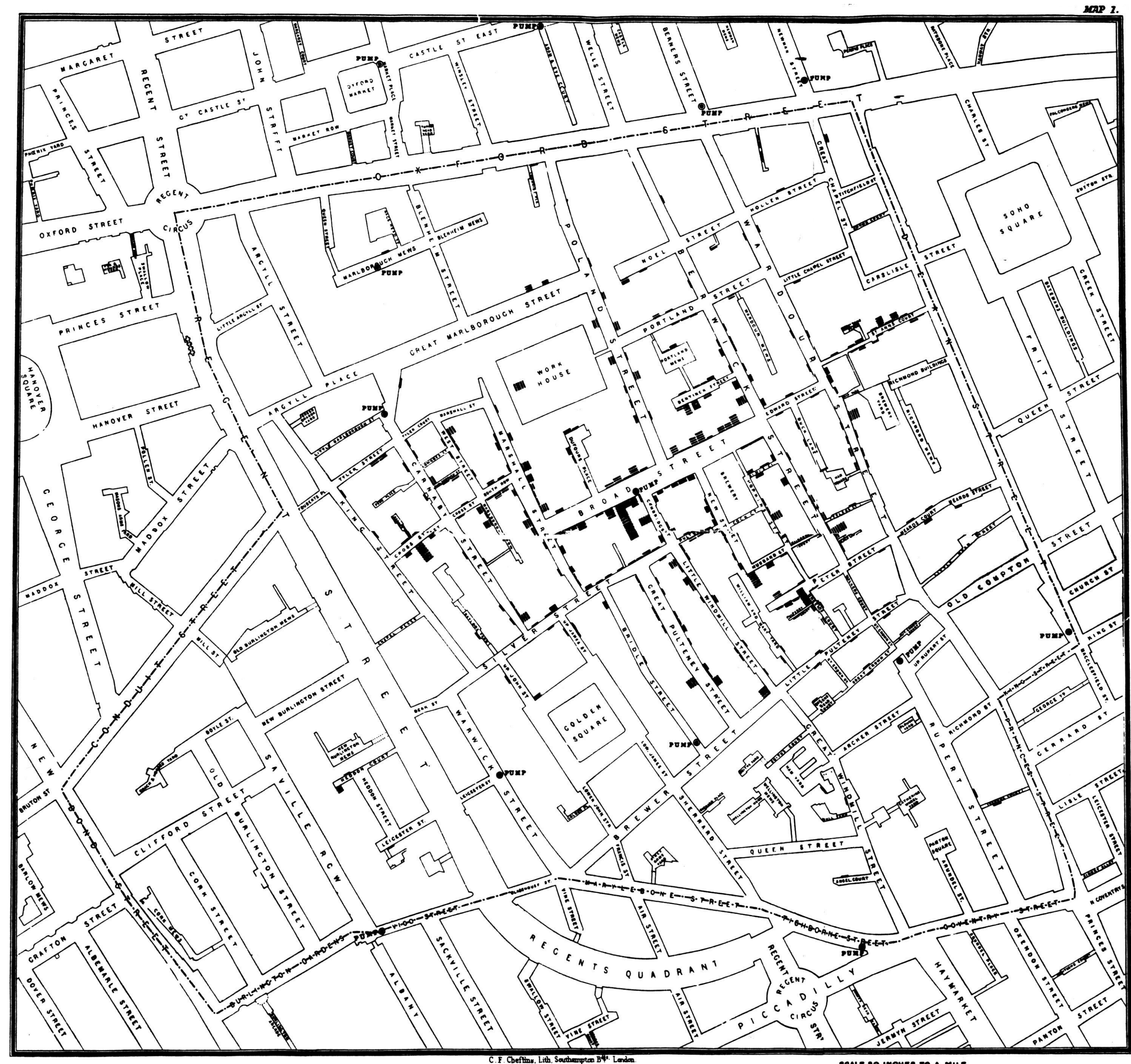


WHAT GOOGLE MAPS DOESN'T SHOW YOU

1854 BROAD STREET CHOLERA OUTBREAK

INVESTIGATION BY JOHN SNOW

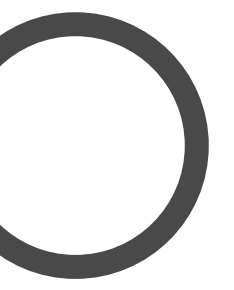
Original map by John Snow showing the clusters of cholera cases (indicated by stacked rectangles) in the London epidemic of 1854. The contaminated pump is located at the intersection of Broad Street and Cambridge Street (now Lexington Street), running into Little Windmill Street.





DETAIL

1854 BROAD STREET CHOLERA OUTBREK



MAP AS AN “INVENTION” TO DETECT NEW PATTERNS

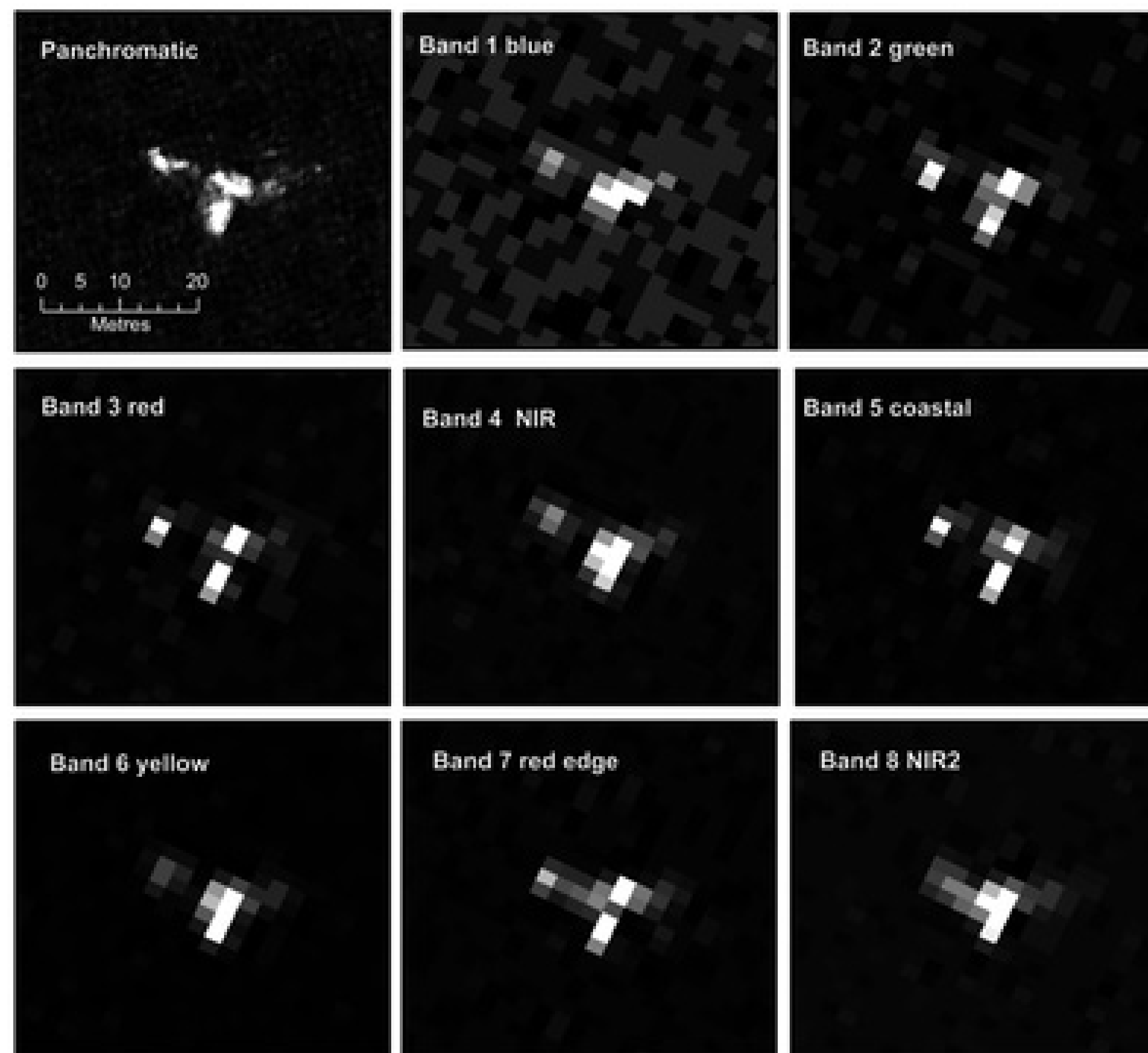
COUNTING WHALES FROM SPACE



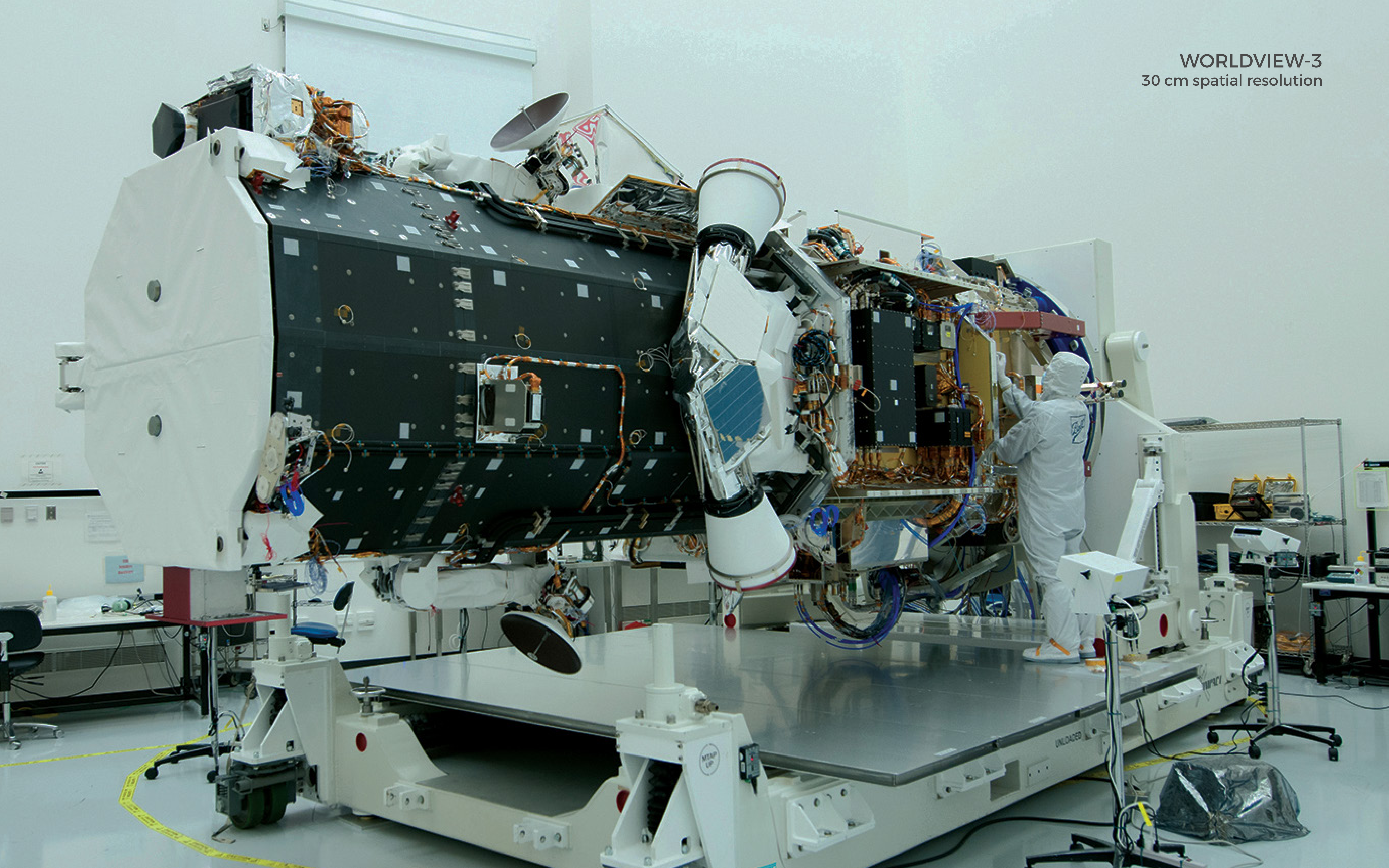
There are many ways to monitor whales, but not quite so many to count them. Scientists can set out to sea and search for whales. Well, almost. Boat work can be formidably expensive and even when you join whale watching vessels to cut the costs, you can still only cover a small area of the ocean. Scientists from the British Antarctic Survey have come up with an incredibly cheap and effective solution.

REF

Fretwell, P. T., Staniland, I. J. and Forcada, J. Whales from Space: Counting Southern Right Whales by Satellite. PLoS ONE 9 e88655 (2014)

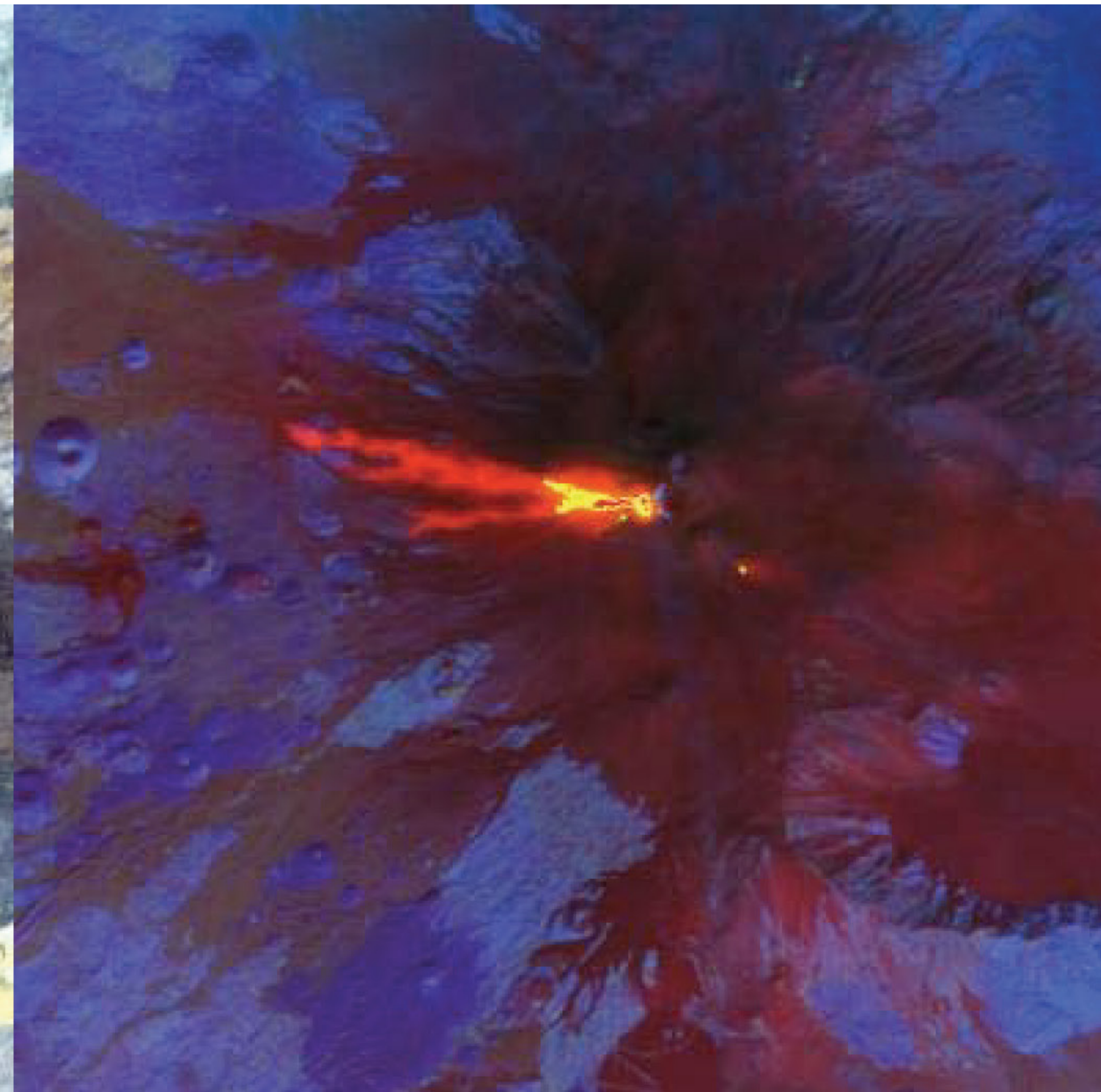


WORLDVIEW-3
30 cm spatial resolution



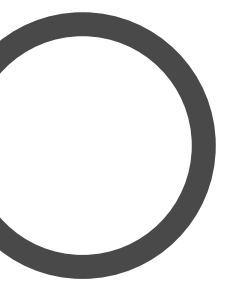


BANDS 3,2,1
VISIBLE LIGHT

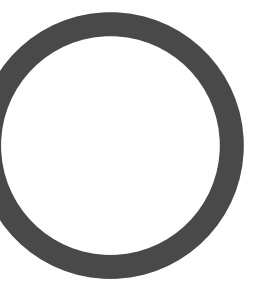


BANDS 6,5,4
INFRARED LIGHT

MT. ETNA ERUPTION



MAP AS SCIENTIFIC INTERPRETATION OF THE IMAGES

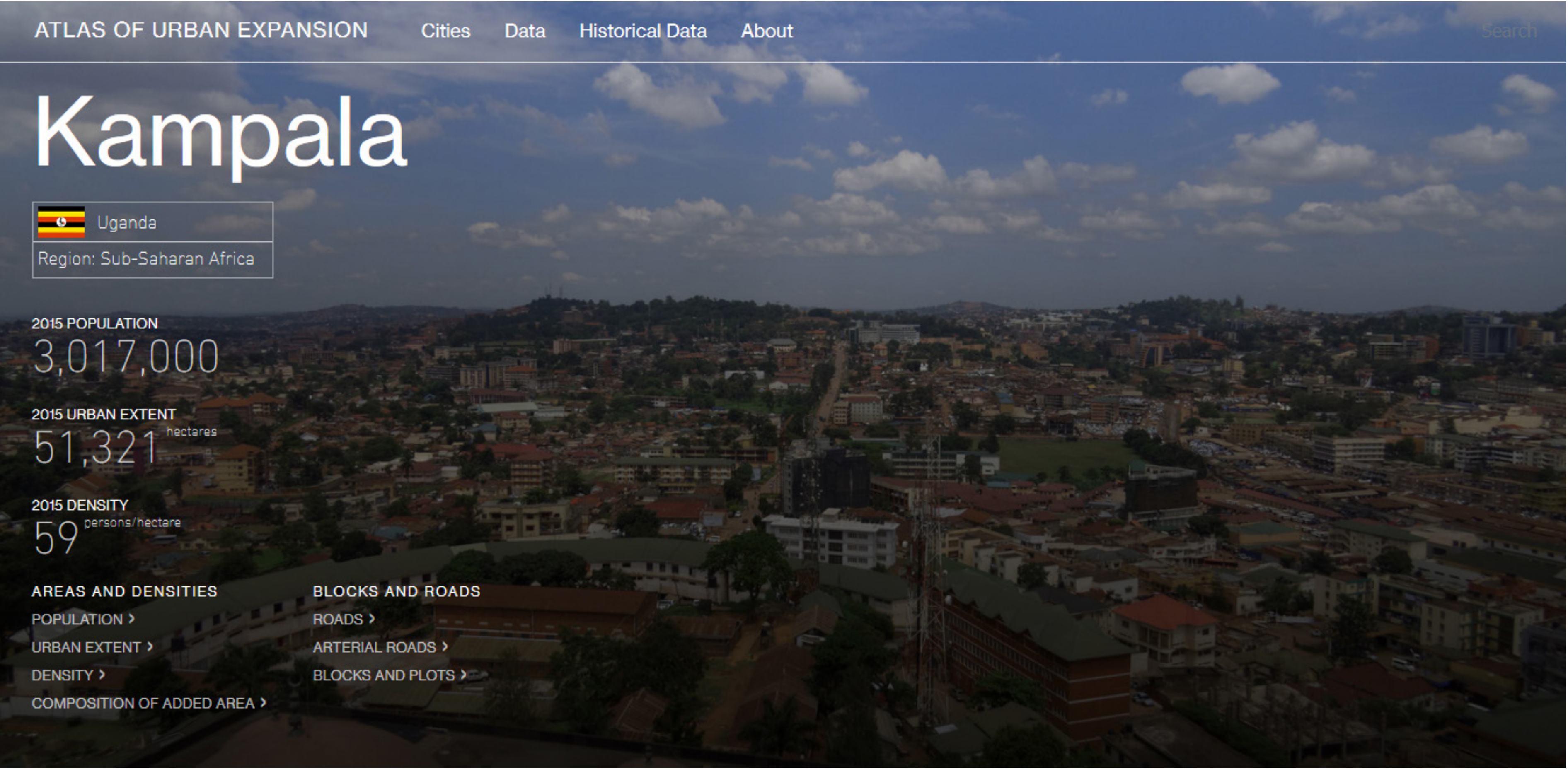


MAP AS (CHEAP *) AND EFFECTIVE SOLUTION TO SUPERVISE PHENOMENA

* CHEAPER THAN TRADITIONAL ANALYSIS

PHENOMENON : URBAN GROWTH

atlasofurbanexpansion



REF
<http://www.atlasofurbanexpansion.org/cities/view/Kampala>

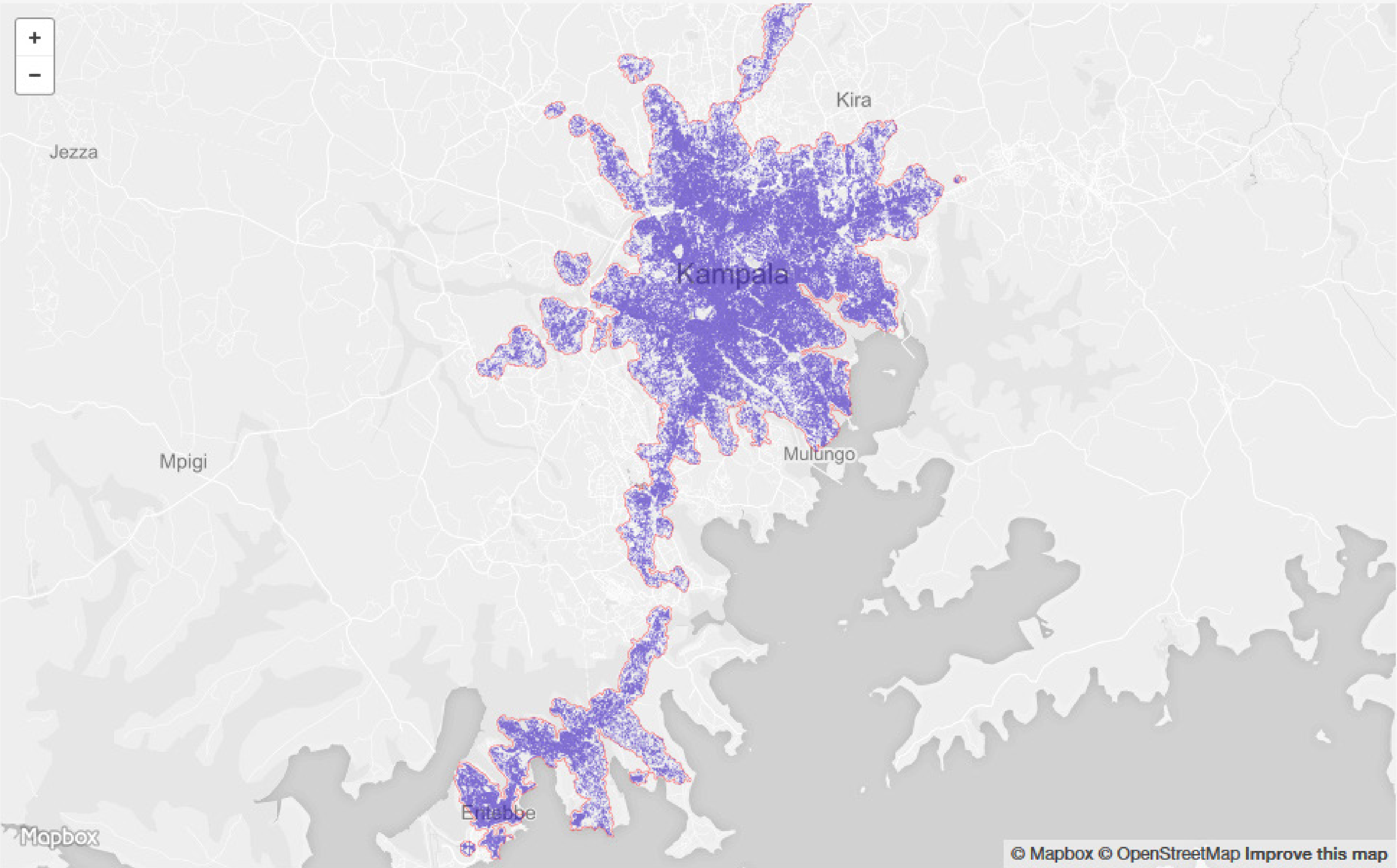
Composition of Added Area

A total of 12,090 hectares of built-up area was added to the Kampala urban extent between 2003 and 2015. Of that added built-up area, 30% was Infill, 41% was Extension, 0% was Leapfrog, and 28% was Inclusion. A total of 9,150 hectares of built-up area was added to the urban extent between 1988 and 2003. Of that added built-up area, 36% was Infill, 28% was Extension, 0% was Leapfrog, and 35% was Inclusion.

1988-2003

2003-2015

- ☒ Built-up Area
- ☐ Infill
- ☐ Extension
- ☐ Leapfrog
- ☐ Inclusion

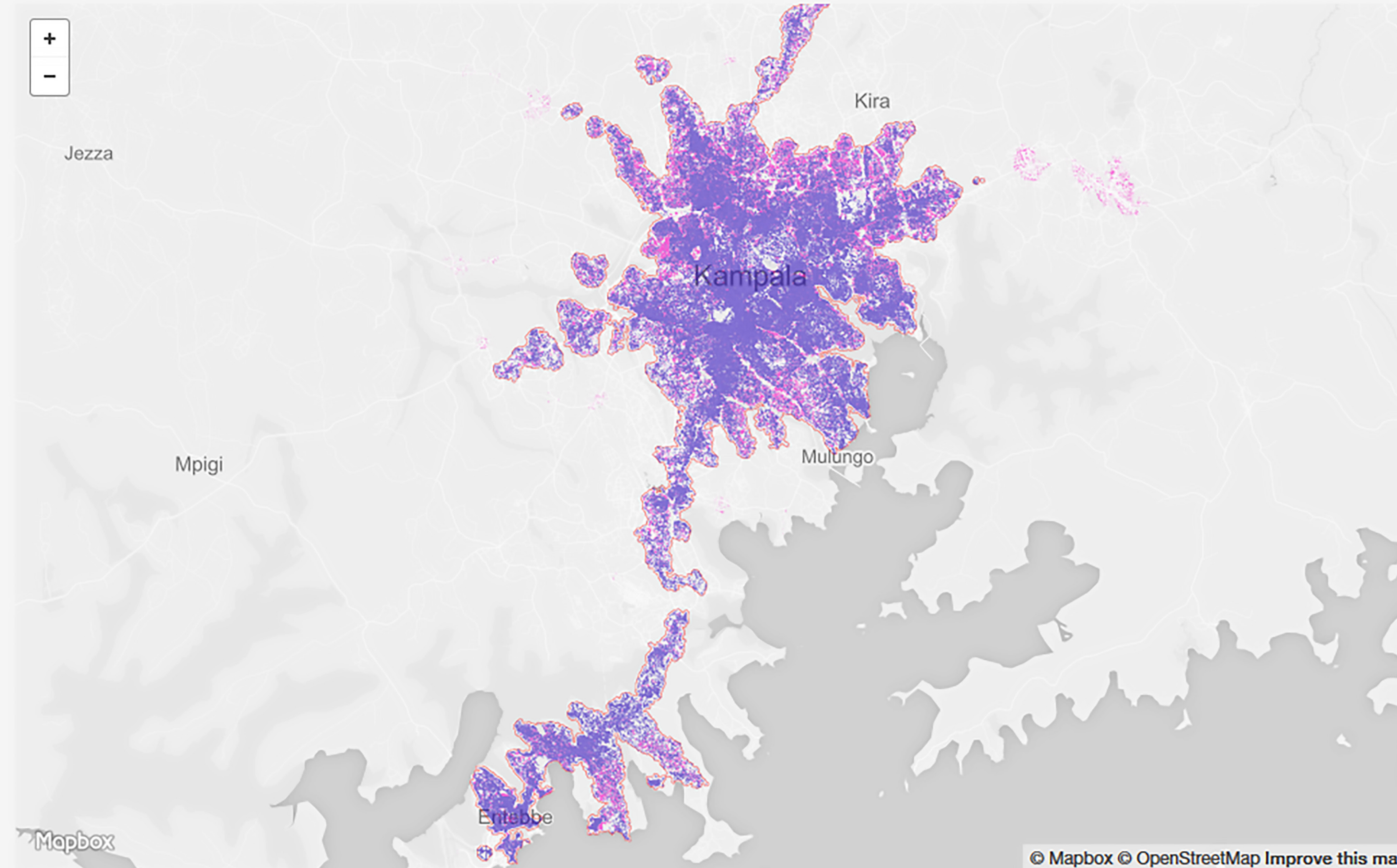


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1988–2003 2003–2015

- ☒ Built-up Area
- ☒ Infill
- ☐ Extension
- ☐ Leapfrog
- ☐ Inclusion



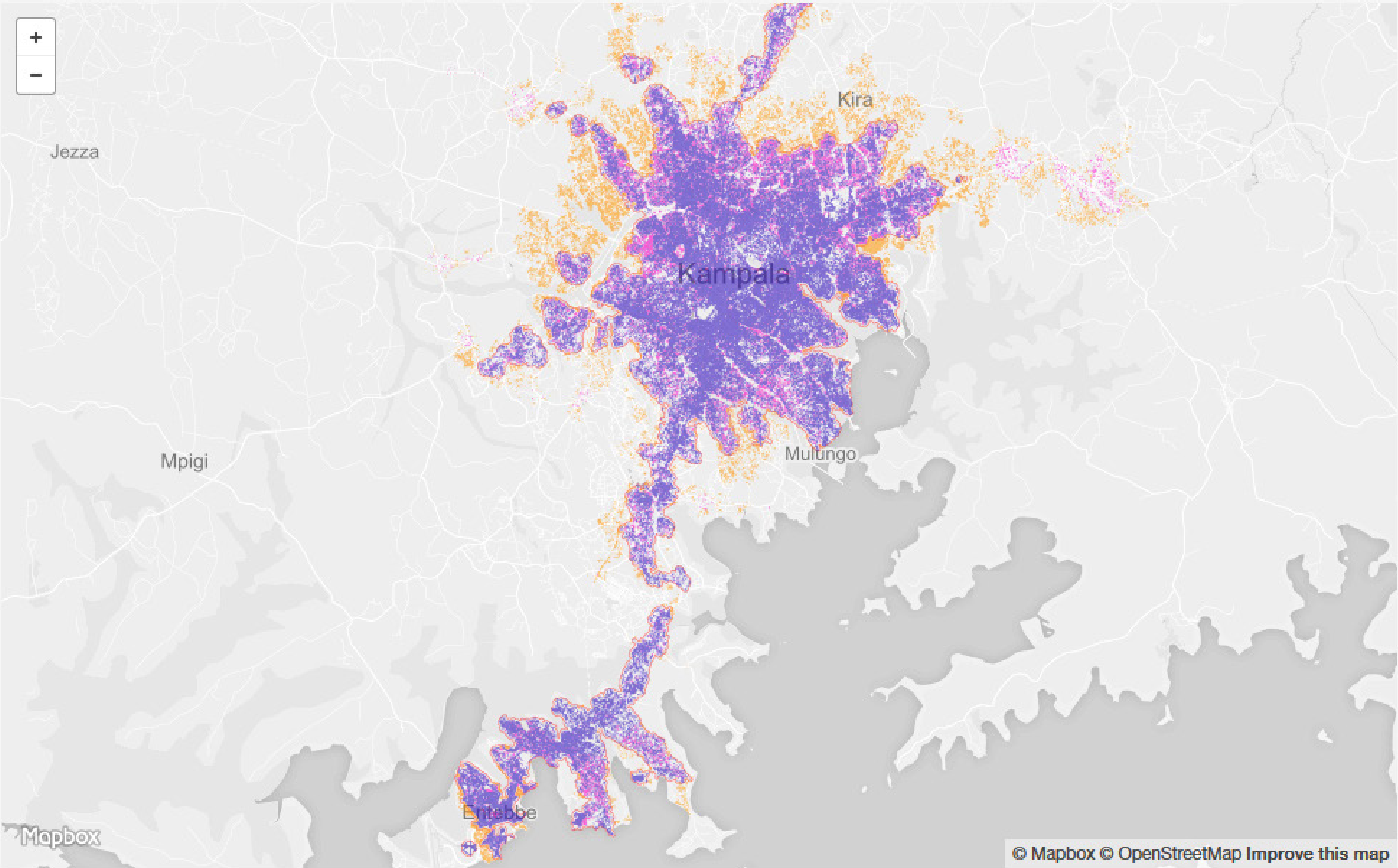
INFILL consists of all built-up pixels added in the new period that occupy urbanized open space within the urban extent of the earlier period.

Composition of Added Area

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1988-2003 2003-2015

- ☒ Built-up Area
- ☒ Infill
- ☒ Extension
- ☐ Leapfrog
- ☐ Inclusion



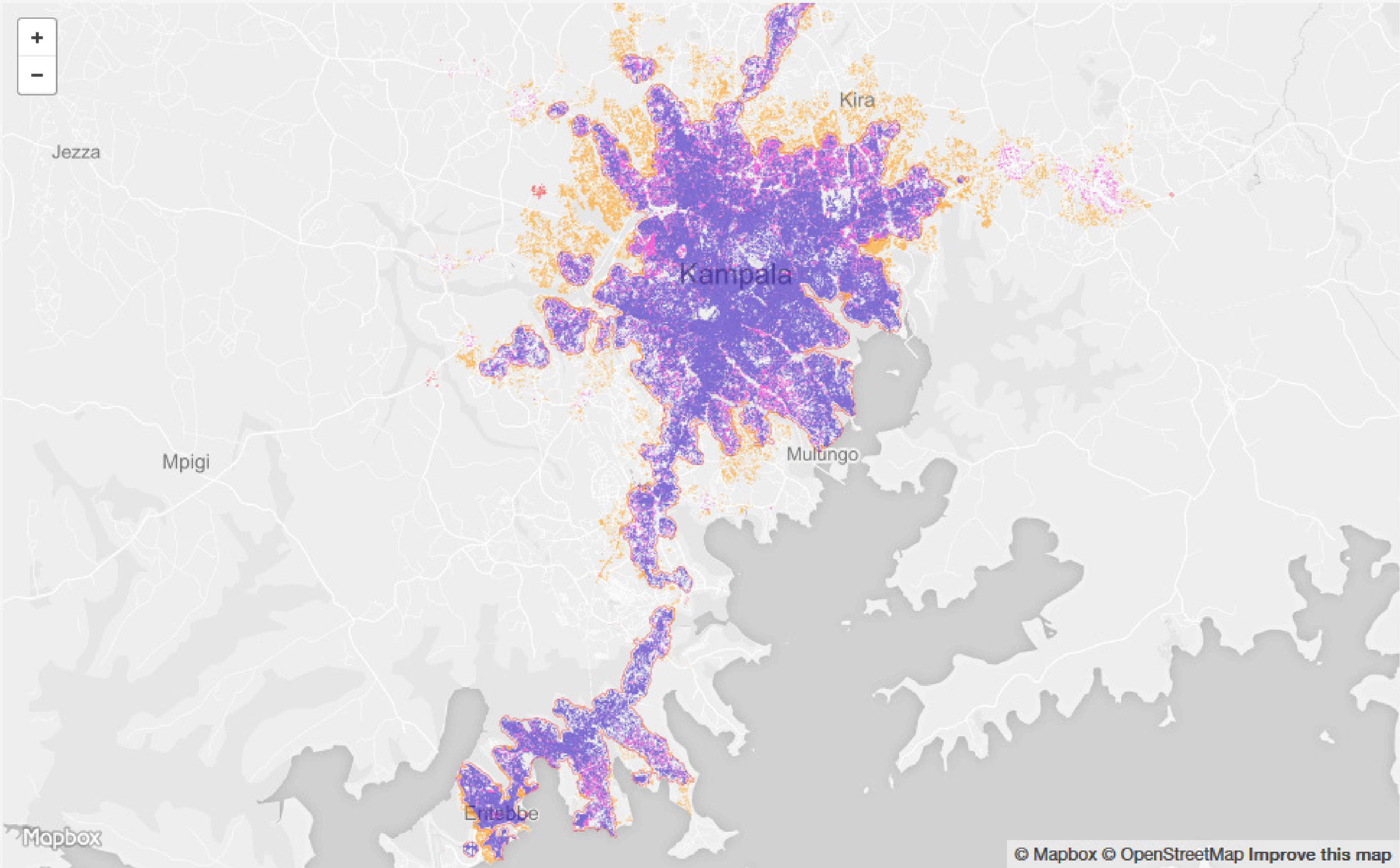
EXTENSION consists of all built-up pixels added in the new period that constitute contiguous urban clusters that are attached to the urban extent of the earlier period.

Composition of Added Area

A total of 12,090 hectares of built-up area was added to the Kampala urban extent between 2003 and 2015. Of that added built-up area, 30% was Infill, 41% was Extension, 0% was Leapfrog, and 28% was Inclusion. A total of 9,150 hectares of built-up area was added to the urban extent between 1988 and 2003. Of that added built-up area, 36% was Infill, 28% was Extension, 0% was Leapfrog, and 35% was Inclusion.

1988–2003 2003–2015

- ☒ Built-up Area
- ☒ Infill
- ☒ Extension
- ☒ Leapfrog
- ☐ Inclusion



LEAPFROG consists of all built-up pixels added in the new period that constitute new contiguous urban clusters that are not attached to the urban extent of the earlier period or to new extension clusters.

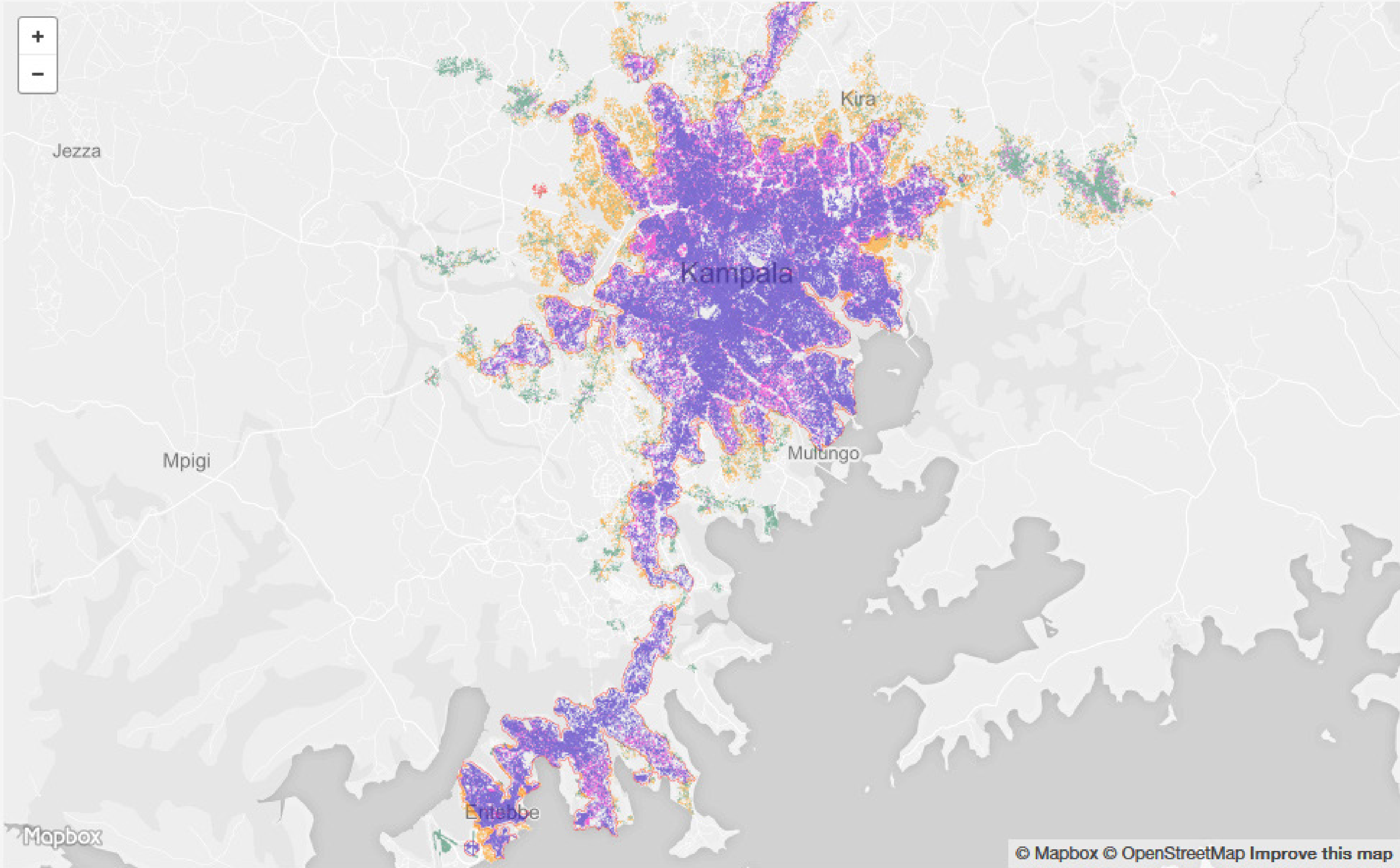
Composition of Added Area

A total of 12,090 hectares of built-up area was added to the Kampala urban extent between 2003 and 2015. Of that added built-up area, 30% was Infill, 41% was Extension, 0% was Leapfrog, and 28% was Inclusion. A total of 9,150 hectares of built-up area was added to the urban extent between 1988 and 2003. Of that added built-up area, 36% was Infill, 28% was Extension, 0% was Leapfrog, and 35% was Inclusion.

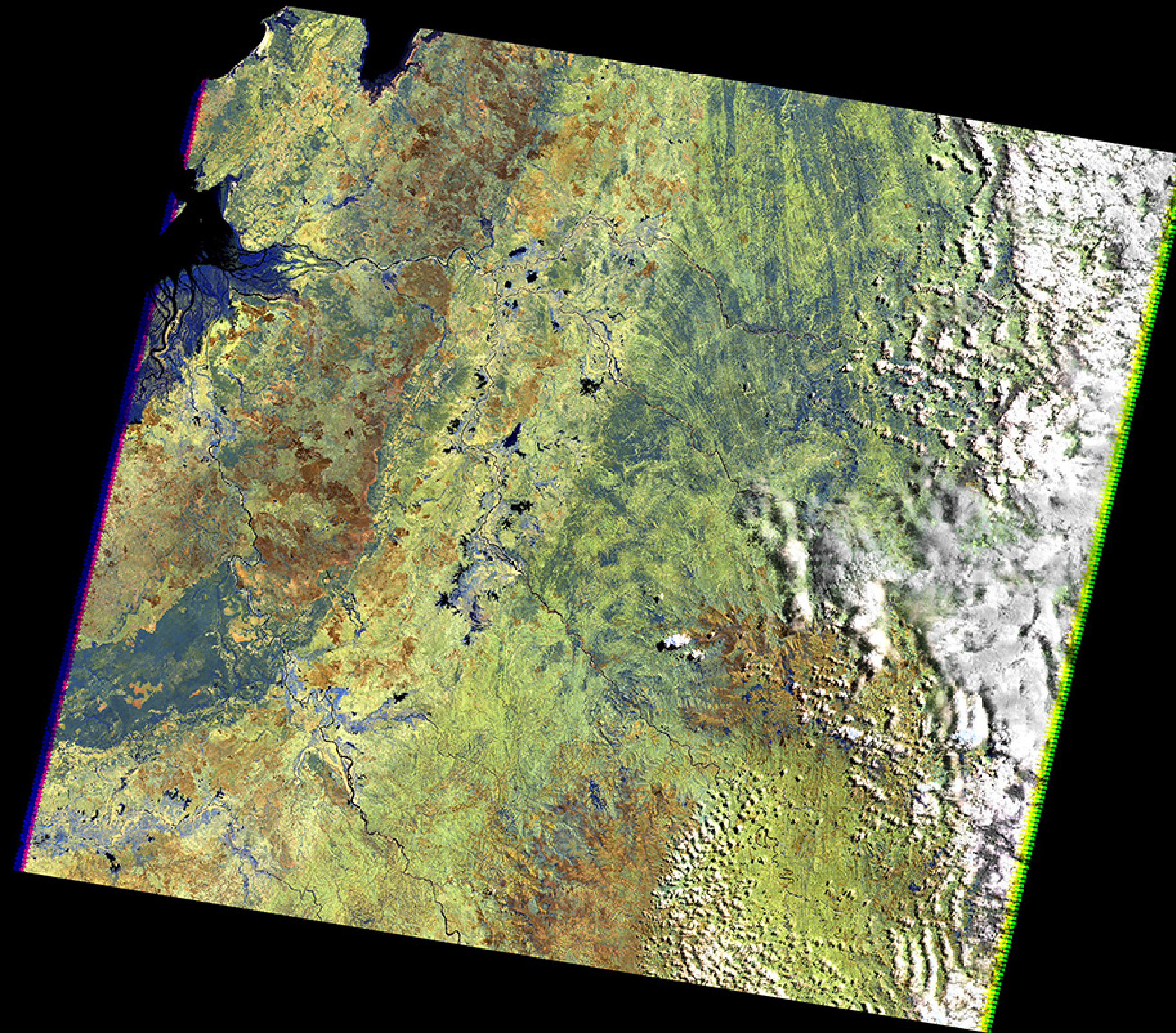
1988–2003

2003–2015

- ☒ Built-up Area
- ☒ Infill
- ☒ Extension
- ☒ Leapfrog
- ☒ Inclusion



INCLUSION consists of added area pixels that existed at the previous time period but were outside of the urban extent at the previous time period. While inclusion pixels contribute to the added area, they do not constitute new development as they already existed at the previous time period.



Landset 8
September 11, 2015

0 5 10 Miles



ATLAS OF URBAN EXPANSION DATA SOURCE
USGS - UNITED STATES GEOLOGICAL SURVEY

OPEN DATA - A SIMPLE DEFINITION

**OPEN DATA IS DATA THAT ANYONE
CAN ACCESS, USE AND SHARE.**

OPEN DATA OPPORTUNITIES

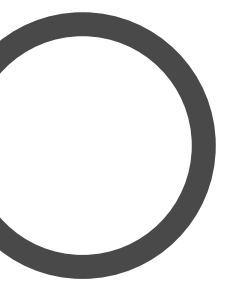
LANDSAT SEEN AS STUNNING RETURN ON PUBLIC INVESTMENT

Summary Table: Estimated Productivity Savings from Uses of Landsat

Landsat Application	Estimated Annual Efficiency Savings
1. USDA Risk Management Agency	over \$100 million
2. U.S. Government Mapping	over \$100 million
3. Monitoring Consumptive Agricultural Water Use	\$20 – \$80 million
4. Monitoring Global Security	\$70 million
5. Landsat Support for Fire Management	\$28 – \$30 million
6. Forest Fragmentation Detection	over \$5 million
7. Forest Change Detection	over \$5 million
8. World Agriculture Supply and Demand Estimates	over \$3 – \$5 million
9. Vineyard Management and Water Conservation	\$3-5 million/year
10. Flood Mitigation Mapping	over \$4.5 million
11. National Agricultural Commodities Mapping	\$1.9 million/year
12. Waterfowl Habitat Mapping and Monitoring	\$1.9 million/year
13. Coastal Change Analysis Program	\$1.5 million
14. Forest Health Monitoring	\$1.9 million/year
15. NGA Global Shoreline	over \$90 million (one time)
16. Wildfire Risk Assessment	\$25-50 million (one time)

Research from **Lateral Economics** showed that open data creates 0.5% more GDP compared to paid data.

In 2013, **McKinsey** estimated a global market powered by open data from all sectors would create an additional \$3tn to \$5tn a year.



MAP AS A TOOL TO FORECASTING INNOVATION

BUT,
THE MOST ADVANCED RESEARCH USE NON-OPEN DATA SOURCES
(1)

WEST AFRICA EBOLA OUTBREAK GUINEA CASE STUDY

telcom data
\$ 3Million per WEEK

BUT,
THE MOST ADVANCED RESEARCH USE NON-OPEN DATA SOURCES
(2)

WORLDVIEW3 DIGITAL GLOBE IMAGERY

4band	17,50\$/sqkm
8band	19,00\$/sqkm

28500 \$ Mexico City (per day)

BUT,
THE MOST ADVANCED RESEARCH USE NON-OPEN DATA AND NON-OPEN SOURCE
SOFTWARE
(3)

GOOGLE API GEOCODING * SERVICE

10000\$ per years
STANDARD LICENSE

* transform addresses into coordinates

WHAT CAN OPEN DATA DO FOR YOU ?

METROPOLITAN CARTOGRAPHY

METROPOLITAN COMPLEXITY BUT, WHAT IS A SYSTEM?

A system is an interconnected set of elements that is coherently organized in a way that achieves something.

ELEMENTS, INTERCONNECTIONS, FUNCTION/PURPOSE

Donella Meadows, Thinking in System

THE BLIND MEN AND THE MATTER OF THE ELEFANT (a Sufi story)

Beyond Ghor, there was a city. All its inhabitants were blind. A king with his entourage arrived nearby; he brought his army and camped in the desert. He had a mighty elephant.

The populace became anxious to see the elephant.

As they did not even know the form or shape of the elephant, they groped sightlessly, gathering information by touching some part of it.

Each thought that he knew something, because he could feel a part ...

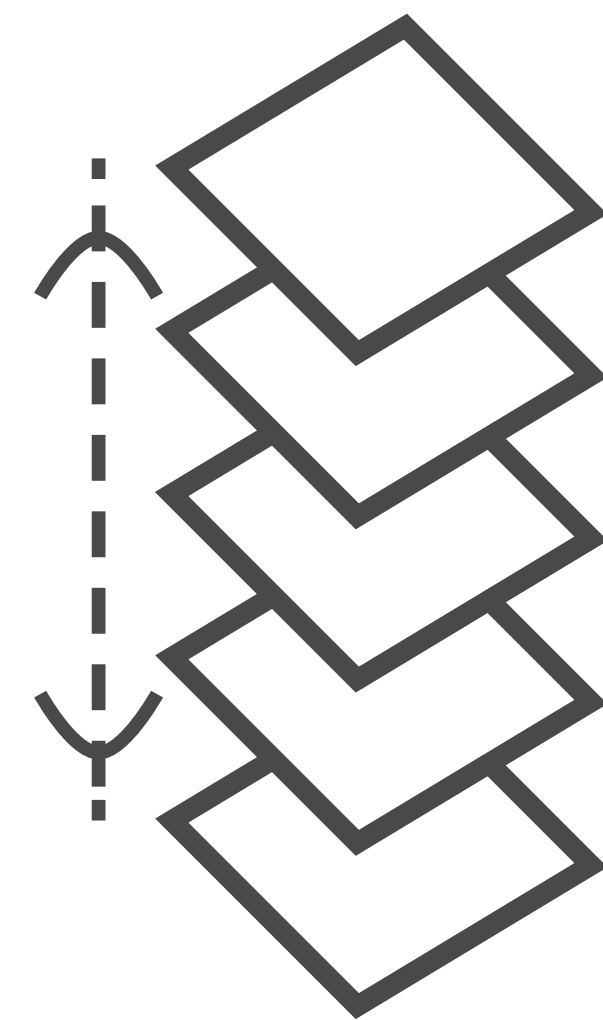
The man whose hand had reached an ear ... said : “ It’s a large, rough thing, wide and broad, like a rug. ”

And the one who had felt the trunk said : “ I have the real fact about it. It is like a straight and hollow pipe, awful and destructive. ”

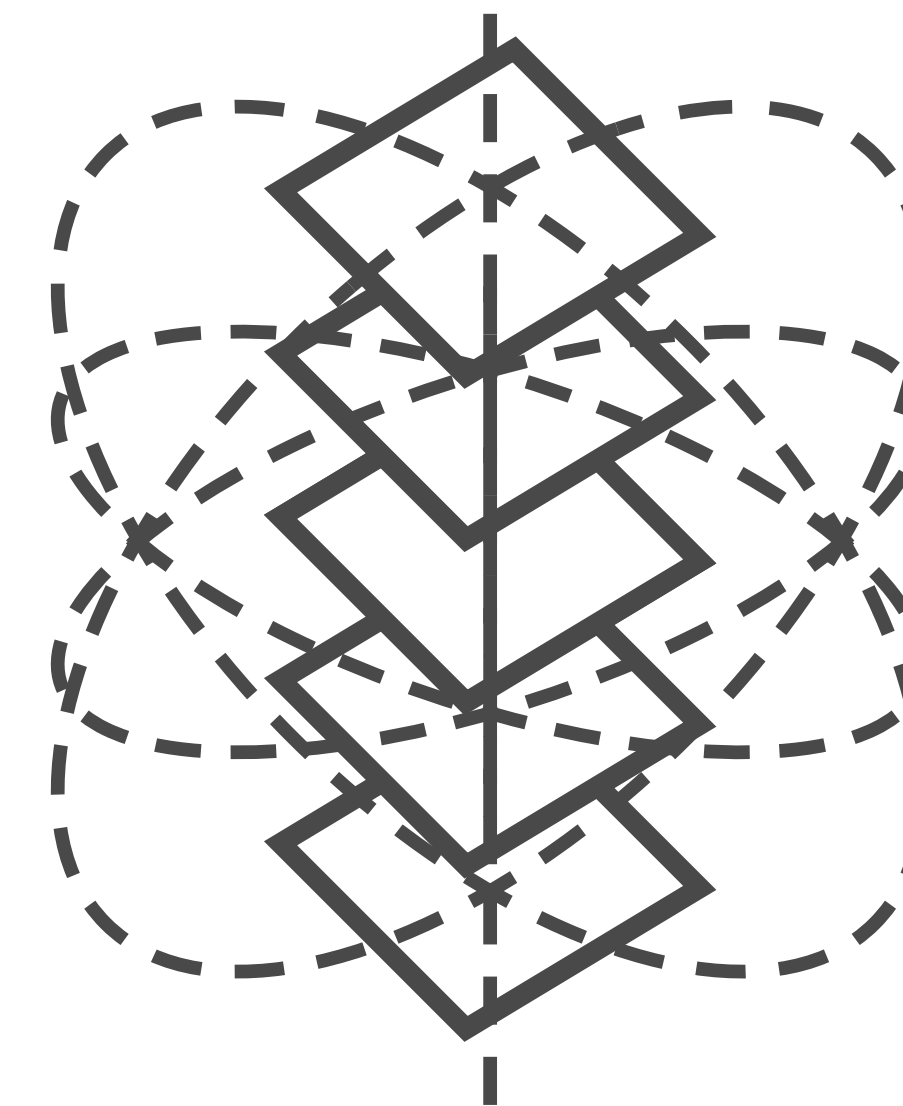
The one who had felt its feet and legs said : “ It is mighty and firm, like a pillar. ”

Each had felt one part out of many. Each had perceived it wrongly ...

THE BEHAVIOR OF A SYSTEM
CANNOT BE KNOWN JUST BY
KNOWING THE ELEMENTS OF
WHICH THE SYSTEM IS MADE.



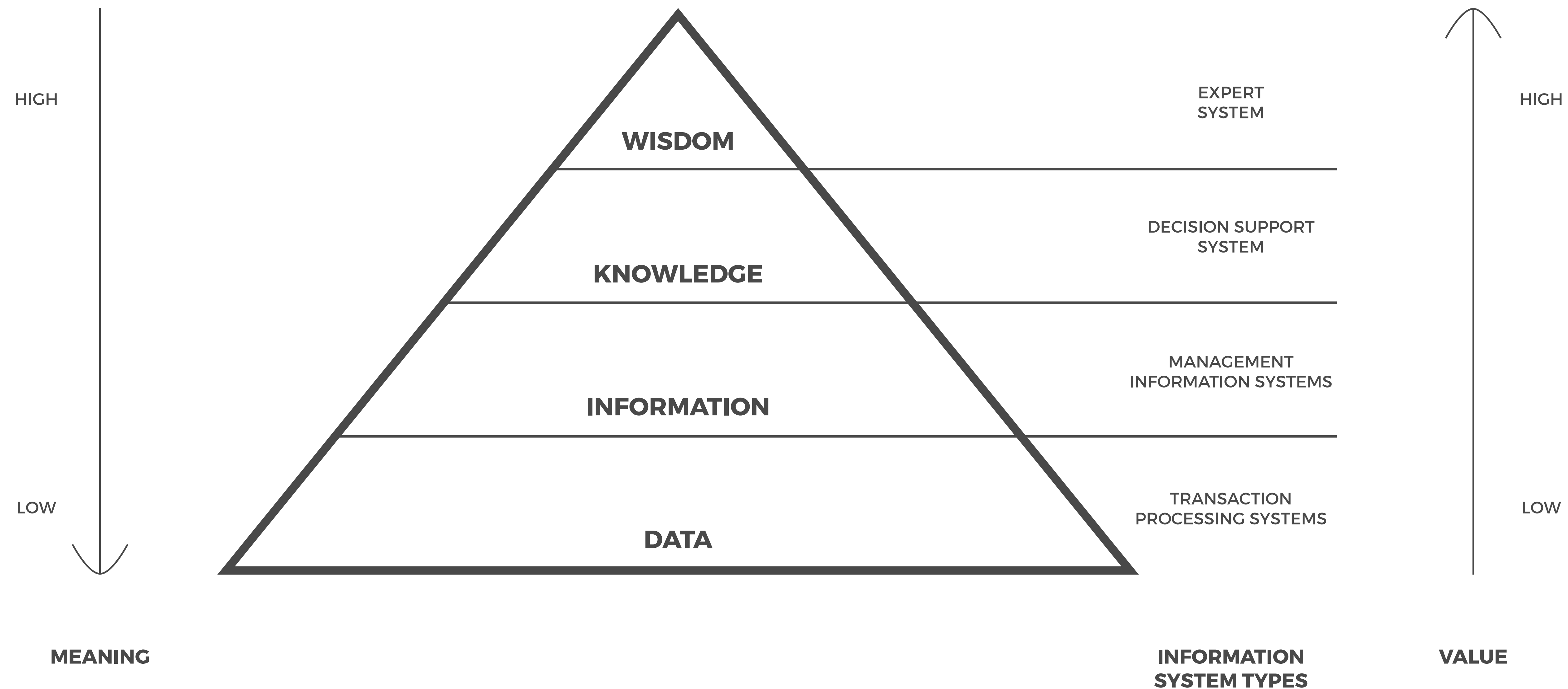
SYSTEM
REPRESENTATION



SYSTEM
BEHAVIOR

ELEMENTS,
INTERCONNECTIONS,
FUNCTION/PURPOSE

DATA-INFORMATION-KNOWLEDGE-WISDOM
(DIKW) HIERARCHY



REF
D. Chaffey and S. Wood, Business Information Management: Improving Performance Using Information Systems (FT Prentice Hall, Harlow, 2005). Jennifer Rowley, The Wisdom Hierarchy: Representations of the DIKW Hierarchy (Journal of Information Science 33, 2007)

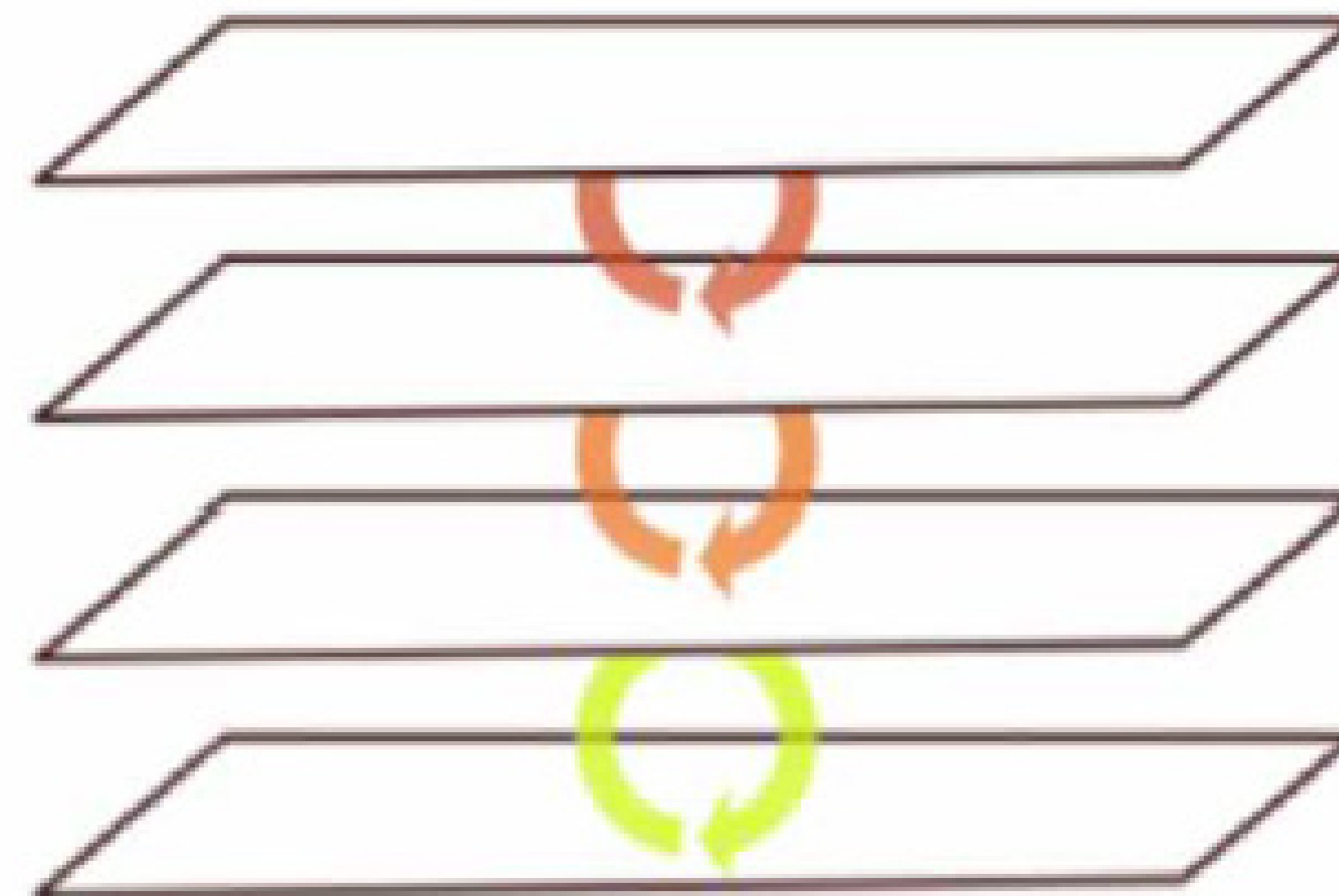
From “Big Data” to “Big Indicators” to “Big Instruments”

Instrument

Indicator

Insight

Information



MORE VALUE
Less Info



More Info
LESS VALUE

REF

Andrew Zolli, AFTER BIG DATA: THE COMING AGE OF “BIG INDICATORS”, STANFORD SOCIAL INNOVATION REVIEW, 22 Jan 2018