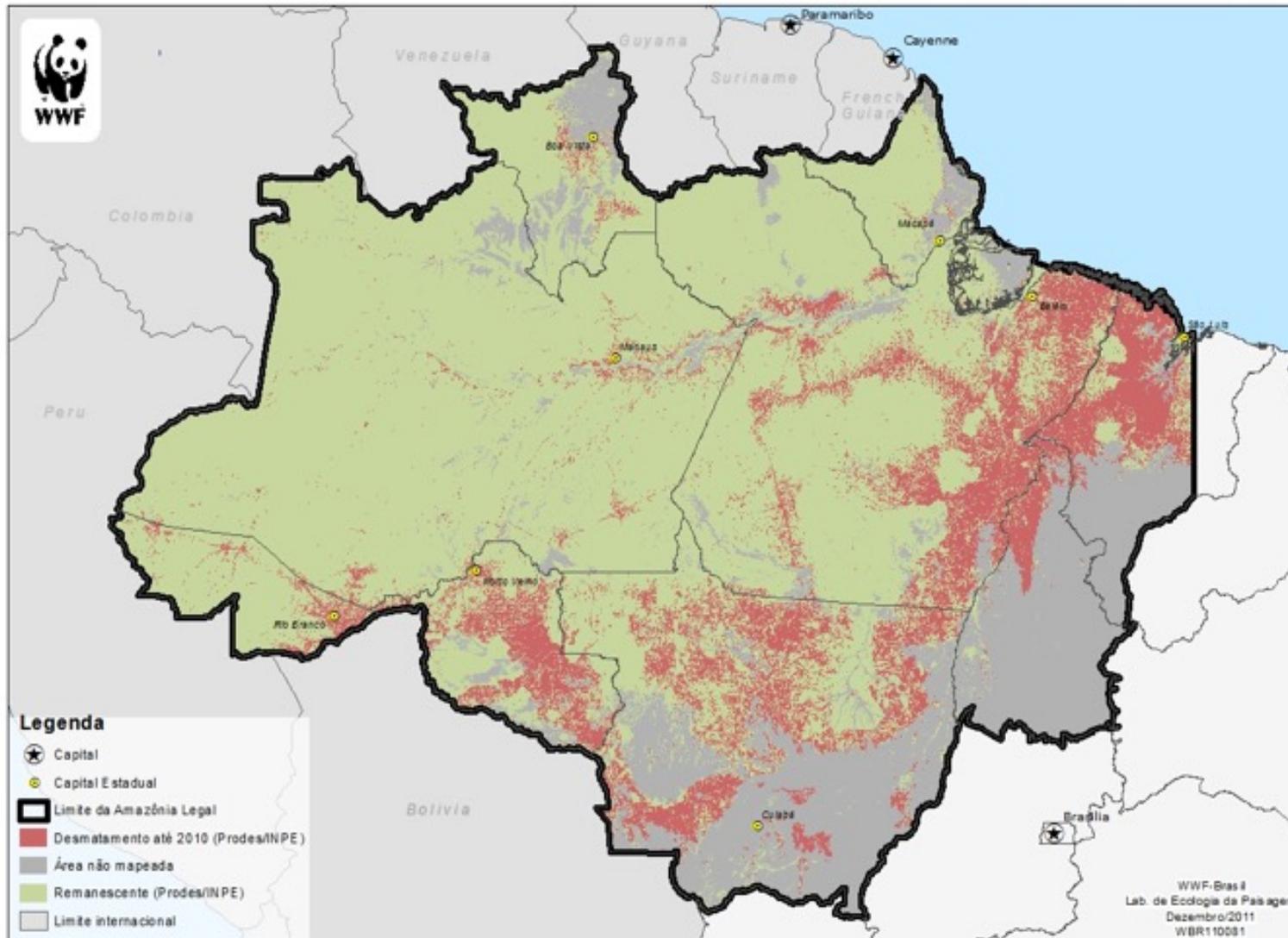


On the use of Earth observation data for auditable nature-based solutions

Gilberto Camara

<https://gilbertocamara.org>

The value of Earth observation: How much? Where? When? Who?



Questions from Shell

1. What is currently already possible with satellites and what can be expected in the next few years?
2. What are opportunities for Earth Observation in future reporting, and where are the gaps which need to be addressed?
3. How do you see the future of tax-payer funded programs vs commercial initiatives?
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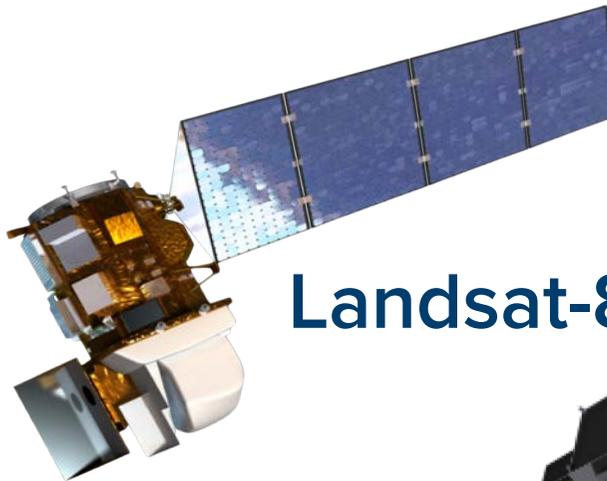
The age of big Earth observation data



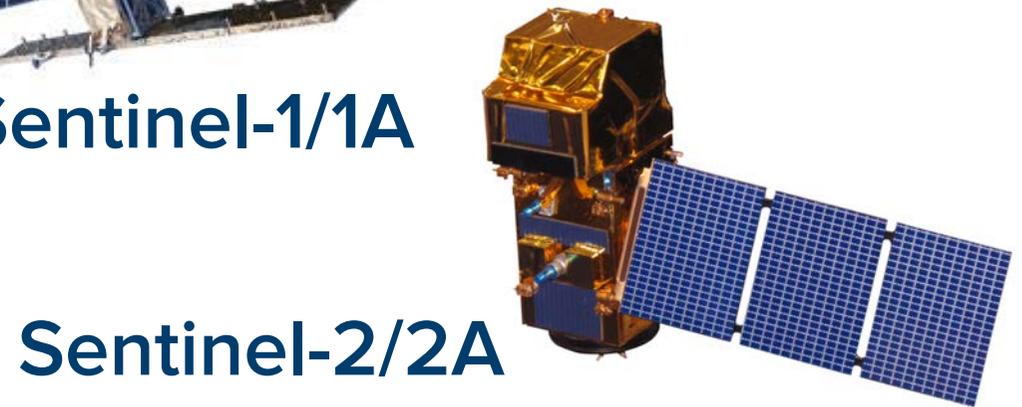
Terra



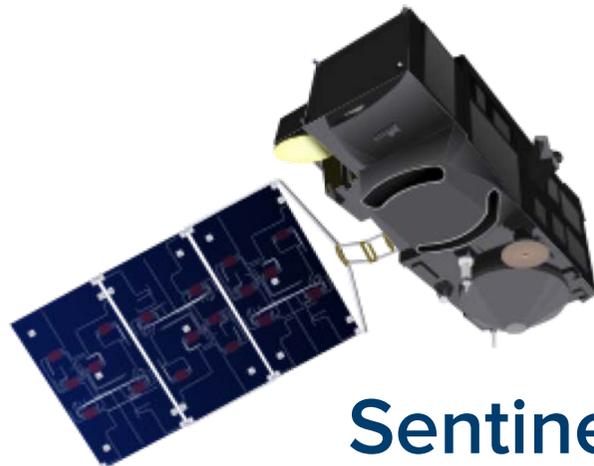
Sentinel-1/1A



Landsat-8



Sentinel-2/2A

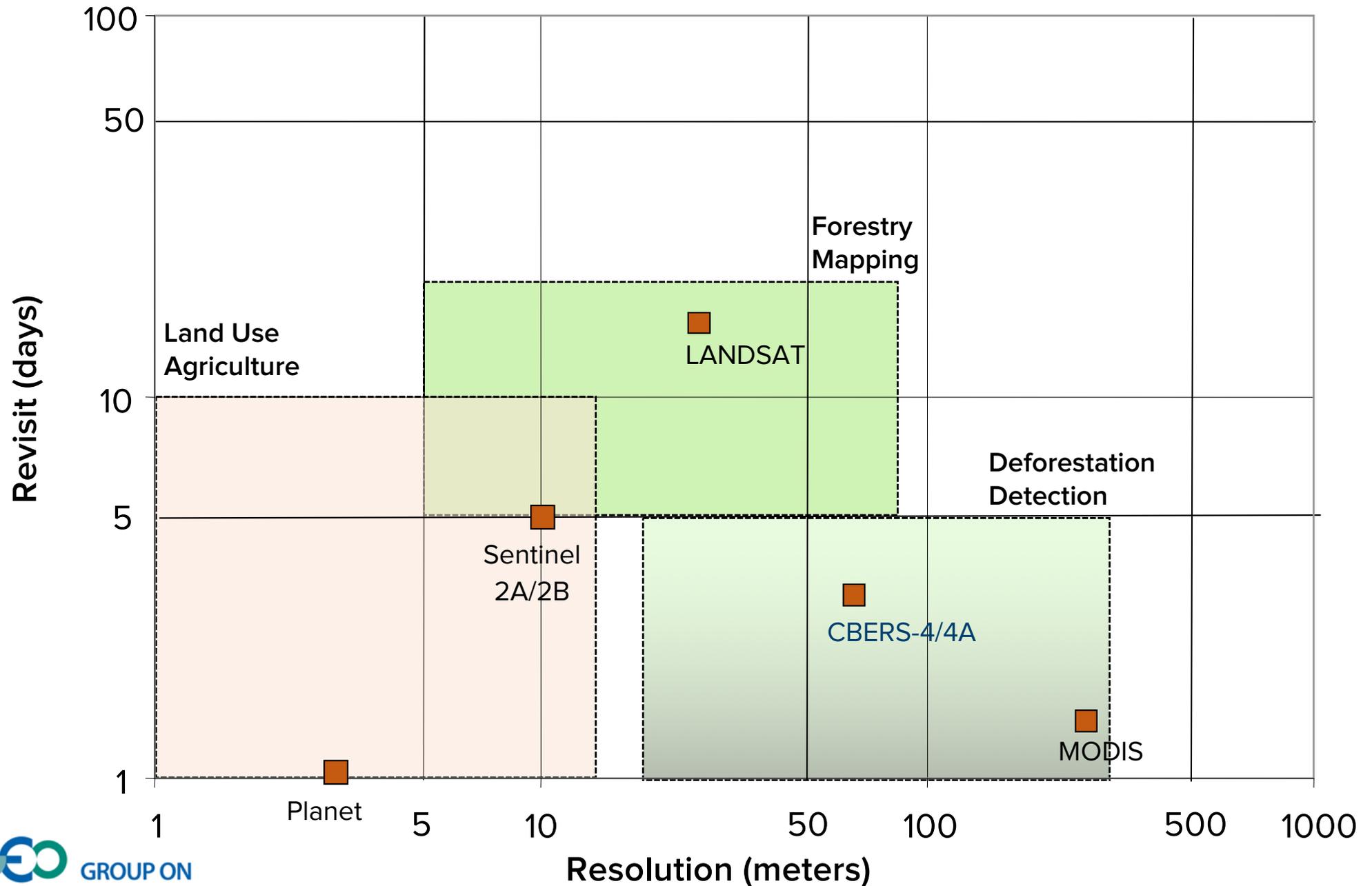


Sentinel-3

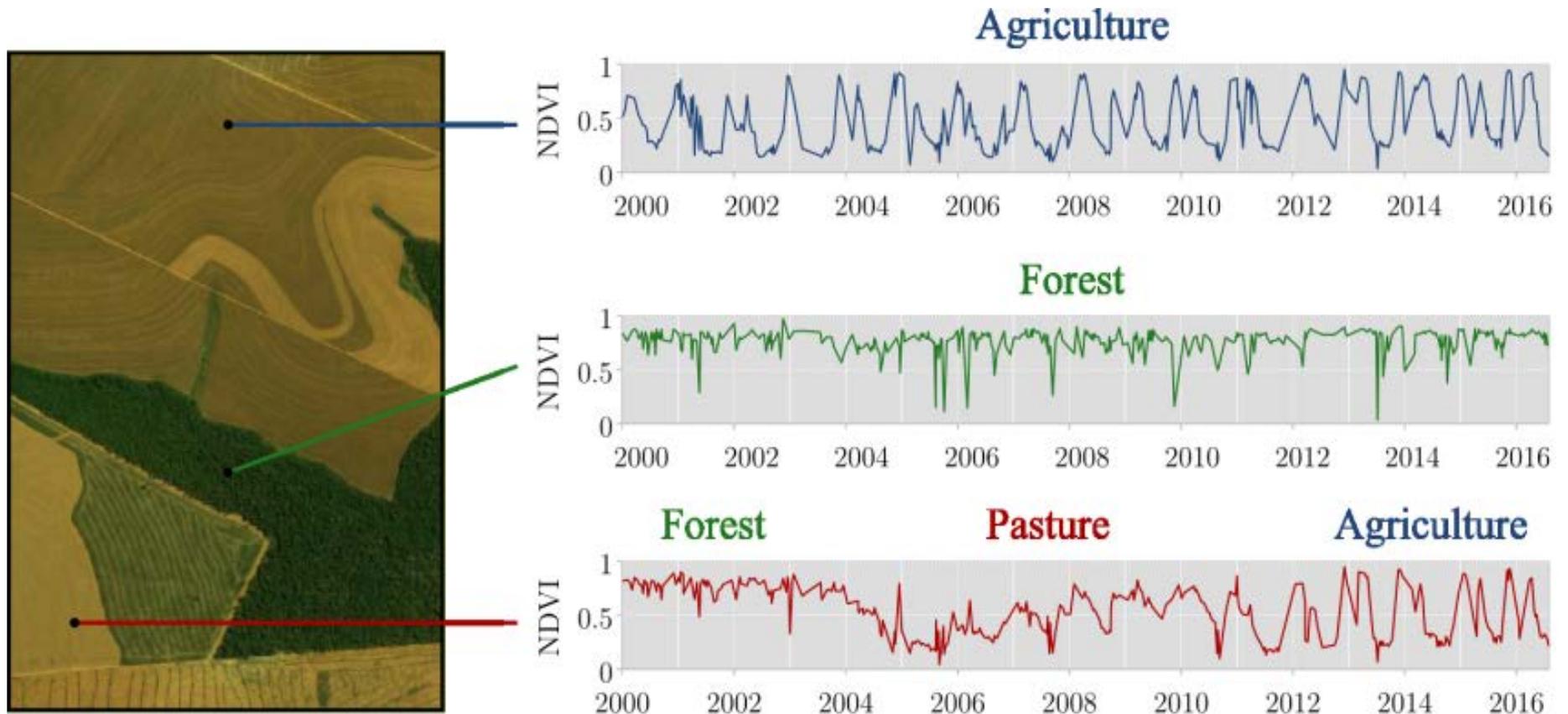


CBERS-4/4A

Optical Satellites for Forestry and Agriculture

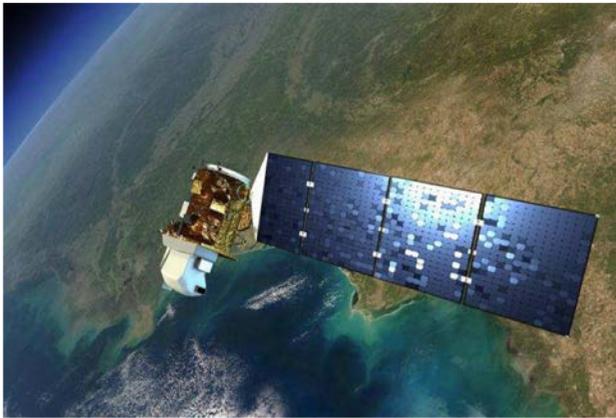


Continuous monitoring of landscapes

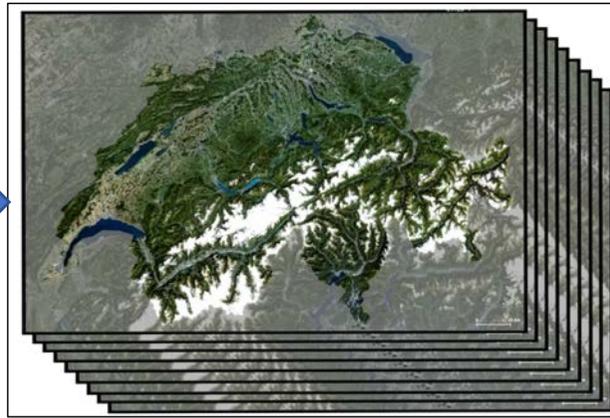


Transformations of land cover due to actions of land use

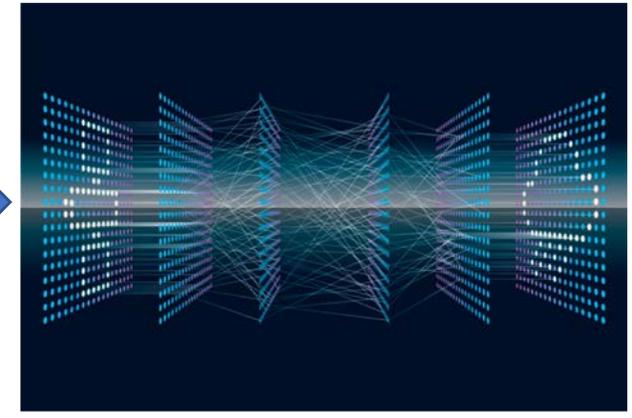
Big EO data for sustainable development



Big satellite data
(2PB per day)



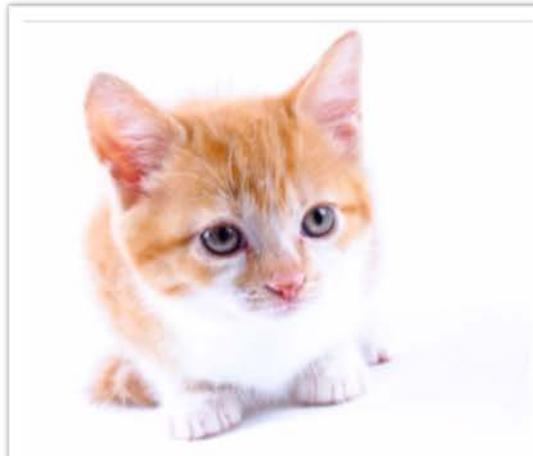
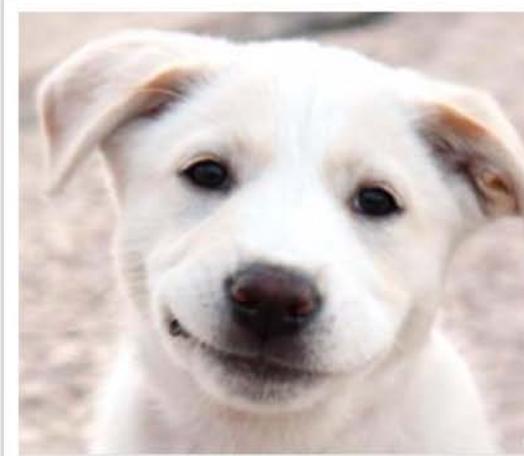
Data cubes
(consistent observations)



Machine learning
(classification)

In what ways is **big spatial data special**?

What are the limits of machine learning?

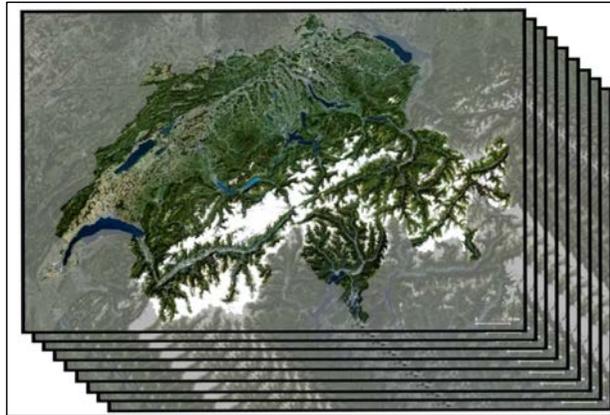


What works for face recognition, automatic translation, and Chess/Go games **does also work for big spatial data?**

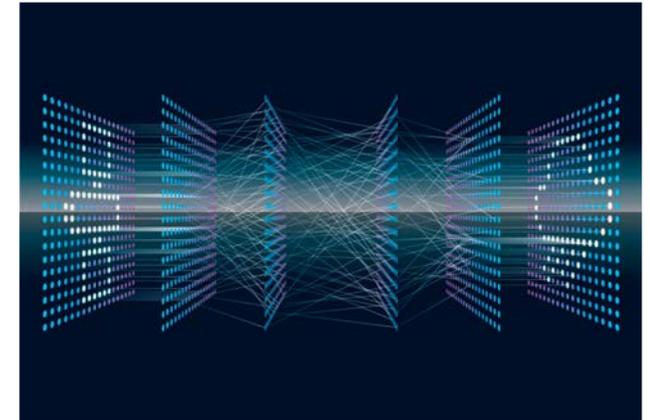
The elephant in the room



Big satellite data



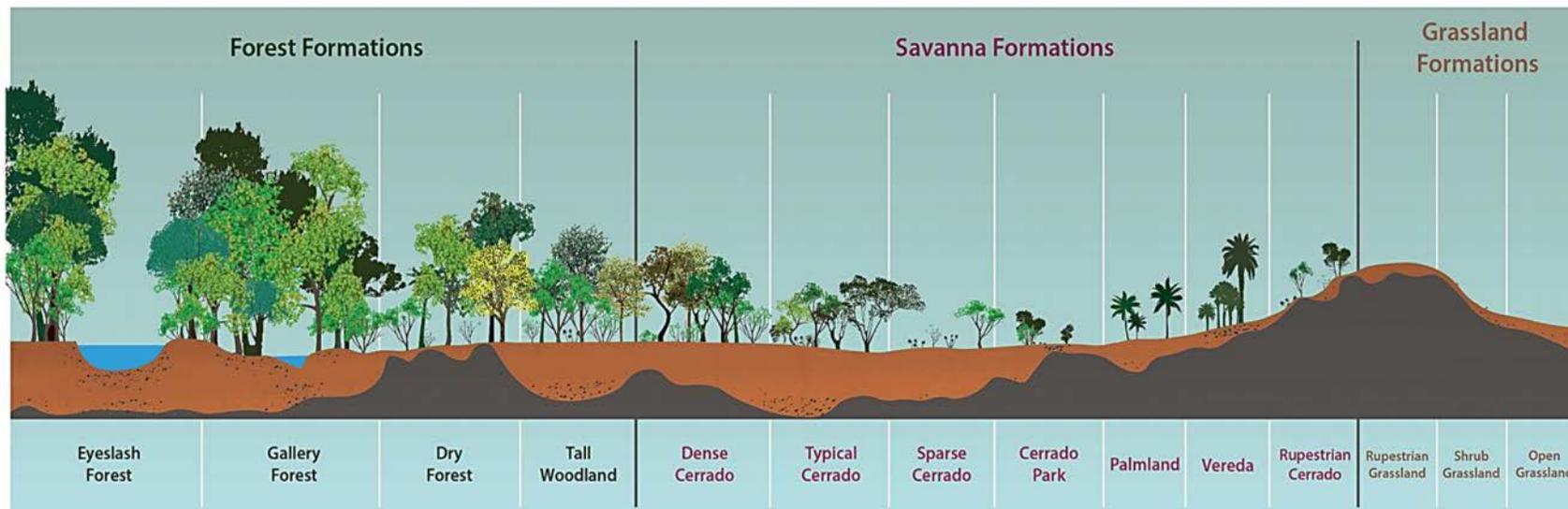
Data cubes



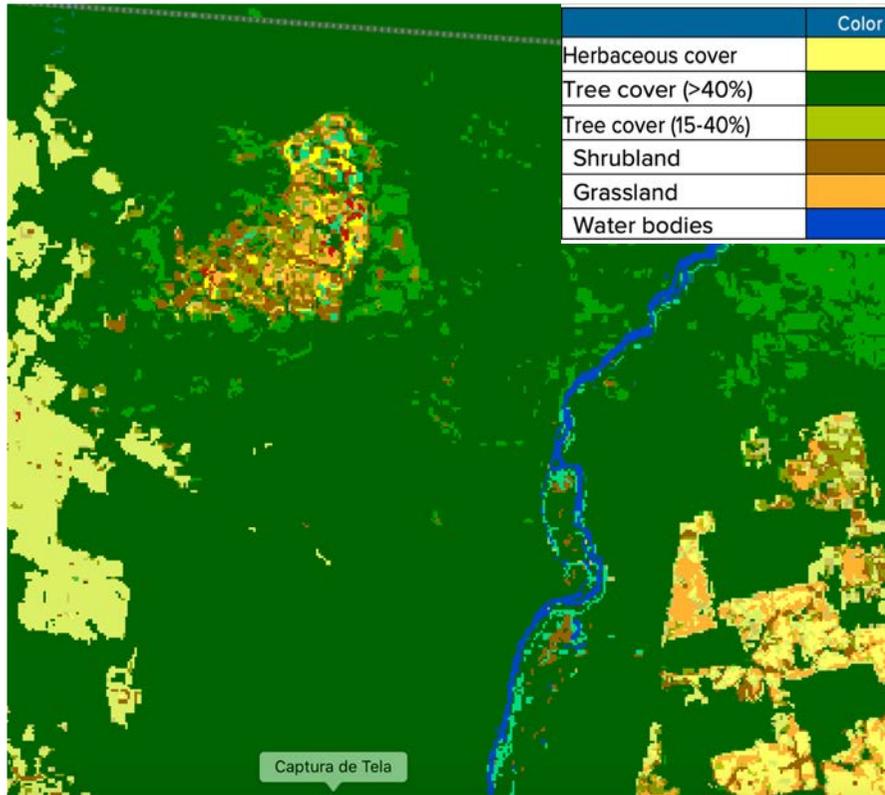
Machine learning

Ecosystems are highly variable
Local knowledge is essential

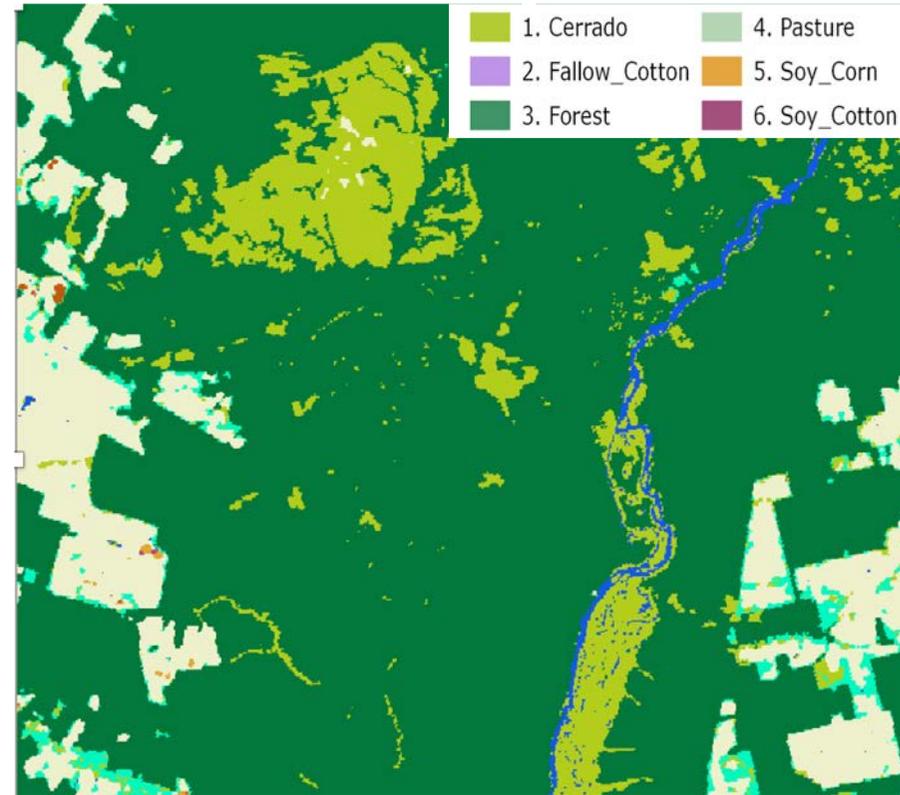
Cerrado: Brazilian savanna



Limitations of global maps



ESA CCI (no distinction btw shrublands and pasture)



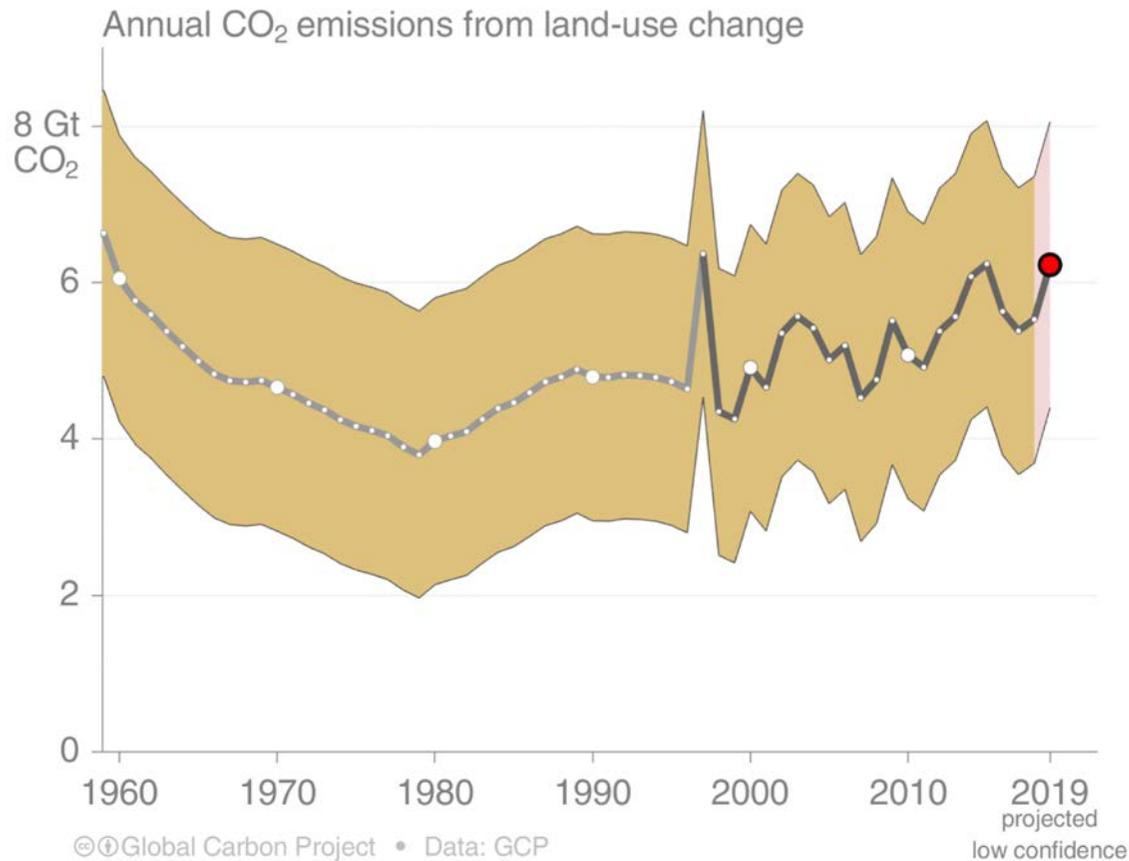
INPE's new map (distinction btw Cerrado and pasture)

Co-design is essential for auditability

Questions from Shell

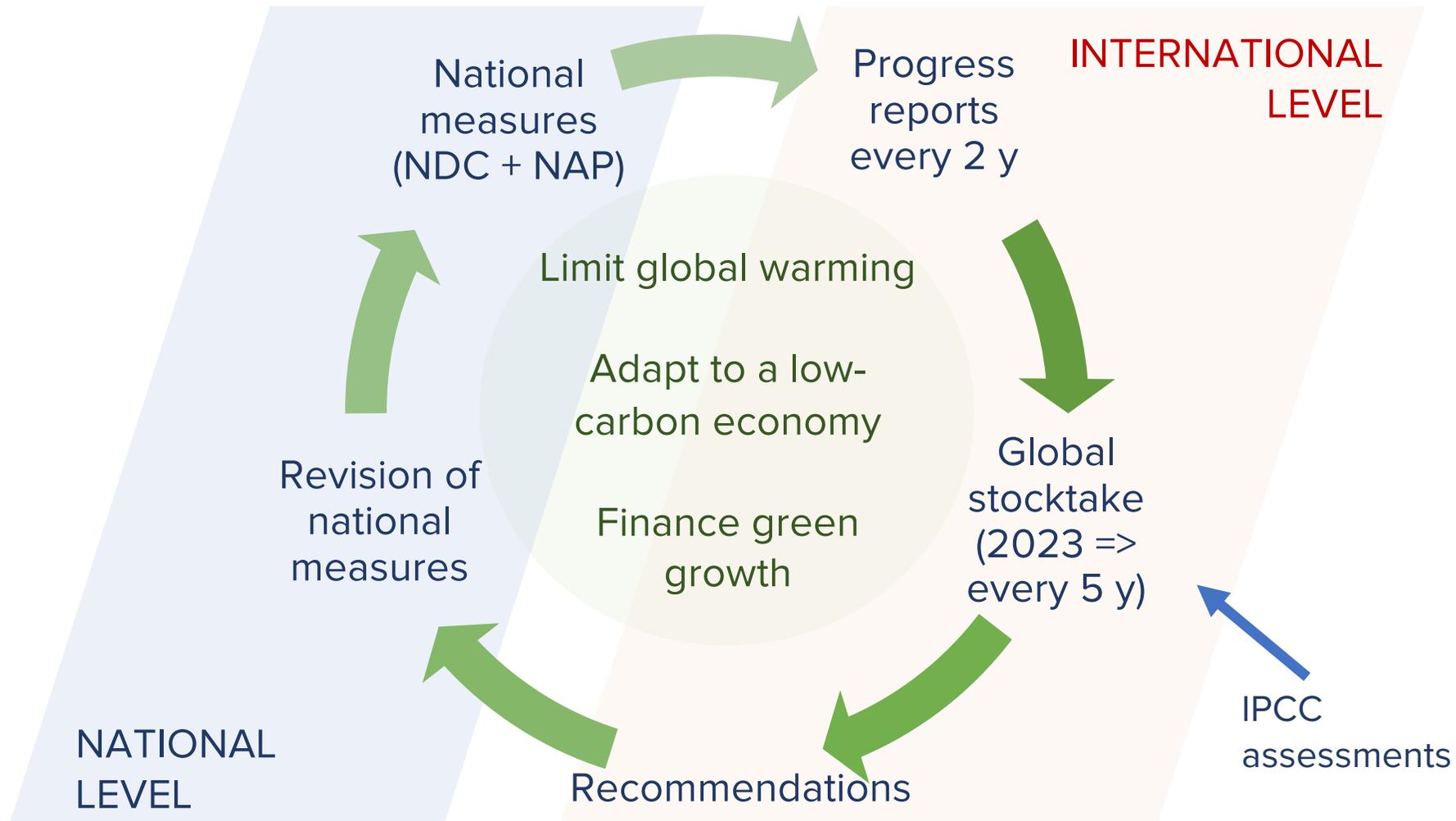
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Land use change emissions

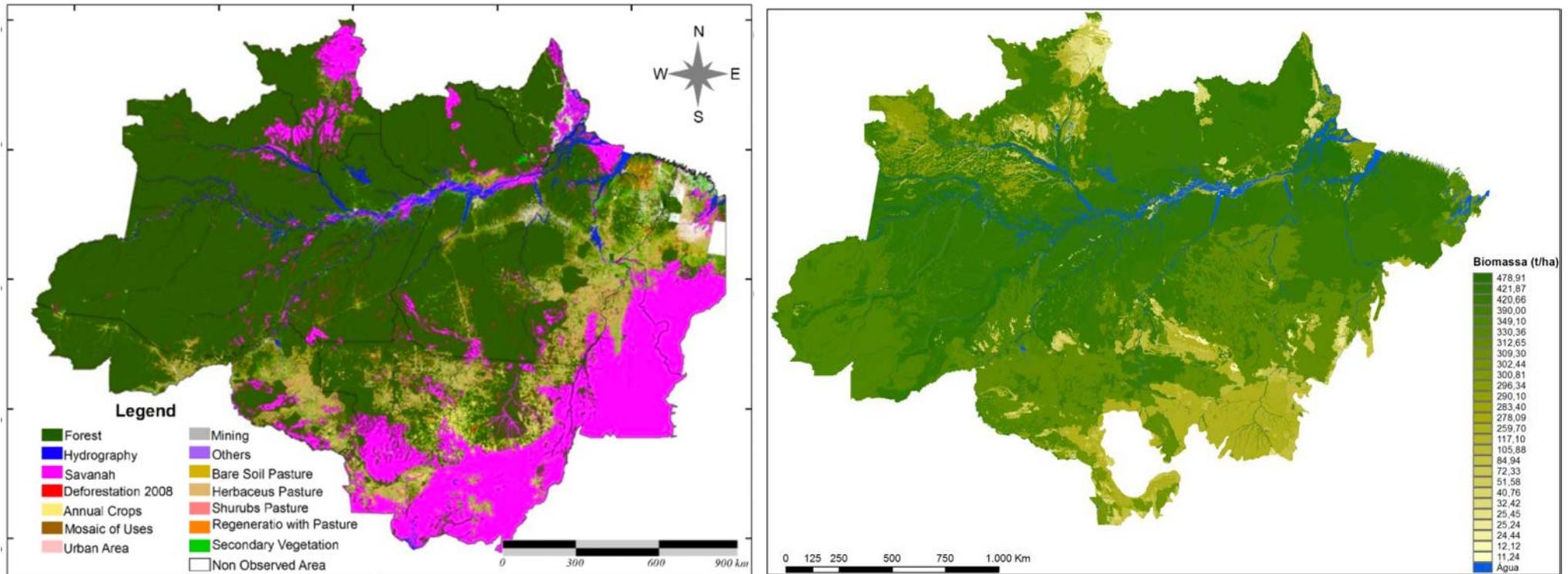


Land-use change emissions are highly uncertain, with no clear trend in the last decade.

The Paris Agreement



Auditable land use emission accounting



Emissions = land-use change * biomass * emission factor



Big data analytics

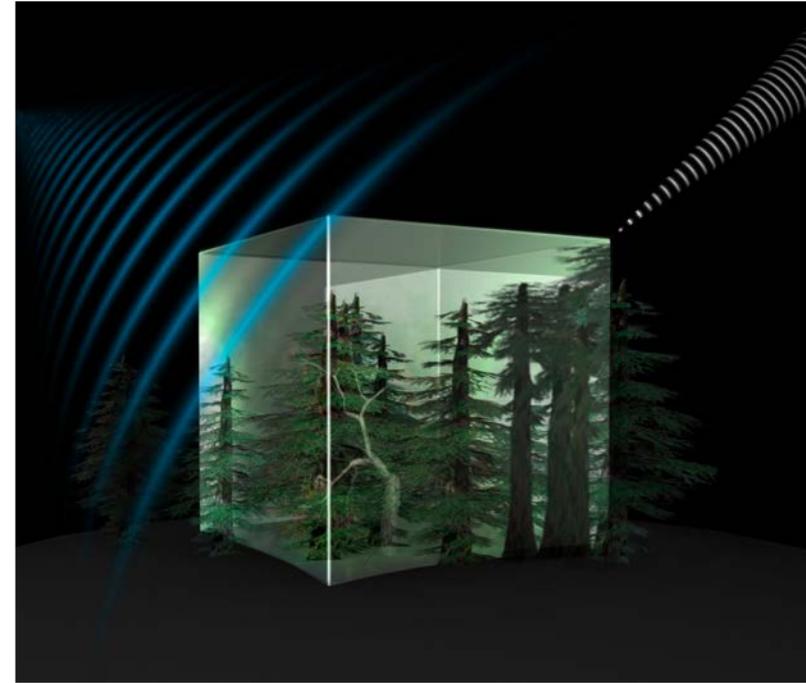
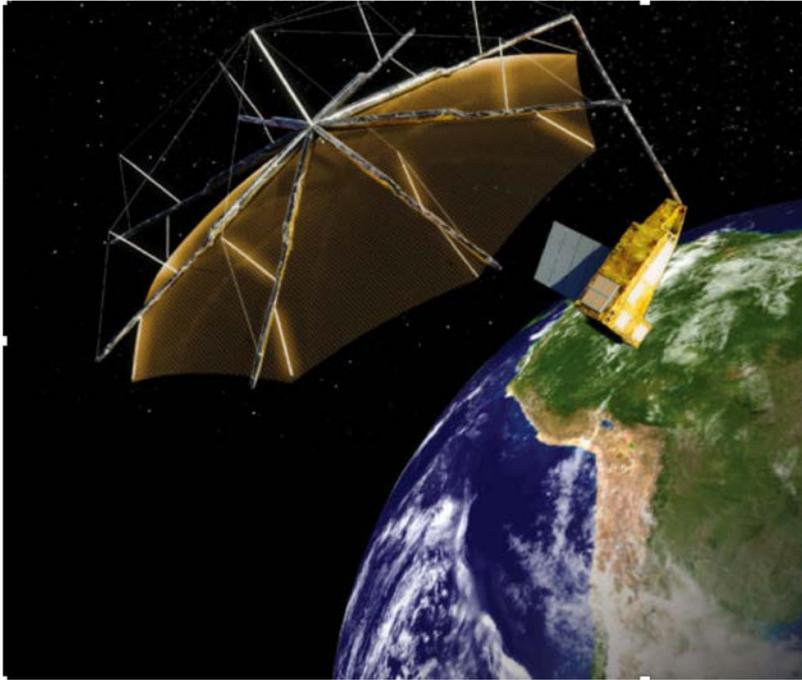


BIOMASS satellite

European Space Agency BIOMASS mission

P-band satellite

maps of forest biomass and forest height at a resolution of 200 m



Launch in 2021 – Data and results will be open
Greatly improved modelling of terrestrial carbon cycle
Gridded high-resolution global estimates of above ground biomass

Auditable country reporting requires trust

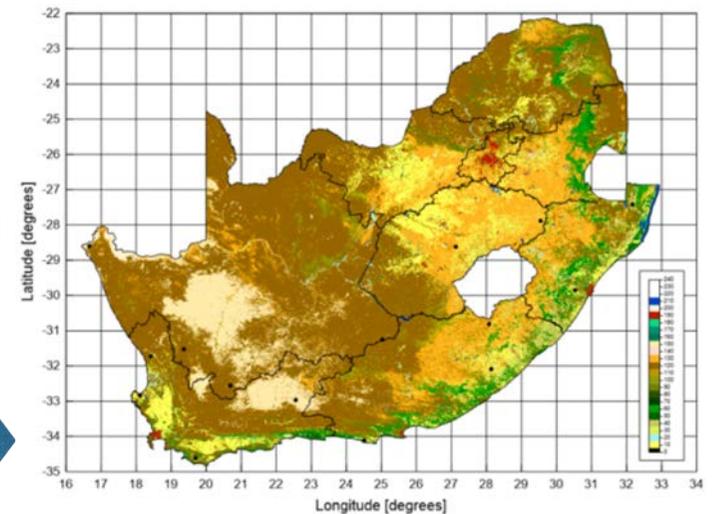


co-design, co-production

EO data



Trusted, auditable results



Questions from Shell

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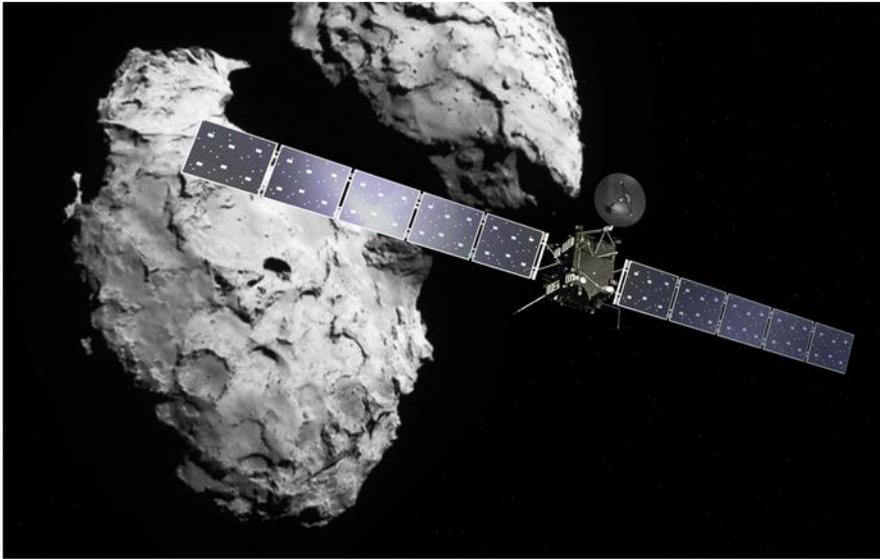


nature

Vol 452 | Issue no. 7184 | 13 March 2008

“A few satellites can cover the entire globe, but there needs to be a system in place to ensure their images are readily available to everyone who needs them. Brazil has set an important precedent by making its Earth-observation data available, and the rest of the world should follow suit.”

Where does the value of EO come from?



Rosetta – the comet chaser



Copernicus – Earth chaser

Open public data is essential for reproducibility and auditability

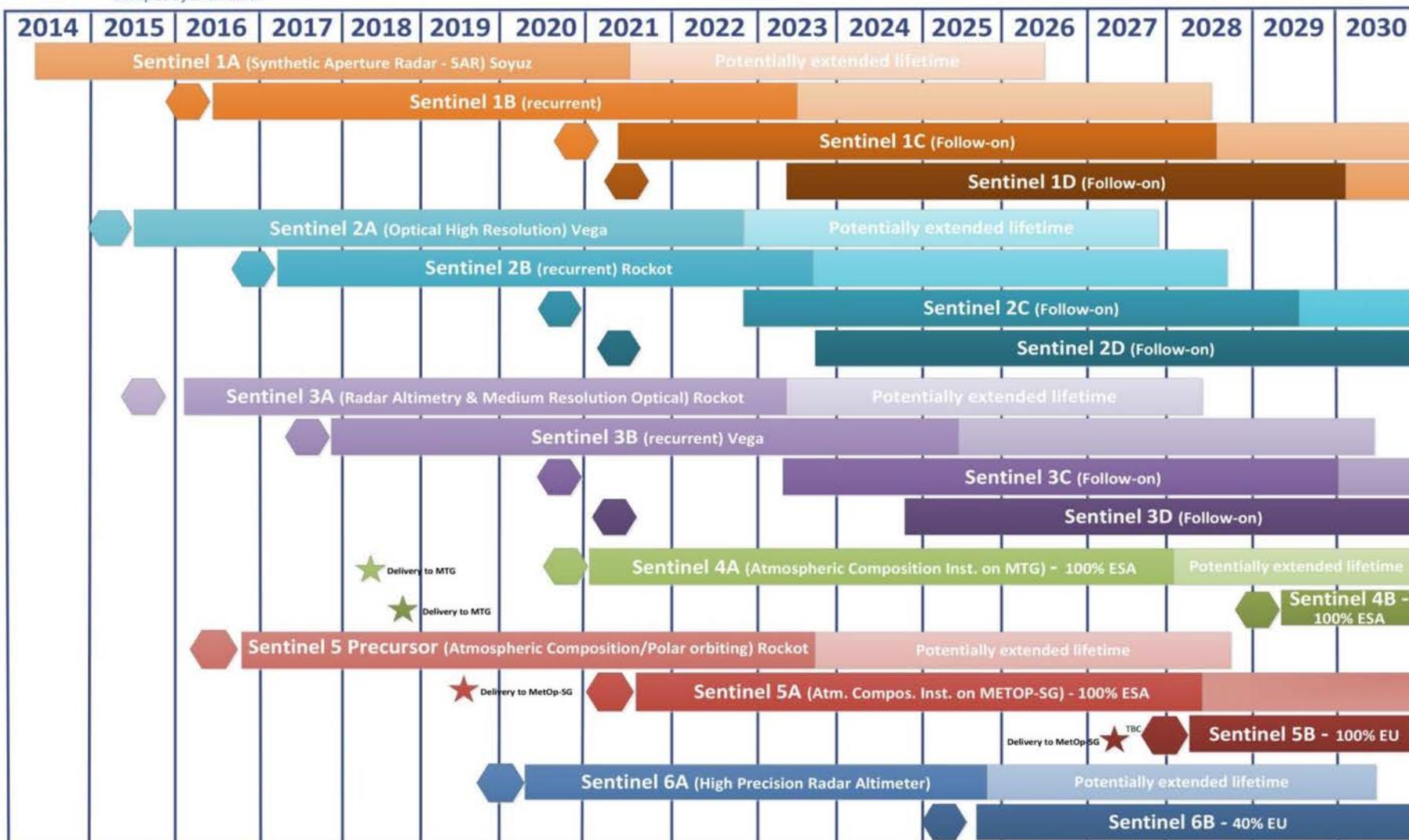


European

Status 24/02/2016



Copernicus Constellations Deployment Schedule



Legend: Flight Acceptance Review

Questions from Shell

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Potential for CO₂ sink in Amazonia: Brazil's NDC

Clear-cut areas



12,000,000 ha (15% of deforested area)



Forest (biomass after 10 years)

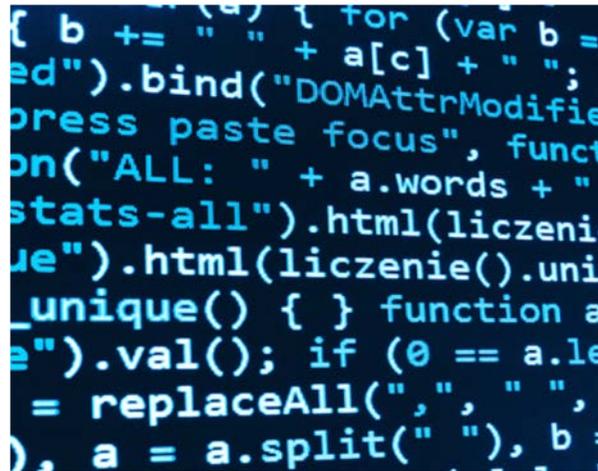
5 Gt CO₂eq (2020-2030)

Advances required for auditable nature-based solutions

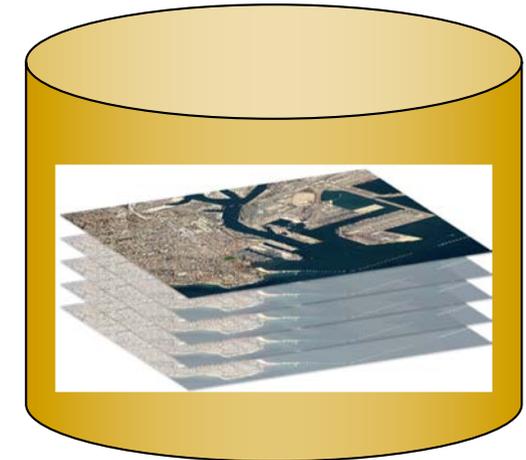
Empowered institutions



Reusable, shared knowledge



Open cloud platforms



Building blocks of a digital ecosystem for the environment

Discussion paper:

The Case for a Digital Ecosystem for the Environment:

Bringing together data, algorithms and
insights for sustainable development

UN 
environment
assembly

The Fourth United Nations
Environment Assembly
of the United Nations
Environment Programme

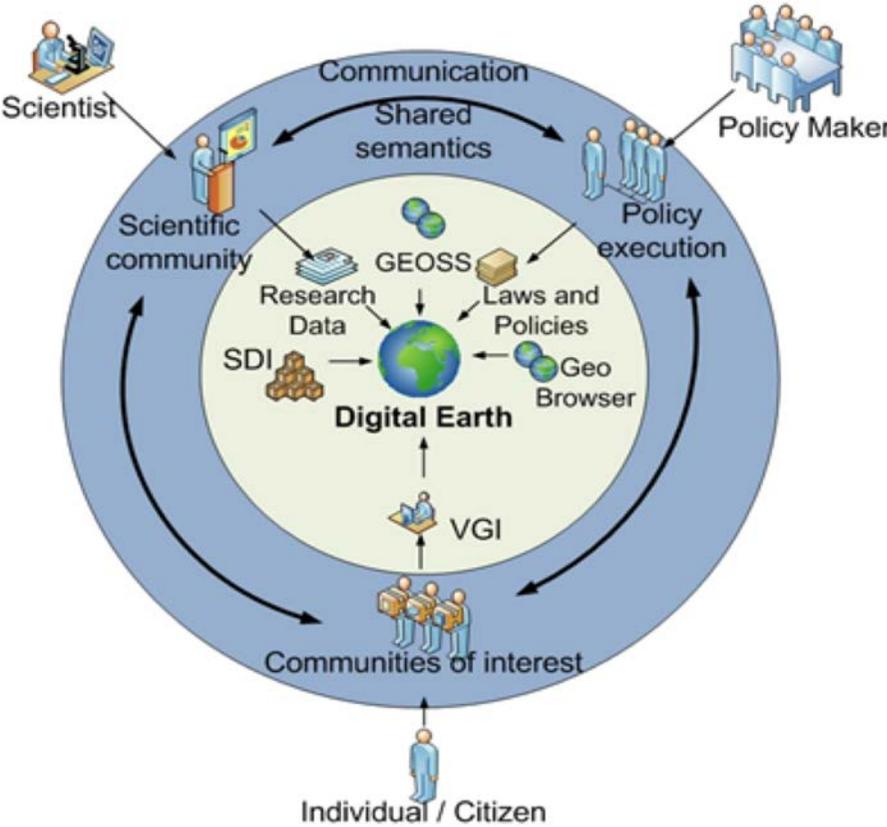
**THINK
BEYOND**

**LIVE
WITHIN**



**SCIENCE
POLICY
BUSINESS
FORUM**

Developing a shared global solution



Could Shell contribute to a global public good solution?

Sustainability Outcomes

<ul style="list-style-type: none">  Atmosphere  Land  Water  Biodiversity  Oceans 	 <p>Planetary monitoring</p>	 <p>Nudging consumer behavior</p>	 <p>Informing markets and supply chains</p>	 <p>Citizen awareness and action through social media</p>
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Concluding thoughts

1. What is currently already possible with satellites and what can be expected in the next few years?

Big EO data analysis can improve land use assessments, but need advances in hybrid ecological-statistics models.

2. What are opportunities for Earth Observation in future reporting, and where are the gaps which need to be addressed?

EO can improve UNFCCC reporting, but countries need empowerment to produce them.

3. How do you see the future of tax-payer funded programs vs commercial initiatives?

Open public programs are essential for global transparency.

4. What are the advances required in S&T to support global (and Shell's) ambitions to deploy auditable nature based solutions?

Open Science: accessible cloud services with reproducible knowledge.