

FORTRACK - Tracking Interactions of Tree Mortality, Functional Diversity & Ecosystem Responses to Climate Stressors with Earth Observation

<https://climate.esa.int/FORTRACK/>

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Institute for Earth System Science and Remote Sensing, **University of Leipzig**

17/02/2026

Related ITT: The project was established in response to ESA ITT ESA-EOP-SC-SC-2025-6 (ESA AO/1-12690/25/I-LR), titled "**CLIMATE-SPACE: BIODIVERSITY-CLIMATE STUDIES - EXPRO+**"

Goals of project:

- Reveal global patterns of **functional diversity**
- Track global **tree mortality dynamics** and related **buffering effects of plant functional diversity**
- Identify **drivers of tree mortality**, including climate extremes
- Assess the **imprint of tree mortality on ecosystem fluxes** and carbon dynamics

Timeframe: October 2025 to September 2027

Connections with...

- wider community: sPlot, TRY trait database, GBIF, International Tree Mortality Network
- policy activities: Joint Research Centre (JRC), IBPES, IPCC

Tree mortality & disturbance dynamics



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DB as of Q1'25 Q2'25 Q3'25 Q4'25 Q1'26 7,093 total | +1.885

Mosig et al. 2026, RSE



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Tree mortality & disturbance dynamics

Location

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Basemap

Streets Imagery

Data Layers

- Tree
- Standing Deadwood

Layer Opacity

Model Info

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Analytics

[Analyze Area](#)

Draw a polygon to see time-series stats

Feedback

Help improve our AI by flagging incorrect predictions

[Flag Area](#)

Show Flags (15)

Fractional Cover

Sentinel-2 based

- Tree 0-100%
- Standing Deadwood 0-100%

Clicked Location

Click on map to see values

Deadtrees.earth EO products

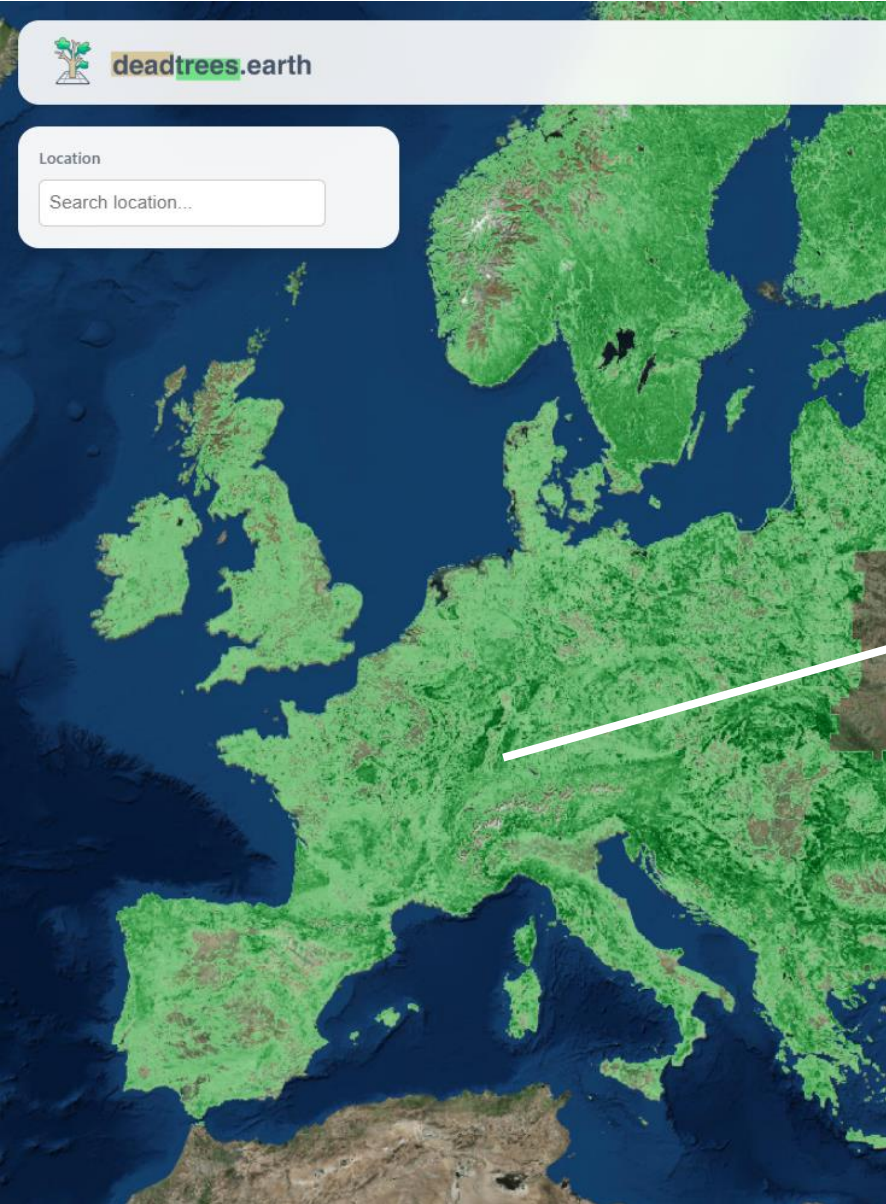
- First annually resolved products of
 - Tree cover [%]
 - Standing deadwood [%]
- Temporal coverage: 2017-2025
- Spatial resolution (Sentinel-2-based, 10m)

Mosig et al. 2026 RSE, Mosig et al. 2026 EarXiv

Tree mortality & disturbance dynamics



Location
Search location...



Basemap
Streets Imagery

Data Layers
 Tree
 Standing Deadwood

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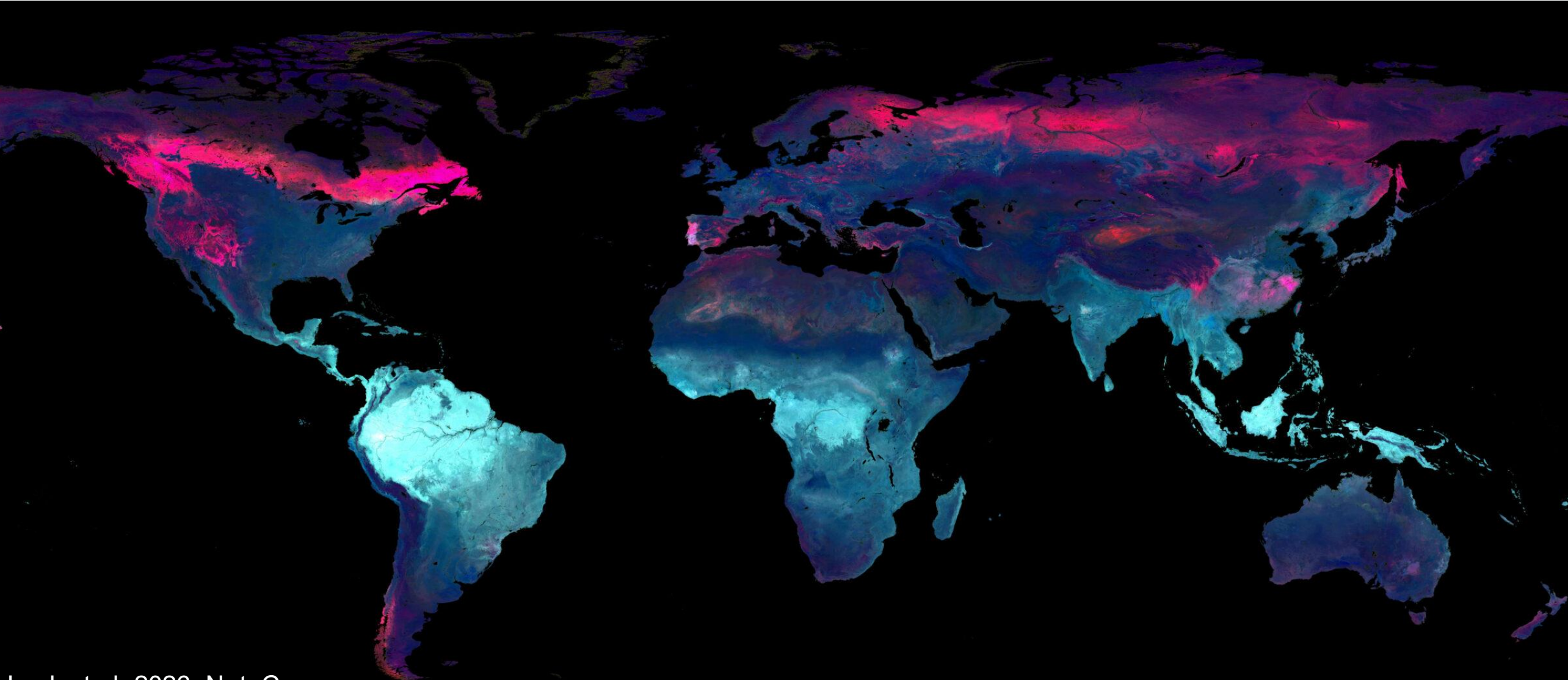
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Sentinel-2 based
Tree 0-100%
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Clicked Location
Click on map to see values

Plant functional diversity global scale

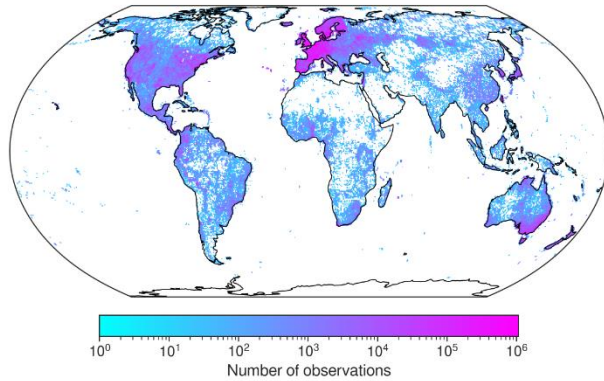


Lusk et al. 2026, Nat. Comms

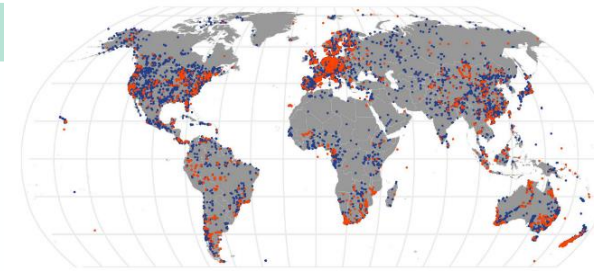


Plant functional diversity global scale

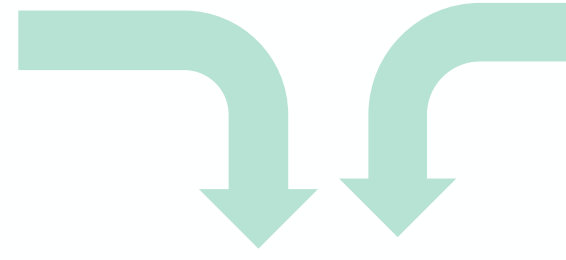
GBIF citizen science species observations (~340M obs.)



TRY plant traits + species name

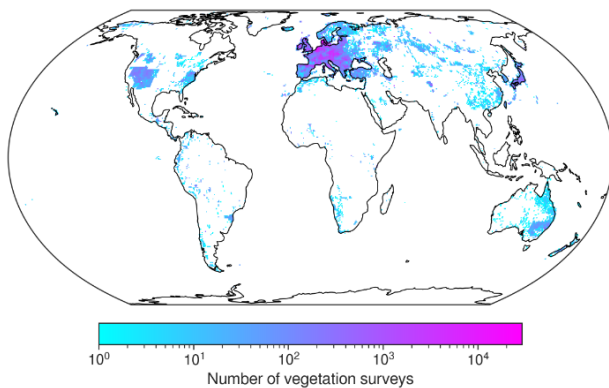


Trait	Data type	Number of requests
Leaf area per leaf dry mass (specific leaf area or 1/LMA) ^a	con	2,977 (41%)
Plant height vegetative	con	2,159 (29%)
Leaf nitrogen (N) content per leaf dry mass	con	1,938 (26%)
Leaf area ^b	con	1,676 (23%)
Plant growth form	cat	1,625 (22%)
Seed dry mass	con	1,580 (22%)
Leaf nitrogen (N) content per leaf area	con	1,221 (17%)
Leaf phosphorus (P) content per leaf dry mass	con	1,170 (16%)
Plant lifespan (longevity)	con	1,168 (16%)
Leaf dry mass per leaf fresh mass (leaf dry matter content)	con	1,147 (16%)
Leaf phenology type	cat	1,047 (14%)
Leaf carbon (C) content per leaf dry mass	con	973 (13%)
Dispersal syndrome	cat	958 (13%)
Stem specific density	con	951 (13%)
Leaf photosynthesis rate per leaf area	con	896 (12%)
Leaf dry mass (single leaf)	con	896 (12%)
Leaf photosynthesis pathway	cat	874 (12%)
Leaf thickness	con	852 (12%)
Plant nitrogen (N) fixation capacity	con	833 (11%)
Leaf carbon/nitrogen (C/N) ratio	con	817 (11%)
Plant life form sensu Raunkiaer	cat	801 (11%)
Leaf lifespan (longevity)	con	790 (11%)
Root rooting depth	con	733 (10%)
Plant growth rate	con	727 (10%)
Leaf type	cat	727 (10%)

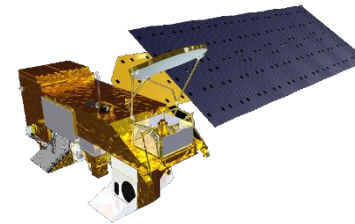


community trait information
reference data

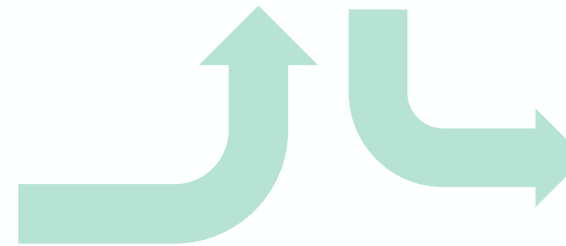
SPlot expert-led vegetation surveys (~54M obs.)



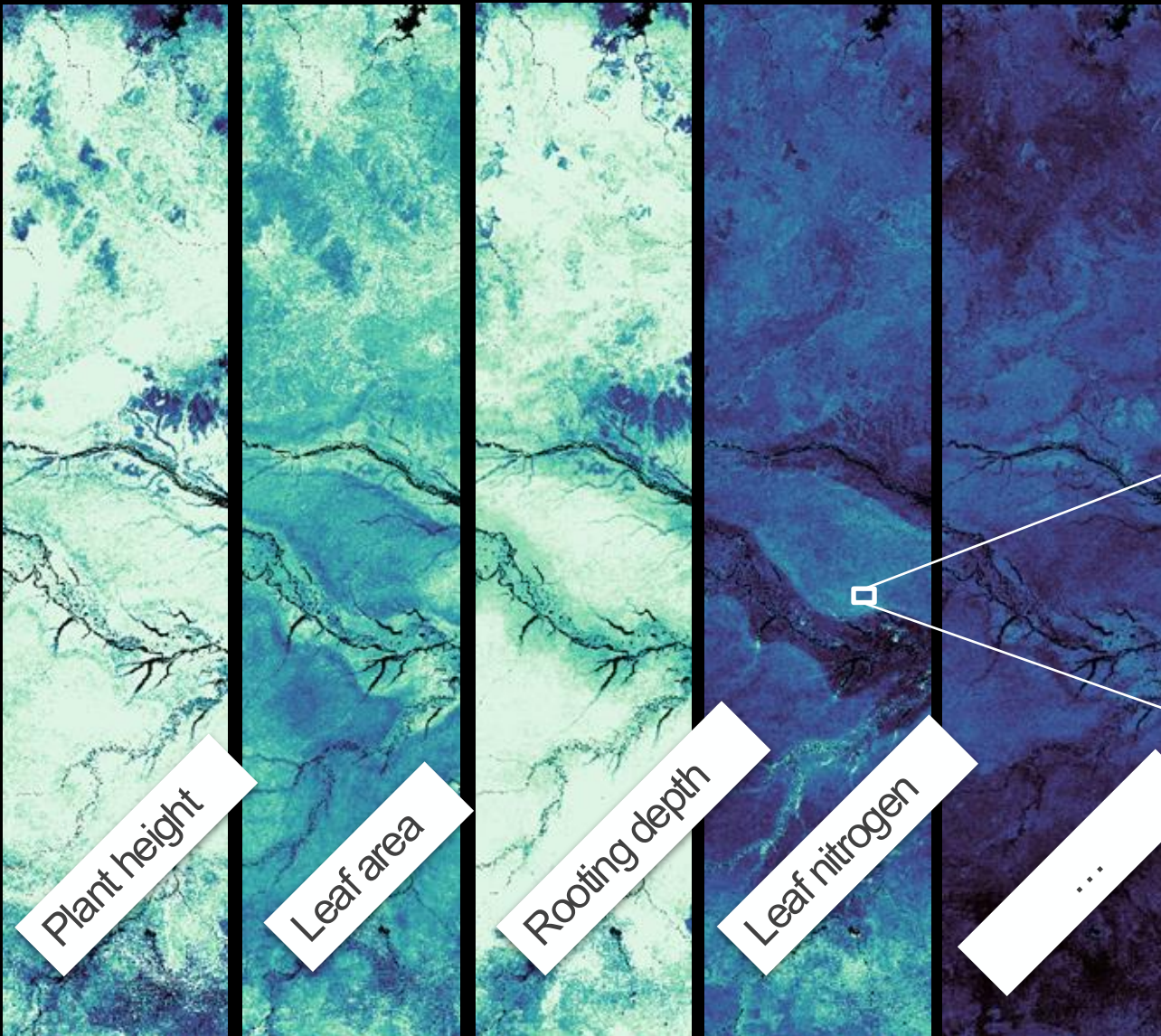
Extrapolation with **EO products**



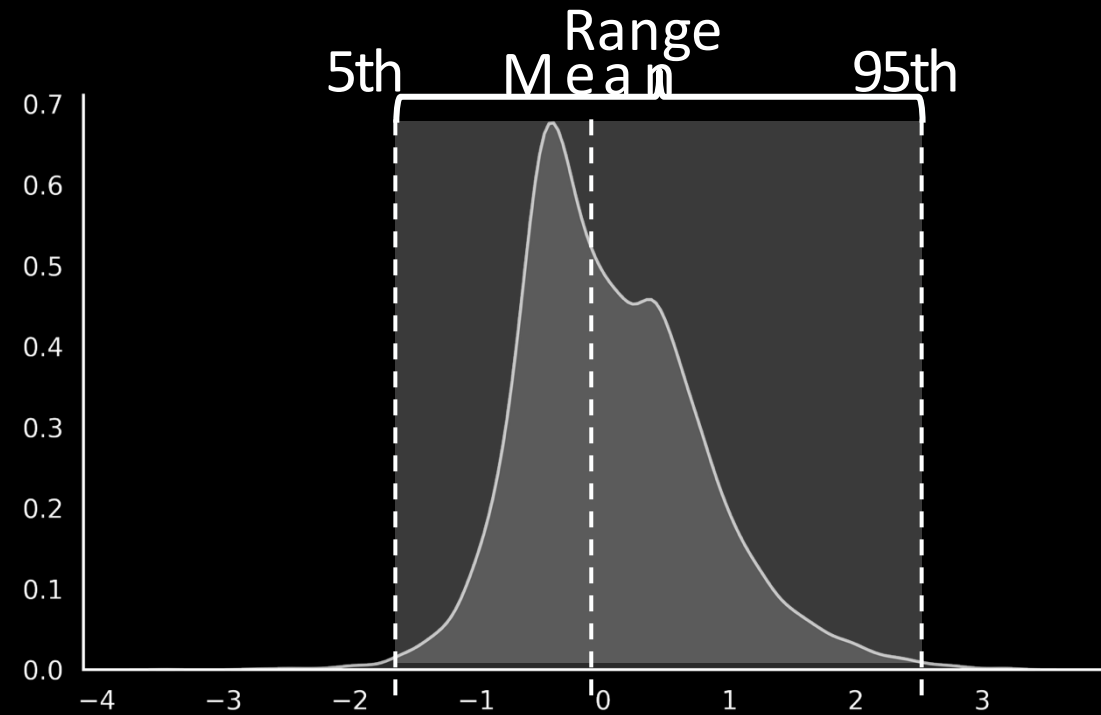
MODIS, WorldClim, SoilGrids, VODCA



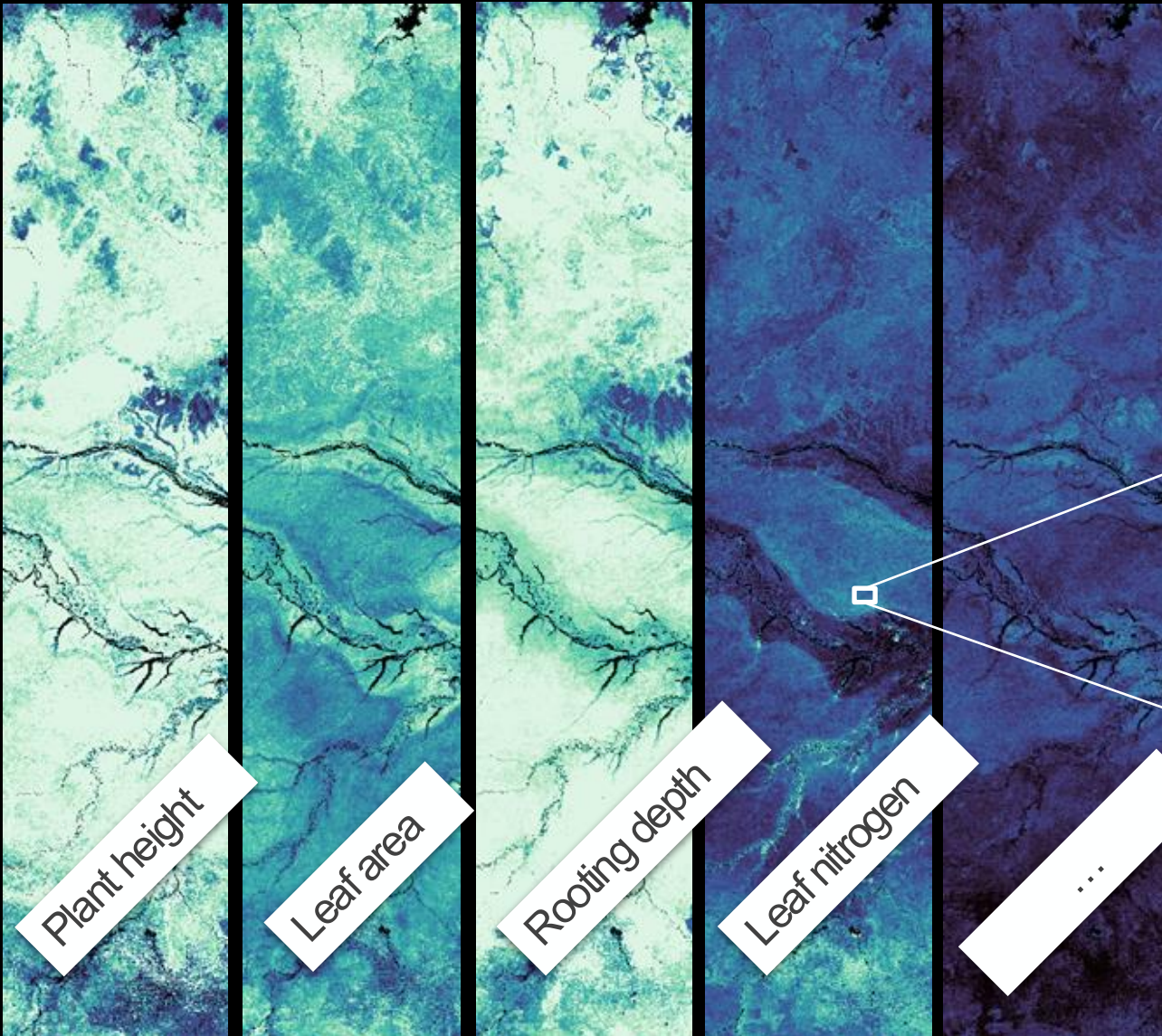
Plant functional diversity global scale



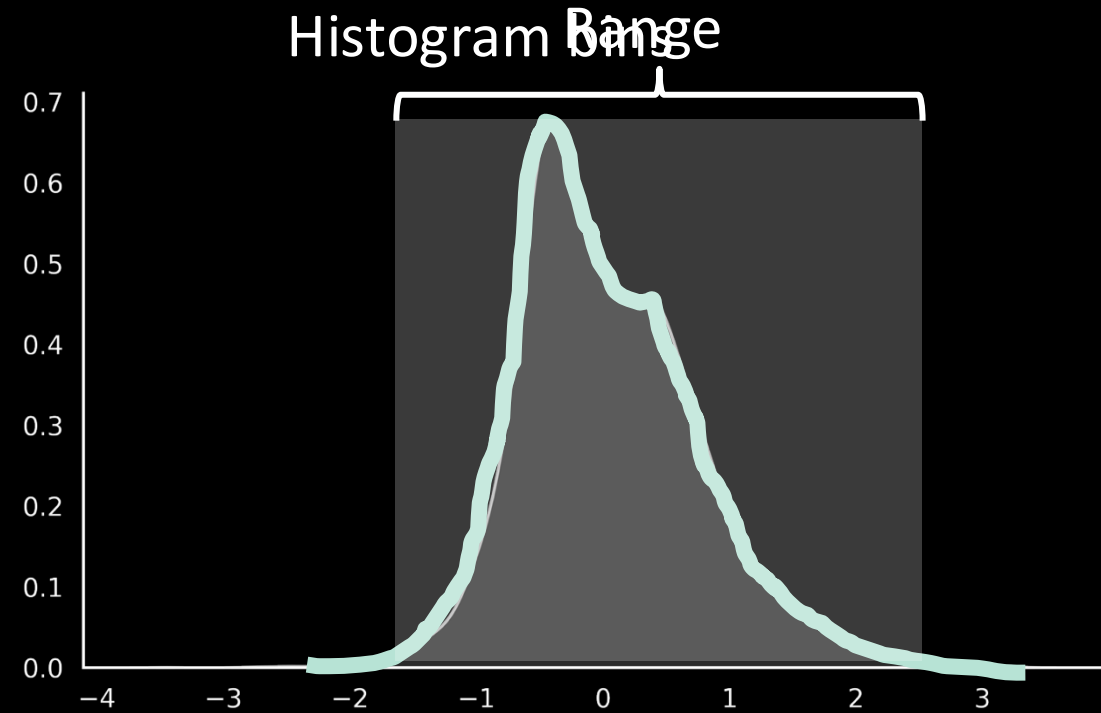
Plant functional trait distributions



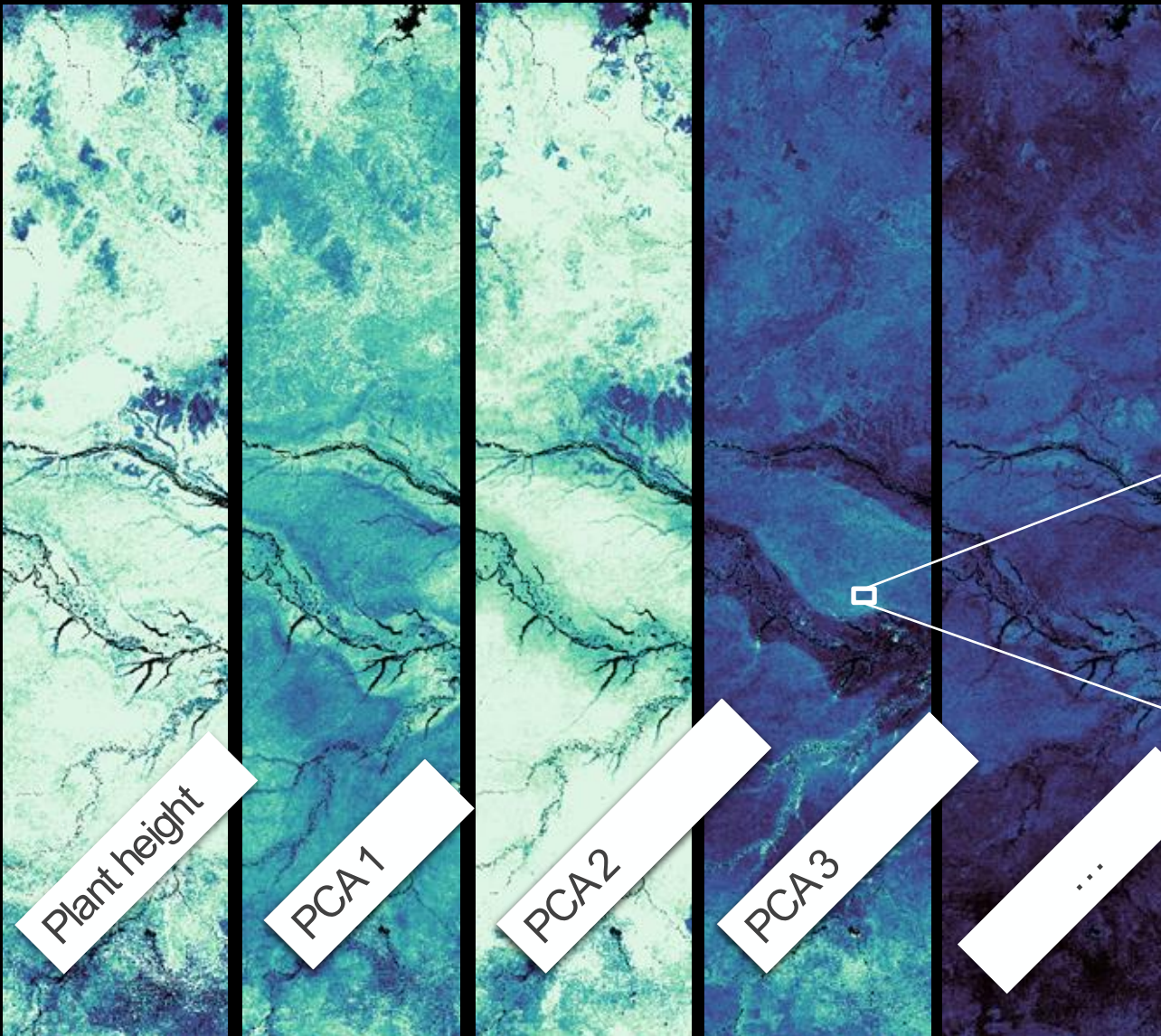
Plant functional diversity global scale



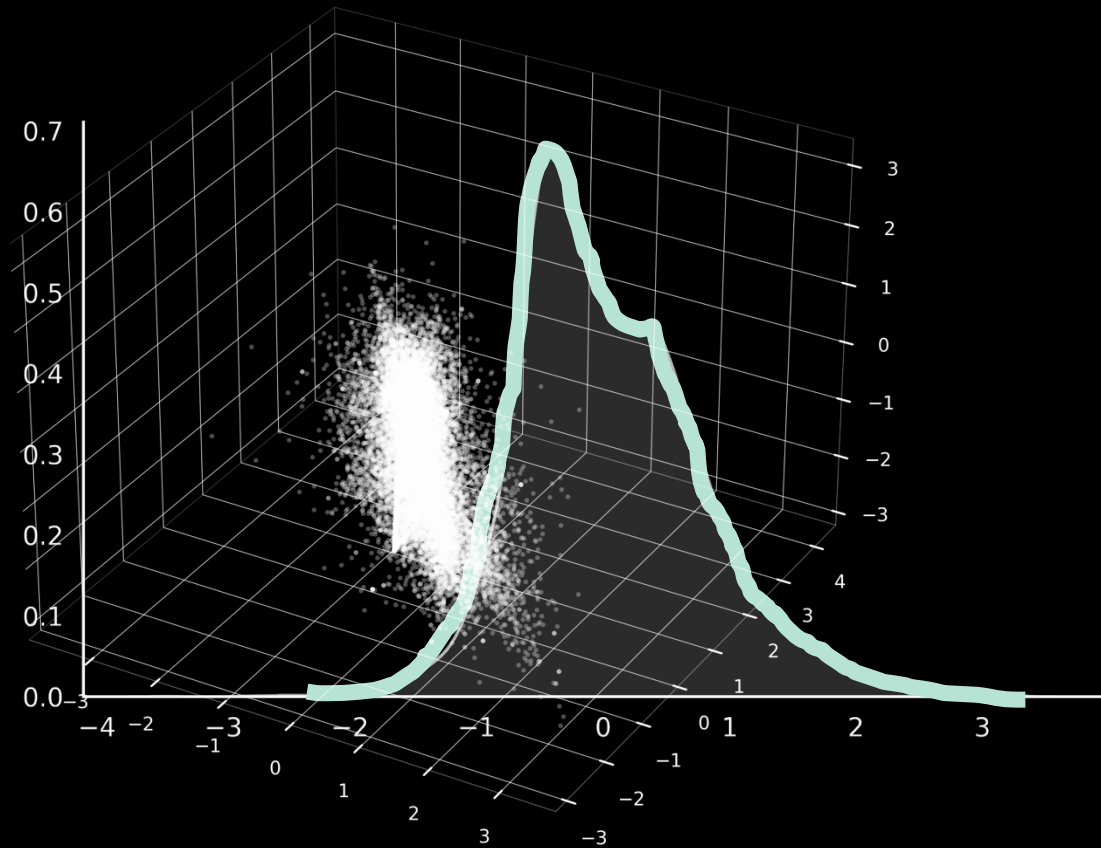
Plant functional trait distributions



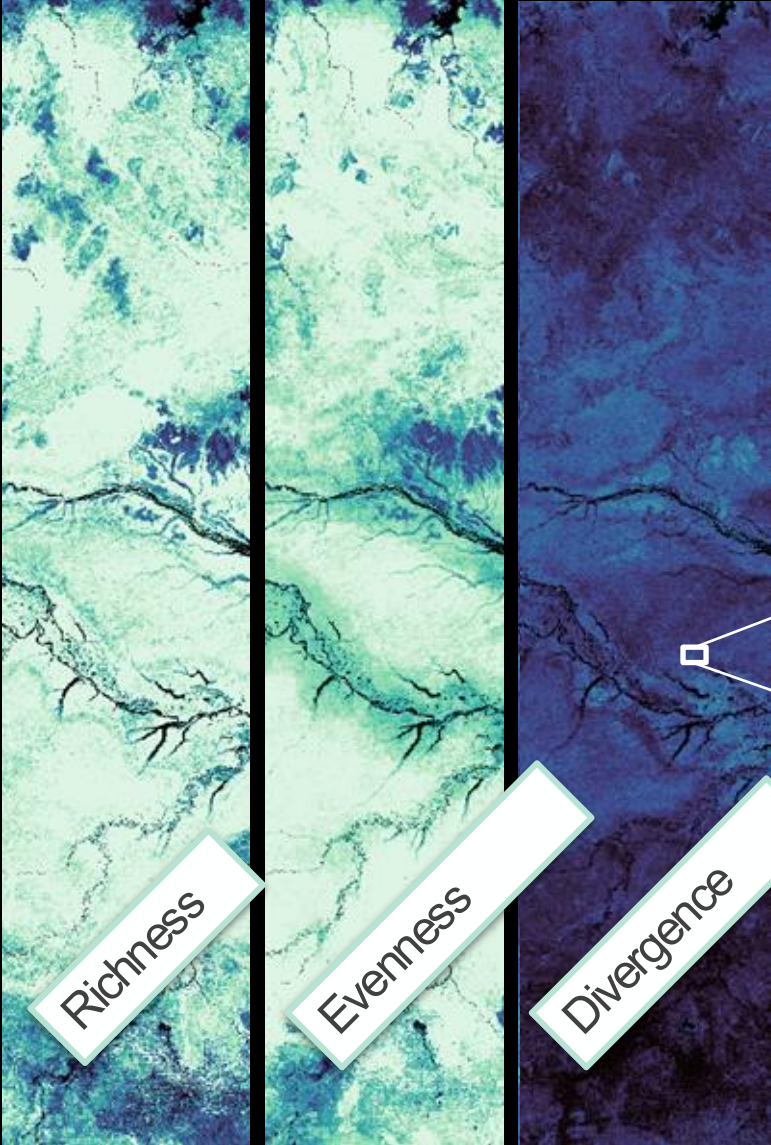
Plant functional diversity global scale



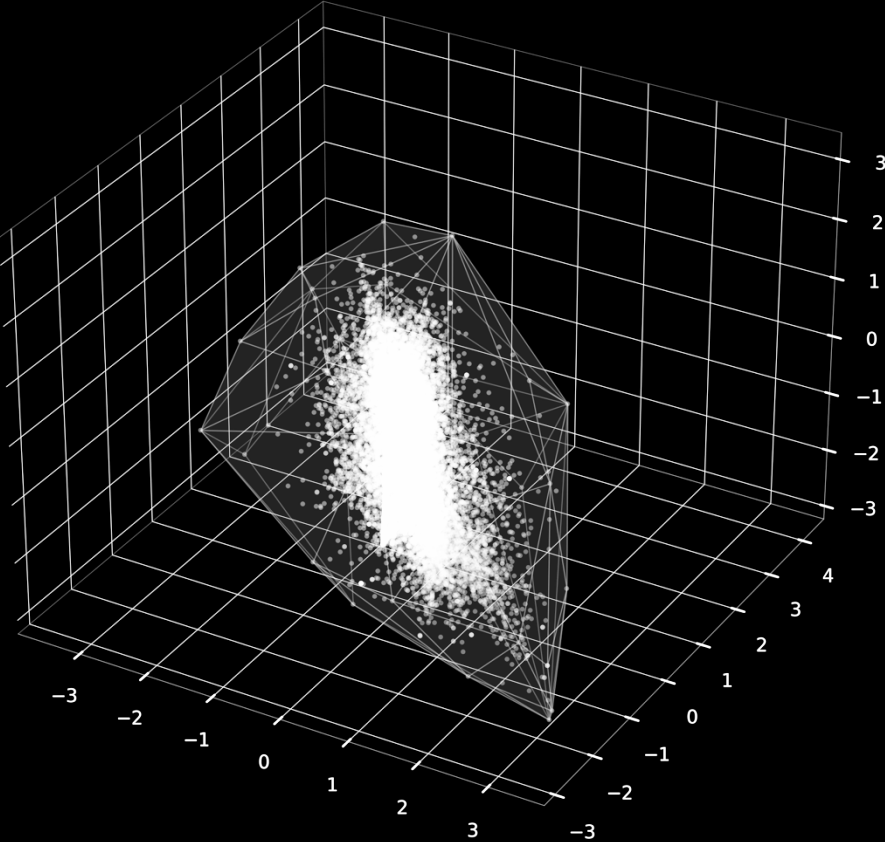
Plant functional trait distributions



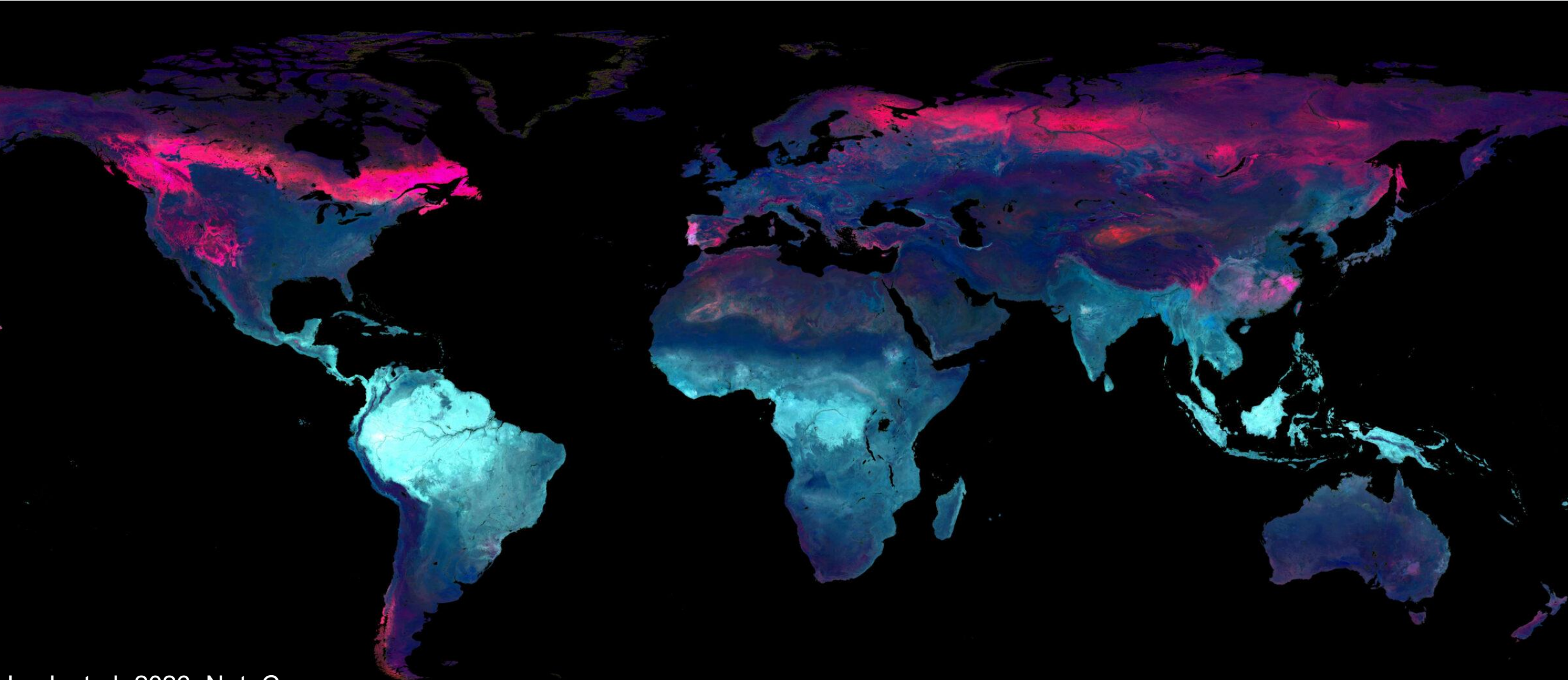
Plant functional diversity global scale



Plant functional diversity

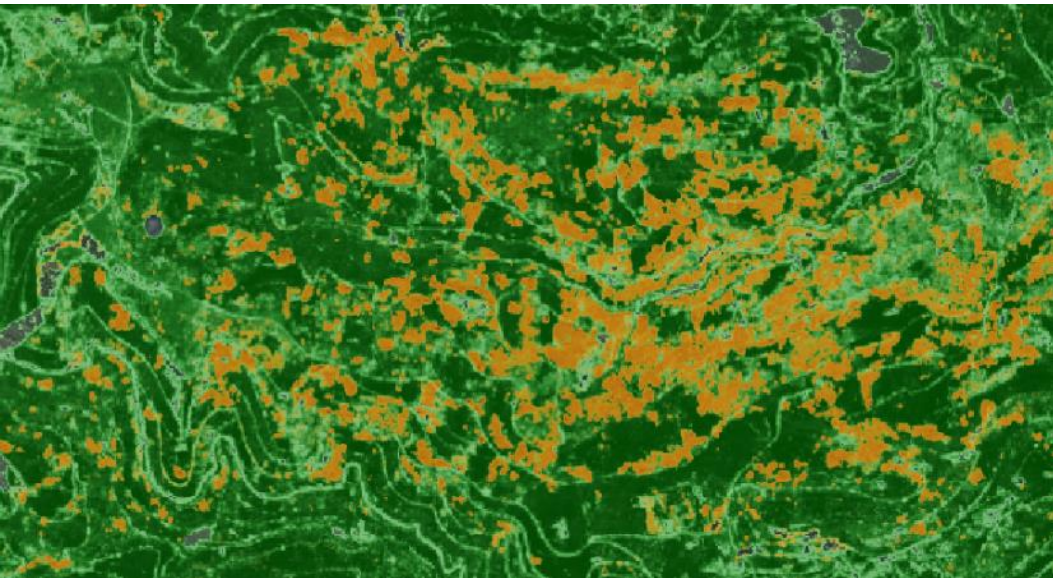
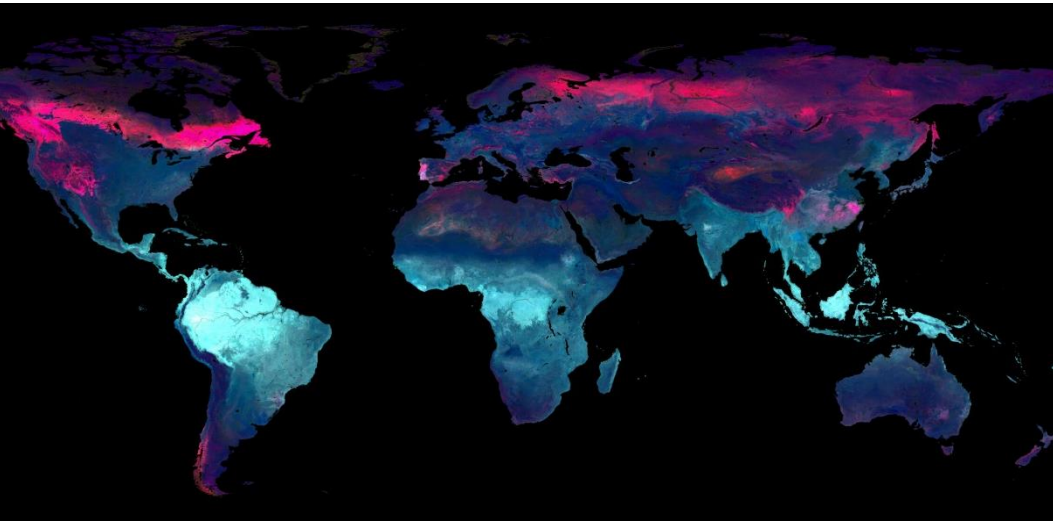


Plant functional diversity global scale



Lusk et al. 2026, Nat. Comms





- Map plant **functional diversity at global scale**
 - Extension to hydraulic traits
- Map global **tree mortality rates & hotspots**
 - Benchmark forest disturbance products
 - Relation to functional diversity
- Quantify **mortality-driven biomass loss** and CO₂ equivalents
 - Combination with ESA CCI Biomass
- Identify **Drivers of mortality**
 - Relation to climate extremes (ERA5, ECVs)
 - Buffer role of plant functional diversity
- Identify **Impacts of mortality on ecosystem functioning**
 - Assess anomalies in fluxes data (ICOS, FluxNet)

Main ECVs being used

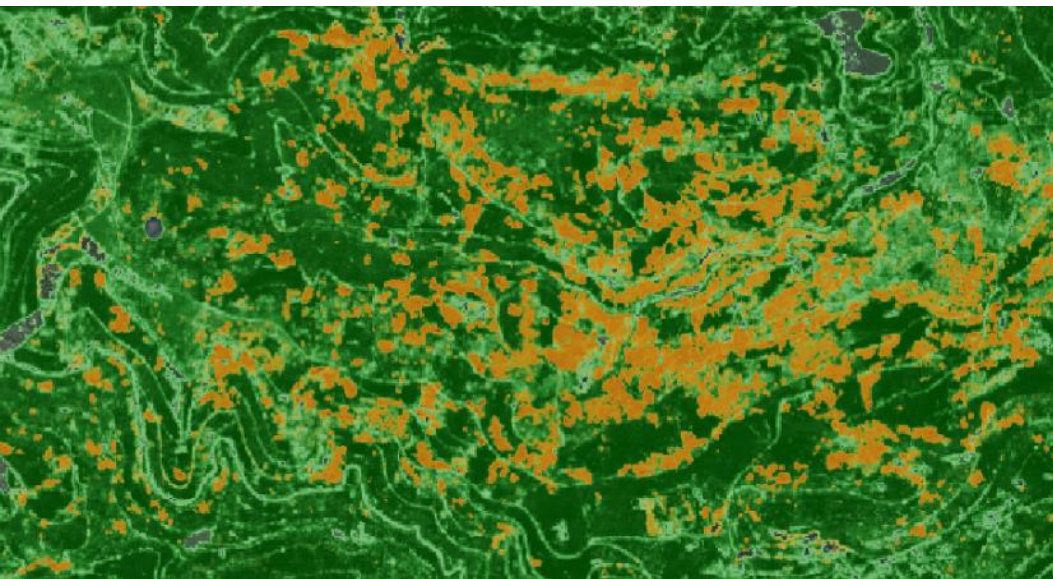
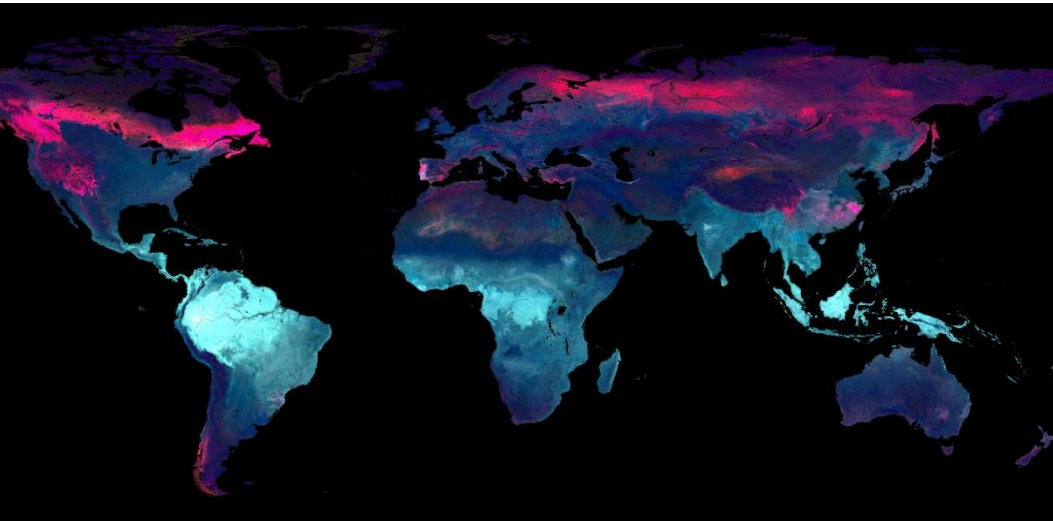
- **On (live) carbon loss:** Aboveground Biomass (ESA CCI Biomass)
- **As drivers of mortality:** Soil Moisture and Land Surface Temperature (LST), Water Vapour
- **For stratification:** Land Cover and Plant Functional Type (PFT)

Strengths

- Transparency and clean documentation, uncertainty estimates (error propagation), global coverage

Wish list for how to improve the ECVs

- More consistent **temporal coverage and extent**
- Mutual Feedback Integration: Use FORTRACK's high-resolution mortality maps to reduce uncertainties in future ESA CCI Biomass products
- Incorporate tree mortality and functional diversity candidates as ECV candidates



Datasets in current production:

- Global functional diversity products
- Carbon loss (Mortality + ESA CCI Biomass)

Publications

- Mosig, C., Kattenborn, T., Montero Loaiza, D., Vanja-Jehle, J... Mahecha, M. (2026). **Sub-pixel mapping of disturbance and tree mortality dynamics from Sentinel-2 time series around the globe.** *EarthArXiv* (preprint).
- Lusk, D., Wolf, S., Svidzinska, D., Dormann, ...Kattenborn, T. (2025). **Crowdsourced biodiversity monitoring fills gaps in global plant trait mapping.** *Nature Communications*.

Links <https://deadtrees.earth/> <https://planttraits.earth/>
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