

# JRC's Nature paper on harvested forest area: clarifications and updates

**Alessandro Cescatti, Giacomo Grassi, Guido Ceccherini**

Joint Research Centre, Directorate D – Sustainable Resources - Bio-Economy Unit

April 2021, VERIFY General Assembly



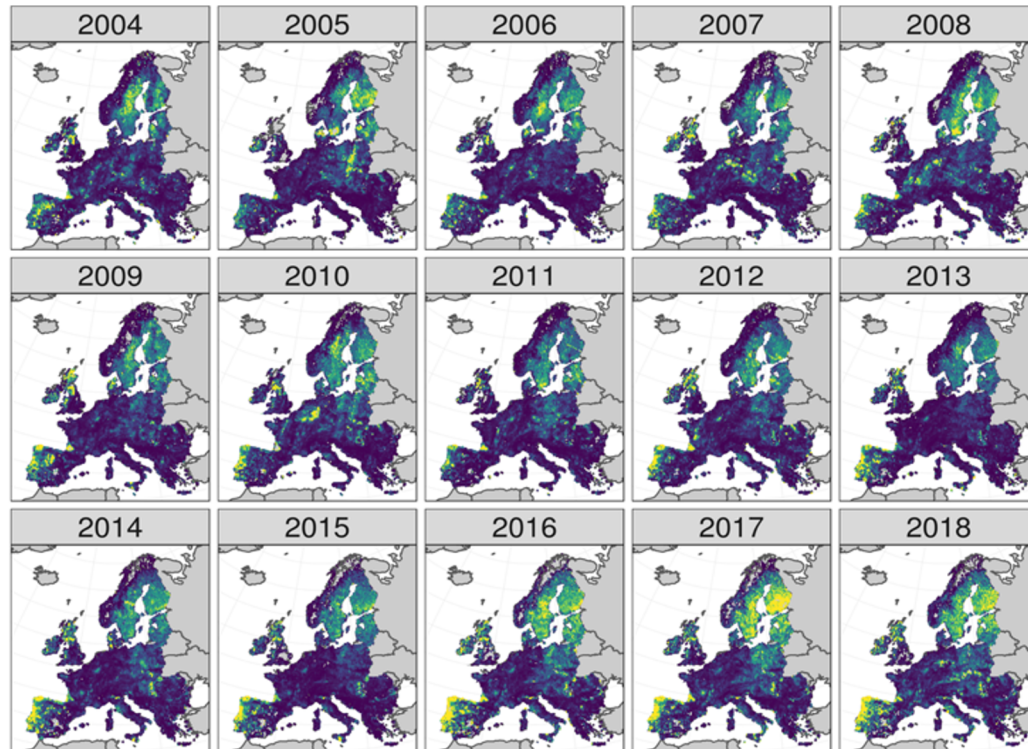
Image courtesy by INGLEBY FARMS


## Abrupt increase in harvested forest area over Europe after 2015

<https://doi.org/10.1038/s41586-020-2438-y>

Guido Ceccherini<sup>1</sup>, Gregory Duveiller<sup>1</sup>, Giacomo Grassi<sup>1</sup>, Guido Lemoine<sup>2</sup>, Valerio Avitabile<sup>1</sup>, Roberto Pilli<sup>1</sup> & Alessandro Cescatti<sup>1</sup>

Received: 17 May 2019



Harvested Forest Per Year [%]   
0.0 0.5 1.0 1.5 2.0

Two comments were published by Nature, along with our reply.

Three main arguments:


- 1) The **Global Forest Change (GFC)** product used in the study to detect harvest is **not consistent over time**, including after 2015. The paper did not follow GFC documentation.
- 2) **Natural disturbances** have not been properly factored out
- 3) The harvested trend is not in line with **country statistics**

# Critique 1: GFC is not consistent over time and cannot be used for temporal analysis

The Global Forest Change(GFC) time series has been extensively tested and used to assess the impact of forest activities as in our study.


None mentions inconsistencies after 2015

Examples:

(2019)  *remote sensing* “the GFC dataset gives a good first approximation of forest loss” (Guyana)

Article  
An Assessment of Global Forest Change Datasets for National Forest Monitoring and Reporting

Nikolaos Galiatsatos<sup>1</sup>, Daniel N.M. Donoghue<sup>2\*</sup>, Pete Watt<sup>3</sup>, Pradeepa Bholanath<sup>4</sup>, Jeffrey Pickering<sup>5</sup>, Matthew C. Hansen<sup>5</sup> and Abu R.J. Mahmood<sup>6</sup>

(2020)  *remote sensing* “Overall, [GFC] proved to be a useful dataset for assessing harvesting activity” (in Norway)

Article  
Assessing Harvested Sites in a Forested Boreal Mountain Catchment through Global Forest Watch

Fernando Rossi, Johannes Breidenbach<sup>1</sup>, Stefano Puliti<sup>2</sup>, Rasmus Astrup and Bruce Talbot<sup>3</sup>

(2020)  *remote sensing* “The GFC map can be used to detect larger forest disturbances, but it should be used cautiously for small-scale disturbances” (Japan)

Article  
Accuracy Assessments of Local and Global Forest Change Data to Estimate Annual Disturbances in Temperate Forests

Katsuto Shimizu<sup>1,\*</sup>, Tetsuji Ota<sup>2</sup> and Nobuya Mizoue<sup>2</sup>

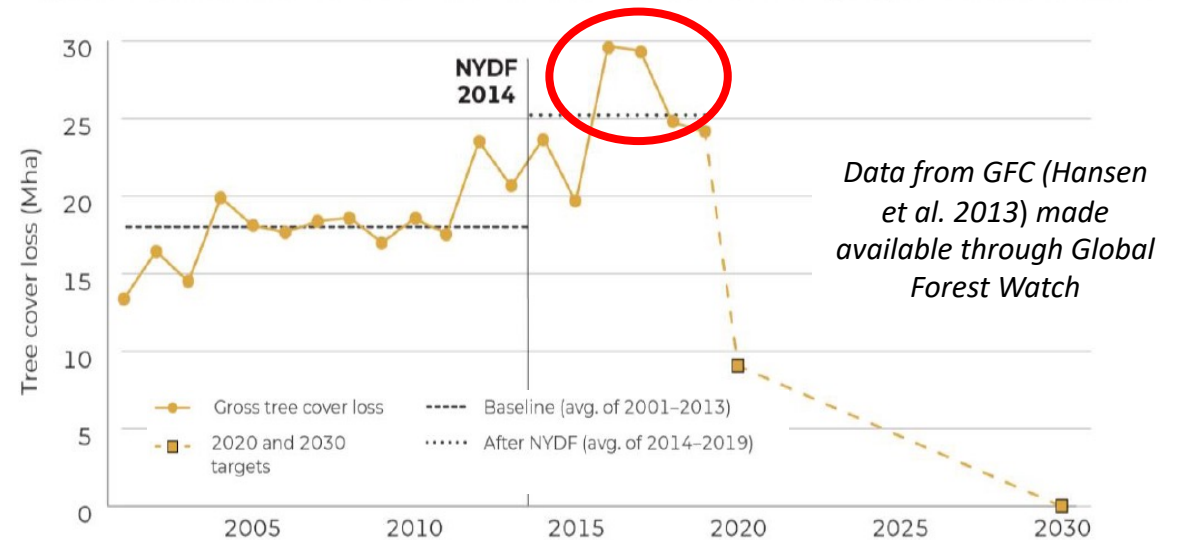
## NEW YORK DECLARATION ON FORESTS

### Goal 1 assessment

November 2020

Striving to end natural forest loss

Figure 2. Global tree cover loss relative to 2020 and 2030 targets, in million hectares

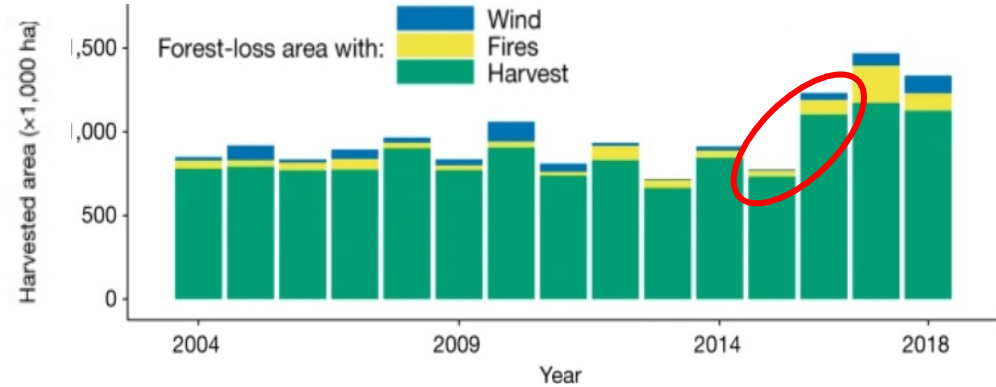
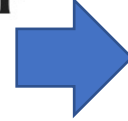


Surprising to hear in 2020 of a totally undocumented change in the GFC tree loss detection algorithm from 2015

Article | Published: 01 July 2020

# Abrupt increase in harvested forest area over Europe after 2015

Guido Ceccherini , Gregory Duveiller, Giacomo Grassi, Guido Lemoine, Valerio Avitabile, Roberto Pilli & Alessandro Cescatti



## Concerns about reported harvested in European forests









M Palahí\*; R Valbuena\*, C Senf, N Acil, TAM Pugh, J Sadler, R Seidl, P Potapov, B Gardiner, L Hetemäki, G Chirici, S Francini, T Hlásny, B Lerink, H Olsson, J González Olabarria, D Ascoli, A Asikainen, J Bauhus, G Berndes, J Donis, J Fridman, M Hanewinkel, H Jactel, M Lindner, M Marchetti, R Marušák, D Sheil, M Tomé, A Trasobares, P Verkerk, M Korhonen, GJ Nabuurs

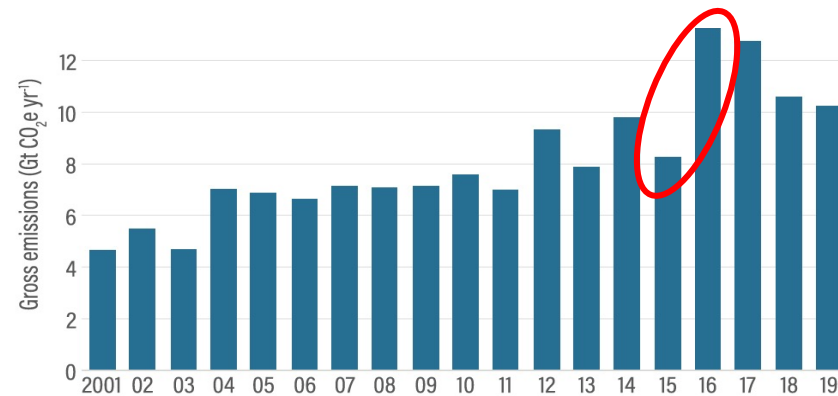


- The Global Forest Change (GFC) dataset has limitations that preclude trend analyses [...] **a major enhancement of detection models in 2015** influences GFC data consistency.
- The **Global Forest Watch (GFW) website advises against using GFC for temporal trend analyses.**
- The abrupt changes in Ceccherini et al. are **largely an artefact stemming from incorrect use of the GFC data time-series.**

Article | Published: 21 January 2021

# Global maps of twenty-first century forest carbon fluxes

Nancy L. Harris , David A. Gibbs , Alessandro Baccini<sup>2,10</sup>, Richard A. Birdsey<sup>2</sup>, Sytze de Bruin , Mary Farina<sup>2,11</sup>, Lola Fatoyinbo<sup>4</sup>, Matthew C. Hansen , Martin Herold , Richard A. Houghton<sup>2</sup>, Peter V. Potapov , Daniela Requena Suarez , Rosa M. Roman-Cuesta<sup>6</sup>, Sassan S. Saatchi<sup>7,8</sup>, Christy M. Slay , Svetlana A. Turubanova<sup>5</sup> and Alexandra Tyukavina<sup>5</sup>



Extended Data Fig. 9 | Gross forest-related emissions, 2001–2019. Emissions reflect all stand-replacement disturbances (natural and anthropogenic) observable in Landsat imagery.

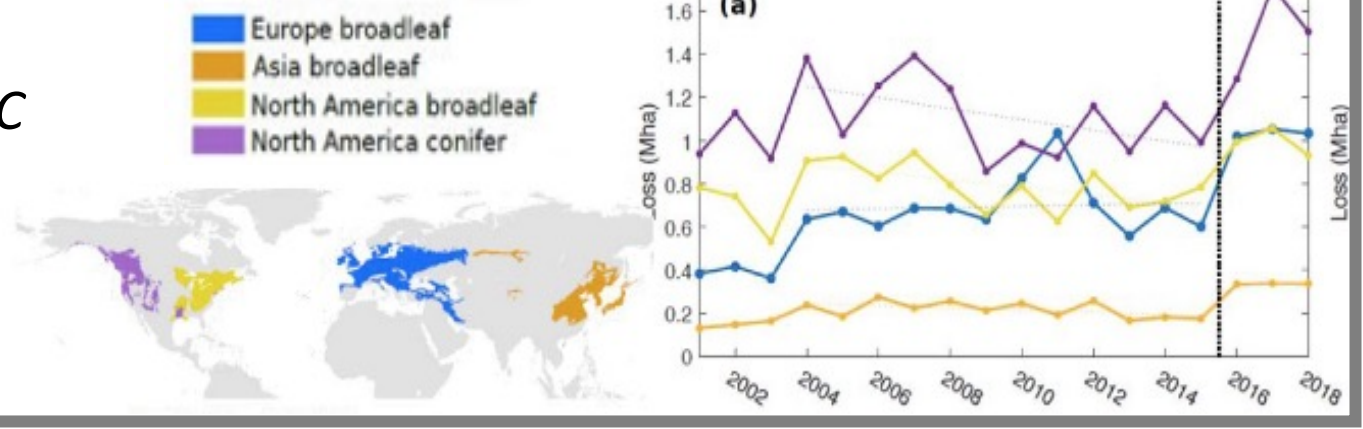
“Temporal inconsistencies are also present within the GFC product: one algorithm covers years 2001–2010 and **another covers 2011–2019**”

“**gross emissions can be estimated annually**”

Nature Climate Change (2021) | Cite this article

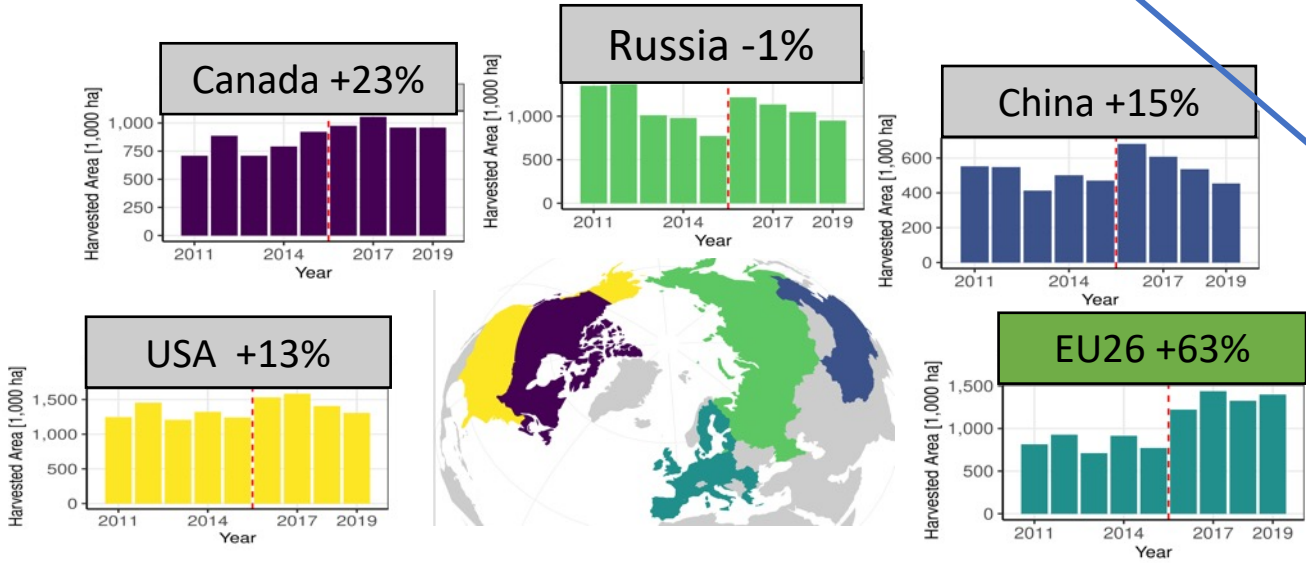
From Palahi et al.:

“Similar abrupt increases appear in GFC data recorded in other regions of the world over the same period”



**Comparison 2011-2015 vs 2016-2018**  
(source: Global Forest Watch, AREA LOSS of tree forest cover due to “forestry”)  
Average non EU: + 15%      EU26: + 59%

- A more complete picture (left) suggests that:
- Something likely happened in **2016**
  - The increase in **harvest in EU is 4 times greater** than in other countries



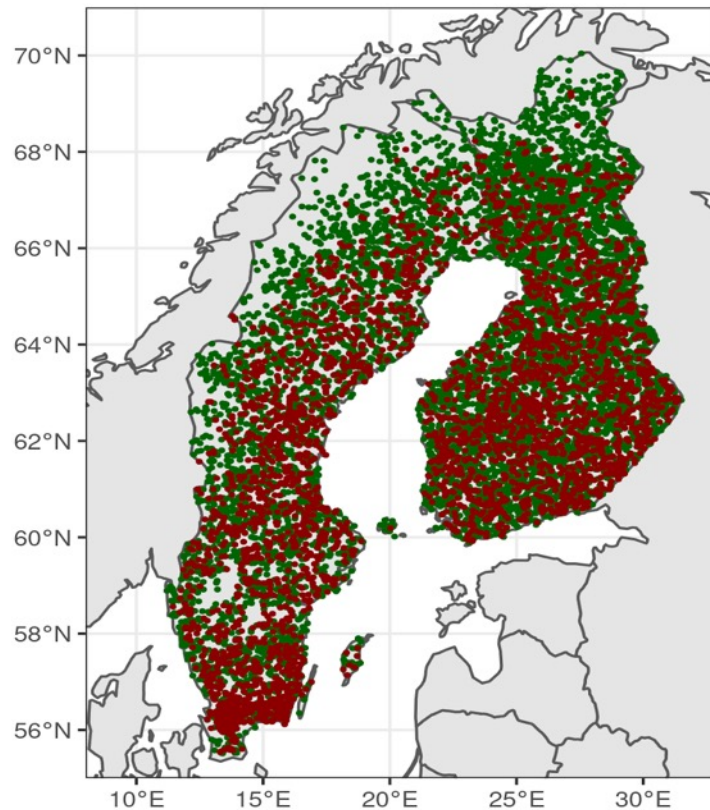
In the same period, JRC suggests +49% because we factored our much more of natural disturbances than GFW

# UPDATED RESULTS

## New sample-based validation

Visual classification of randomly selected sample points in land strata (e.g forest, loss). About 10000 points assessed in order to classify

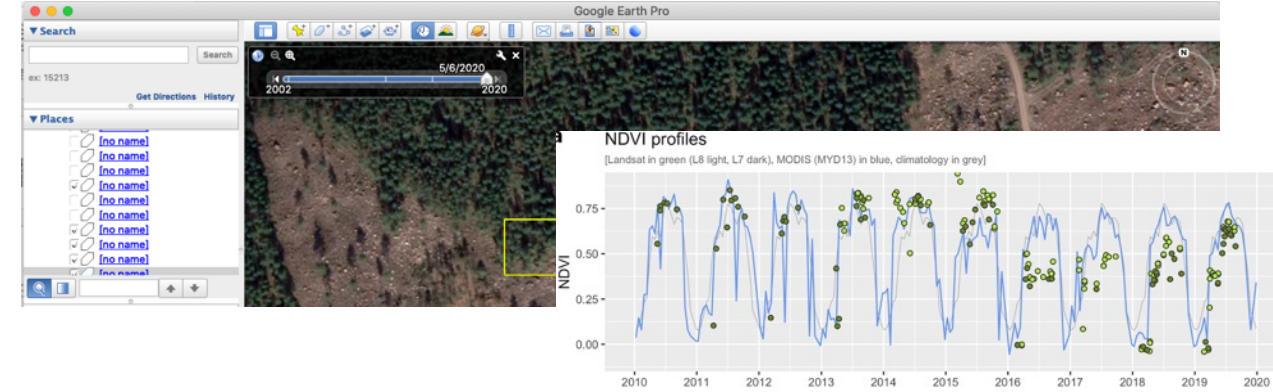
- loss area: 1846 points
- forest area: 3491 points



Legend:

- Forest
- Loss

## Time series of aerial photographs and satellite images



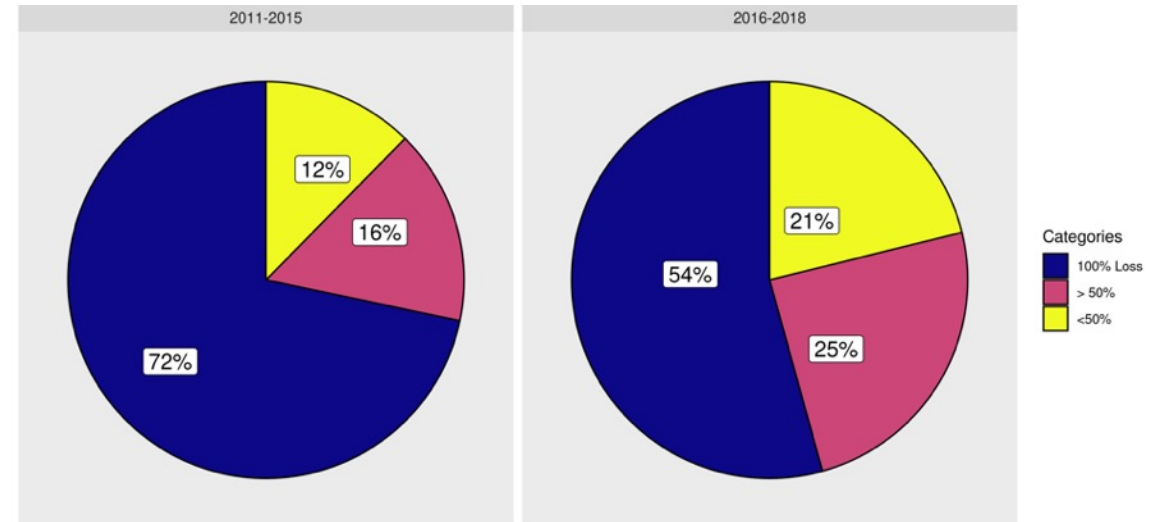
**Results** - harvest 2016-2018 versus 2011-2015

**Pixel based estimate**

**+ 54%**

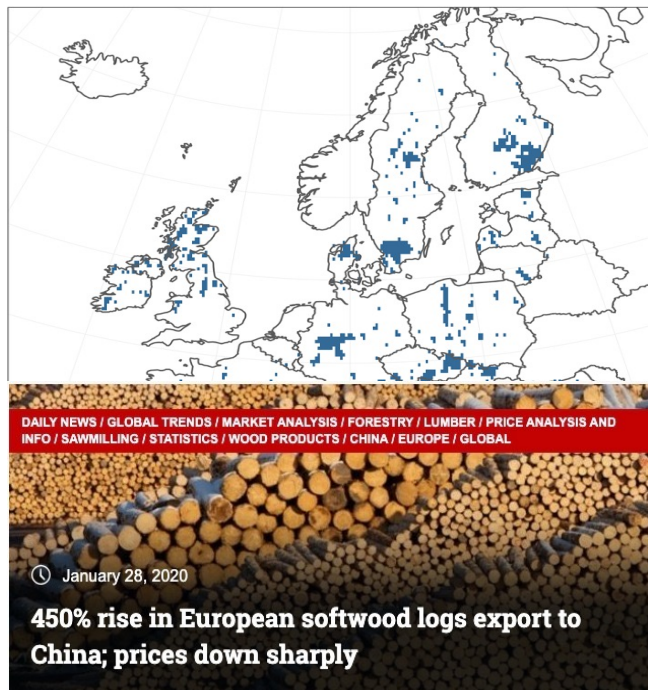
**Adjusted estimate**

**+ 35% ± 16% sampling error**

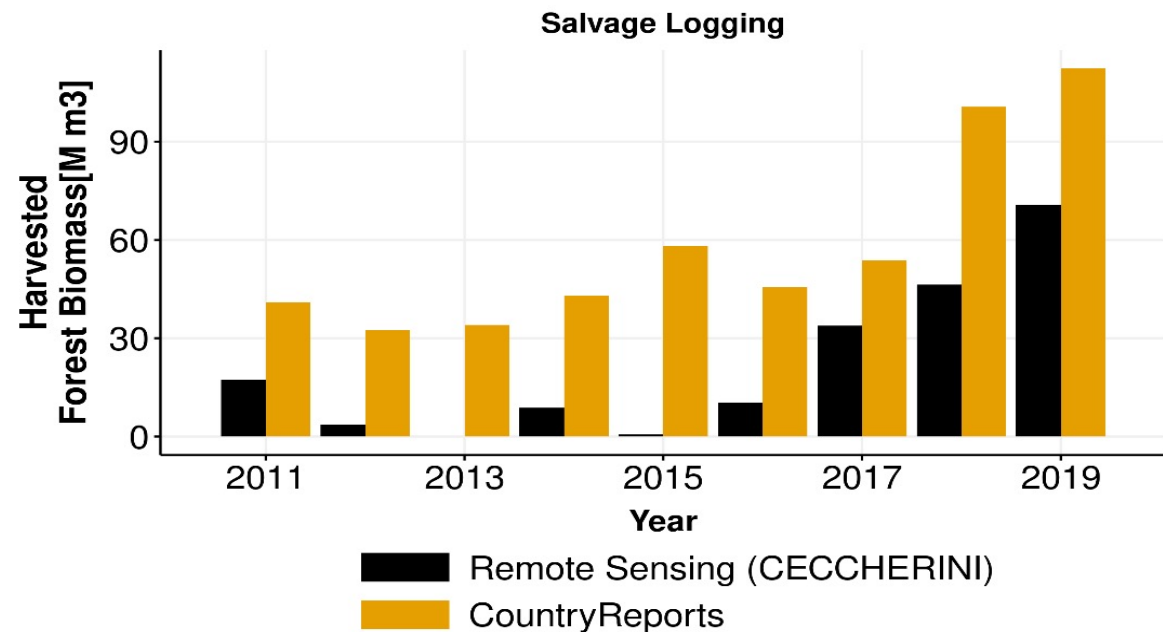


## Critique 2: Natural disturbances have not been properly factored out

- Our method detects anomalies in forest cover losses, therefore **major events** but not the “background” level of natural disturbances.
- While our approach is an approximation, no better data for the EU is currently available.
- Recent country-based evidence suggests that **our study underestimated the absolute level of natural disturbances, but captured well the trend**



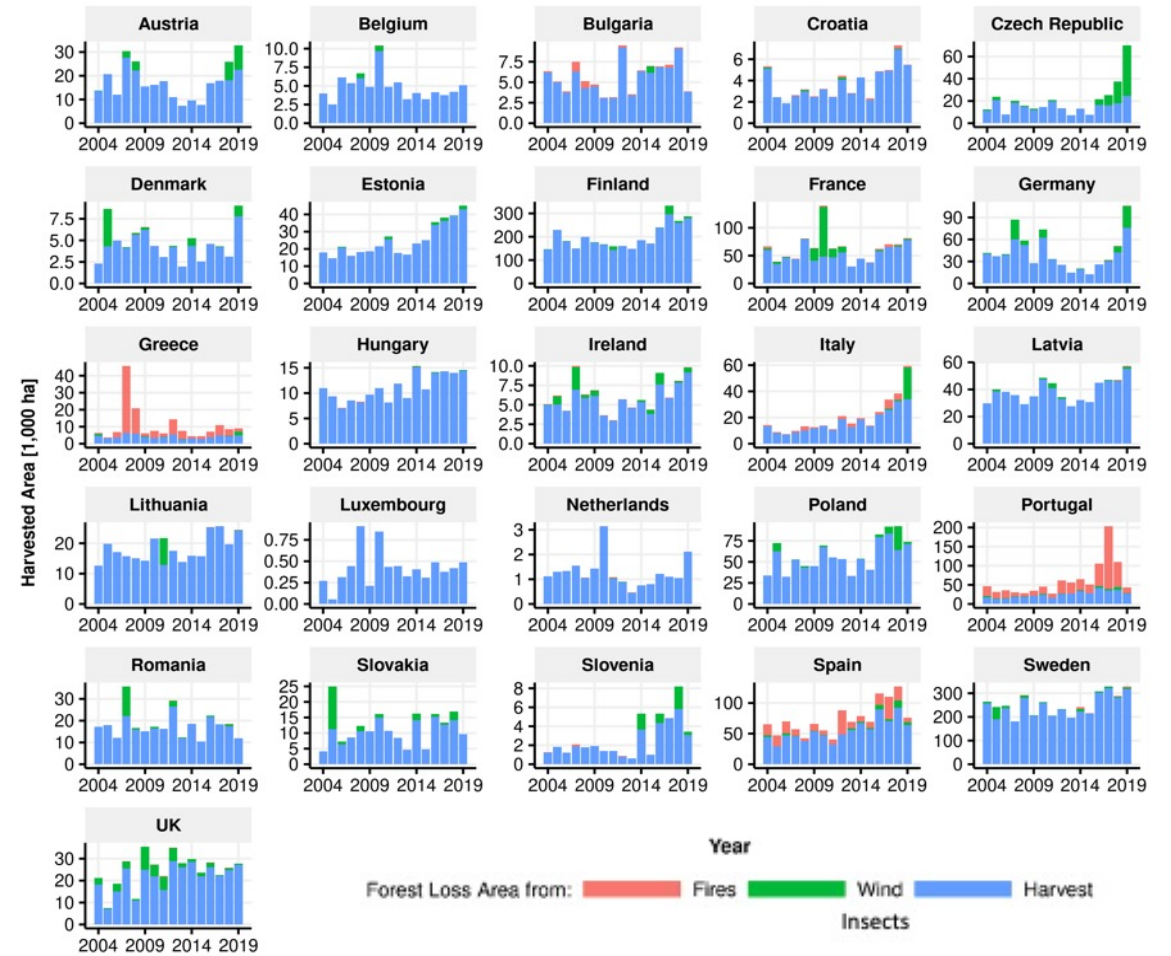
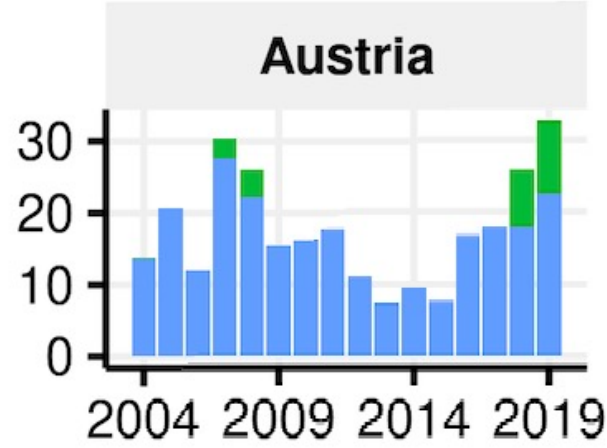
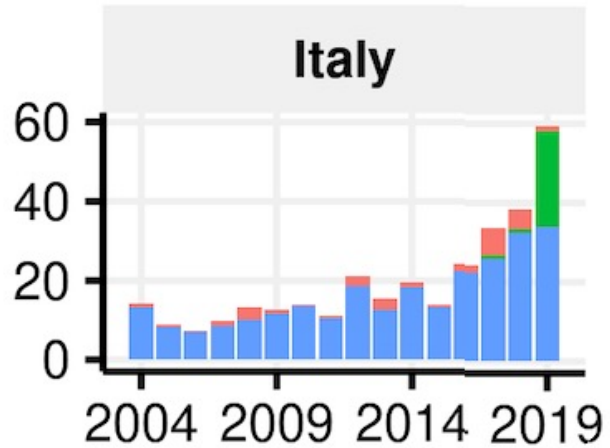
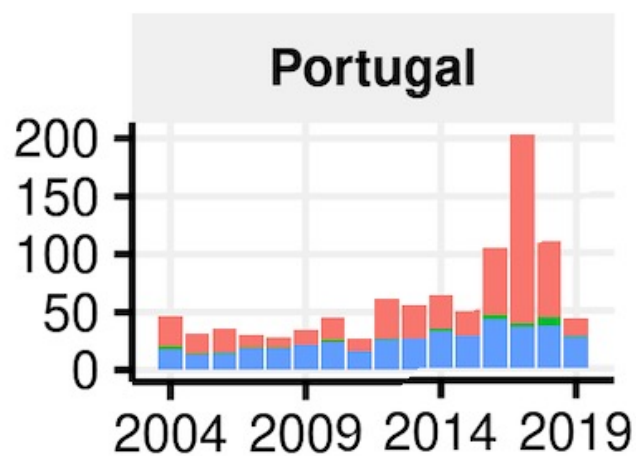
<https://www.globalwoodmarketsinfo.com/>



Reports on harvested biomass from salvage logging from 14 MSs: Austria, Bulgaria, Croatia, Czechia, Estonia, Finland, France, Germany, Hungary, Lithuania, Poland, Slovakia, Slovenia, Sweden

# Detection of natural disturbances

- Georeferenced datasets (FORWIND, DEFID2, IUFRO Tree Mortality Network) will improve estimates.



- Possible early warning system for major events
- The method can become operational at continental and global scale (annual update).

## Critique 3: the reported harvest trend not supported by statistics

Our study indicated **wood demand** as a **probable main driver** of the harvest increase **not because of a direct causal connection**, but because **we excluded other potential alternatives** (*better* explained in the rebuttal)

More importantly, our paper measured **clear-cuts**, not total harvest

While this was *unfortunately* not clear in the abstract, it was explained *five* times in the text

We note that the GFC dataset is sensitive to clear-cuts instead of the actual wood harvest, which can be complemented by thinning operations that may not be seen by the satellite—such as when the change in crown cover is not large

Our approach has limitations in the detection of small-scale silvicultural practices.

Although the GFC clearly does not require full clear-cuts to detect forest-cover loss, it is not able to reliably capture partial removal of trees caused by forest thinning, selective logging,

addition, most changes occurring below the canopy cannot be detected by optical instruments, potentially leading further to an underestimation of actual harvest wood.

30 m. Small-scale silvicultural practices such as thinning or selective logging—which are relevant in some EU countries—could therefore not be fully detected.

The Suppl Information quantifies this for each country, e.g.:

Member State	Share of final cut on the managed area (or volume in case of CBM)
Sweden	≈ 37%, as total area

Sweden. The lack of correlation between the GFC data and harvest-removal data is probably due to: (1) when large disturbance

Sweden); and (3) for this country, final felling covered (In terms of area) about 37% of the area annually affected by fellings between 2000 and 2015<sup>56</sup>. This area is not statistically correlated with the total amount

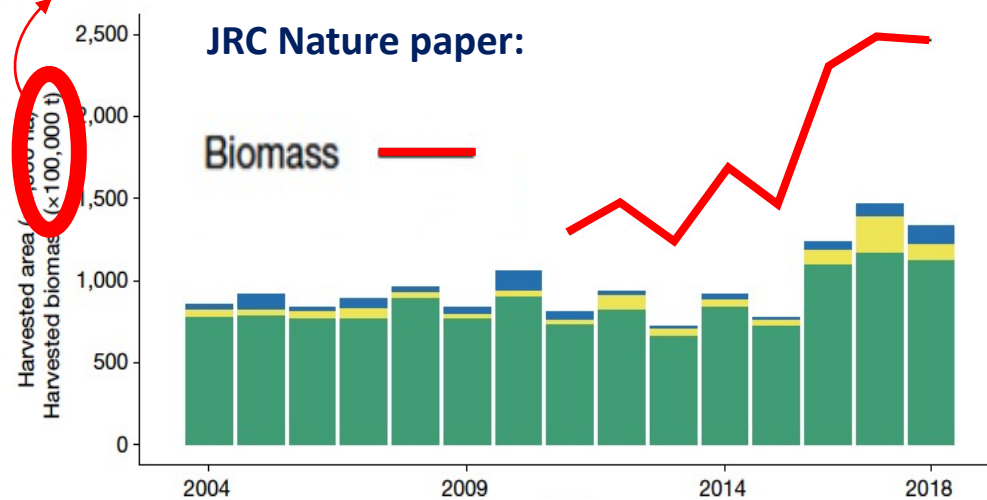
**At EU level, ~ 40-50% of harvest appears to come from clear-cuts (final fellings)**

# Resolving misunderstandings in comparing Ceccherini et al. with country statistics

Tonnes of clear-cut fellings overbark (JRC study) *cannot be compared with* m3 of total removals underbark (country statistics)



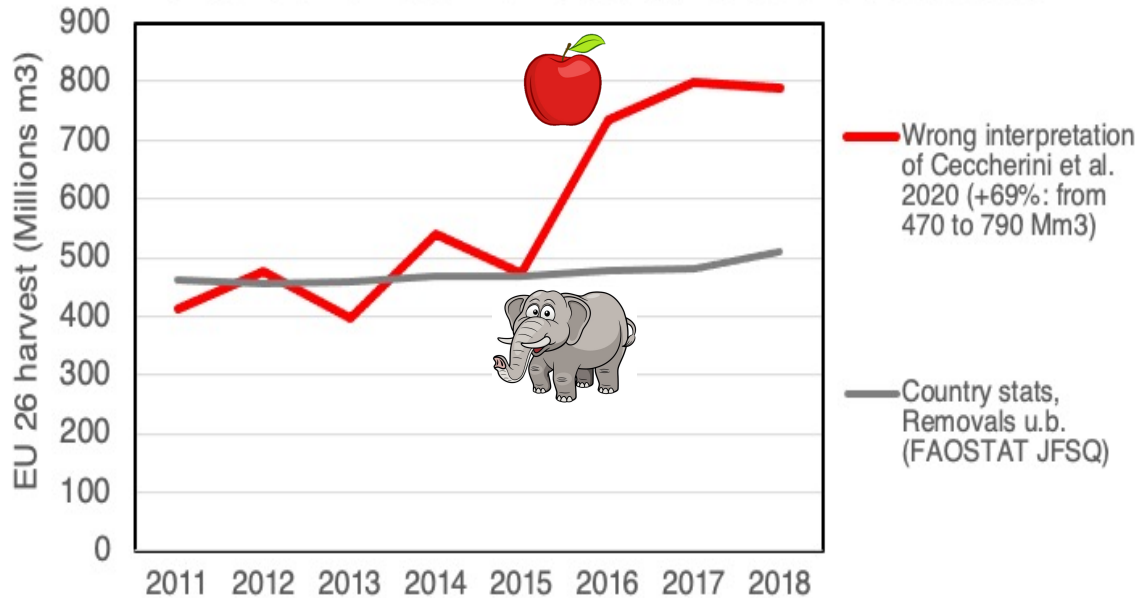
Multiply by ~ 2 to obtain m<sup>3</sup>



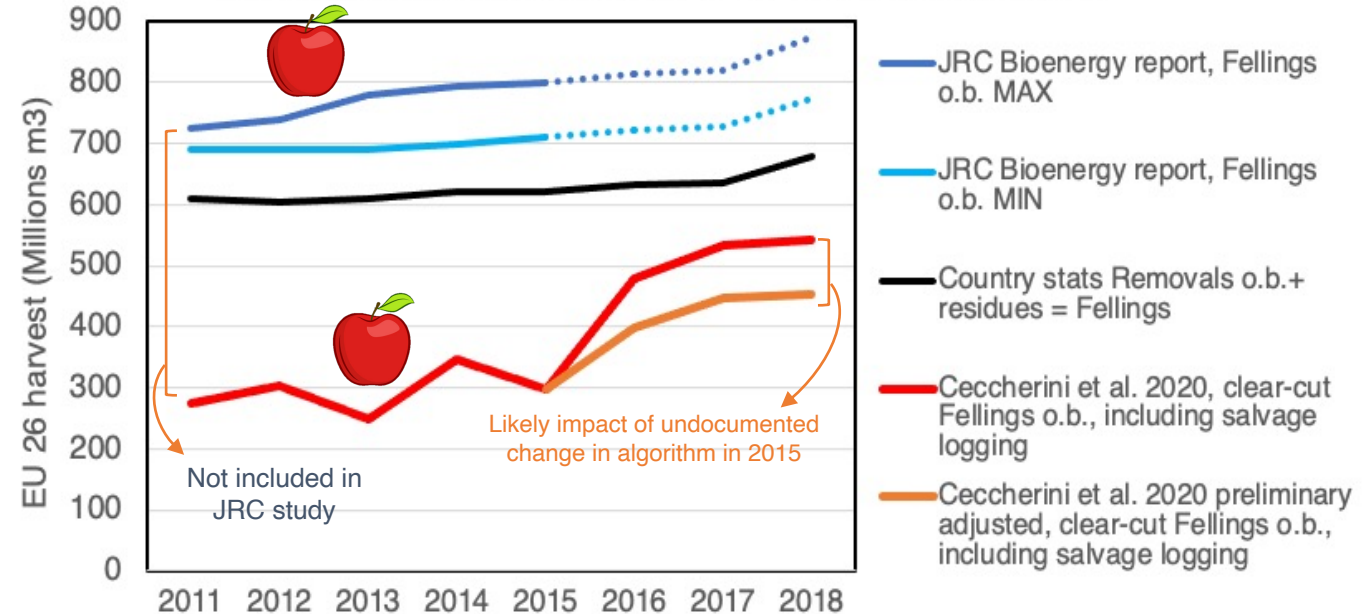
When latest and more realistic statistics are used, **JRC results are well below country statistics**



Perceived harvest in JRC study vs. country statistics



Correct harvest in JRC study vs. country statistics



# CONCLUSIONS

## Consistency of Global Forest Change product and impact on our results

- Has a change in the forest loss detection algorithm occurred in 2015? **YES**
- Had this change been previously documented? **NO** (it's a GFC mistake, *unnoticed by all other studies*)
- Are the original results "*largely an artefact stemming from incorrect use of the GFC*"?

The mistake was by the GFC, not by us. By correcting for this mistake, results change, but not so *largely*. After the extra validation, in SWE and FIN the estimated increase in *clear-cut harvest area* goes from **+54% to +35%** (2016-2018 vs. 2011-2015)

**Method used for natural disturbances** Our method correctly captured the trend.

**Do our results contradict country statistics?** Not necessarily, because we aimed to assess clear-cuts only. The perceived contradiction is due to misunderstandings. Our results should be interpreted as a warning on a recent increase in clear-cuts observed by satellites.

Overall, the comments received gave us the opportunity to:

- **Rectify the results** due to the impact of the undocumented GFC change
- **Clarify** aspects originally poorly explained and **correct misperceptions of the paper.**

## WAY FORWARD

- Great demand for robust, spatially explicit and timely forest harvest data
  - Harvest is relevant for a multitude of ecosystem services (i.e. climate mitigation, biodiversity, harvested wood products) but is affected by the rapid increase in natural disturbances/
- Sample-based methods cannot become the operational way to meet this demand
  - Expensive, complex. Produces unbiased but uncertain outputs.
- Despite its popularity, GFC proved to be poorly documented and inconsistent
  - We need a tree-cover satellite product which is robust, temporally consistent and fully documented.
  - Copernicus has the potential to build reliable (sample-validated) tree cover loss maps.