From pixels to events: identifying storms and fires from satellite-based disturbance maps

Dr. Cornelius Senf
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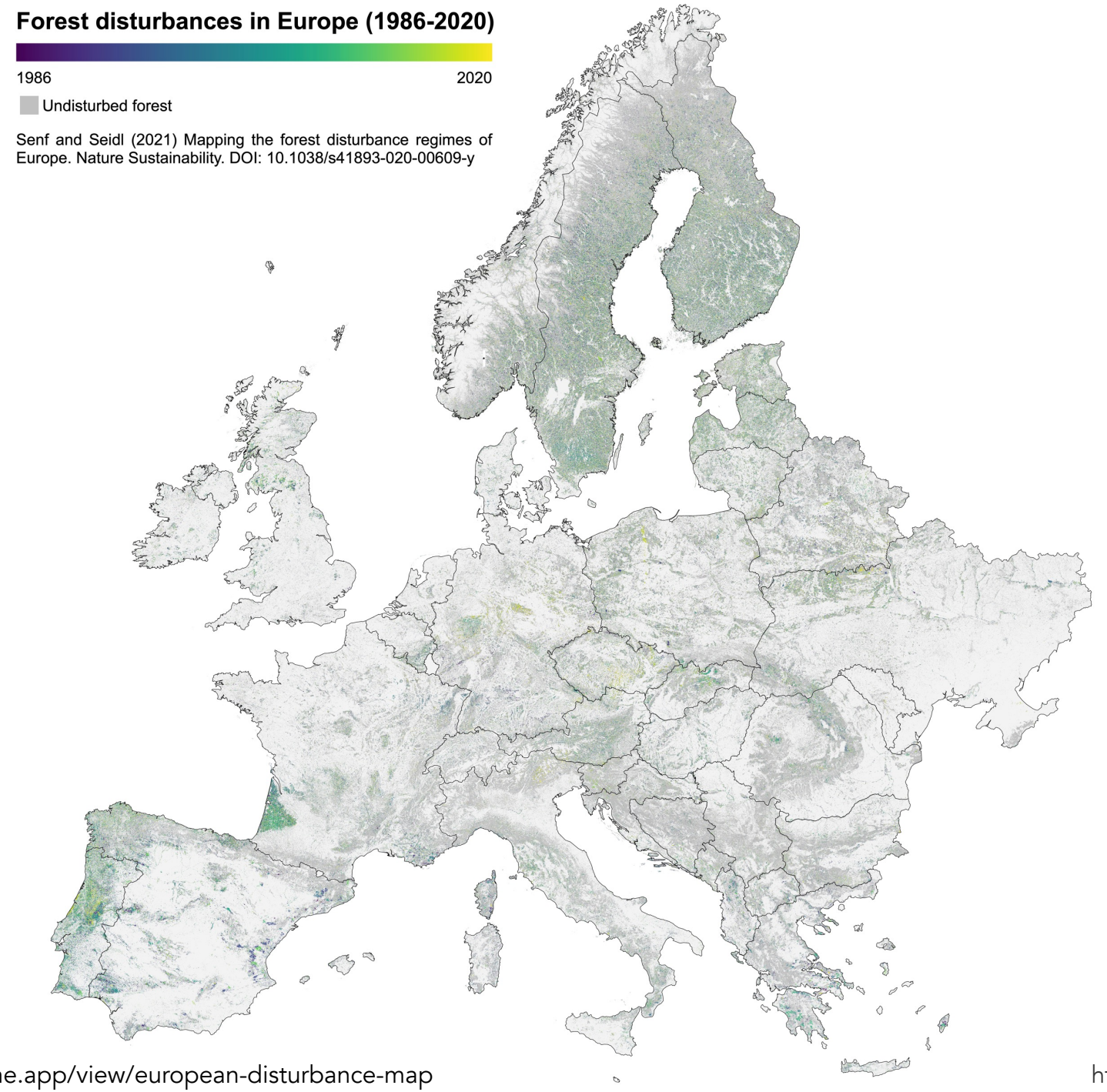
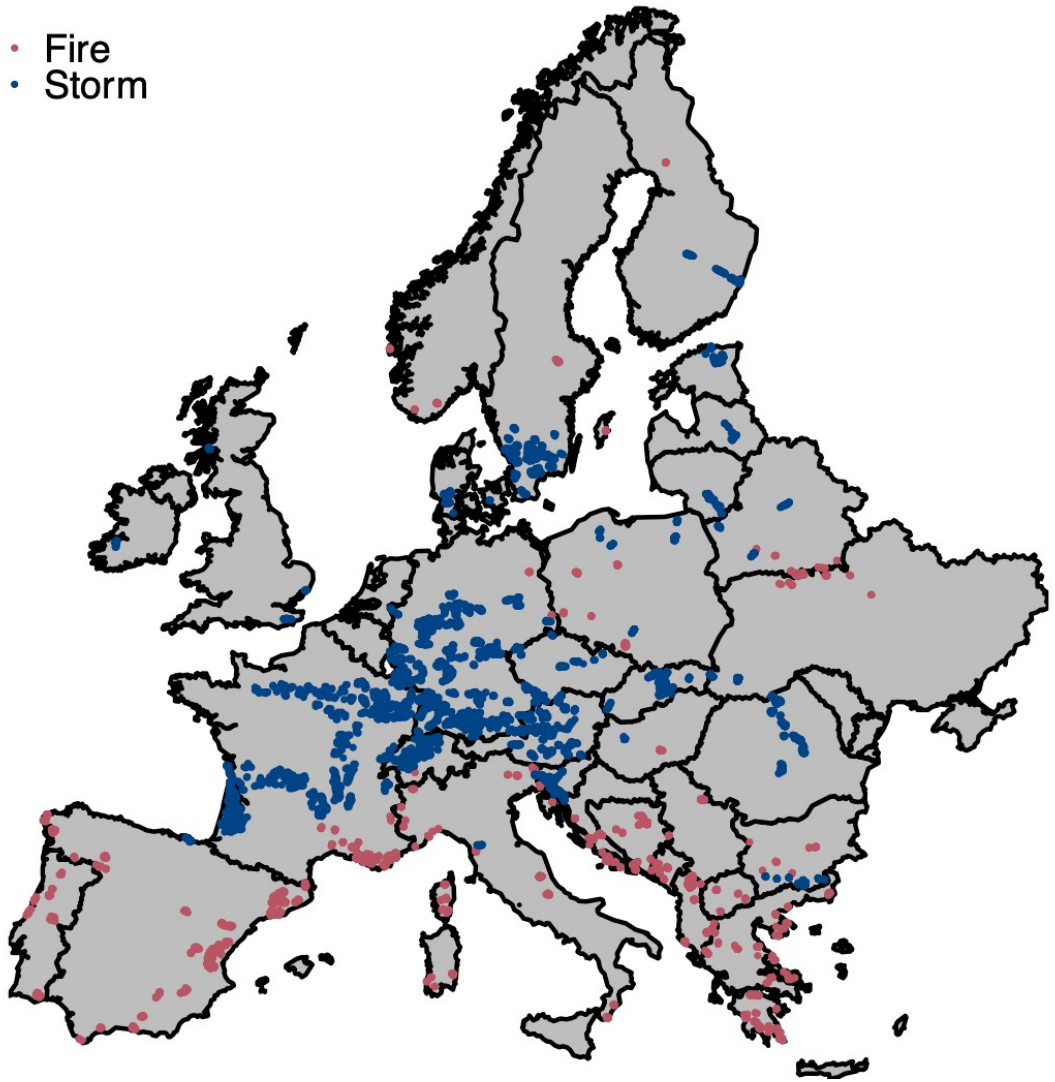


https://corneliussenf.users.earthengine.app/view/european-disturbance-map

https://doi.org/10.5281/zenodo.4746129

What is the prevalence of abiotic storm and fire disturbances in Europe?

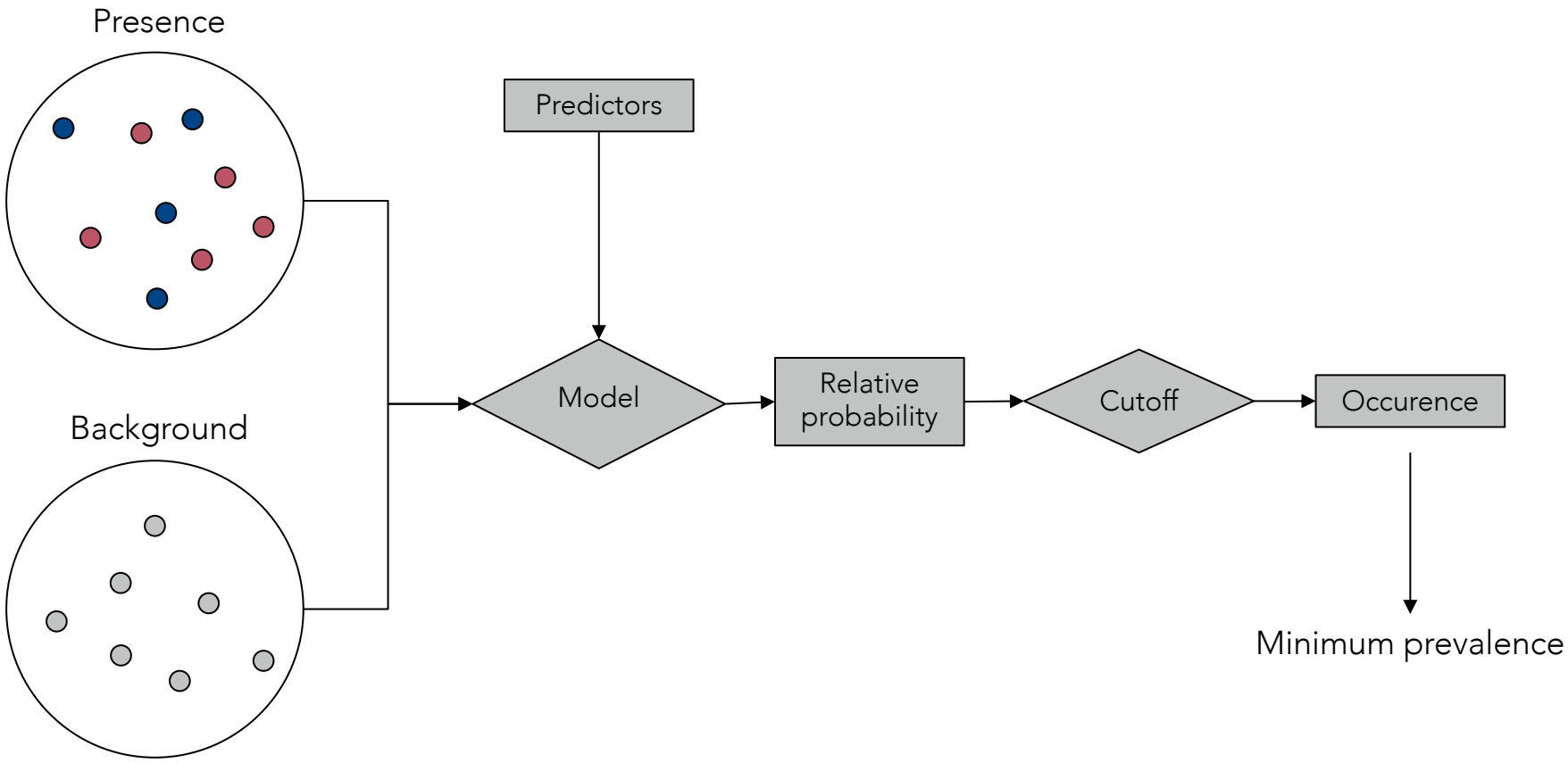
Creating a database of true occurrences



Over 7000 true occurrences collected using:

- Map interpretation
- Non-spatial storm databases
- FORWIND database
- EFFIS database
- Newspaper articles
- Personal communications

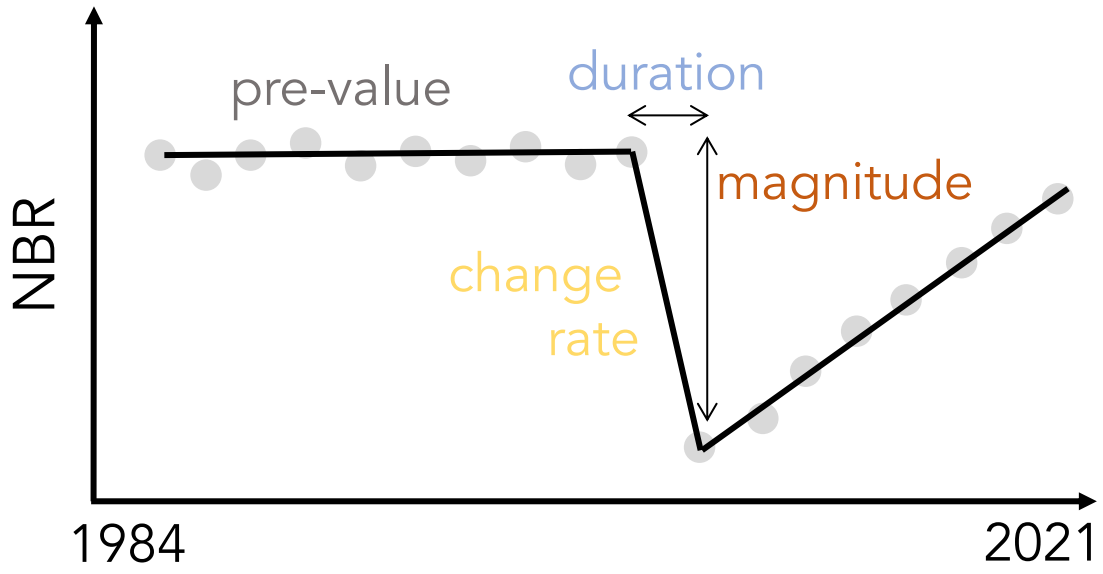
How to deal with presence only data?



Predictors

A total 16 predictor variables in three groups:

- **Spectral:** Pre-disturbance value, spectral change magnitude, change duration and spectral change rate during disturbance in the Normalized Burn Ratio

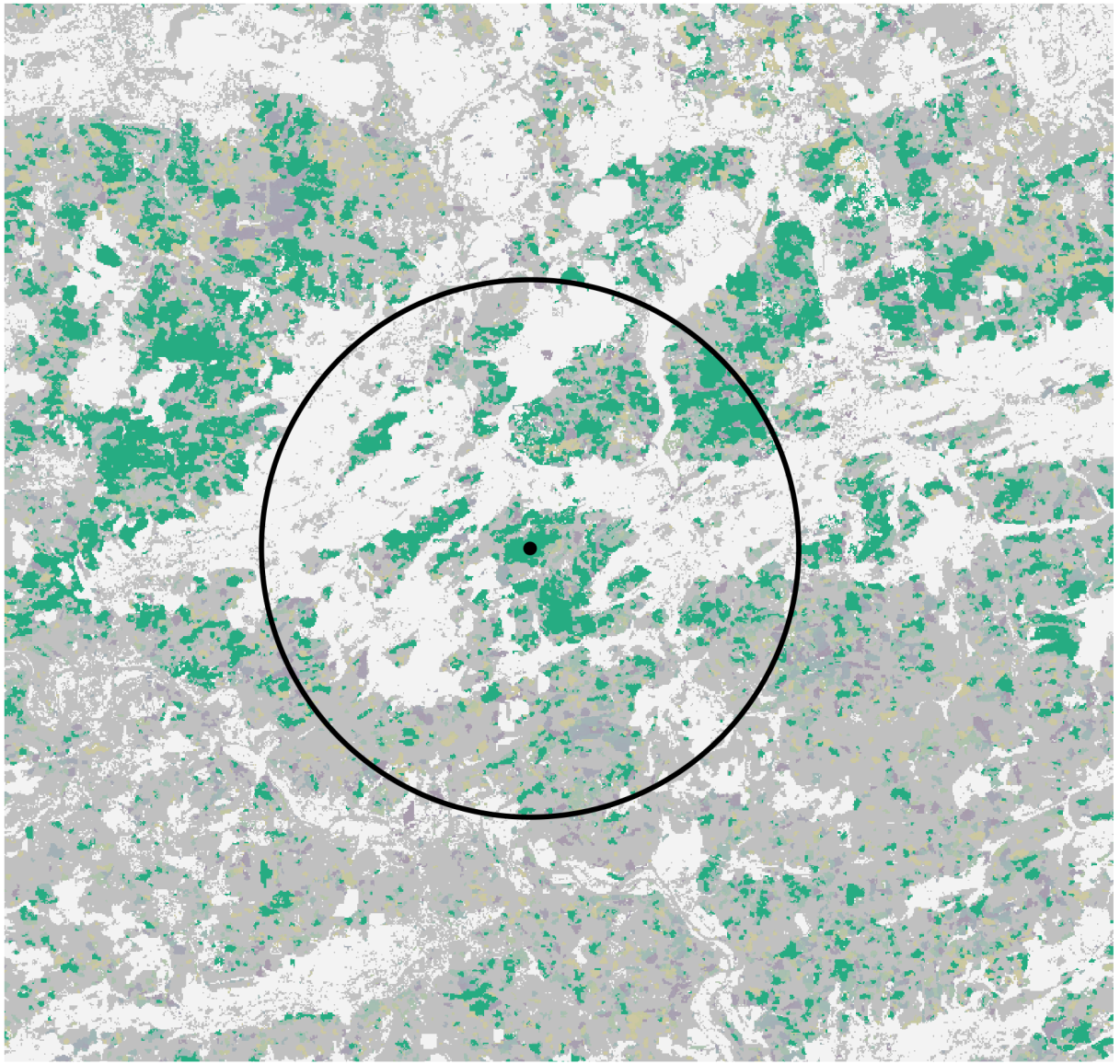


Predictors

A total 16 predictor variables in three groups:

- **Spectral:** Pre-disturbance value, spectral change magnitude, change duration and spectral change rate during disturbance in the Normalized Burn Ratio
- **Spatial:** Patch area and fractional dimension index
- **Landscape:** Local spatio-temporal auto-correlation in a 5 km radial Kernel

Predictors – the importance of the landscape context



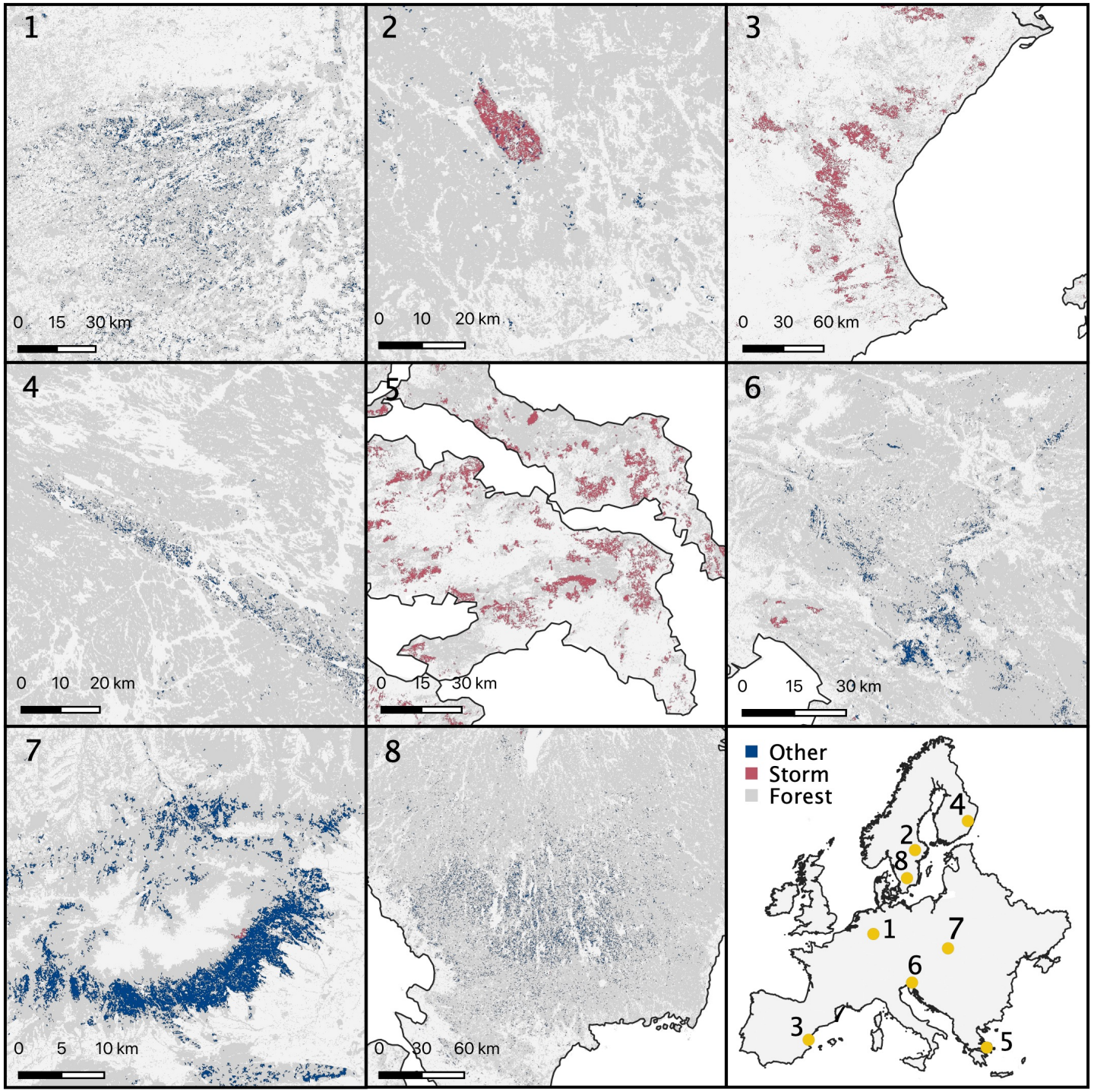
Example:
Storm Kyrill in Germany

Predictors

A total 16 predictor variables in three groups:

- **Spectral:** Pre-disturbance value, spectral change magnitude, change duration and spectral change rate during disturbance in the Normalized Burn Ratio
- **Spatial:** Patch area and fractional dimension index
- **Landscape:** Local spatio-temporal auto-correlation in a 5 km radial Kernel: number of patches and percentage of all disturbances occurring in the same, previous and following years

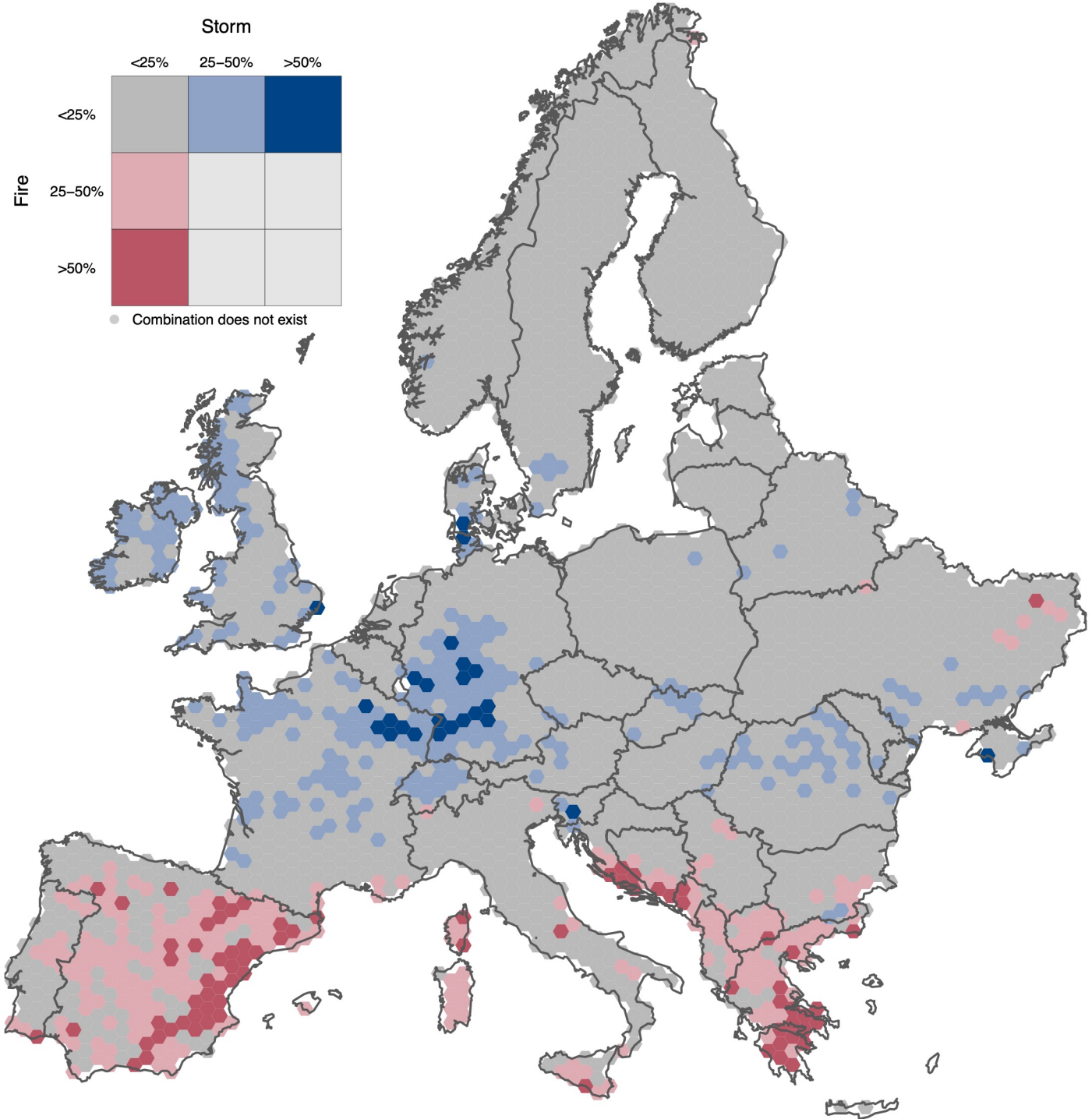
Results



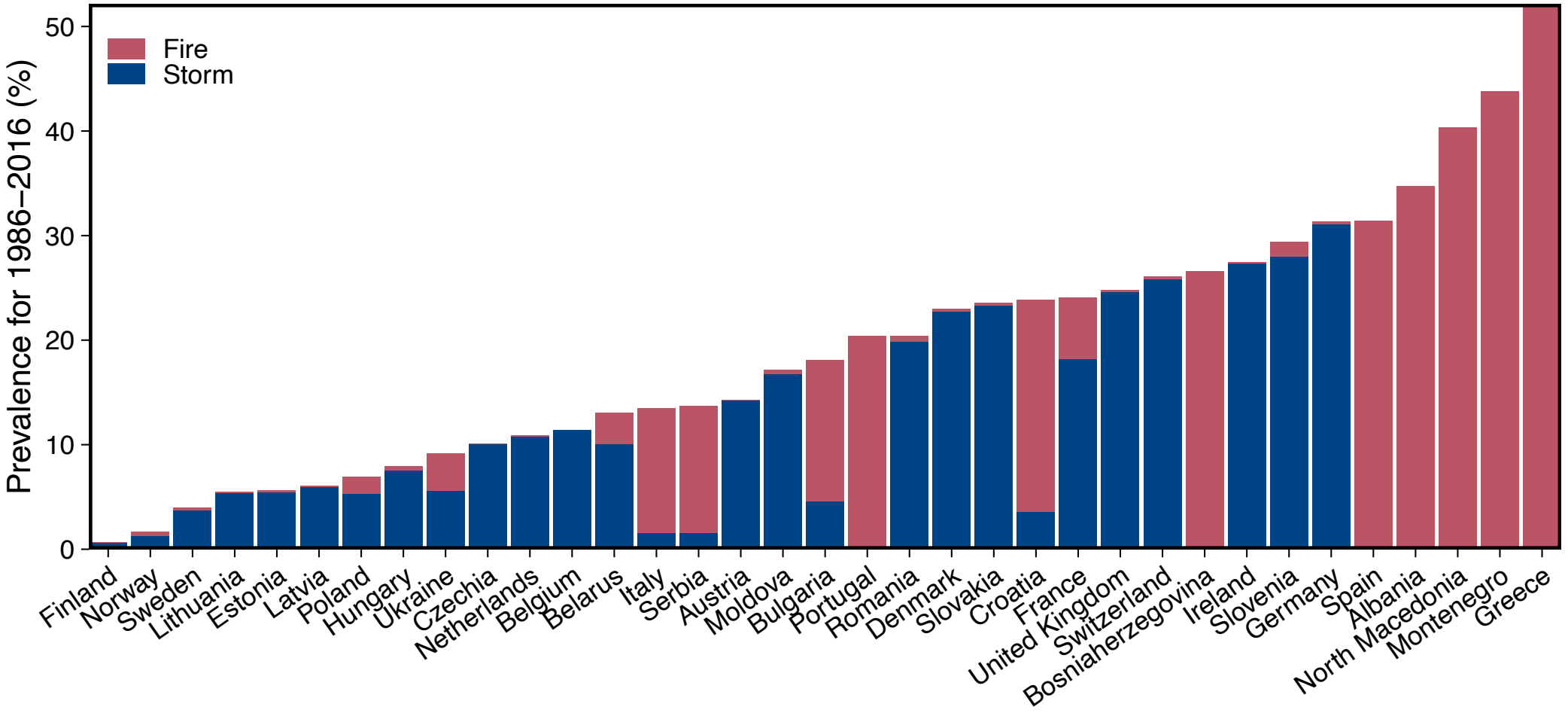
OA = 92 %
CE = 8-13 %
OE = 4-23 %

Only model accuracies, not map accuracies!

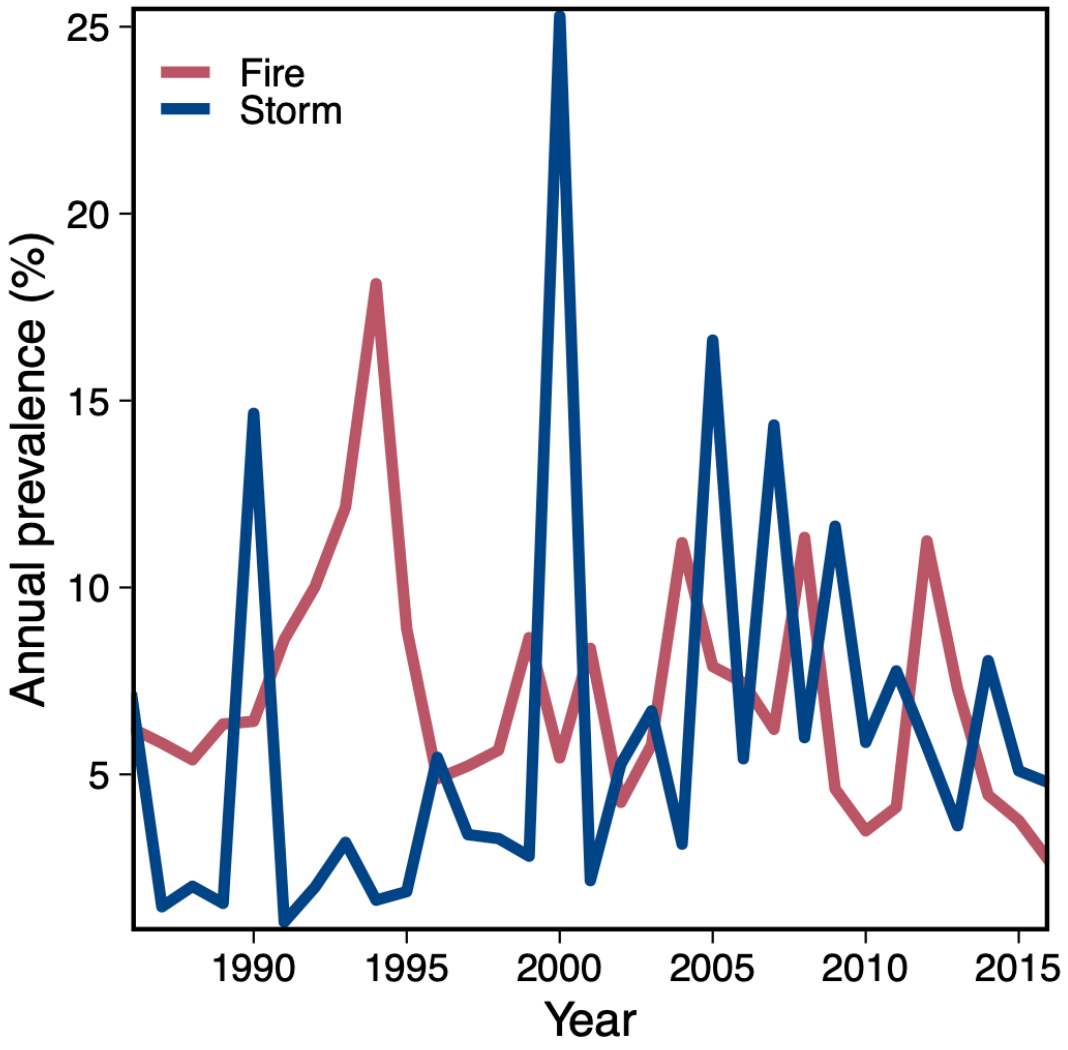
Results



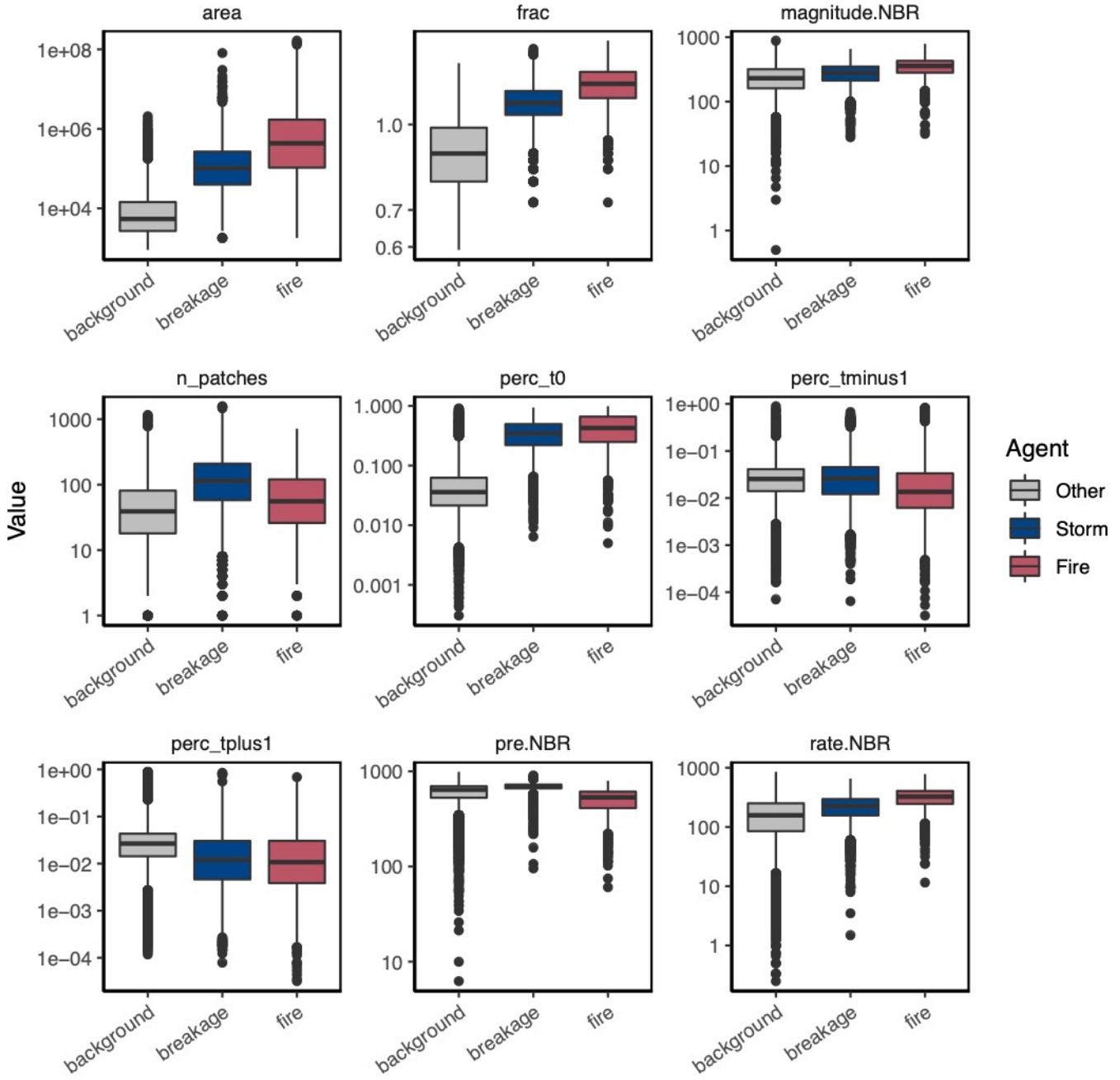
Results


Fire
Storm
Prevalence for 1986–2016 (%)
0
10
20
30
40
50
Finland
Norway
Sweden
Lithuania
Estonia
Latvia
Poland
Hungary
Ukraine
Czechia
Netherlands
Belgium
Belarus
Italy
Serbia
Austria
Moldova
Bulgaria
Portugal
Romania
Denmark
Slovakia
Croatia
France
United Kingdom
Switzerland
Bosniaherzegovina
Ireland
Slovenia
Germany
Spain
Albania
North Macedonia
Montenegro
Greece

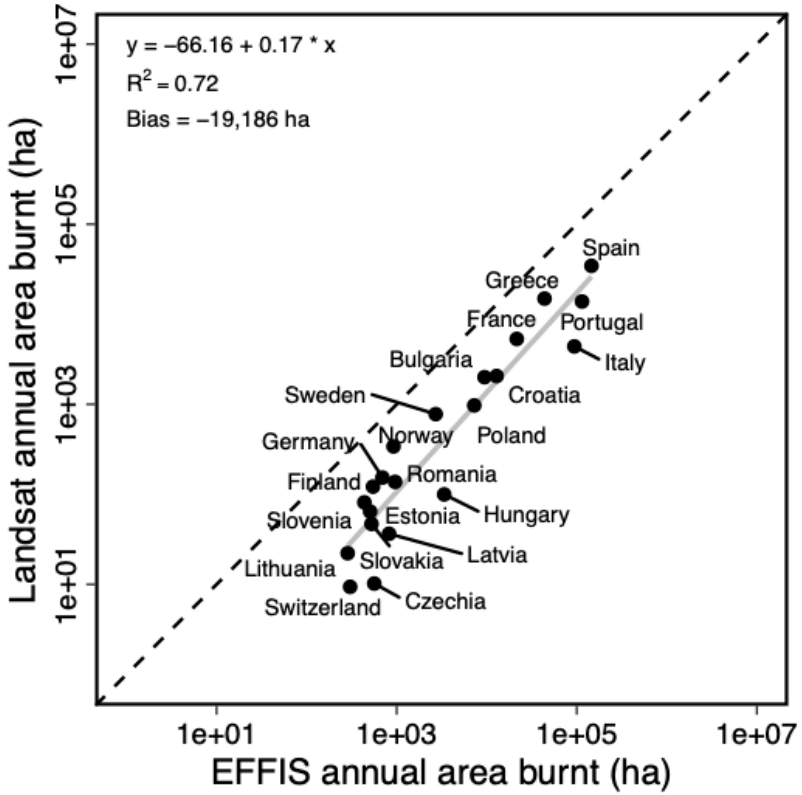
Results

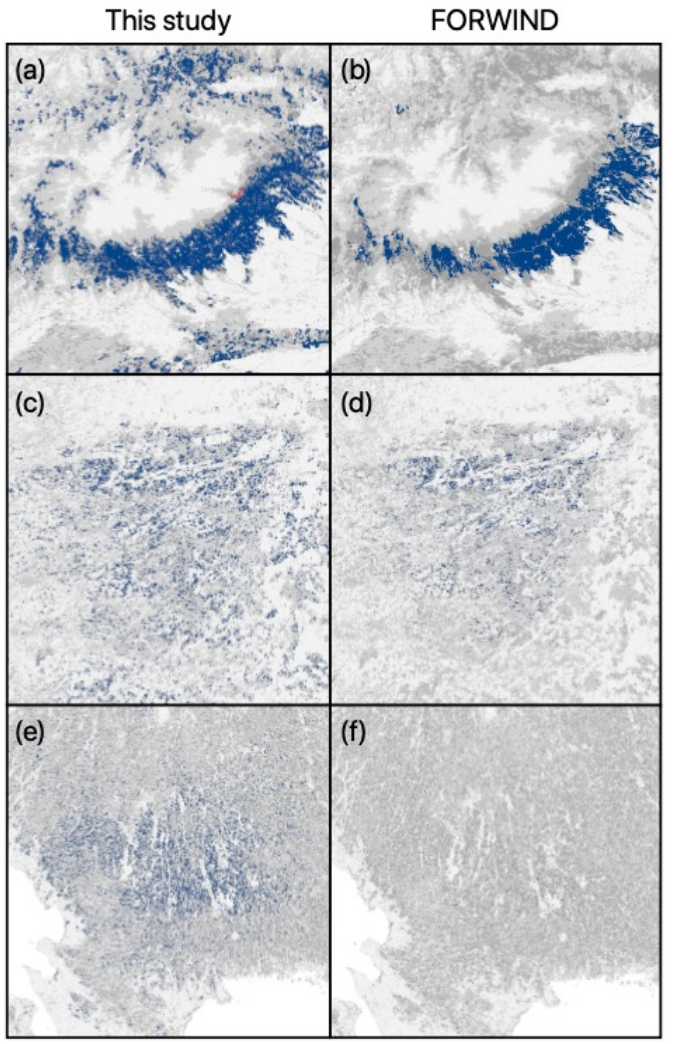

Fire
Storm
Annual prevalence (%)
25
20
15
10
5
1990
1995
2000
2005
2010
2015
Year

Results


area
frac
magnitude.NBR
n_patches
perc_t0
perc_tminus1
perc_tplus1
pre.NBR
rate.NBR
Value
background
breakage
fire
Agent
Other
Storm
Fire

Results

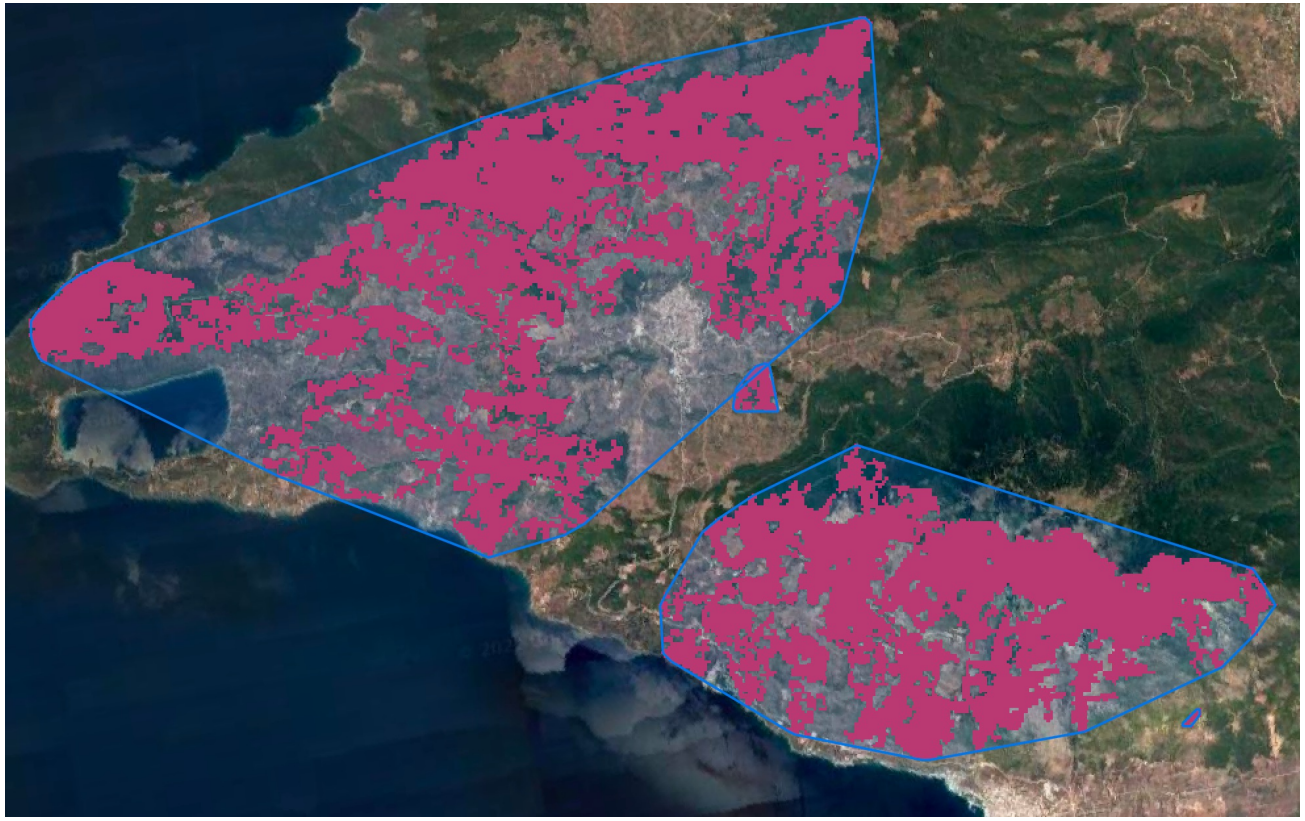

y = −66.16 + 0.17 * x
R^2 = 0.72
Bias = −19,186 ha
Landsat annual area burnt (ha)
EFFIS annual area burnt (ha)
1e+01
1e+03
1e+05
1e+07
Spain
Greece
France
Portugal
Italy
Bulgaria
Croatia
Sweden
Norway
Poland
Germany
Finland
Romania
Slovenia
Estonia
Hungary
Latvia
Lithuania
Slovakia
Switzerland
Czechia


This study
FORWIND
(a)
(b)
(c)
(d)
(e)
(f)

Outlook

We recently updated the data until 2020 (further updates planned).

We are currently developing new ways of grouping patches to fire complexes/storm events based on spatial clustering to enhance modelling:



References

nature sustainability

ANALYSIS

https://doi.org/10.1038/s41893-020-00609-y

Check for updates

Mapping the forest disturbance regimes of Europe

Cornelius Senf [1,2] ✉ and Rupert Seidl [1,2,3]

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Global Change Biology WILEY

PRIMARY RESEARCH ARTICLE

Storm and fire disturbances in Europe: Distribution and trends

Cornelius Senf[1] | Rupert Seidl[1,2]

Remote Sensing of Environment 262 (2021) 112502

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/rse

ELSEVIER

Check for updates

Human or natural? Landscape context improves the attribution of forest disturbances mapped from Landsat in Central Europe

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Work with us!

Ecosystem Dynamics and Forest Management Group
TUM School of Life Sciences
Technical University of Munich

Opportunities for Talents

Postdoc in remote sensing of forest disturbances

The Ecosystem Dynamics and Forest Management group is looking for a postdoc working on the remote sensing of forest disturbances, starting in September 2022.

Your responsibilities

The Ecosystem Dynamics and Forest Management (EDFM) group is one of Europe's leading research groups in the field of ecosystem dynamics and forest management. Within the EU-funded project "ForestPaths", the EDFM group is strengthening its work in the field of remote sensing, in particular remote sensing of forest disturbances. Building upon previous work on pan-European forest disturbance mapping, your activities will include the development and application of state-of-the-art remotes sensing approaches for mapping and attributing forest disturbances across Europe. Furthermore, you will analyze the remote sensing-based disturbance maps to better understand drivers of forest disturbances. The position moreover includes an active collaboration within the research network of the project, as well as the presentation and publication of results at international conferences and in peer-reviewed journals.

Your qualifications

You have a PhD in remote sensing, geoinformation sciences, geography, environmental sciences or similar, former experience in remote sensing analyses and a strong interest in forest and landscape ecology. Experiences in handling large-scale remote sensing data, programming (R, Python, Julia) or cloud-based remote sensing tools (e.g., Google Earth Engine) are a surplus. You enjoy working in an international team and you are keen on further developing your research skills, in particular writing and presenting research results.

Ecosystem Dynamics and Forest Management Group
TUM School of Life Sciences
Technical University of Munich

Opportunities for Talents

Our offer

We offer a full-time (40 hours/week) position limited to two years, with a salary based on the Collective Agreement for the Civil Service of the Länder (*TV-L*) and including social security, health insurance, 30 holidays and several employee benefits. The position is based at TUM's School of Life Sciences in Freising, approx. 30 minutes north of Munich. We explicitly encourage applications from women. Applications from disabled persons with essentially the same qualifications will be given preference.

Your application

If you are interested in working in our team, please send your application together with a CV and supporting documentation as one PDF to the Ecosystem Dynamics and Forest Management Group of the Technical University of Munich, attn. Violeta Aramayo, Hans-Carl-von-Carlowitz-Platz 2, 85354 Freising, no later than 30th June 2022, email address: violeta.aramayo@tum.de. Do not hesitate to contact Dr. Cornelius Senf for any questions you may have: cornelius.senf@tum.de. If you apply in writing, we request that you submit only copies of official documents, as we cannot return your materials after completion of the application process.

As part of your application, you provide personal data to the Technical University of Munich. Please view our privacy policy on collecting and processing personal data in the course of the application process pursuant to Art. 13 of the General Data Protection Regulation of the European Union (GDPR) at https://portal.mytum.de/kompass/datenschutz/Bewerbung/. By submitting your application you confirm to have read and understood the data protection information provided by TUM.

Find out more about us at https://www.edfm.wzw.tum.de.

Contact: cornelius.senf@tum.de

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