RESONATE

Resilient Forests for Society

Deliverable 2.1

Online map of hotspots of disturbance at the continental scale

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VERSION HISTORY

Version	Date	Author /Reviewers	Partner	Description
0.1	16.03.2022	Cornelius Senf, Rupert Seidl	TUM	Draft description
0.2	21.03.2022	Marco Patacca, Tomas Hlasny, Marcus Lindner	WenR, CZU, EFI	Review of draft deliverable 0.1
1.0	30.03.2022	Cornelius Senf, Rupert Seidl	TUM	Final version for submission

REFERENCE

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DISCLAIMER

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Executive Summary

This deliverable consists of an interactive online map for exploring disturbance hotspots in Europe. Hotspots are identified through seven annual satellite-based indicators: (1) the total disturbance rate (percent of forest cover disturbed per year), (2) the total disturbance frequency (number of disturbance patches per hectare forest per year), (3) the average disturbance patch size per year, (4) the maximum disturbance patch size per year (calculated from the 99th percentile), and the annual prevalence of (5) biotic/wind, (6) fire and (7) harvest disturbances (with prevalence defined as the percentage of the total disturbance area causally attributable to each agent per year). All indicators are calculated at a regional level of 50 x 50 km hexagons (with each hexagon being 2,165 km² in size) and available for all years between 1986 to 2020.

Keywords

Disturbances, windthrow, forest fire, bark beetle

1. Overview

This deliverable consists of an interactive online map for exploring disturbance hotspots in Europe, which is briefly described (a more comprehensive description will follow in Deliverable D2.2). The map consists of seven individual layers depicting different aspects of Europe's disturbance regimes derived from satellite data (see 1.1 for details). The layers are interactive and allow for exploring regional and temporal variation in disturbance regimes and thus for the identification of disturbance hot spots (Fig 1) and subsequent analysis on Europe's disturbance regimes and their changes over time (to be reported in Deliverable D2.2). The map furthermore has an interactive visualization tool that allows for locating the RESONATE case studies in relation to Europe's overall disturbance regimes (Fig 2), that is it allows for checking whether the RESONATE case studies are representative for all aspects of disturbances found in Europe's forests.

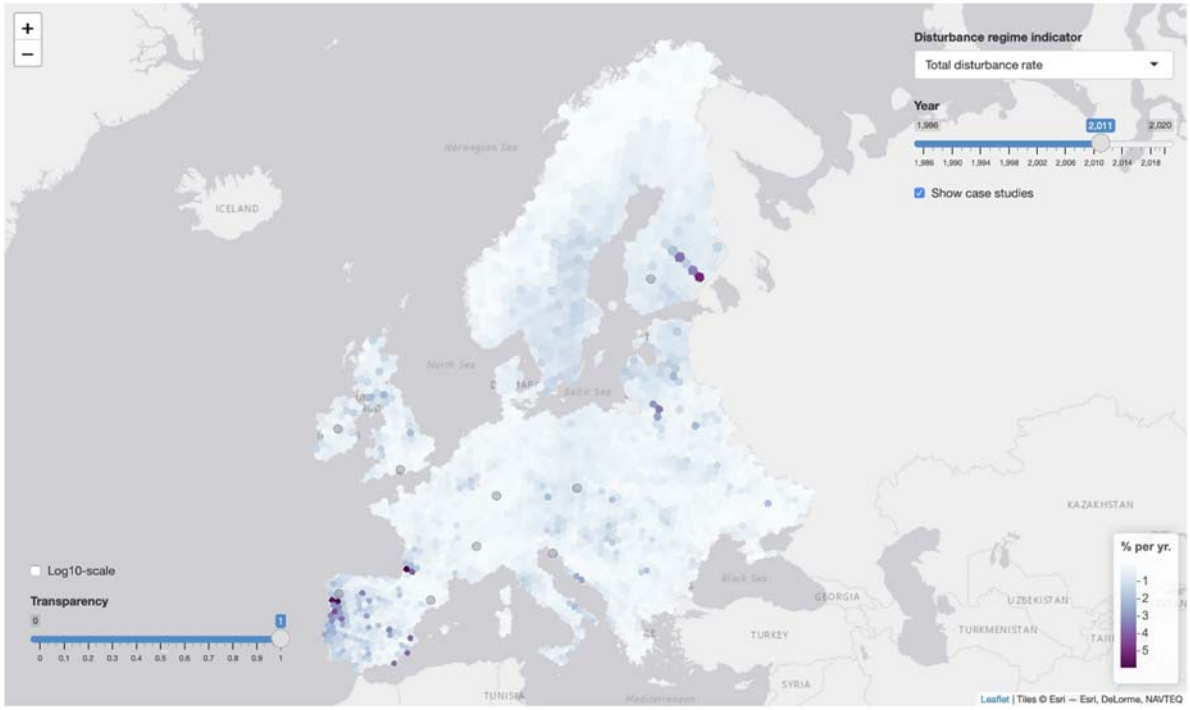

Figure 1. The online map with one of the disturbance regime indicators (total disturbance rate) mapped for the year 2011. The location of the RESONATE study sites are shown as light black dots. The widget allows for mapping different disturbance regime indicators for all years (1986-2020). The map is interactive and several tools for visualization are available.

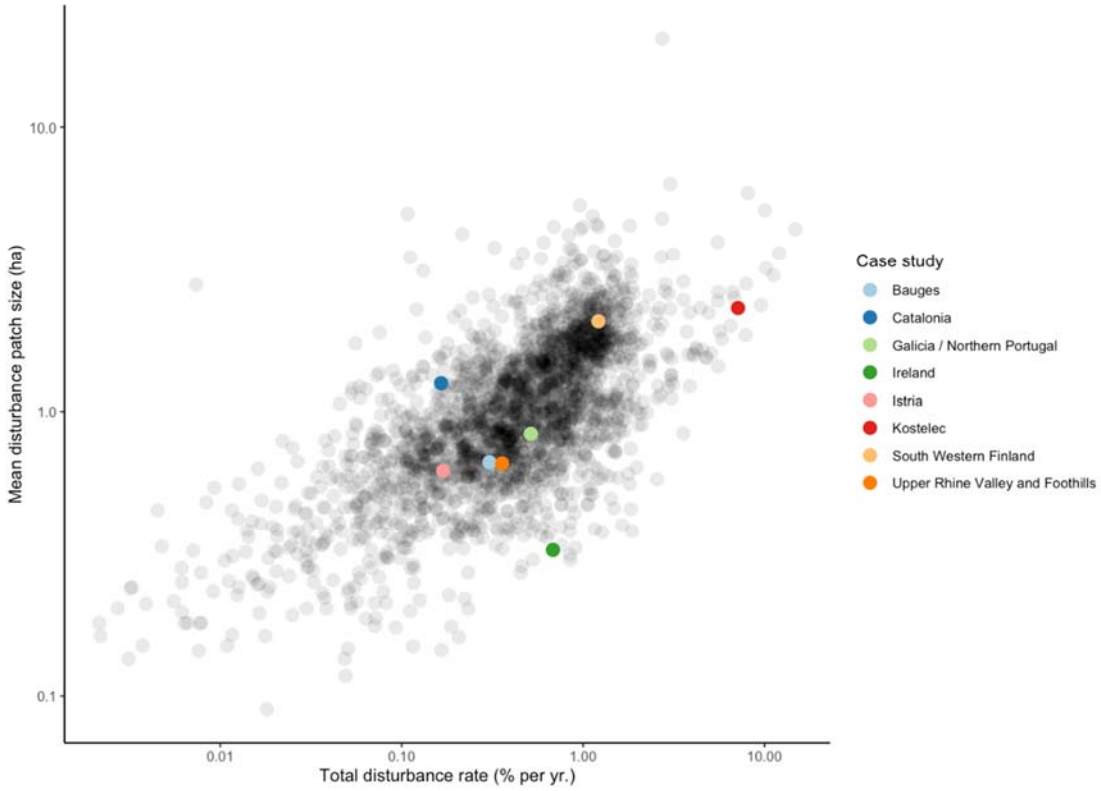

Figure 2. Interactive graph showing two disturbance regime indicators (mean disturbance rate and mean disturbance patch size) for the year 2020 for all of Europe (black dots) and for the RESONATE case studies overlayed. The case study locations are shown in Fig. 1 as black dots.

1.1 Disturbance regime indicators

The disturbance regime indicators are derived from satellite-based disturbance data (Senf and Seidl 2021 a/b), which were updated to the year 2020 within the RESONATE project using a newly generated set of reference data for the years 2018-2020 including recent major storm events (e.g., Vaia) and biotic outbreaks (e.g., Central Europe). The base maps depict for a regular grid of 30 x 30 m pixels if, when and by what causal agent (i.e., biotic/wind, fire, harvest) forests were disturbed over the time period 1986-2020. A disturbance is defined as any abrupt change in the top canopy at the spatial grain of 30 x 30 m (i.e., excluding individual tree mortality as well as sub-canopy changes in tree cover). The class biotic/wind includes any disturbance either caused by uprooting/breakage from strong winds or storms (e.g., cyclonic events, local down bursts, foehn winds, snow/ice storms) or caused by major biotic disturbance agents in Europe, including bark beetles and other tree-killing insect species. Biotic and wind was grouped as a separation from satellites is impossible with current methods and both agents often occur in synergy (i.e., bark beetle utilizing recently windthrown trees as breeding material, edges created from bark beetle increasing wind susceptibility, see Seidl and Rammer 2017). Fire disturbances are defined as any disturbance caused by ground- or crown-fires. Harvest disturbances are any disturbance not attributable to biotic/wind and fire, as harvest is the major cause of disturbance in Europe. This definition might include salvage logging of small natural disturbances that are not attributable from satellites. From this data, seven disturbance regime indicators were calculated on an annual basis and at a regional level of 50 x 50 km hexagons (with each hexagon being 2,165 km² in size): (1) the total disturbance rate (percent of forest cover disturbed by year within a hexagon), (2) the total disturbance frequency (number of distinct disturbance patches [i.e., continuous groups of

disturbed pixels sharing an edge or corner] per hectare forest per year within a hexagon), (3) the average disturbance patch size (in hectare within a hexagon), (4) the maximum disturbance patch size (calculated from the 99th percentile in hectare within a hexagon), and the prevalence of (5) biotic/wind, (6) fire and (7) harvest disturbances (with prevalence defined as the percentage of the total disturbance area causally attributable to each agent per year within a hexagon).

2. Resources

The widget can be found under: https://tum-edfm.shinyapps.io/resonate-deliverable-2-1/.
The base maps are available at: https://doi.org/10.5281/zenodo.4746129.

3. References

Seidl R, Rammer W. (2017) Climate change amplifies the interactions between wind and bark beetle disturbances in forest landscapes. Landscape Ecology, 32, 1385-498. https://doi.org/10.1007/s10980-016-0396-4

Senf, C. and Seidl, R. (2021a) Mapping the forest disturbance regimes of Europe. Nature Sustainability, 4, 63-70. https://doi.org/10.1038/s41893-020-00609-y

Senf, C. and Seidl, R. (2021b) Storm and fire disturbance in Europe: Distribution and trends. Global Change Biology, 27(15), 3605-3619. https://doi.org/10.1111/gcb.15679