

Support to climate policy needs: UNFCCC Paris Agreement

Philippe Ciais

CMUG March 2026



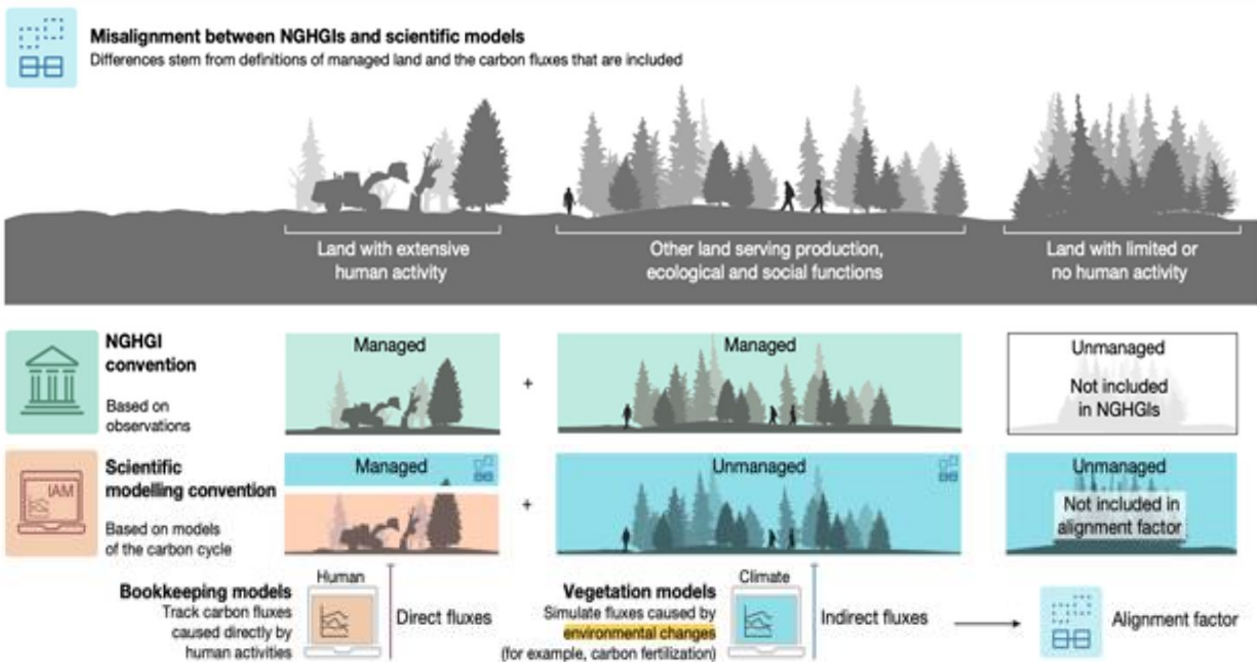
INRAE



CITEPA



Aligning Scientific Modelling with countries reports



Main Objectives of RECCAP-2 Climate Space (2024-2027)

- Assessment of GHG gross and net fluxes for six case study regions
- **Closure of regional budgets** Top down and bottom-up estimates using EO will be compared and reconciled with inventories.
- These regional case studies are completed by the collection and analysis of global ECVs aiming to reduce the uncertainty on the global biomass carbon change and methane budgets
- **This project integrates across CCI ECVs**

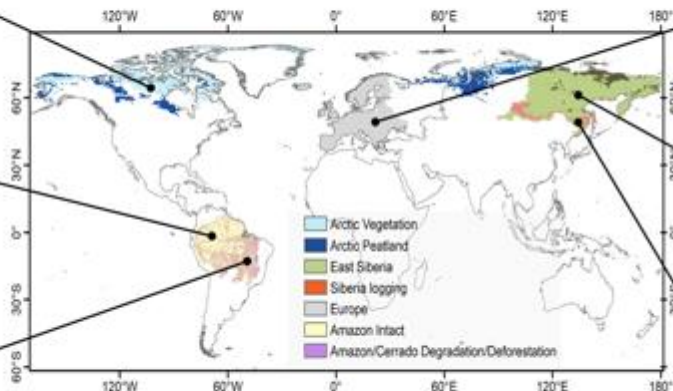
Arctic tundra and peatlands



Amazon 'intact'



Amazon 'deforestation and degradation'



Europe



Siberia 'intact'



Siberia 'logging'





Key scientific achievements : 15 Nature family papers More in the pipeline ...

nature geoscience

Article <https://doi.org/10.1038/s41561-023-01274-4>

Global increase in biomass carbon stock dominated by growth of northern young forests over past decade

PNAS RESEARCH ARTICLE ENVIRONMENTAL SCIENCES

Check for updates

Climatic and biotic factors influencing regional declines and recovery of tropical forest biomass from the 2015/16 El Niño

Hui Yang¹, Philippe Ciais², Jean-Pierre Wigneron³, Jérôme Chave⁴, Oliver Cartus⁵, Xuzhi Chen⁶, Lei Fan⁷, Julia K. Green⁸, Yuanyuan Huang⁹, Emile Joetjjer⁸, Heather Kay⁸, David Makowski⁸, Fabienne Maignan⁸, Maurizio Santoro⁸, Shengji Tao⁸, Uyang Liu^{10,11}, and Yitong Yao¹

communications earth & environment

ARTICLE <https://doi.org/10.1038/s43247-023-00008-1> OPEN

Synthesis of the land carbon fluxes of the Amazon region between 2010 and 2020

Thais M. Rosan^{1,2}, Stephen Storch¹, Michael O'Sullivan¹, Luana S. Basso^{2,3}, Chris Wilson^{4,5}, Camilla Silva^{1,6}, Emanuel Gloor², Dominic Fawcett^{1,7}, Viola Heinrich¹, Jefferson G. Souza¹, Francisco Giney Silva Bezerra¹, Celso von Randow¹, Lina M. Mercado^{1,8}, Luciana Gatti¹, Andy Wilbshire^{1,9}, Pieter Friedlingstein¹, Julia Pongratz^{1,10}, Clemens Scheinghacker^{1,11}, Matthew Williams^{1,12}, Luke Snatman^{1,13}, Jürgen Knauer^{1,14}, Vivek Arora¹⁵, Daniel Kennedy^{1,16}, Herwin Tian^{1,17}, Wuping Yuan^{1,18}, Abul K. Jain^{1,19}, Stefanie Falk^{1,20}, Benjamin Poulter^{2,21}, Almut Arneth^{2,22}, Qing Sun^{2,23}, Sōkei Zaehra²⁴, Anthony P. Walker²⁵, Etsushi Kato²⁶, Xu Yuan²⁷, Ana Bastos²⁸, Philippe Ciais²⁹, Jean-Pierre Wigneron³⁰, Clement Allgeier³¹ & Luiz E. O. C. Aragão^{3,3}

nature geoscience

Article <https://doi.org/10.1038/s41561-023-01067-1>

Siberian carbon sink reduced by forest disturbances

Received 23 July 2021
Accepted 21 October 2022
Published online: 12 December 2022

Check for updates

Lei Fan¹, Jean-Pierre Wigneron^{1,2}, Philippe Ciais³, Jérôme Chave⁴, Martin Brandt⁵, Stephen Storch⁶, Chao Yue⁷, Ana Bastos⁸, Xin Li⁹, Yanwei Qin¹⁰, Wuping Yuan¹¹, Dmitry Schepaschenko^{12,13}, Ludmila Mukhortova¹⁴, Xiaojun Li¹⁵, Xiangshuo Liu¹⁶, Mengjia Wang¹⁷, Frédéric Froggatt¹⁸, Xiangming Xiao¹⁹, Jingming Chen²⁰, Mingqiao Ma²¹, Jingsong Wu²², Xuzhi Chen²³, Hui Yang²⁴, Dave van Wes²⁵ & Ramona Fernandes²⁶

ARTICLE <https://doi.org/10.1038/s41467-023-22050-1> OPEN

Check for updates

Large carbon sink potential of secondary forests in the Brazilian Amazon to mitigate climate change

Viola H. A. Heinrich^{1,2}, Ricardo Dalagnol², Henrique L. G. Cassol², Thais M. Rosan³, Catherine Torres de Almeida², Celso H. L. Silva Junior², Wesley A. Campanharo², Joanna I. House^{1,4}, Stephen Storch⁵, Tristram C. Hales⁵, Marcos Adams⁶, Liana O. Anderson⁷ & Luiz E. O. C. Aragão^{2,3}

nature sustainability ANALYSIS <https://doi.org/10.1038/s41892-023-00008-1>

OPEN

Doubling of annual forest carbon loss over tropics during the early twenty-first century

Key contribution to GCP RECCAP-2 protocols and synthesis
 Inversions for the 2023 global stock-stake : Deng et al. , Byrne et al. 2022
 New datasets : L-VOD processing, inundated areas
 New methodologies : loss and recovery C budgeting models
 Exchange with IPCC task force on national GHG inventories (workshops in 2023 and 2024)

Integration and synthesis

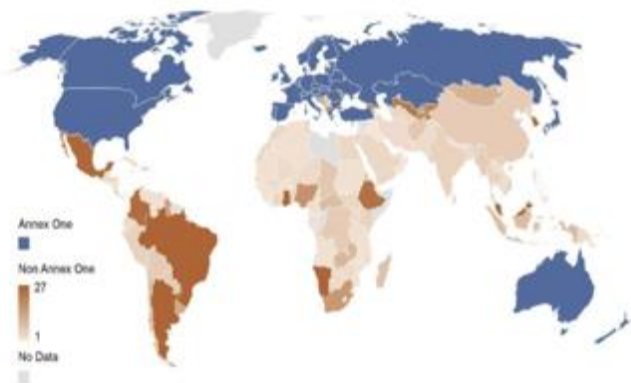


Fig 8. Number of years covered by NGHGI reports (National communications + Biennial Update Reports) in each country (as of March 6, 2023)

- **Partnership with CITEPA, CMCC. Collaboration with UKDES and INPE**
- **Make system boundaries & definitions as close as possible between EO data and IPCC Guidelines used for NGHGI**
- **Data cube for data homogenization and visualisation (Brockmann)**
- **Scientific publication to track progress of national mitigation efforts (LSCE)**
- **National Agency engagement and contribution to the Global Stocktake (U Leipzig)**



reccap-2

Peat fires in the arctic

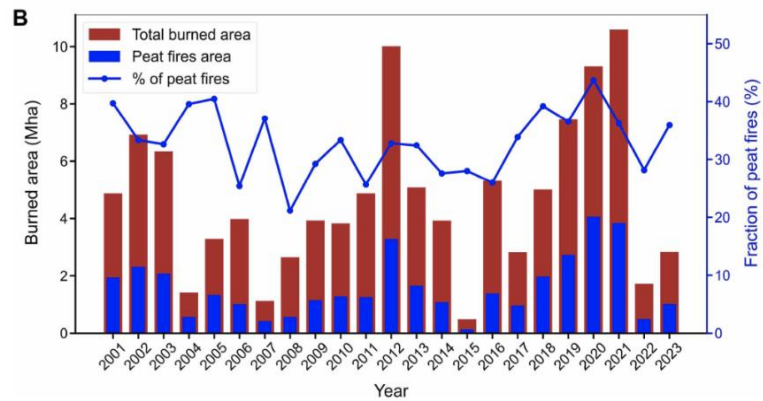
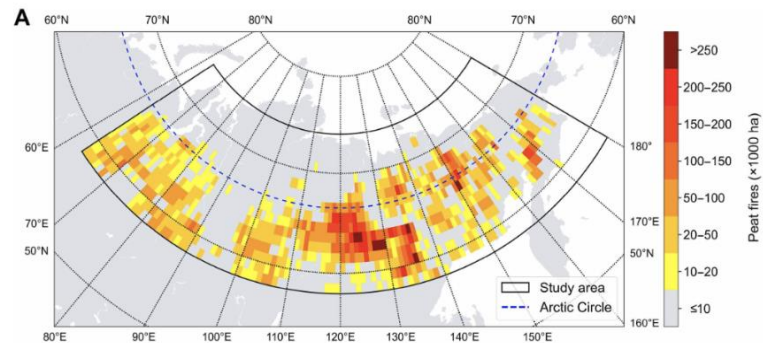
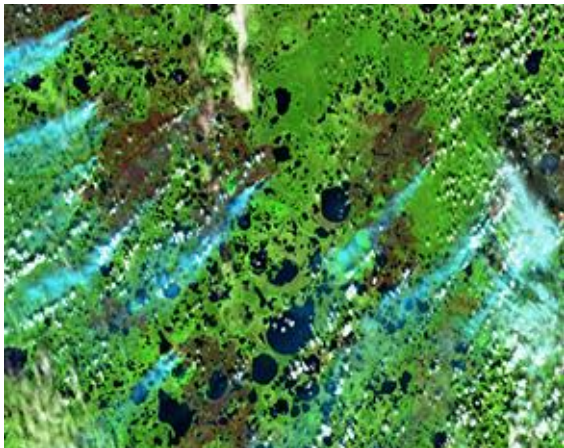
Kairoun *et al.* March 18, *Science Advances* Highlights by ESA

SCIENCE ADVANCES | RESEARCH ARTICLE

APPLIED ECOLOGY

Peat fires contribute disproportionately to Siberian fire carbon emissions

Amin Khairoun^{1*}, Philippe Ciais², Thu Hang Nguyen², Chunjing Qiu³, Chengliuhui Fang³, Filipe Aires⁴, Sander Veraverbeke^{5,6}, Clement J. F. Delcourt⁵, Bo Zheng^{7,8}, Emilio Chuvieco¹





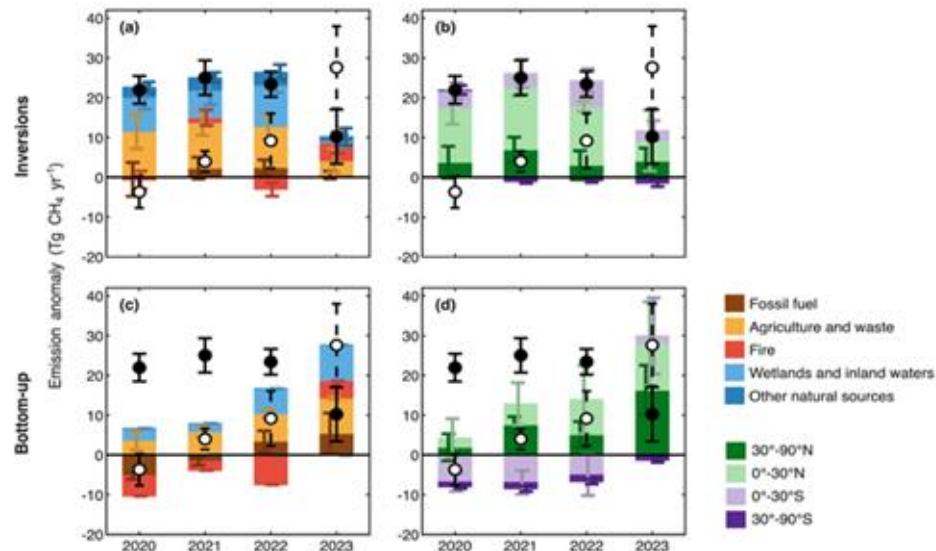
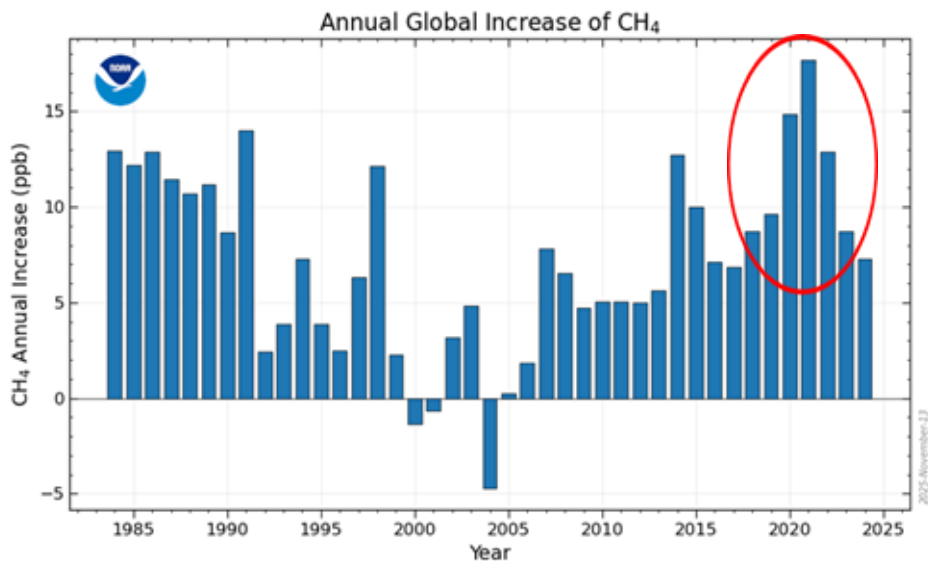
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Recent spike in methane growth rate

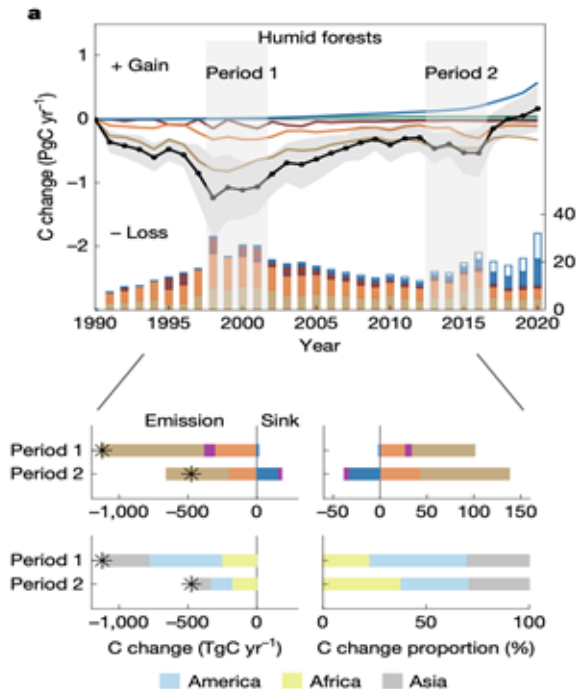
Ciais *et al.* Article published in Science, Feb. 2026

News item published by ESA



Xu *et al.* Article published in Nature, Jan. 2026

News item published by ESA



Article

Small persistent humid forest clearings drive tropical forest biomass losses

<https://doi.org/10.1038/s41586-025-09870-7>

Received: 8 January 2025

Accepted: 5 November 2025

Yidi Xu¹, Philippe Ciais^{1,2,3}, Maurizio Santoro², Clément Bourgoin³, François Ritter^{1,4}, Agnès Pellissier-Tanon¹, Yu Feng^{1,5}, Chuanlong Zhou¹, Guojin He⁶, Viola Heinrich^{1,8}, Simon Besnard⁷, Nathaniel Robinson⁹, Susan C. Cook-Patton¹⁰, Jérôme Chave¹¹, Luiz E. O. C. Aragao^{12,13}, Jean P. Ometto¹², Simon P. K. Bowring¹, Ibrahim Fayad¹, Lei Zhu¹⁴, Yang Su^{1,15}, Jean-Pierre Wigneron¹⁶ & Wei Li^{1,14,15}

nature communications



Article

<https://doi.org/10.1038/s41467-025-59999-2>

Large live biomass carbon losses from droughts in the northern temperate ecosystems during 2016-2022

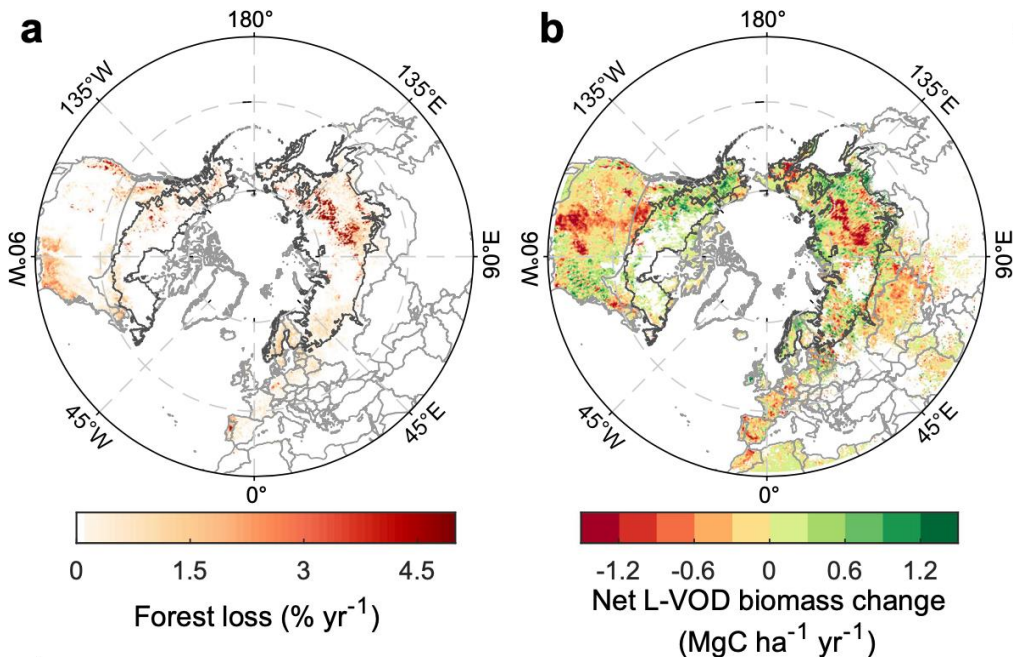
Received: 30 July 2024

Accepted: 12 May 2025

Published online: 02 June 2025

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Xiaojun Li^{1,2}✉, Philippe Ciais³, Rasmus Fensholt⁴, Jérôme Chave⁵, Stephen Sitch⁶, Josep G. Canadell⁷, Martin Brandt⁴, Lei Fan⁸, Xiangming Xiao⁹, Shengli Tao¹⁰, Huan Wang¹⁰, Clément Albergel¹¹, Hui Yang¹⁰, Frédéric Frappart¹, Mengjia Wang¹², Ana Bastos¹³, Philippe Maisongrande¹⁴, Yuanwei Qin¹⁵, Zanpin Xing¹, Tianxiang Cui¹⁶, Ling Yu⁸, Lei He¹⁷, Yi Zheng^{1,8}, Xiangzhuo Liu¹, Yuqing Liu¹, Aurelien De Truchis¹⁹ & Jean-Pierre Wigneron¹✉

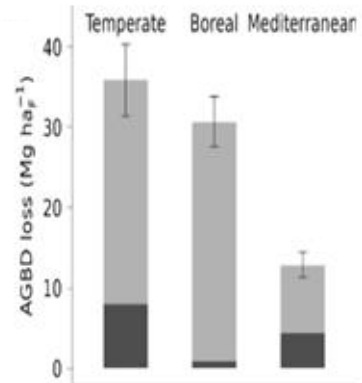
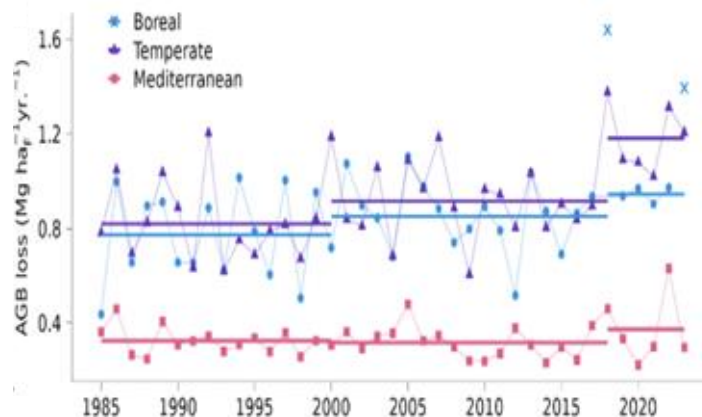
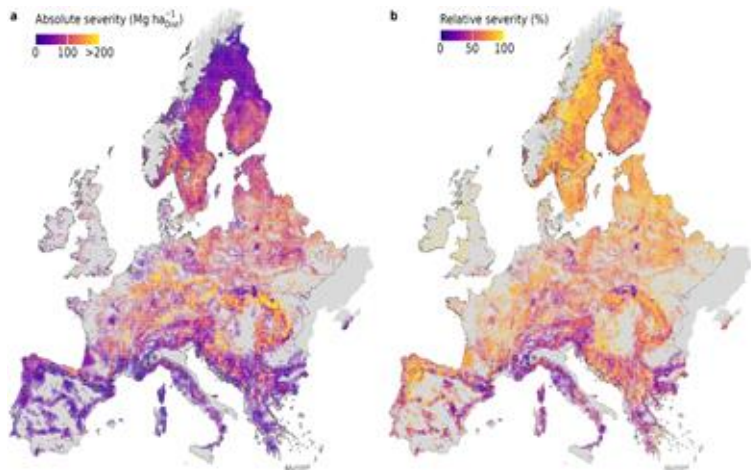




Kowalski *et al.* Article accepted in Nature Geosciences

Title: Accelerating biomass loss from forest disturbances across Europe

Authors: Katja Kowalski¹, Alba Viana-Soto¹, Martin Brandt², Philippe Ciais³, Wanda De Keersmaecker⁴, Rasmus Fensholt², Thomas A. M. Pugh^{5,6,7}, Yidi Xu³, Cornelius Senf¹



RECCAP2 Climate Space in a nutshell

- Robust framework established to **compare** scientific estimates of national GHG budgets & inventories
- We have extended this framework to **reconcile** EO-based estimates and inventories
- Use of CCI Fire, Biomass, GHG, Soil moisture, LST, Snow, Permafrost, Vegetation, Lakes, Land cover
 - High resolution top-down and bottom-up methods to achieve verification of Country Reports
 - Focus on missing components: dead wood, soil C changes, lakes and rivers CH₄ emissions
 - Attribution of forest disturbances to human vs natural events on managed land
 - Estimation of carbon losses during extreme events
 - Integrate ECVs -> multimodal GHG fluxes low latency analysis & attribution
 - Data cube and data visualization
- RECCAP2-CS focuses on addressing these research gaps for 6 regions by developing new synergies between EO-based products and national inventory agencies
- 🚀 Go global in next CS phase 🚀