Harnessing the power of big data & frontier technologies for climate action

13 CLIMATE ACTION

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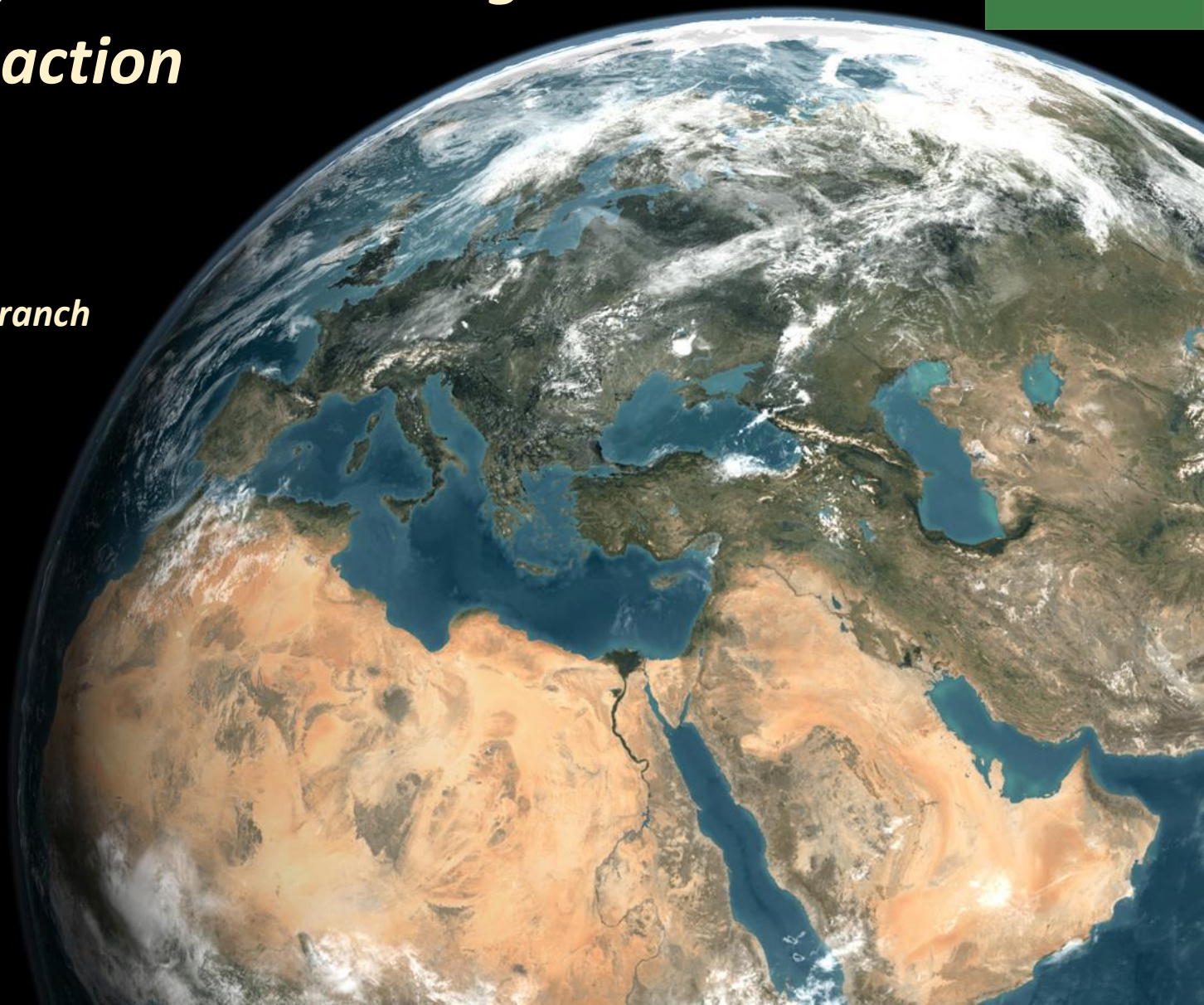
UN Environment

UN environment

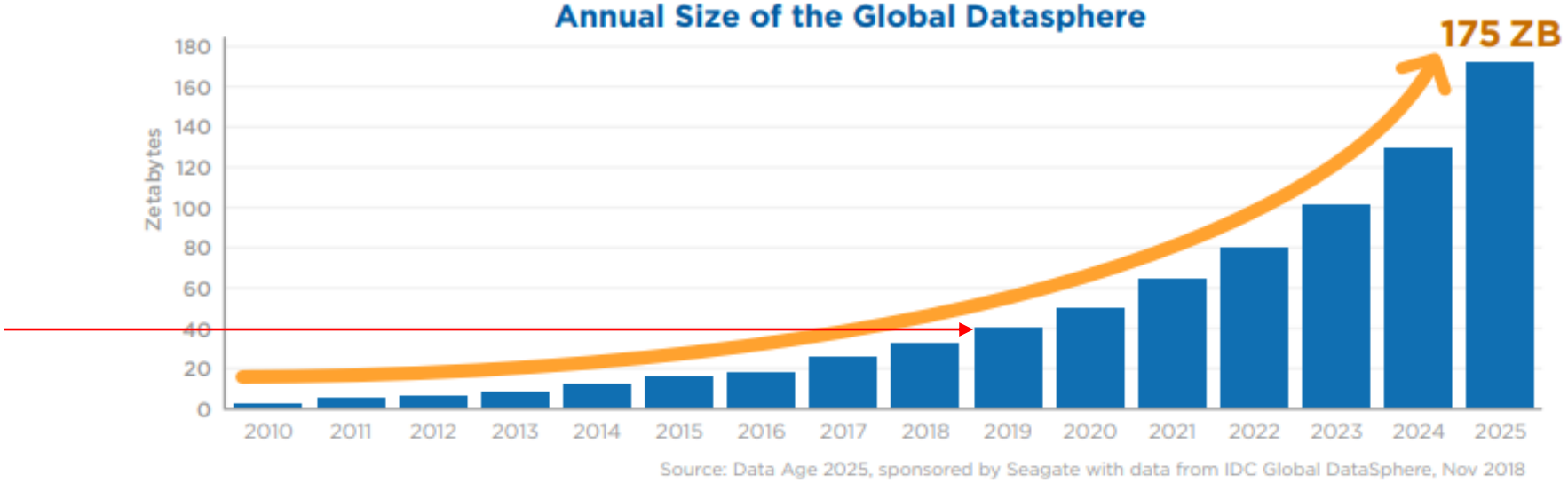
SCIENCE POLICY BUSINESS FORUM



This conversation isn't only about big data

"**Big data**": extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.

Figure 1 – Annual Size of the Global Datasphere



1 zettabyte = 1 billion terabytes

175 zettabytes in DVDs would circle the earth 222 times or 23 times to the moon

Digital and big data are the new normal

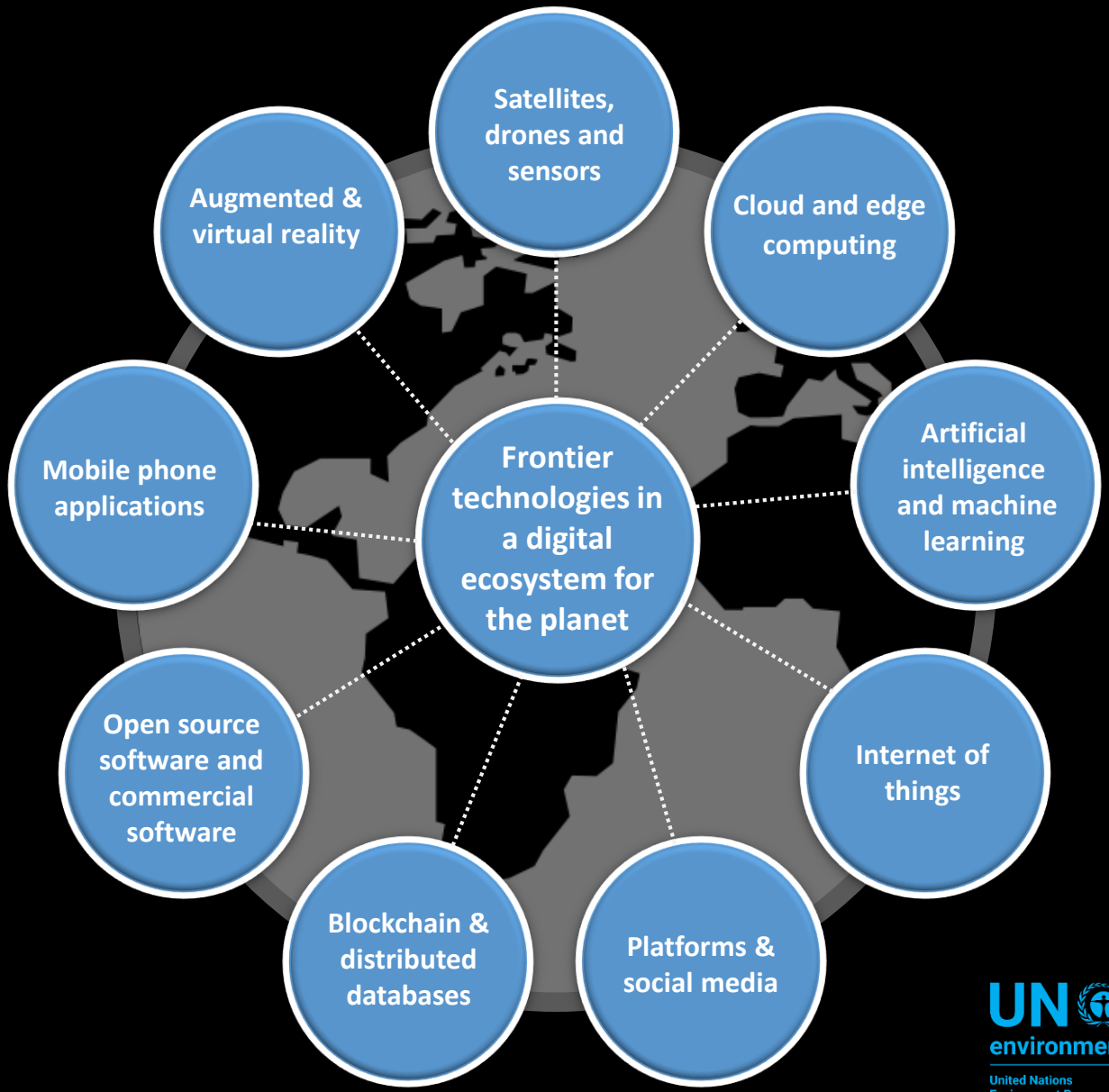
HOW LONG DOES IT TAKE HUMANITY TODAY?

Minutes? Hours? Days? Months? Years

Internet Protocol version 4:
4,294,967,296 IP addresses
Exhausted in 2011

Internet Protocol version 6:
340,282,366,920,938,463,463,374,607,431,768,211,456 IP
A unique IP address for every cell in the human body

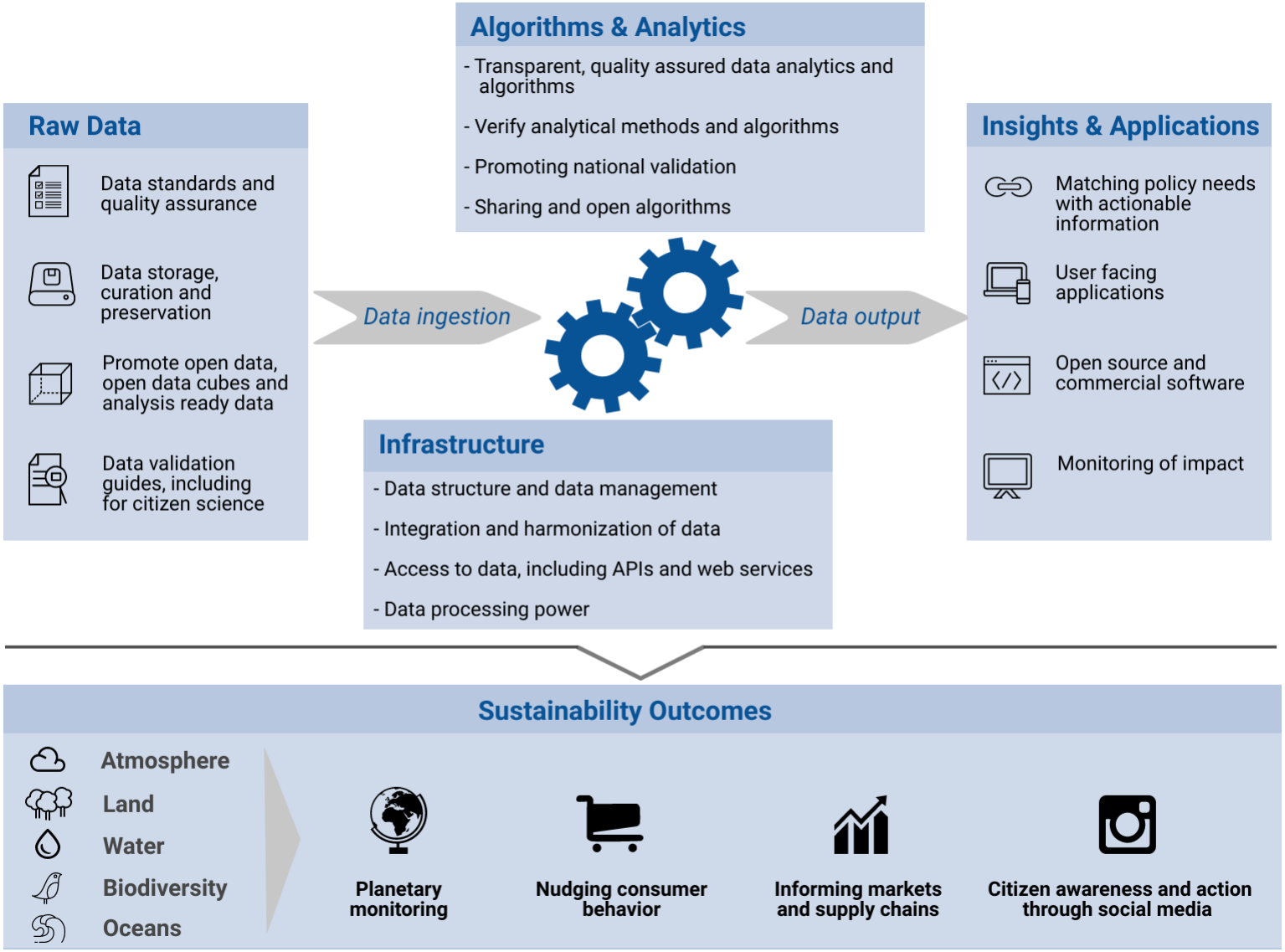
It is about the **convergence** of nine technology trends that can transform the way we monitor our planet and act on climate change



Source:
The promise and peril of a digital ecosystem for the planet (UNEP, 2019)

UN environment
United Nations Environment Programme

It is about **collaboration** between public and private sector actors to generate digital public goods about the environment and climate – **a digital ecosystem for the planet**

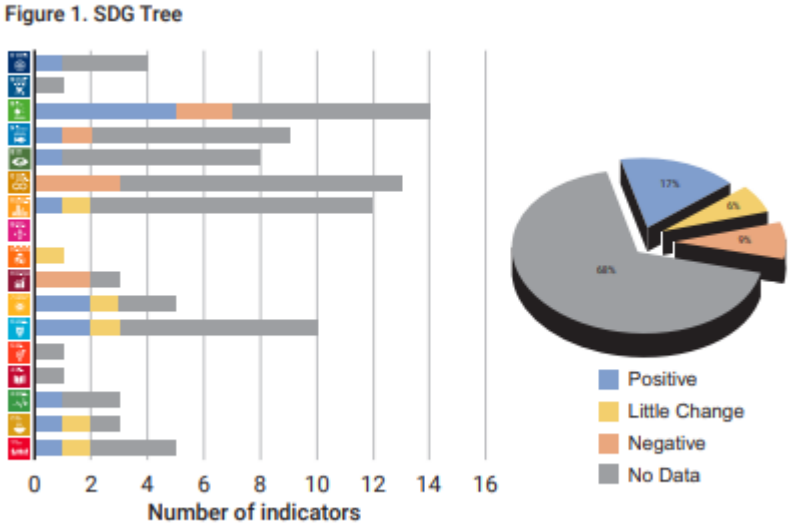


Source:
The promise and peril of a digital ecosystem for the planet (UNEP, 2019)

It is about **closing the gap** between data, decision-making and accountability

"*Our world is bursting with information, yet we have a lack of data where we need it most: in and about the poorest and most marginalized communities*" UN Deputy Secretary-General Jan Eliasson

"…and for environmental and climate issues. 68% of the 93 environmental indicators for the SDGs have no global data"



Without high-quality data providing the right information on the right things at the right time; designing, monitoring and evaluating effective policies becomes almost impossible.

Indeed, data will be the lifeblood of decision-making and the raw material for accountability

It is about **co-creating a new governance model** for the digital age that leverages technology to monitor and achieve the SDGs

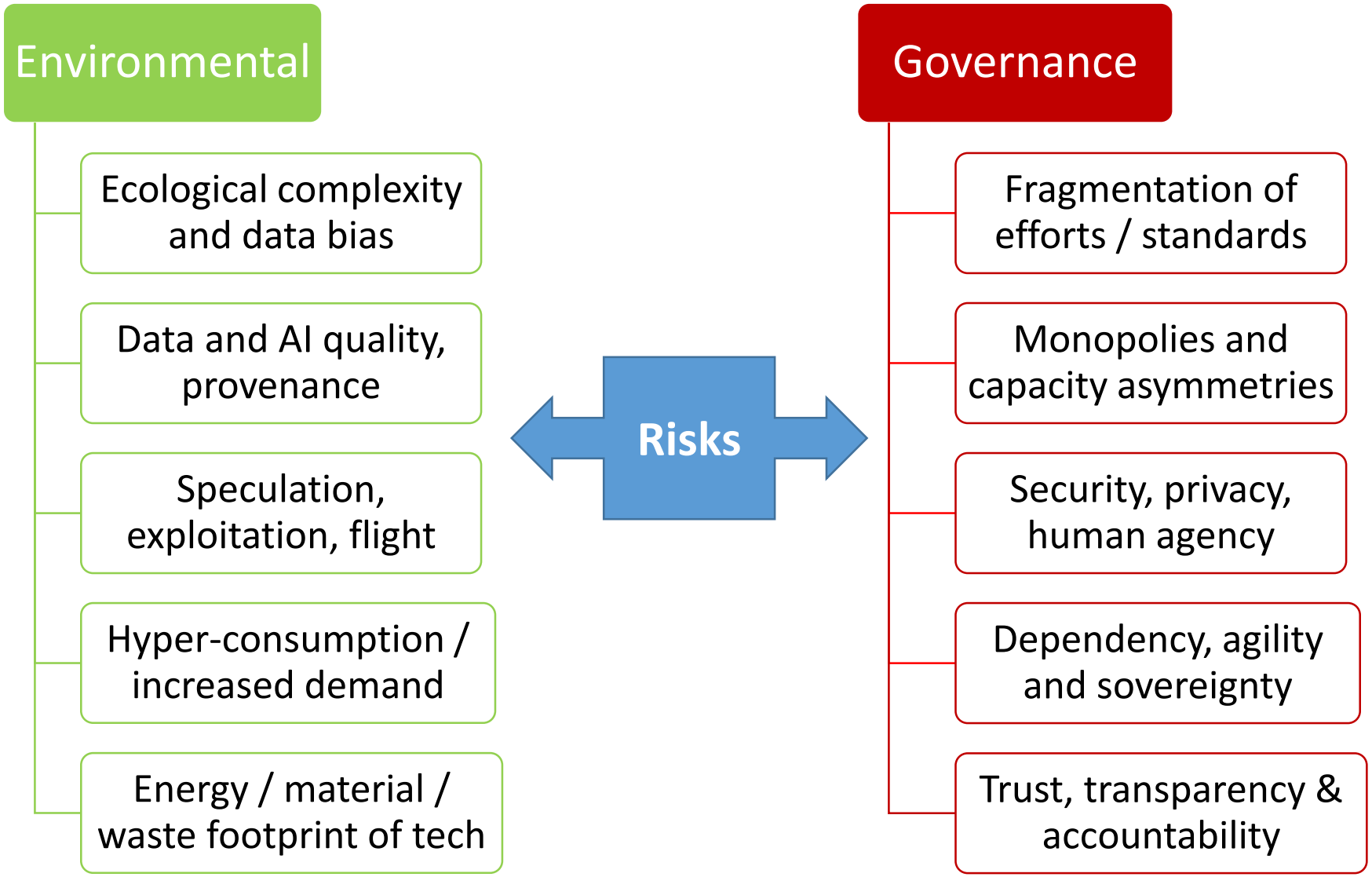
"Growing opportunities created by the application of digital technologies are paralleled by stark abuses and unintended consequences. Digital dividends co-exist with digital divides. And, as technological change has accelerated, the mechanisms for cooperation and governance of this landscape have failed to keep pace."

1B: We recommend that a broad, multi-stakeholder alliance, involving the UN, create a platform for sharing digital public goods, engaging talent and pooling data sets, in a manner that respects privacy, in areas related to attaining the SDGs.

What's at stake for people and planet from digital technology?

1. **Speed of decision making:** More rapid impact monitoring and decision-making based on data.
2. **Improved spatial approach and resolution:** A planetary dashboard is now in reach combined with high resolution spatial data.
3. **Algorithms and visualizations for assessing and optimizing multiple values:** SDGs are about achieving multiple goals – not a single side of the Rubik's cube.
4. **Environmental transparency and accountability:** can only manage what can be measured. Shift to data-driven decision making.
5. **Collaboration and engagement of companies and markets:** integrate risk information & business models that turn problem into opportunit
6. **Citizen participation:** data generation, co-designing solutions, impact monitoring, informing consumer choice, collective action at scale.

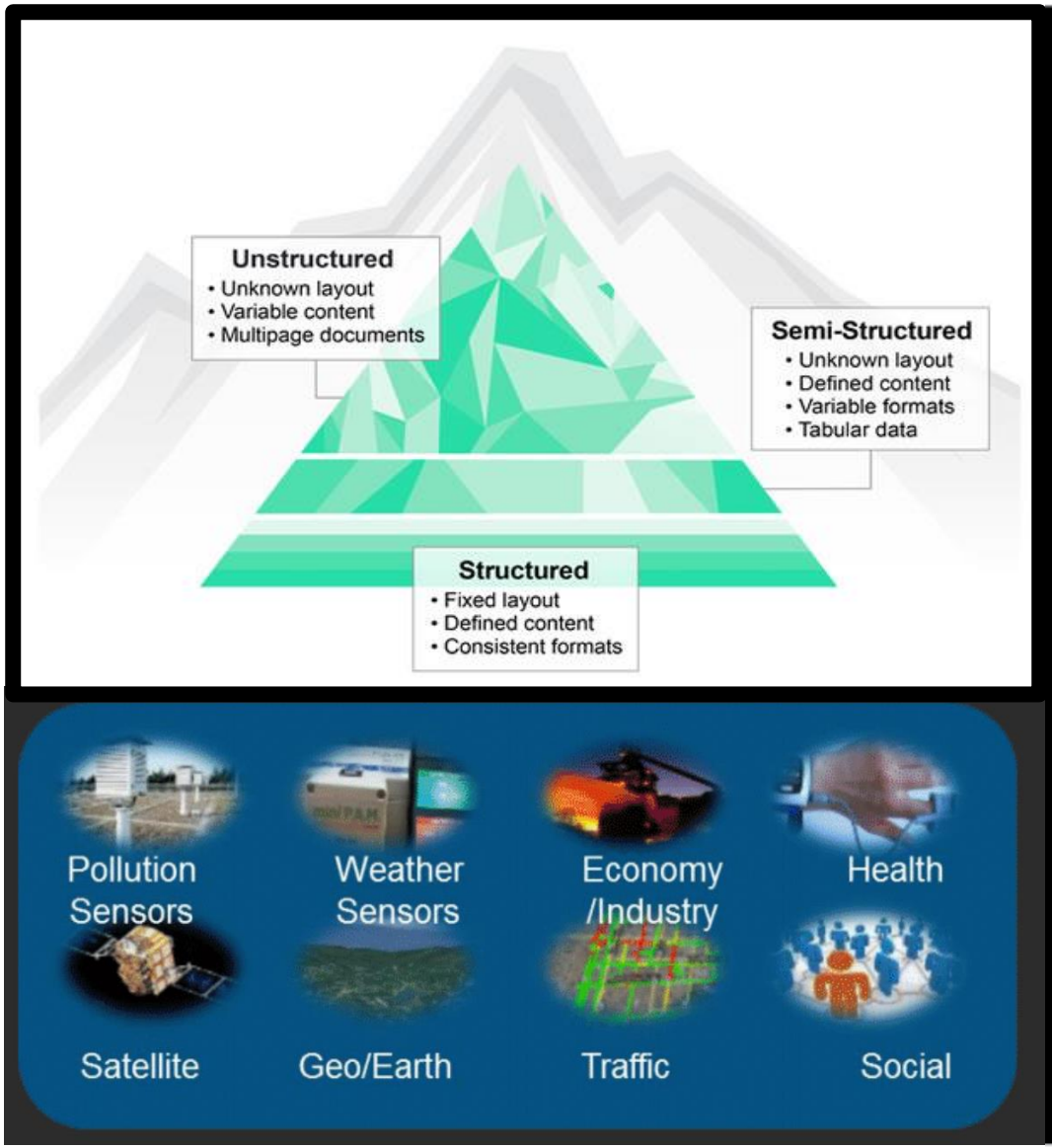
What are the core risks and governance challenges?



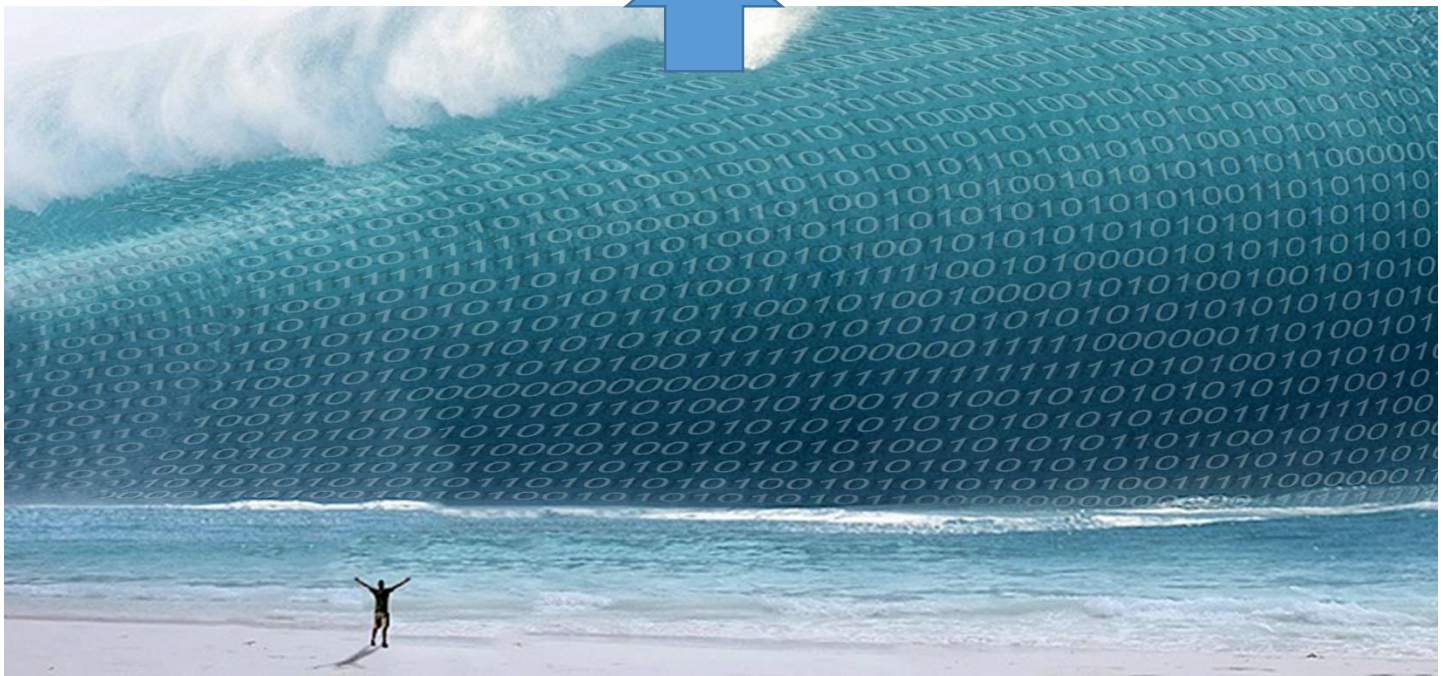
We are at a pivotal moment in environmental history where the way in which we deploy these technologies can fundamentally change our trajectory and underpin a sustainable future.

The future is what we make it.

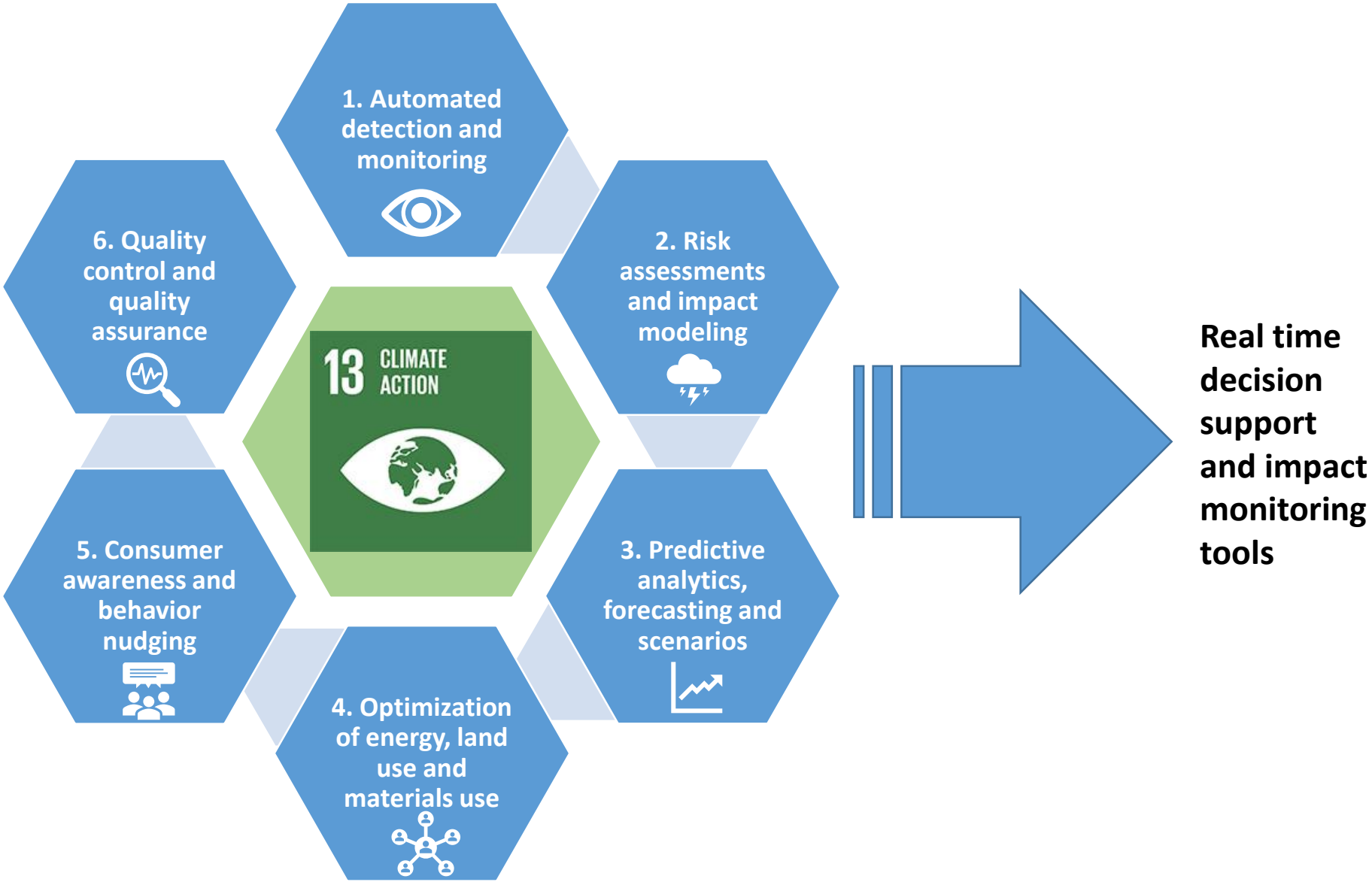
Climate change and ecological measurement is the ultimate big data challenge



How can we transform the tsunami of big data into user friendly insights that can power decision-making and accountability ?

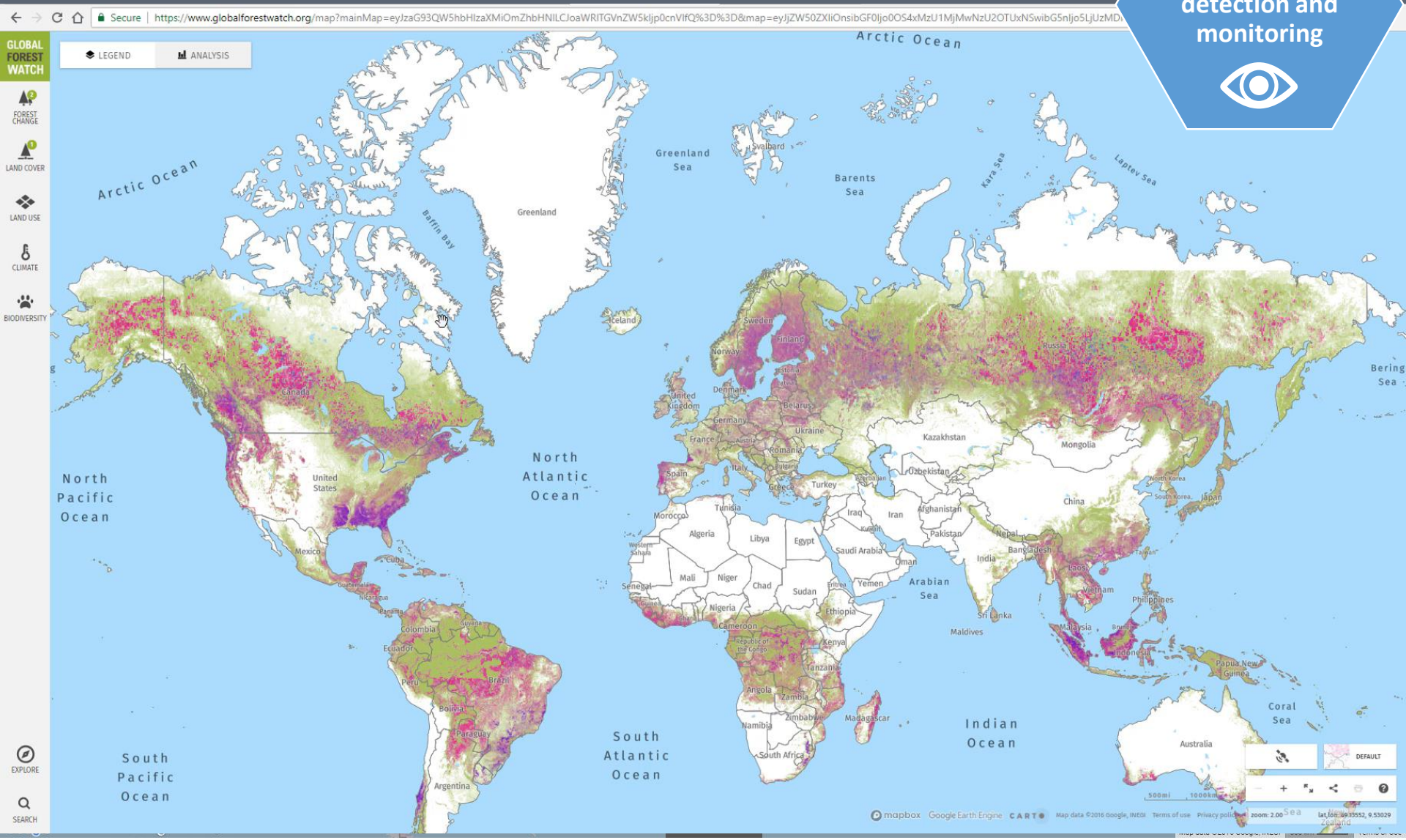


UNEP is exploring six main categories of ICT for climate action



Global forest cover

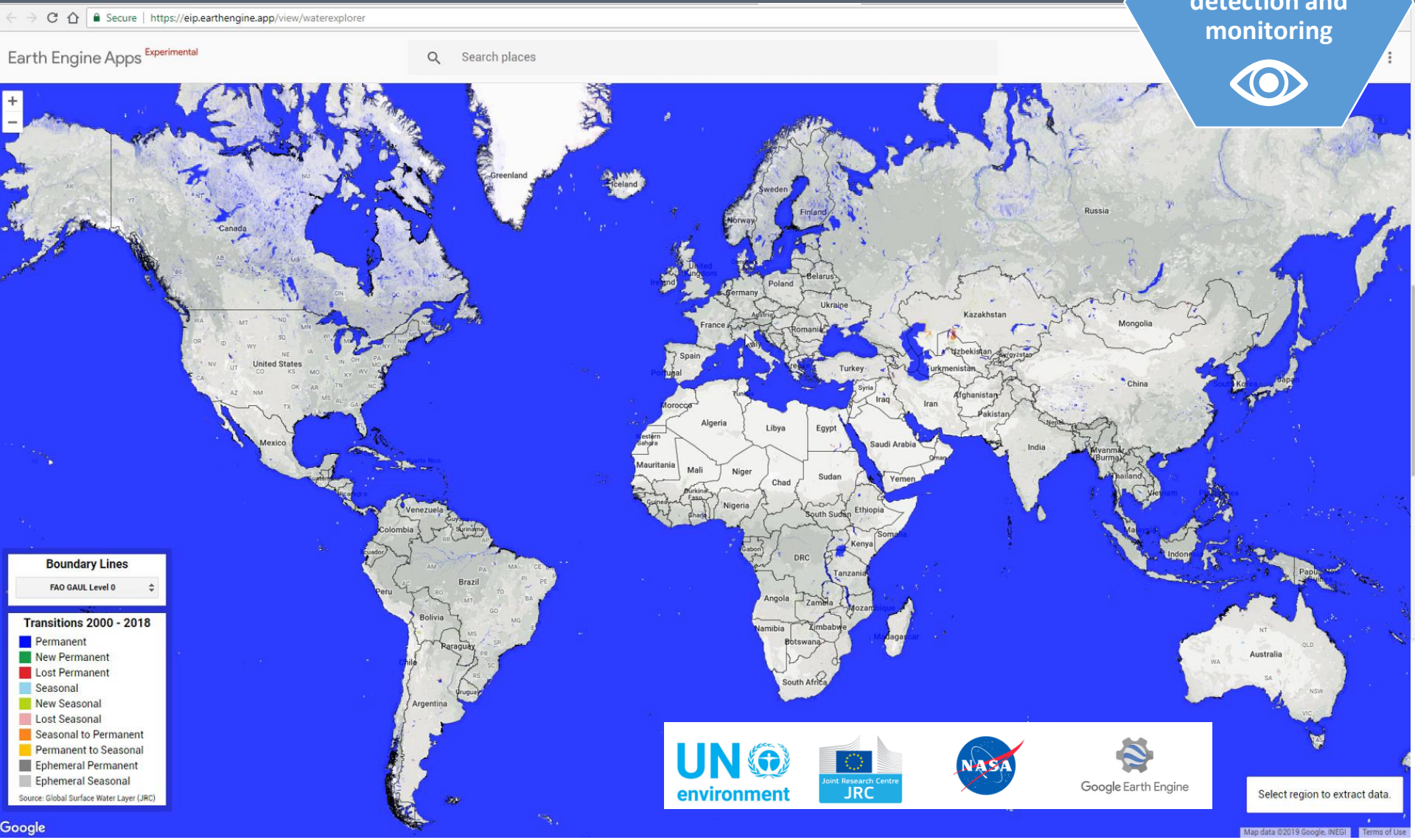
1. Automated detection and monitoring



https://www.globalforestwatch.org/

Global surface water explorer

1. Automated detection and monitoring



https://www.sdg661.app/

Global surface water explorer

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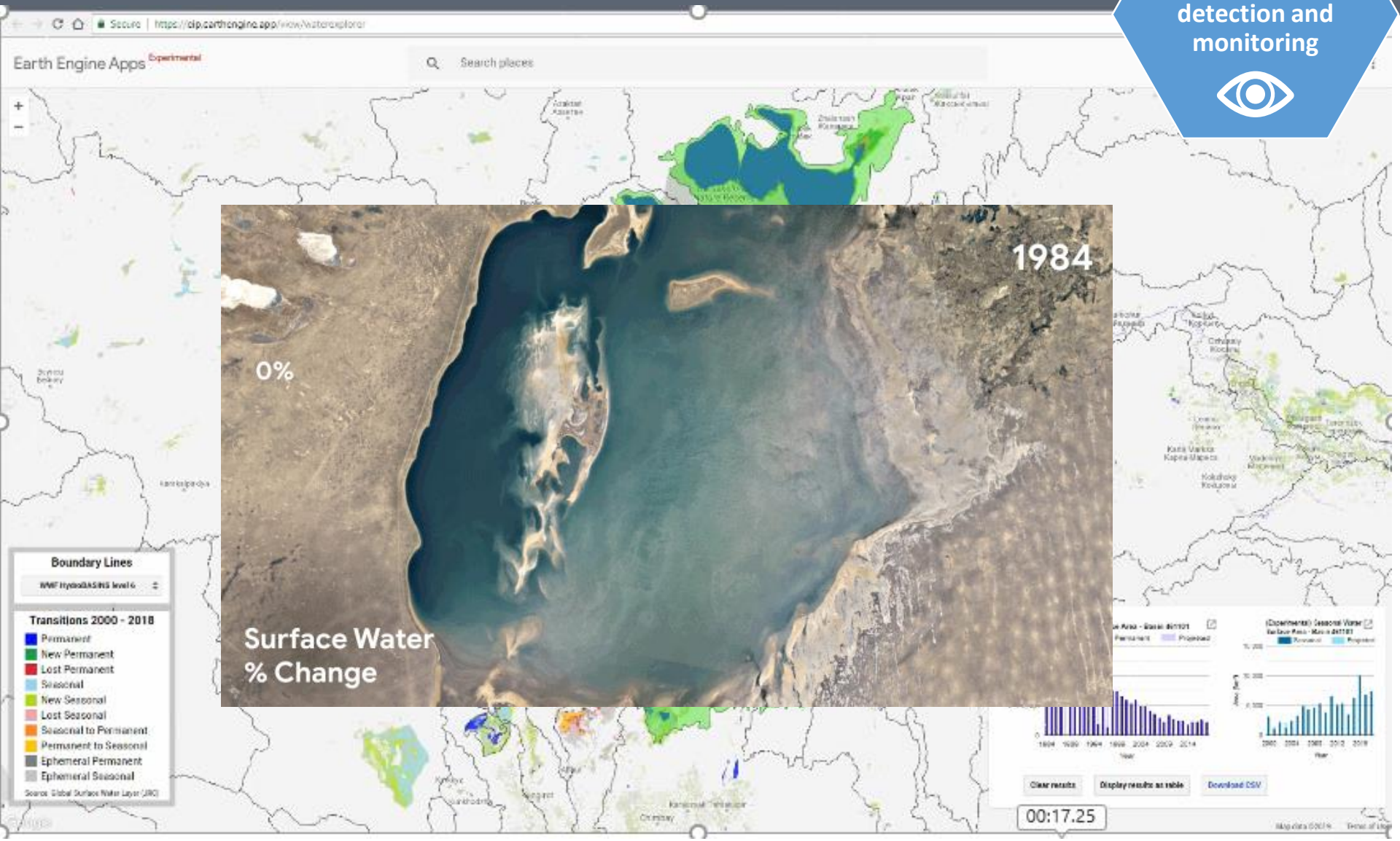


Can we integrate commercial high-resolution imagery and climate models to assess risks ?

2. Risk assessments and impact modeling

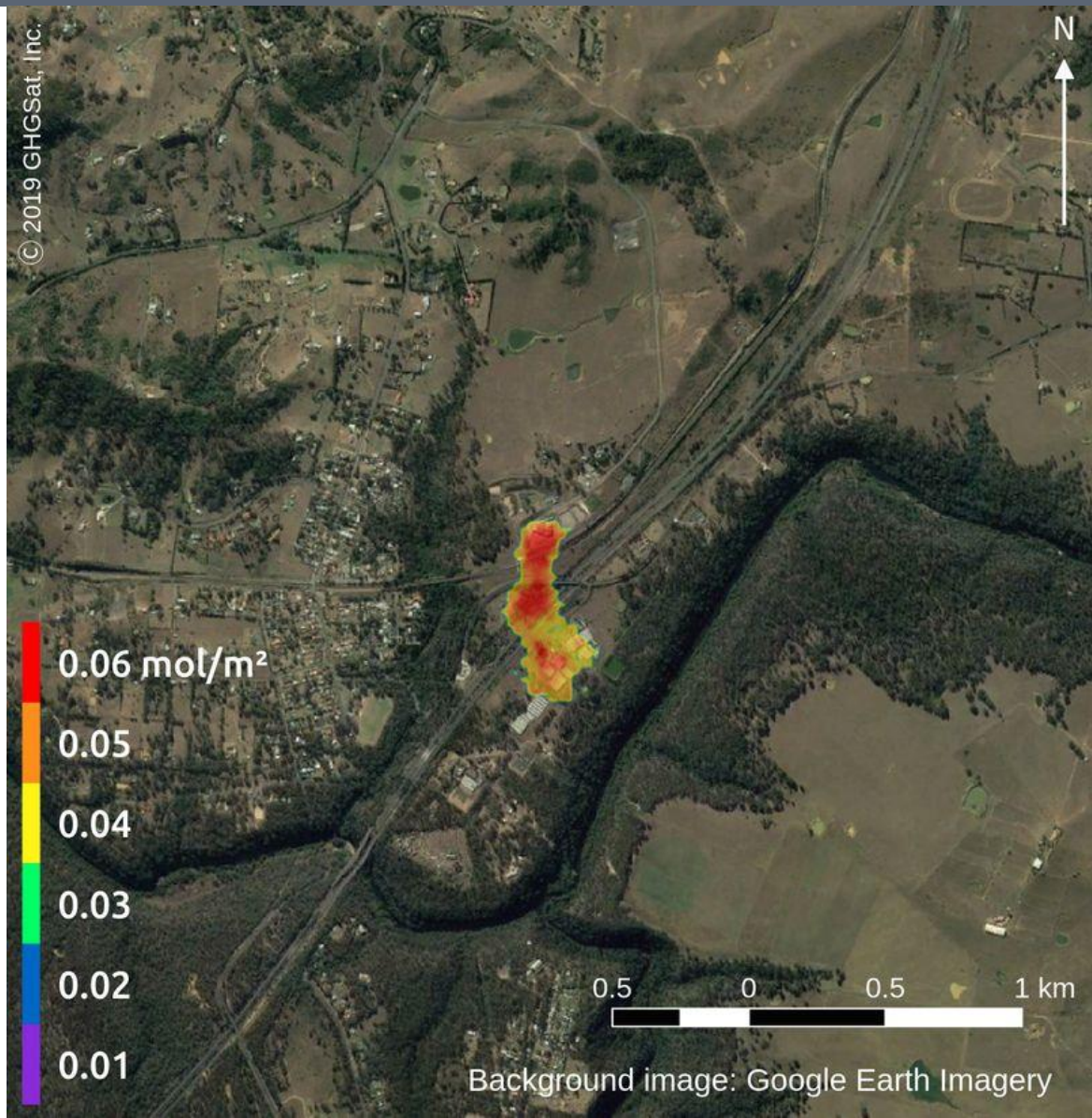
New range of satellites and sensors are game changing

Satellites for Climate Action:

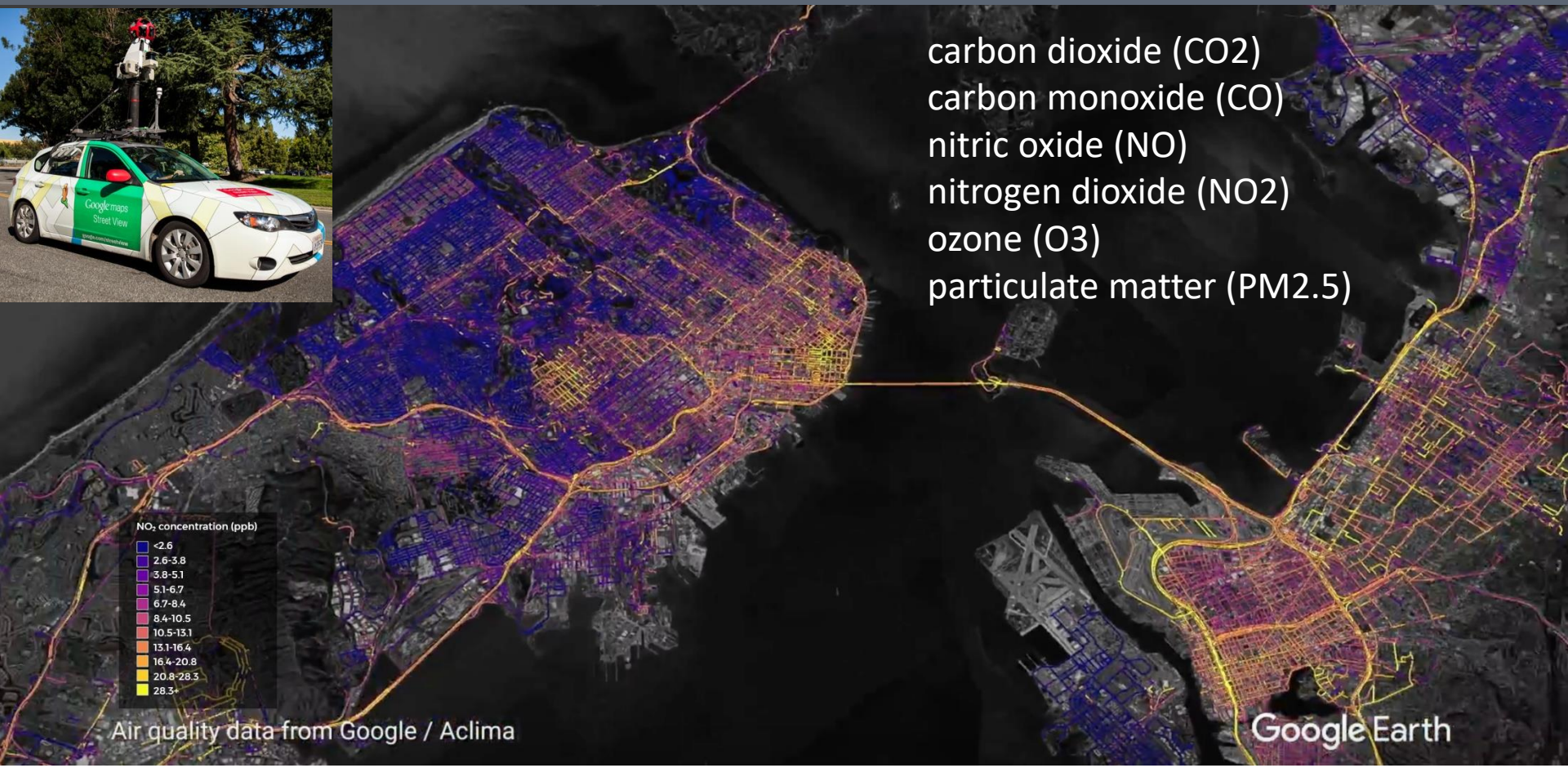
New initiative that will use satellite data to inform and accelerate climate protection. Collaboration by UN, Planet Labs, California Governor and Michael Bloomberg.

ESA to launch in 2025:

3 sentinel 7s for Carbon Dioxide –
3 day repeat period
Critical tool for the 2028 Paris review

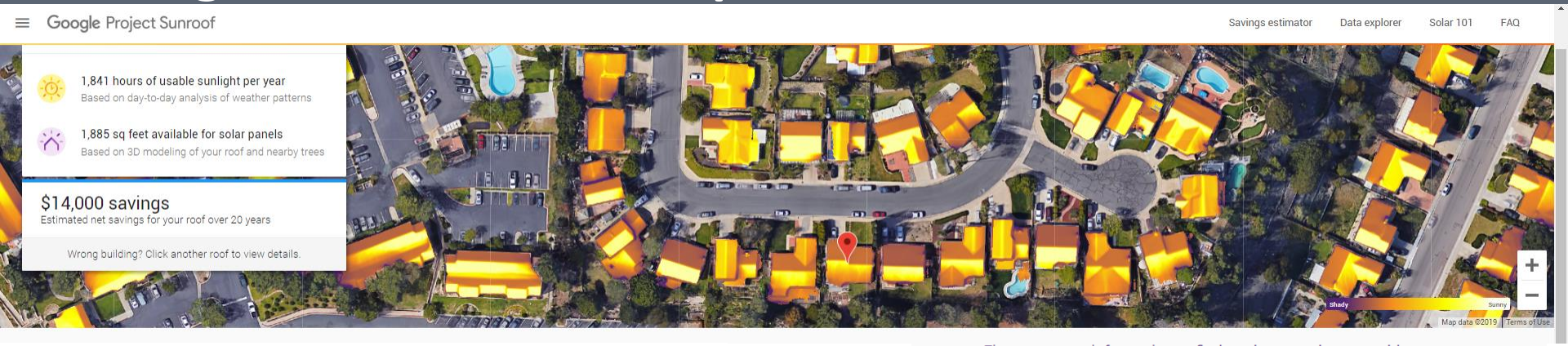


Private sector partnerships generating hyperlocal high-quality emissions data



Google and environmental sensor company Aclima have announced plans to scale and integrate Aclima's mobile sensing platform into Google's global fleet of Street View vehicles. This would allow hyper local mapping of emissions.

Google is integrating big data sets and using machine learning to assess the solar potential of homes



How Project Sunroof Works

Your own personalized solar savings estimator, powered by Google Earth imagery.

1
Search for your home

We use Google Earth imagery to analyze your roof shape and local weather patterns to create a personalized solar plan.

2
Personalize your solar analysis

Adjust your electric bill to fine-tune your savings estimate and the recommended number of solar panels for your home.

3
Compare finance options

Compare loan, lease, and purchase options for your solar panels based on your results.

Fine-tune your information to find out how much you could save.

YOUR AVERAGE MONTHLY ELECTRIC BILL

We use your bill to estimate how much electricity you use based on typical utility rates in your area.

$90

YOUR RECOMMENDED SOLAR INSTALLATION SIZE

This size will cover about 98% of your electricity usage. Solar installations are sized in kilowatts (kW).

2.8 kW
(194 ft²)

YOUR POTENTIAL ENVIRONMENTAL IMPACT

Estimated annual environmental impact of the recommended solar installation size.

Carbon dioxide	=	Passenger cars	=	Tree seedlings
2.1 metric tons		0.5 taken off the road for 1 yr		54.8 grown for 10 yrs

SEE TOTAL SOLAR POTENTIAL FOR THIS ZIP CODE

LEARN HOW TO FINANCE YOUR SOLAR PANELS

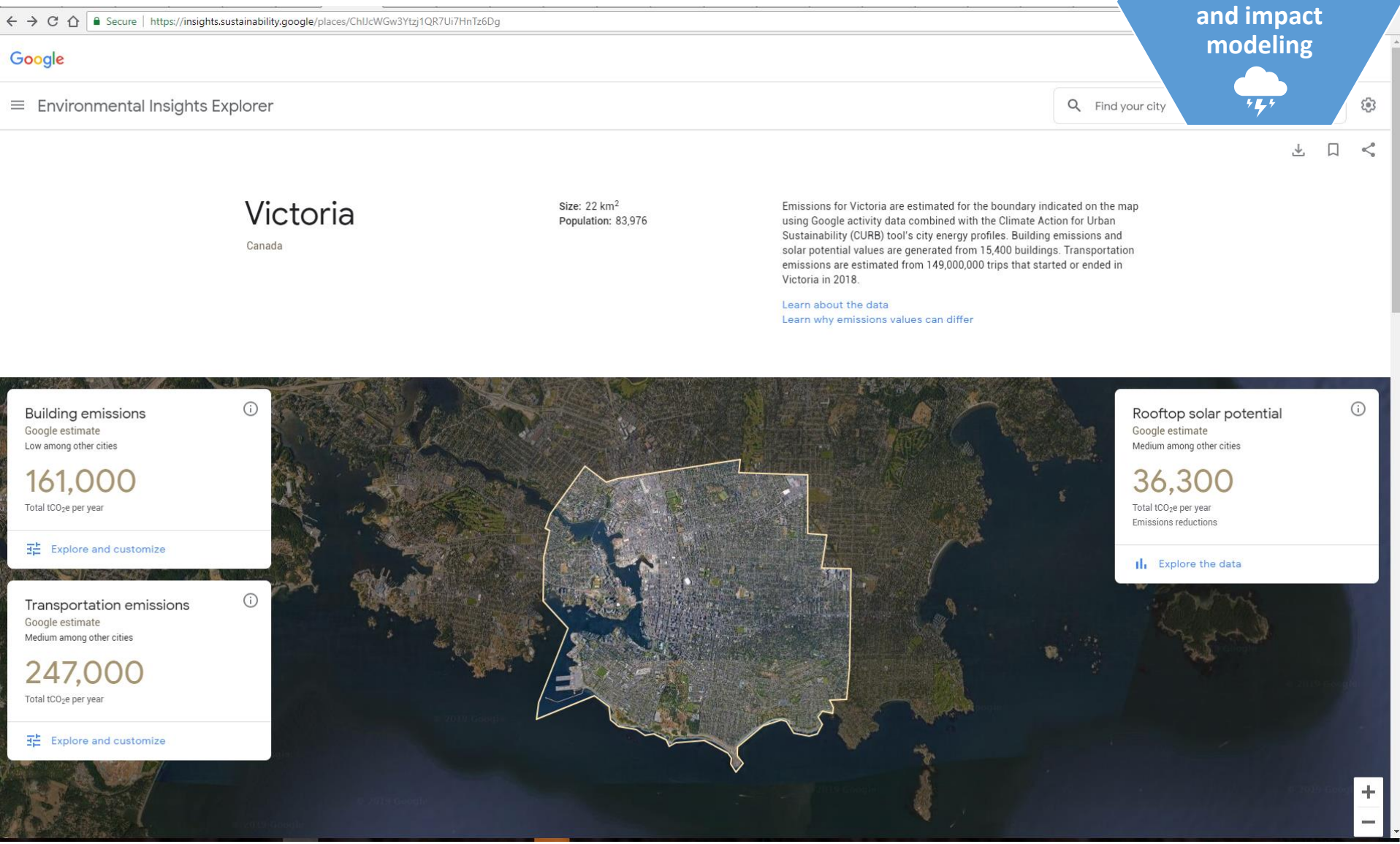
BUY | LEASE / PPA | LOAN

Pay up front, largest lifetime savings. You pay the full cost up front and own the solar system without any additional payments over time. As the outright owner, you may claim any local, state, or federal incentives.

$10,000	$24,000	$14,000
UPFRONT COST AFTER INCENTIVES	20-YEAR BENEFITS	TOTAL 20-YEAR SAVINGS

These analysis can be scaled to the size of cities

2. Risk assessments and impact modeling



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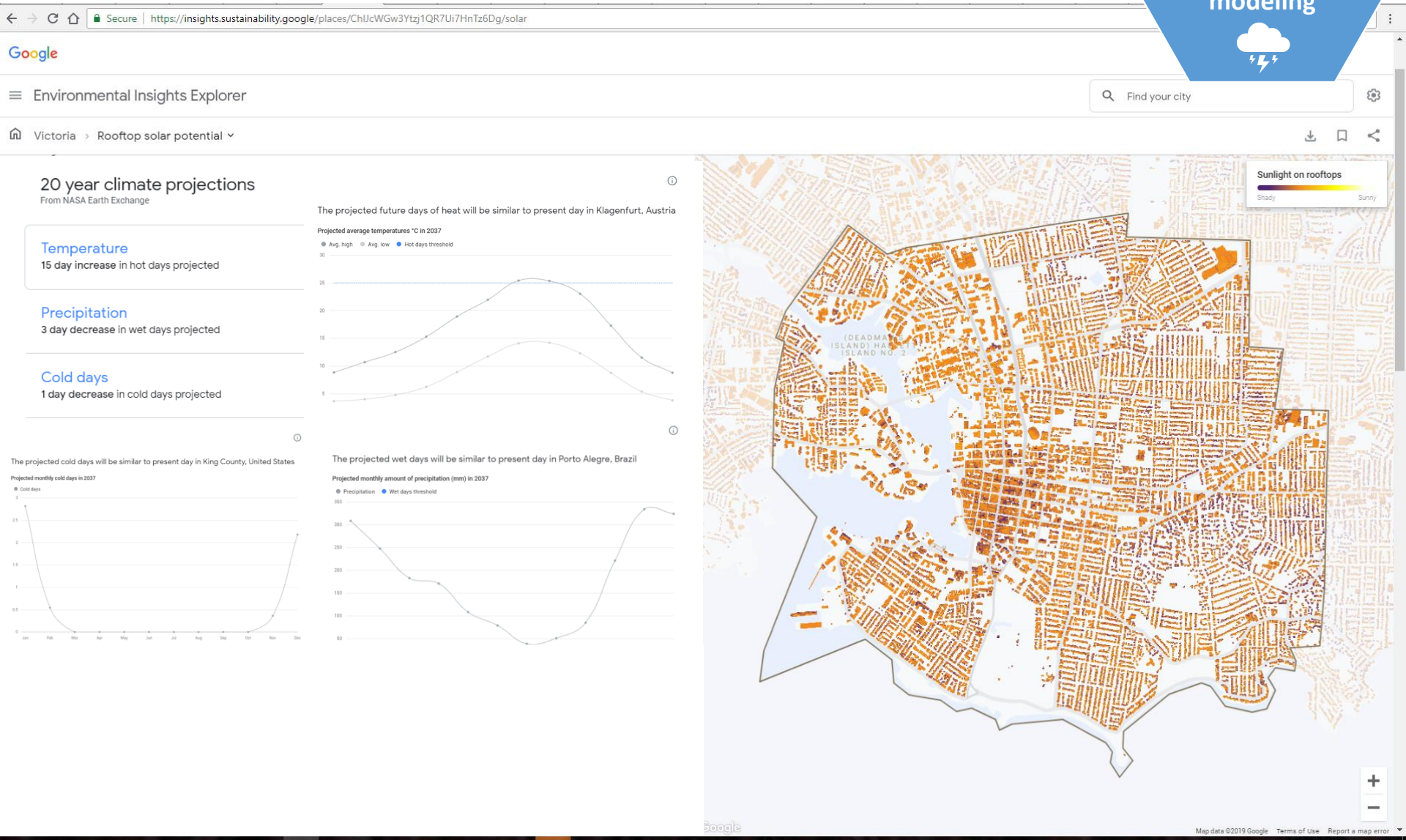
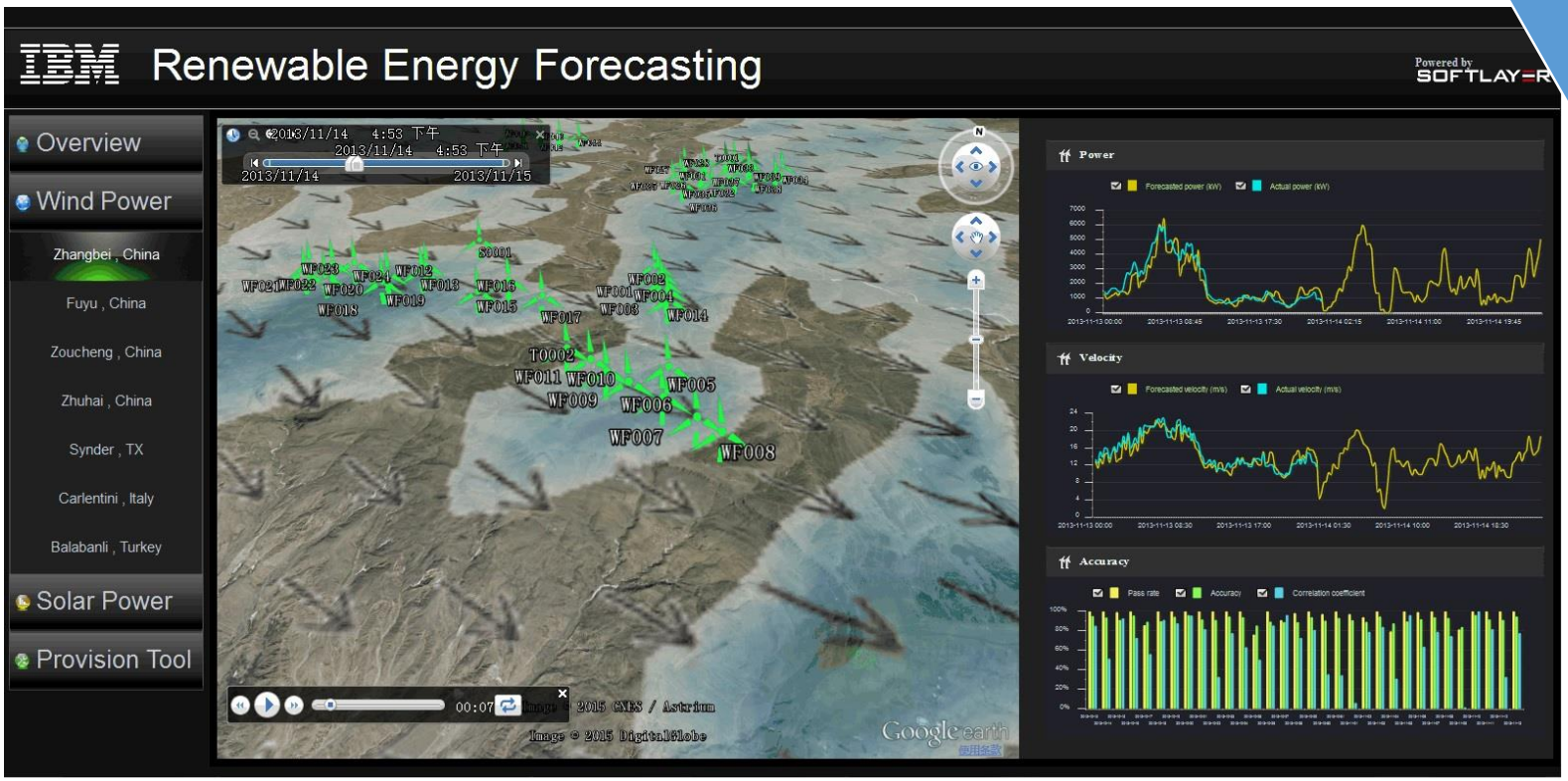


IBM's Green Horizon's program is improving the accuracy of solar energy forecasting

3. Predictive analytics, forecasting and scenarios



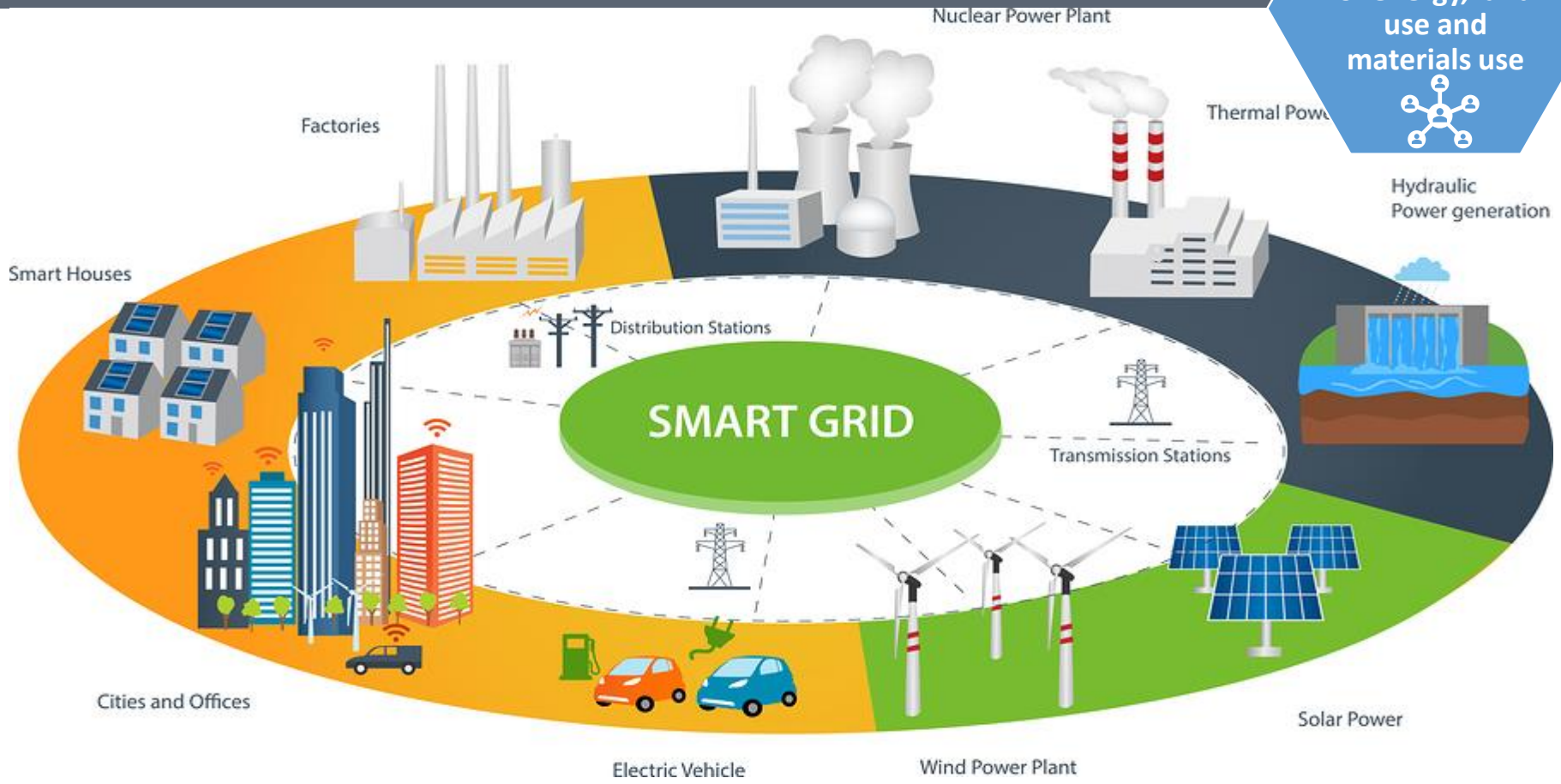
Solar energy forecasting system that is up to 30% more accurate than the next-best conventional system.

Deep learning techniques to blend:

- ✓ domain data
- ✓ information from sensor networks
- ✓ local weather stations
- ✓ cloud motion physics derived from sky cameras and satellite observations,
- ✓ multiple weather prediction models

SMART grids, cities, agriculture, transport, etc

4. Optimization of energy, land use and materials use



Automated optimization and decision-making

Institutional investors and companies measuring risks and making commitments

4. Optimization of energy, land use and materials use

CDP
DISCLOSURE INSIGHT ACTION

RE 100

You can't manage what you don't measure

Globally consistent environmental disclosure system helping companies to measure and manage their risks and opportunities on climate change across supply chain.

1,800 CDP members have a total revenue of over US$35 trillion.

225 of world's 500 largest companies identified 1 trillion of potential climate risks, BUT 2.1 trillion of potential opportunities .

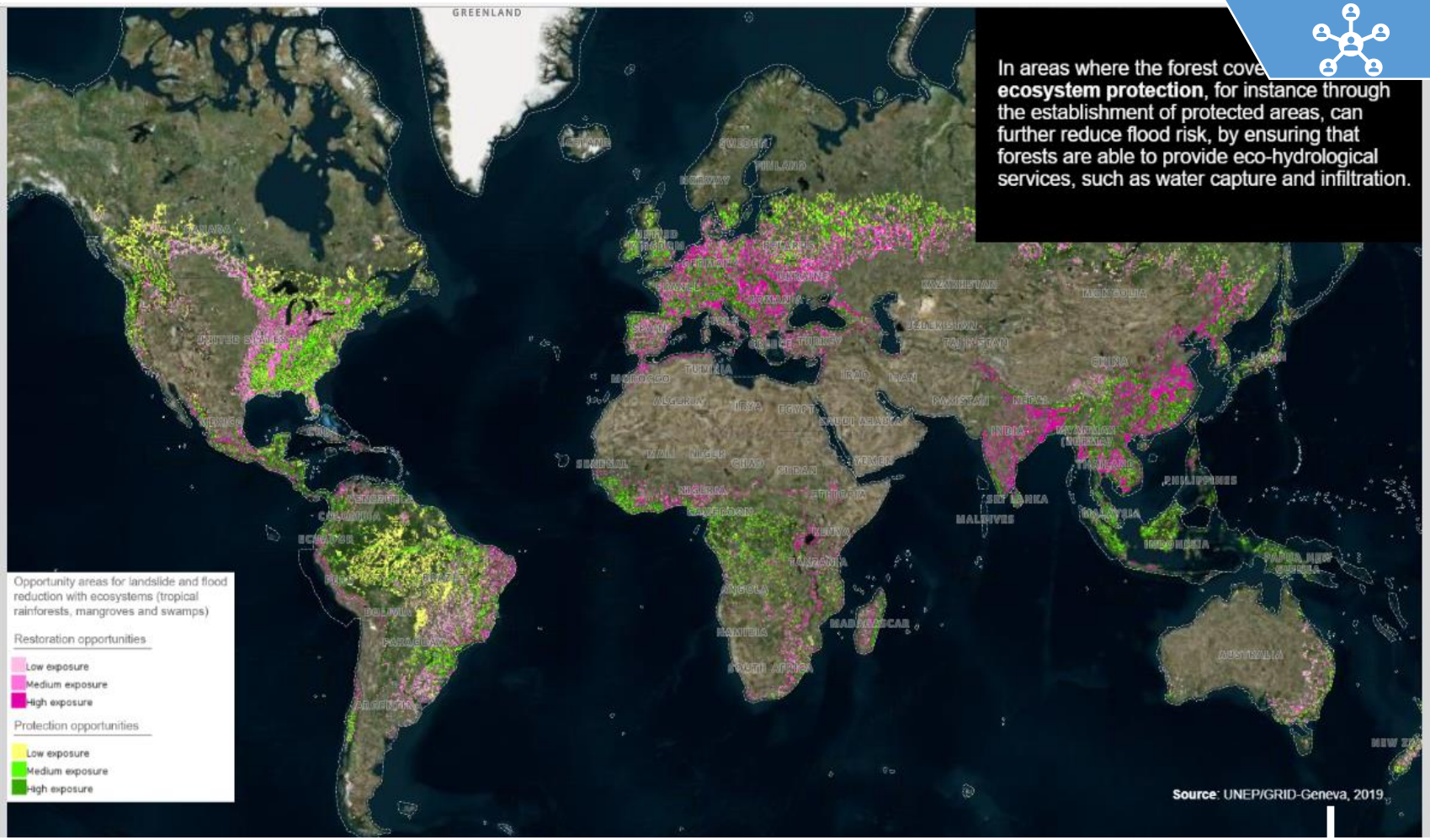
Accelerate change towards zero carbon grids using a variety of frontier technologies.

The world's most influential companies, committed to 100% renewable power by 2050 (at the latest).

204 RE100 members, including Global Fortune 500 companies, have a total revenue of over US$4.5 trillion.

Where to protect or restore ecosystems to capture disaster risk reduction benefits?

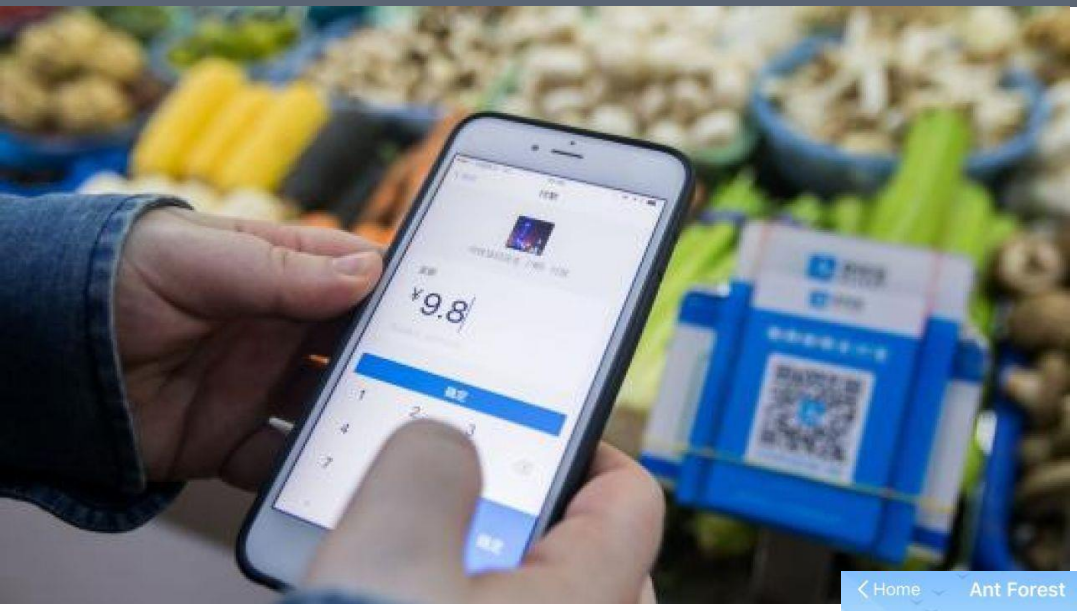
4. Optimization of energy, land use and materials use



Story map:
https://app.mapx.org?project=MX-2LD-FBB-58N-ROK-8RH&views=MX-Z4K0U-DBRFW-O36SG

Fintech offers gamification and incentives to reduce carbon footprints

5. Consumer awareness and behavior nudging



Alipay annual active users:
700 million
1.7 trillion in funds flow through

By mid 2019, over **500 million people** had joined Ant Forest's initiative.

This has resulted in over **122 million trees** being planted in Gansu Province, Inner Mongolia Autonomous Region educing carbon emissions by over 6 **million tons.**

Fintech offers gamification and incentives to reduce carbon footprints

5. Consumer awareness and behavior nudging

110,000 hectares planted

Enabling traceability and trust for carbon markets, climate finance, and clean energy

6. Quality control and quality assurance

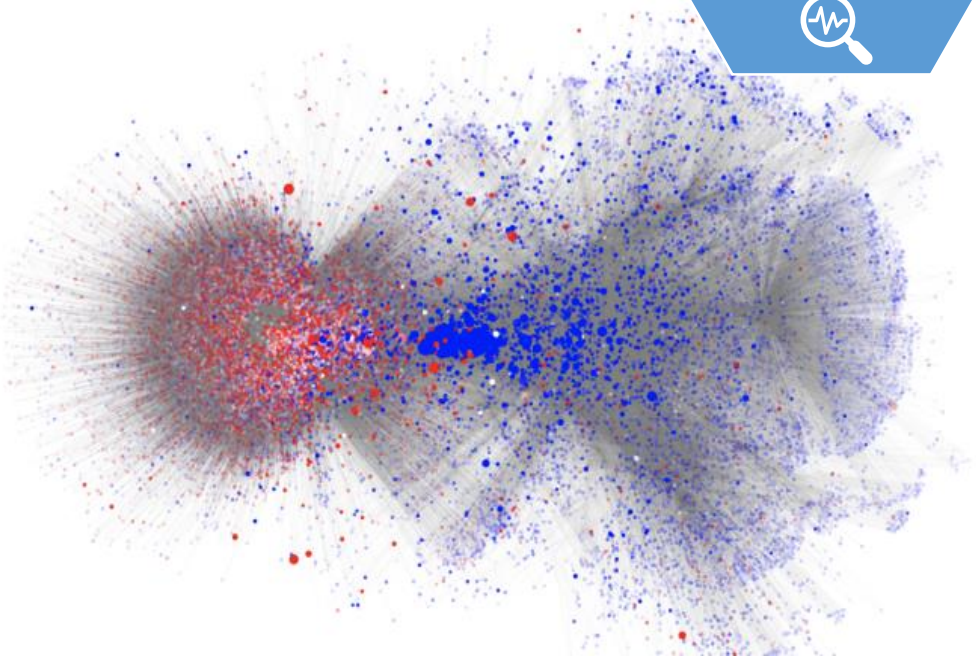
BLOCKCHAIN SOLUTIONS

APPLICATION	POTENTIAL ADVANTAGES
 **Carbon markets:** Enabling mechanism for trading and accounting of mitigation outcomes.	• Immutable audit trail of the creation and transfer of mitigation outcomes; • Facilitated trading with various granularity levels and units; • Lower transaction and management costs and increased transaction speed; • Traceability of emissions reductions and certificates trades across countries.
 **Climate finance:** Facilitating and enabling of climate-smart investments through traceability of financial flows.	• Enhanced accountability through traceability of capital flows; • Facilitation of earmarked and results-based financing; • Enabling of automated micro-payments to reduce micro-payments for loan repayment; • Reduced management and transaction costs.
 **Clean energy:** Enabling prosumer business models for decentralized energy systems.	• Enabling of peer-to-peer energy transactions; • Better energy prices for both consumer and producer; • Traceability and certification of renewable energy production; • Facilitated addition of energy generation incentives (e.g. tokens).

Help detect fake or non-scientific news and data on climate action – battle of the algorithms

6. Quality control and quality assurance

- **Network behavior:** Is the article proliferating through social platforms and networks in ways typically associated with misinformation?
- **Publisher metadata**: Is the article from a known, reliable, and trustworthy publisher with a history of credible journalism?
- **Content:** AI can scan articles for hundreds of known indicators typically found in misinformation.



FACTMATA

Logically

Barriers to overcome in using big data for climate action

Digital ecosystem

- Disclosure of emissions data
- Data sharing and licensing
- Inter-operability
- Global standards for the digital ecosystem
- Concerns about data & algorithm quality
- High fragmentation / limited strategic collaboration
- Dominated by few large players

Financial

- Need for new business models
- Incentives for public-private partnerships
- Potential for capital flight
- Pay to play potential

Governance issues

- Information and capacity asymmetries
- Privacy and data security
- Governance needs per use case
- Geopolitics
- Ethical frameworks

Key partnerships

- **Global Climate Observing System:** co-sponsored by WMO, IOC-UNESCO, UNEP and ISC. It regularly assesses the status of global climate observations of the atmosphere, land and ocean and produces guidance for its improvement.
- **Essential Climate Variables (ECV):** An ECV is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth' s climate. GCOS currently specifies 54 ECVs.
- **The C3S Climate Data Store (CDS)** is a one-stop shop for information about the climate: past, present and future. It provides easy access to a wide range of climate datasets via a searchable catalogue. An online toolbox is available that allows users to build workflows and applications suited to their needs.
- **Space Climate Observatory (SCO):** Its goal is to combine satellite and field data with scientific research to model, predict and track climate change and its impact. It does so at national, regional and local levels based on data from 20 space agencies.
- **World Environment Situation Room powered by MapX:** one stop shop for best available global data (statistical and spatial) on different environmental themes.
- **Working group on big data and frontier technology**: addressing governance risks from frontier technologies and brokering public private partnerships on thematic issues to help build a digital ecosystem for the planet.

We have 10 years left to change achieve the SDGs.
Only frontier technologies move at this speed and scale.

We must move our institutions from an analog to a digital world.

The future is ours to shape.

The UN will continue to play a leadership role.

EXTRA SLIDES

Applications of ICT for climate action

UN environment

1. Automated detection and monitoring

- Emissions
- Renewable energy potential
- Climate-related hazards

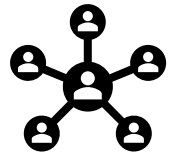
2. Risk assessments and impact modeling

- Security: hazards, conflict, migration, geopolitics
- Species / ecosystem distribution
- Insurance

3. Predictive analytics, forecasting and scenarios (what if) for decision-support

- Solar / clouds
- Temperature
- Agriculture
- Water
- Air quality

4. Optimization of energy and materials use



- SMART cities, agriculture, electrical grids/load management, thermostats
- Product design
- Supply chains on carbon intensity
- Oil and gas reserves

5. Consumer awareness and behavior nudging

- Calculation of carbon footprint
- Peak load periods

6. Quality control / assurance

- Blockchain
- Stopping fake news / fake data
- Hackers and gaming the system

An array of big data sources

Satellites

4,987 Satellites in orbit in 2019[12]
5,700 generated scenes per day (open source)
Landsat archive **32 years** - over **5 million scenes**[13]
Entire terrestrial surface imaged every day

Sensors

15.4 billion sensors in 2015
75 billion by 2025[14]

Internet of Things

IoT creates **40** **zettabytes of data** per year[15]

Mobile phones

5 billion unique phones offering opportunities for geocoded data collection as well as daily movements[16]

Mobile apps

3 million unique apps[17]

Internet access

Over **4.4 billion people, 57.3%** of population[18]

Digital platforms

Every minute of the day in 2018:
Youtube users watch **4,333,560 videos**
Amazon ships **1,111 packages**
Uber users take **1,389 rides**[19]

Censuses and surveys

More than **7 billion people** are covered by censuses every 10 years[20]

Citizen science

500 million records on eBird[21]
58 million records on Artportalen[22]
16 million records on iNaturalist[23]

Publications and doc

Over **2.2 million scientific articles** on science and engineering[24]
Over **50,000 corporate sustainability reports**[25]

Administrative data

Governments, utility companies, and other services providers maintain data related to **registration, transaction and record keeping**[26]

Finance data

Financial databases cover **189 countries** to date[27]