



EO4Paris

HOW EO CAN INFORM THE PARIS AGREEMENT

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Supporting national action towards Paris Goals – the evolving role of observations

ESA UNCLASSIFIED – For ESA Official Use Only



→ THE EUROPEAN SPACE AGENCY

CLIMATE DATA RECORDS



- EO in the form of long-term CDRs, has contributed greatly to the monitoring of the slow changes in the climate system (shrinking glaciers and sea-ice, rising sea-levels...)



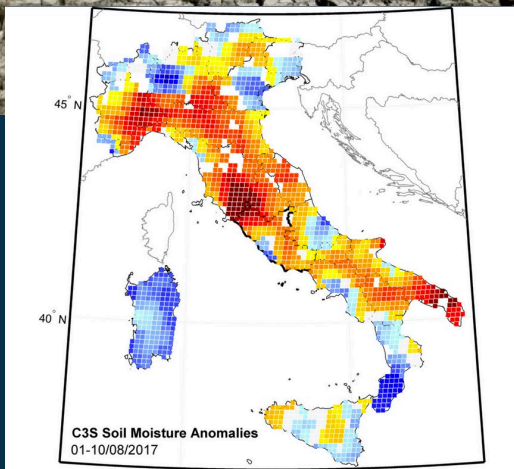
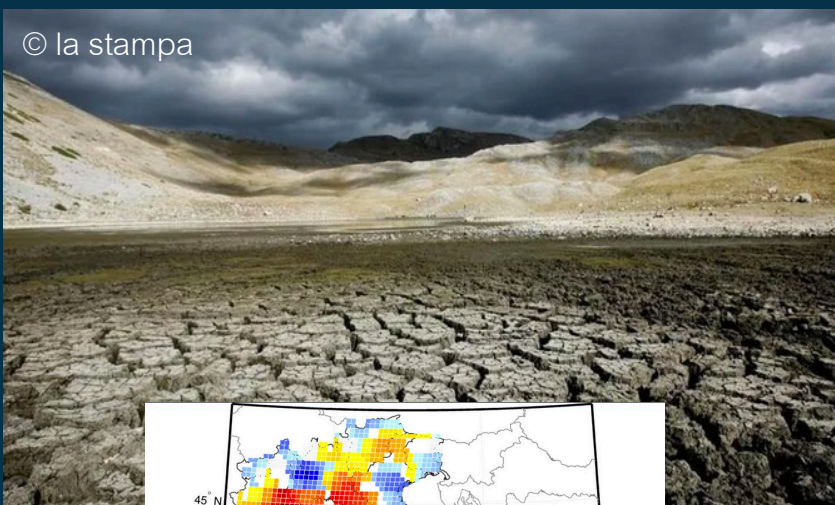
The retreat of the Columbia Glacier in Alaska is captured by Landsat and Copernicus Sentinel-2 observations going back to 1995.

Zemp *et al.*, *Nature* 2018

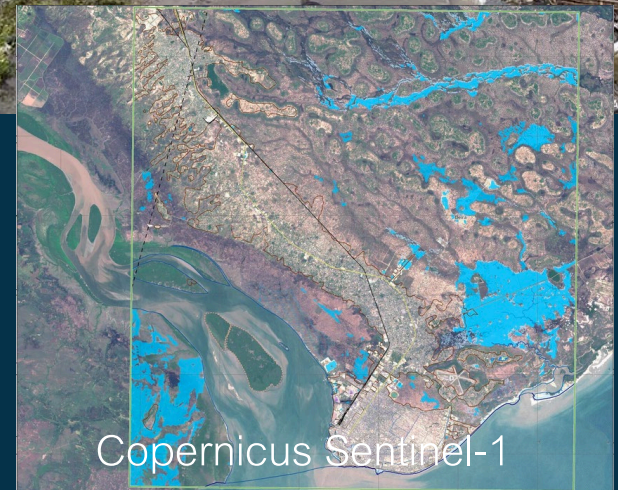
NEW SPACE INFORMATION



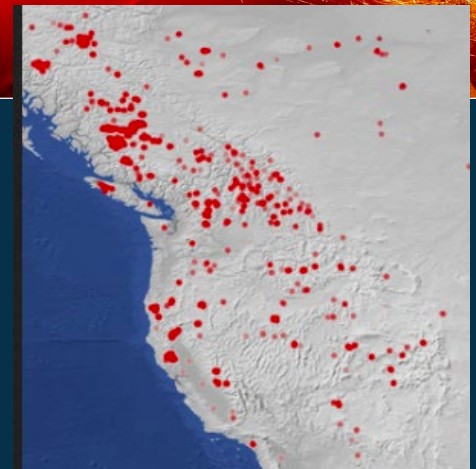
- However, climate change is in our face through more intense and frequent extreme events (heatwaves, droughts, wildfires, and flooding); EO can capture its impacts in single images.



ESA CCI soil moisture (Italy drought 2017)



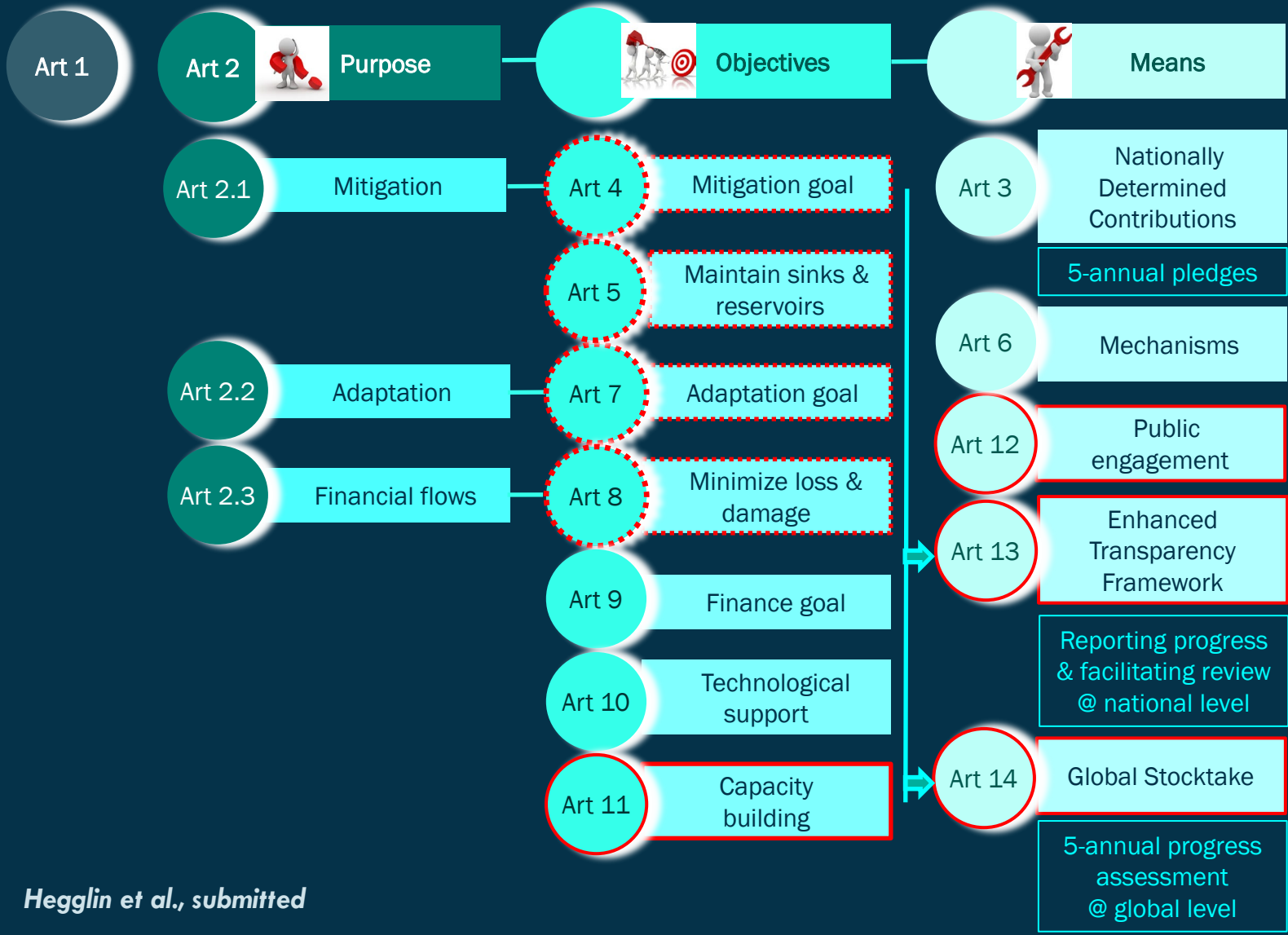
(cyclone Idai Mozambique 2019)



ESA CCI fire (California fires 2019)



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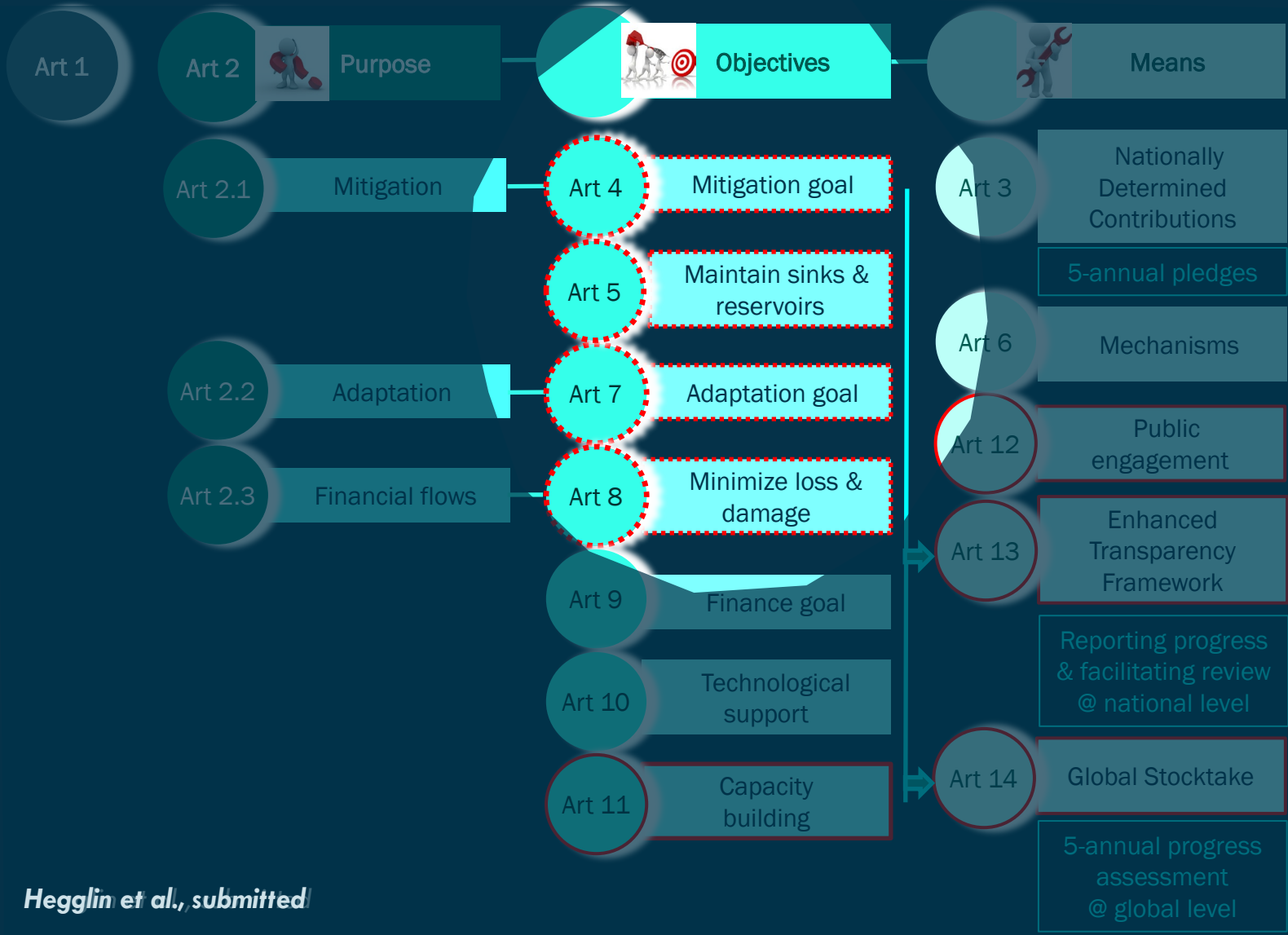


..... thematic areas EO can support
 _____ action pathways EO can support

Heggin et al., submitted



THE UNFCCC PARIS AGREEMENT



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Heggin et al., submitted



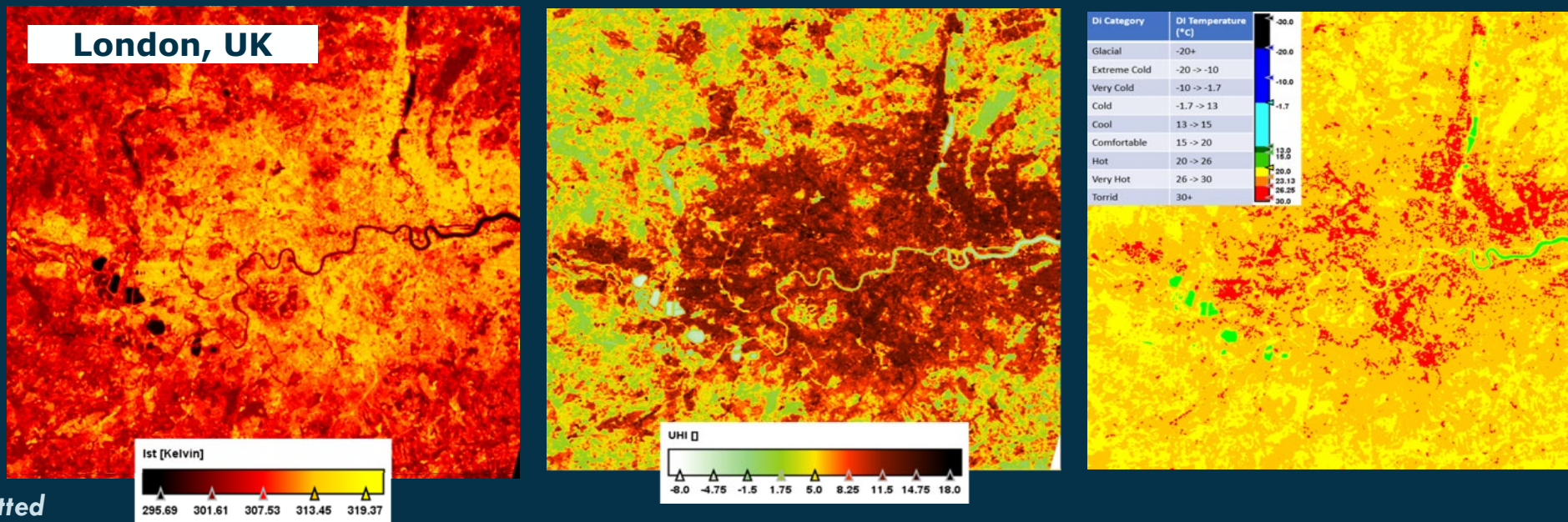
Are our adaptation efforts adequate?

- Adaptation has no global target and common indicators are lacking since it is dependent on location-specific economic, social, and environmental conditions.

→ EO helps answer this question by providing information on observable adaptation measures (e.g., urban greening) over time. However, there is a clear need for **co-development of adaptation indicators!**

ESA CCI high resolution LST observations

Urban heat island effect and implications for human wellbeing



Courtesy Darren Ghent

Heggin et al., submitted

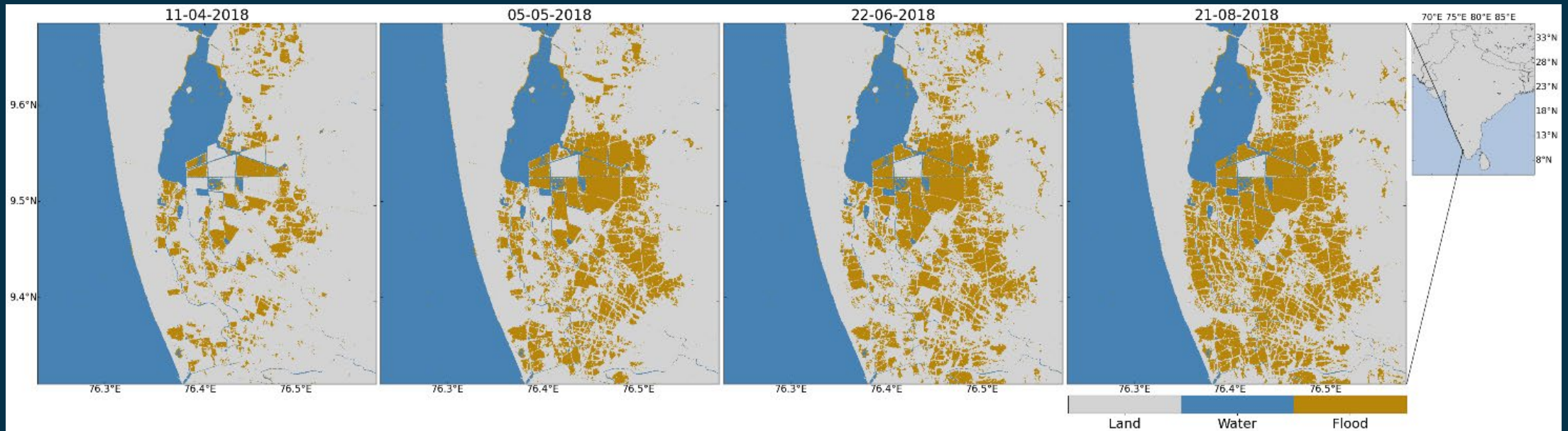
Are we protected against economic and non-economic loss & damage?

- Loss & damage occurs due to both **sudden-onset** (e.g., cyclones, flooding, heat-waves, fires) and **slow-onset events** (e.g., sea-level rise, glacial melting, drought).

→ EO help answer this question by measuring the extent of loss & damage events. **Again, co-development of indicators is needed!**

Sentinel-1A and -1B SAR images

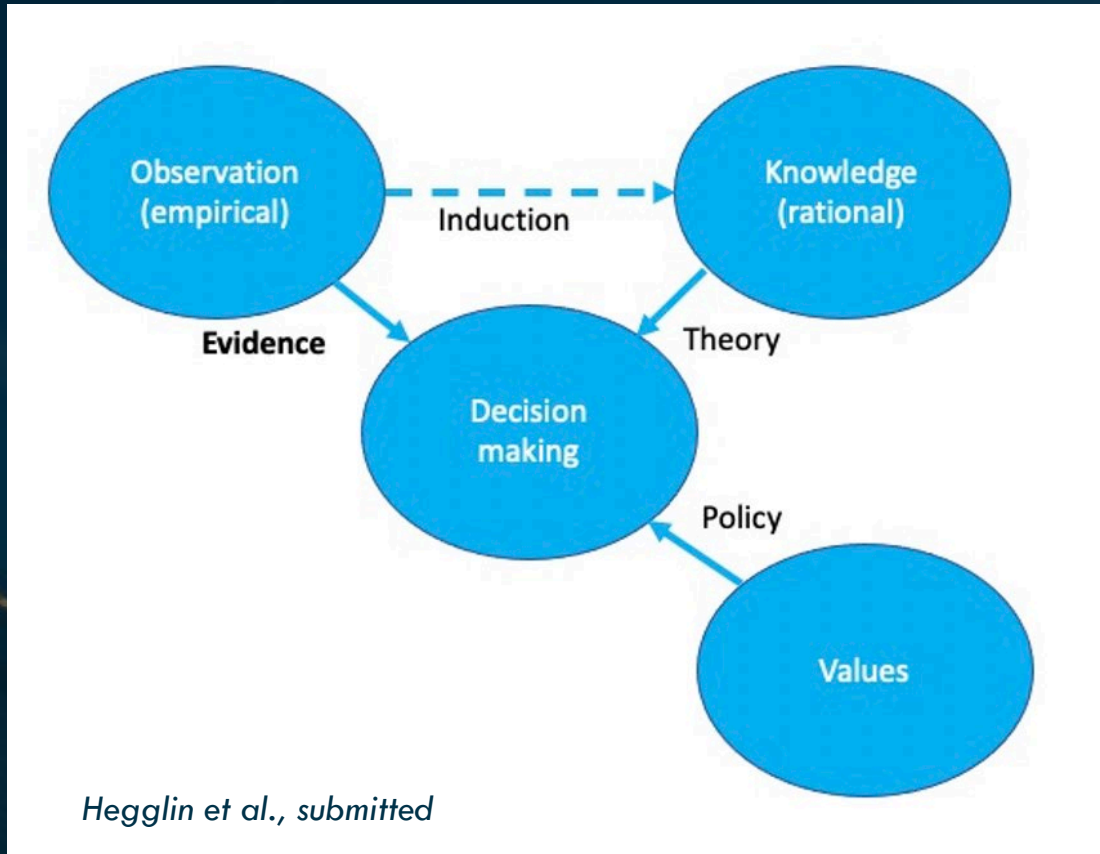
Flooding during extreme monsoon season in 2018 Kerala, India



Courtesy Gemma Kulk and Shubha Sathyendranath

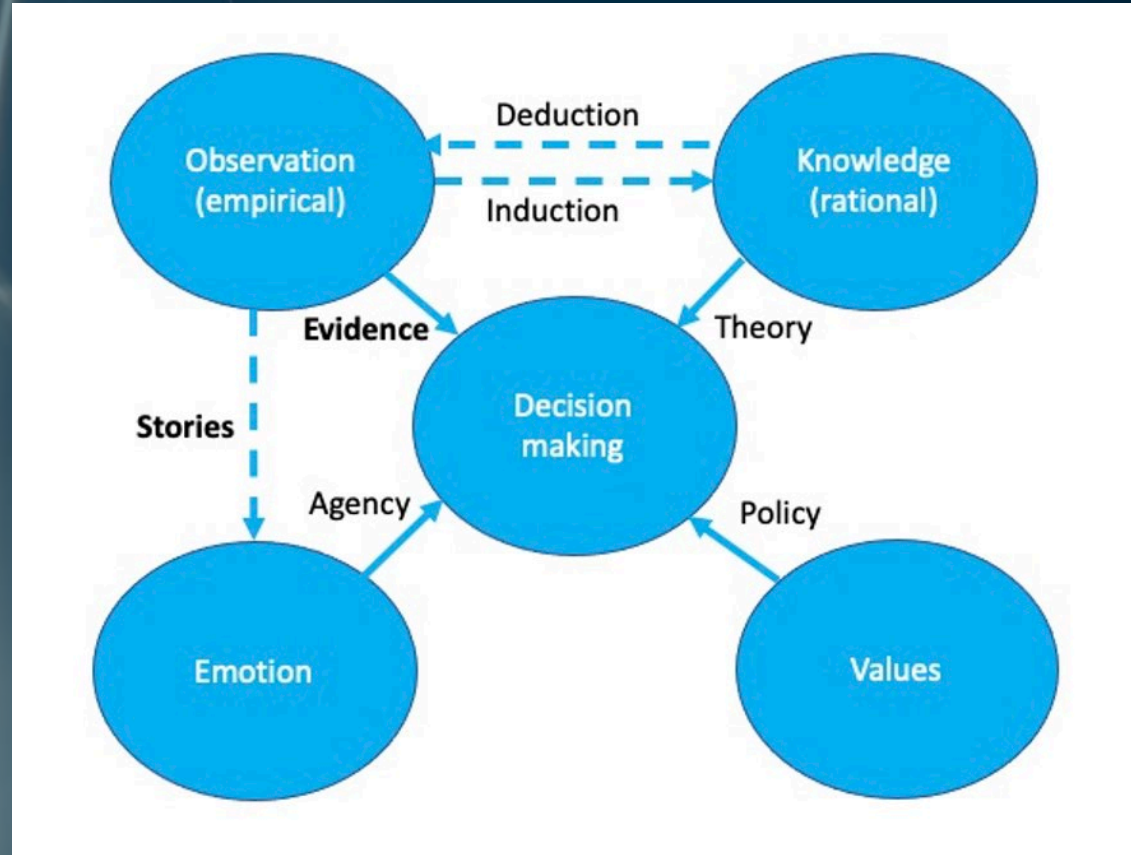
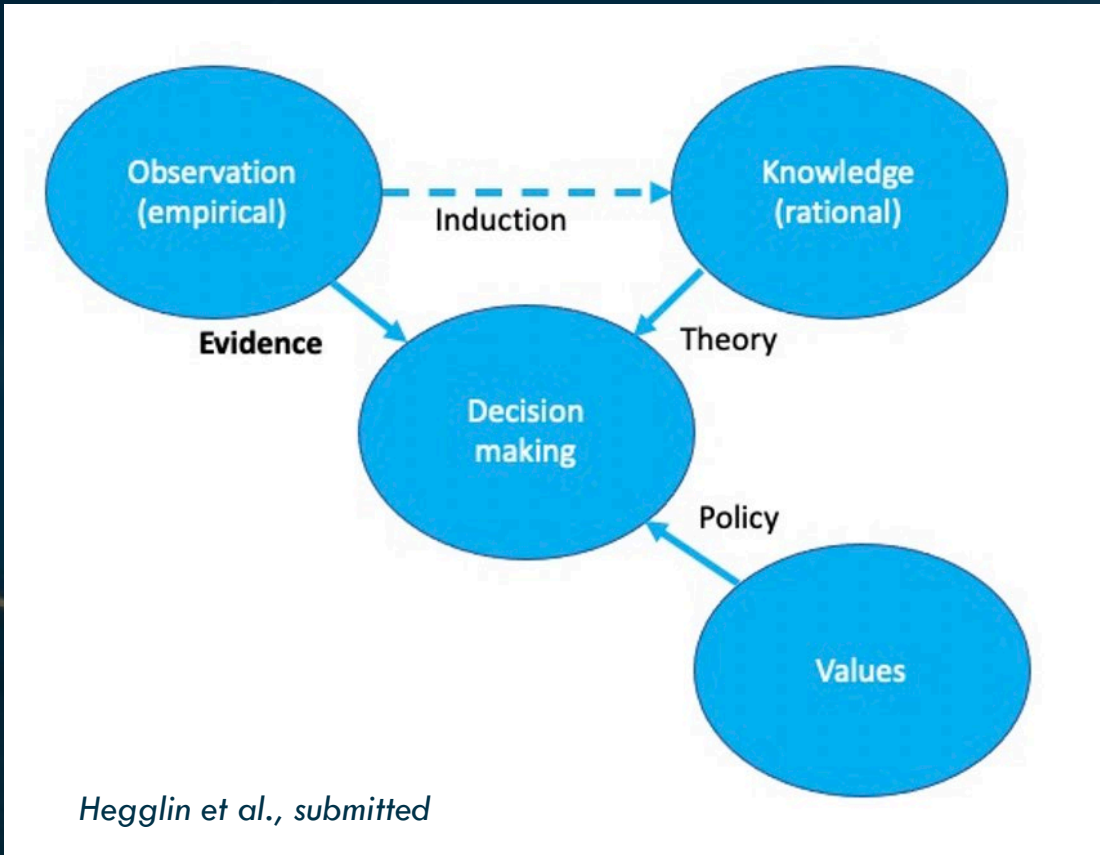
Heggin et al., submitted

CHANGING OUR APPROACH



CHANGING OUR APPROACH

- Using EO to create stories (instead of generalizing the information using induction) of how climate change is expressing itself in a localized context, will not only provide actionable information for adaptation design but also generate emotions, necessary for agency.



TAKE-HOME MESSAGES



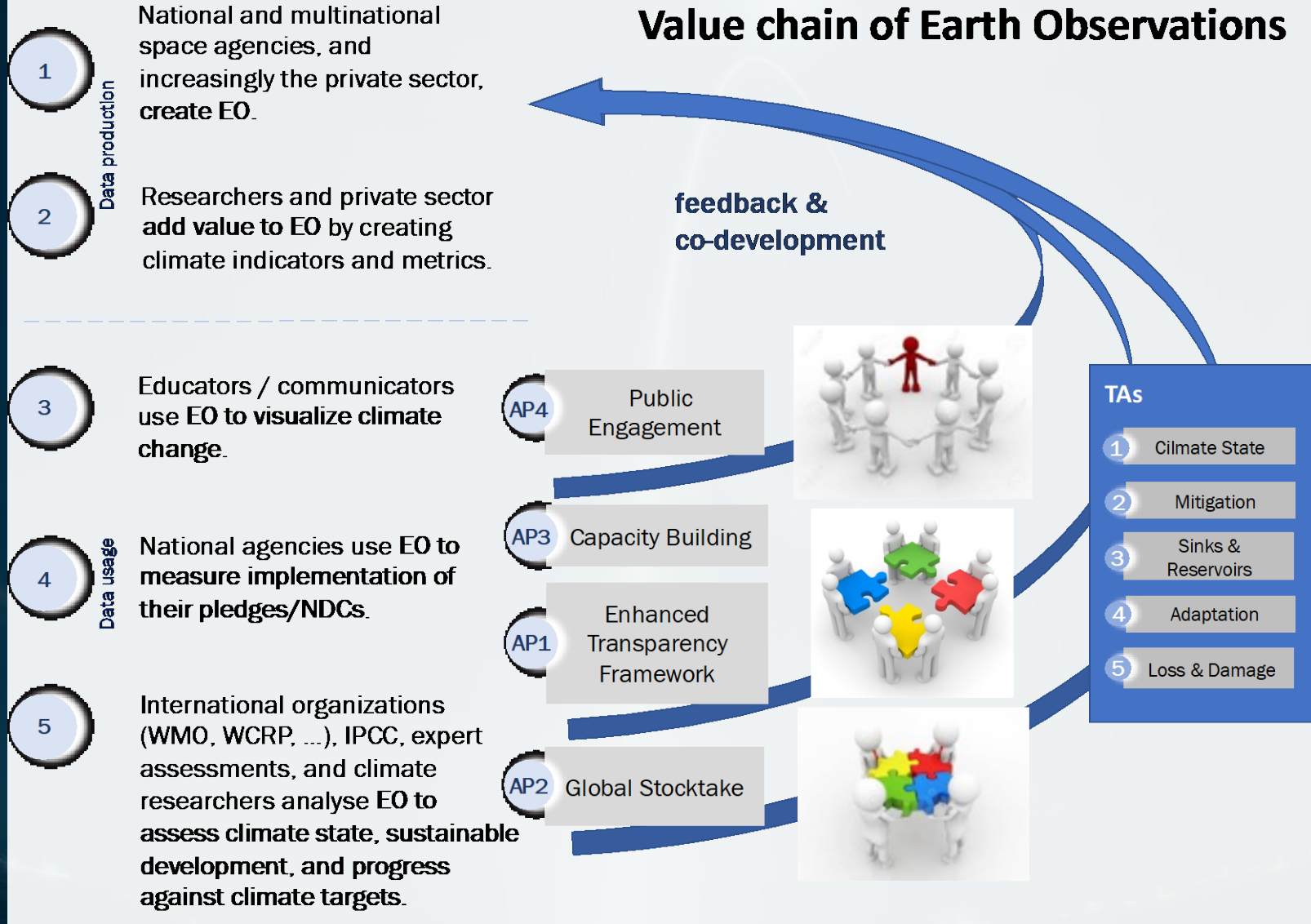
- In addition to using EO to prove that climate change is happening, EO (backed by theoretical understanding) can be used to illustrate change at the local scale in a salient way (thus engaging emotion).
- This opens a new avenue for using climate information from EO not only for policy making and monitoring its effectiveness towards the Paris Agreement's overarching goals (mitigation, sources & sinks, adaptation, loss & damage), but also for climate change communication and education.
- While EO shows great potential to support the UNFCCC Paris Agreement at both the national (via the ETF) and global level (via the GST), its full potential is still to be realized (i.e., transformation to actionable information useful for decision-making).
- To be successful with this new mandate, EO science must undergo a radical overhaul: it must become more user-oriented, collaborative, and transdisciplinary; span the range from fiducial to contextual data; and embrace new technologies for data analysis (e.g., artificial intelligence).
- Key to realising EO's full potential is the co-development of innovative solutions-oriented information derived from EO.

THE EO VALUE CHAIN



Hegglin et al., submitted

Value chain of Earth Observations



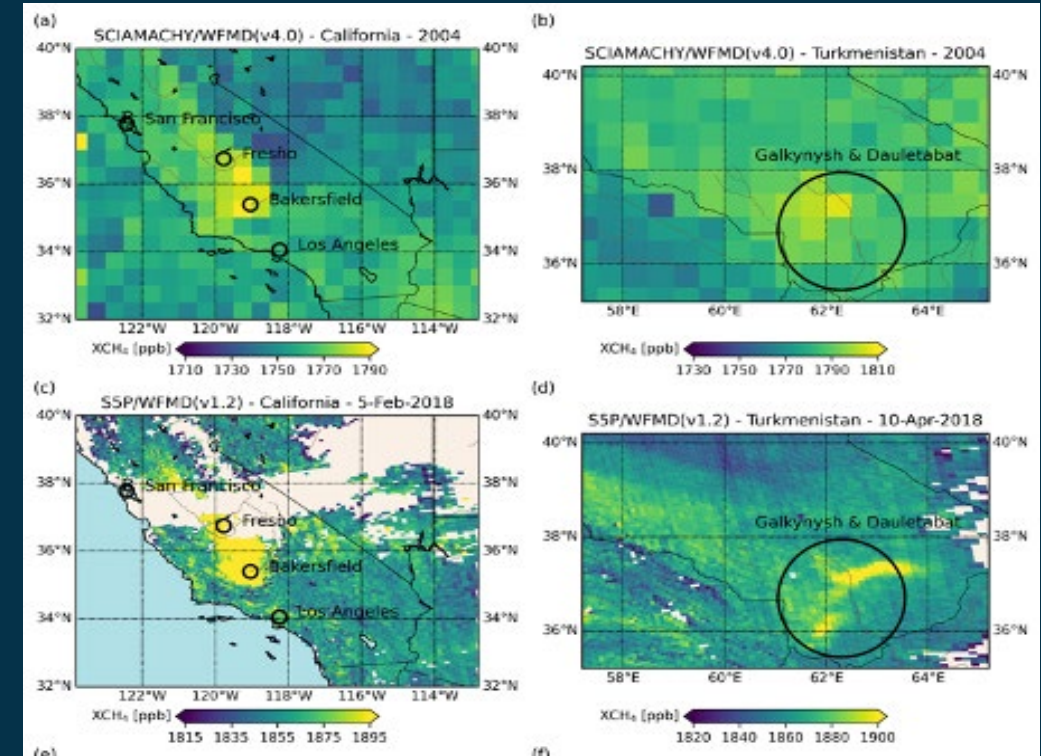
Are our mitigation efforts effective?

- Currently the **best developed EO capability** in direct support of the UNFCCC PA.
- EO are used to detect CO₂ and CH₄ emission hotspots.
 - Identifies targeted mitigation opportunities.
- EO help quantify natural and human sources & sinks on country to continental scales using model-based inversions.
 - Identifies whether NDC pledges are kept and mitigation mechanisms (e.g., carbon trading) work.

→ EO help answer this question by supporting national reporting of greenhouse gas emissions within the **ETF** and by delivering top-down emission estimates for the **GST**.

SCIAMACHY and Sentinel-5P CH₄ observations

Detection of emission hotspots in California.



Case study courtesy Michael Buchwitz & Heinrich Bovensmann

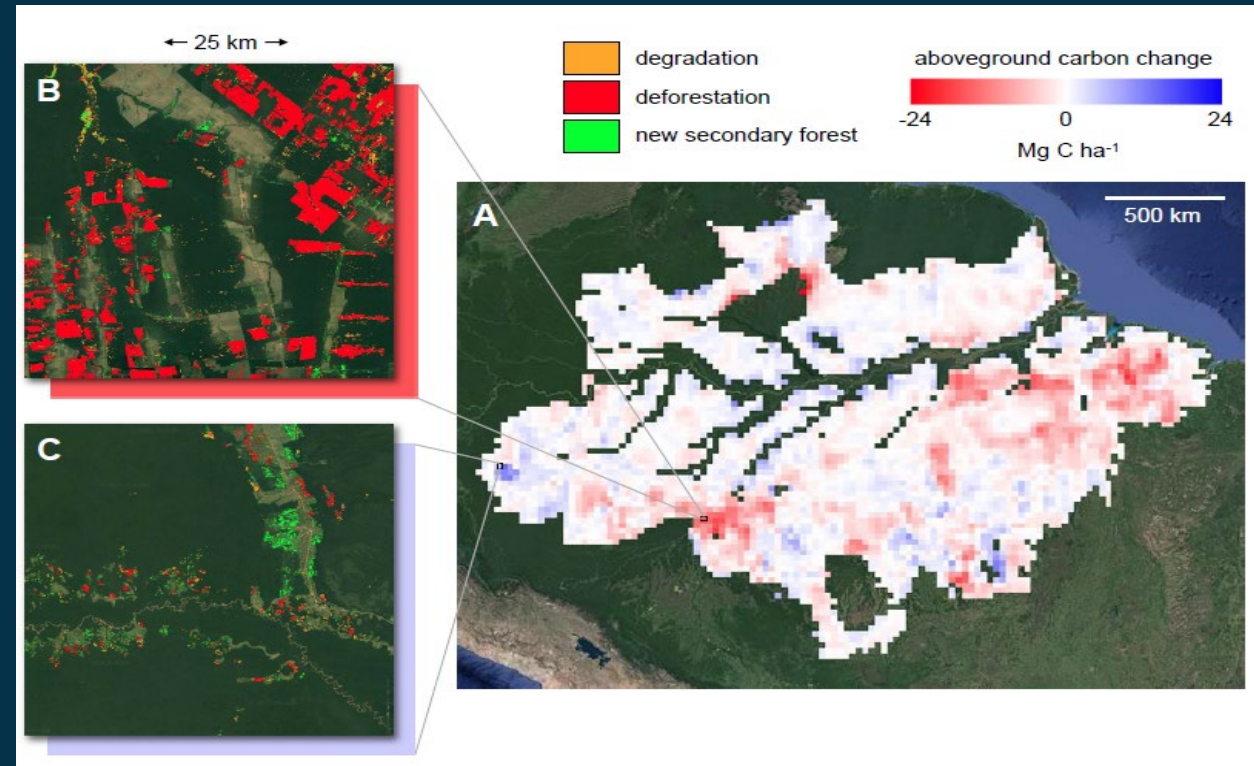
Are we maintaining the magnitude of greenhouse gas sinks and reservoirs?

- Focus is on agriculture, forestry and other land use change (AFOLU).
- Key task is the global **assessment of the temporal changes** in sinks and reservoirs and their **attribution to natural** (e.g., fires, drought, disease) and **anthropogenic drivers** (e.g., logging, agricultural and urban expansion).
 - Verifies effectiveness of carbon offsetting (e.g., planting trees).

reporting of AFOLU changes within the **ETF** and by delivering assessment of AFOLU within the **GST**.

Imagery from Landsat and Sentinels

Remotely sensed land-cover changes in the Brazilian Amazon and illustration of associated carbon dynamics.



Case study courtesy RECCAP: Dominic Fawcett and Ana Bastos