

LULUCF in transition: present and future challenges for LULUCF reporting and accounting
7-8 June 2021

ACCOUNTING EMISSIONS FROM NATURAL DISTURBANCES: CHALLENGES AND METHODOLOGICAL ISSUES

Roberto Pilli – Matteo Vizzarri

Background

- Natural disturbances, and in particular **windstorms**, **determine year-by-year variations of about 10–15% of the forest C sink at EU level**, and even more, if considered at national scale.
- **Windstorms are projected to damage more than 40 10⁶ m³ growing stock yr⁻¹ in 2030 in Europe**—three times more than fires and insect outbreaks— of which about 3 10⁶ m³ growing stock yr⁻¹ in the Alpine.
- There is poor understanding on how to face the **immediate and counterfactual effects of natural disturbances and forest management**.
- This is the case of **salvage logging** that may reduce the stand carbon stock in situ and improve the carbon storage in harvested wood products.

In autumn 2018, an extra-tropical windstorm, named Vaia, broke down at least $9.5 \cdot 10^6$ m³ of merchantable wood in Northern Italy (\approx 45 kha)

Even if not comparable with the same type of events recorded in other European countries, Vaia is considered the major windstorm affecting the Italian territory since the last war.

Indeed, Vaia damages corresponds to more than 70% of the total roundwood removed in Italy in the same year.



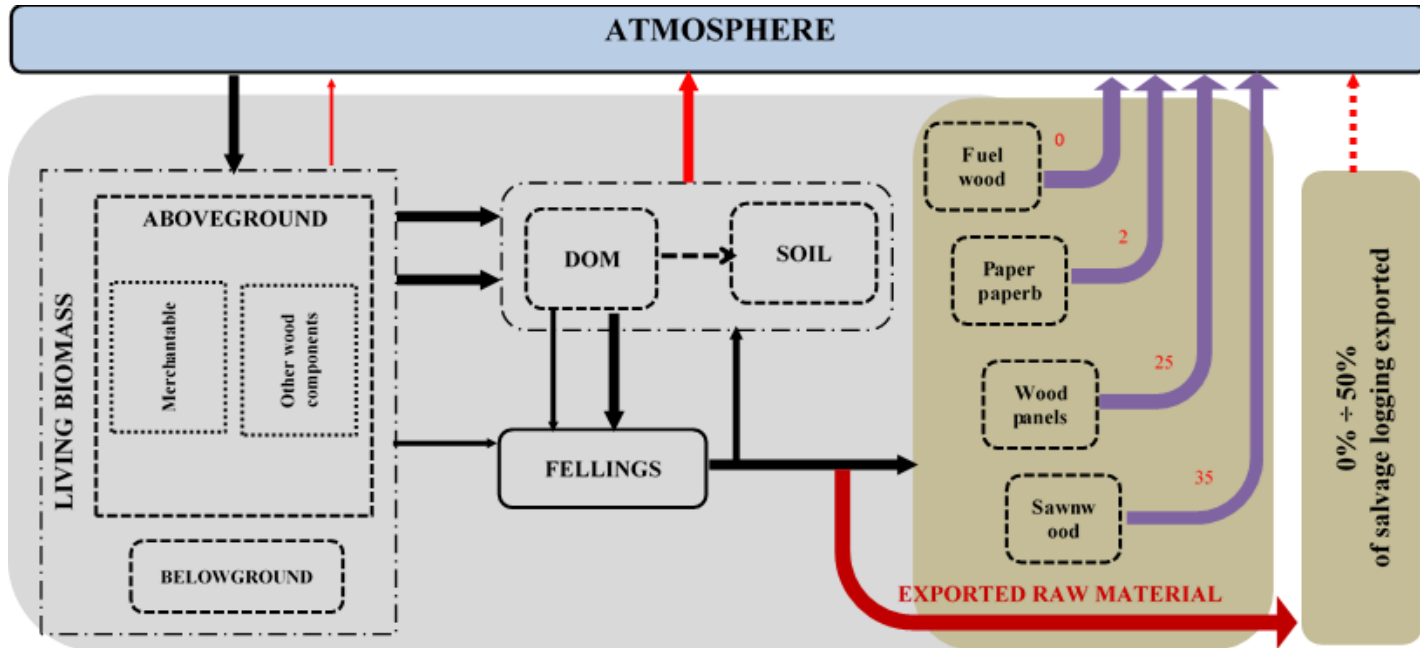
Objectives

Combined effects of natural disturbances and management on forest carbon sequestration: the case of Vaia storm in Italy

Roberto Pilli¹ · Matteo Vizzarri¹ · Gherardo Chirici²

- **Quantify the potential effect of Vaia storm on the Italian forest carbon sink** - assumed as representative case study - by comparing through a modelling approach:
 - **a business-as-usual scenario (BaU)**, based on the historical (until 2018) and theoretical (from 2019 to 2030) evolution of the forest carbon sink, with
 - a second scenario (“Vaia Storm”, **VS**) including:
 - the **direct effect of the windstorm on the forest carbon pools**: living biomass, DOM and soil
 - the **indirect effects of salvage logging on Harvested Wood Products (HWP) pool**, considering different share of raw wood directly exported to other countries
 - the **overall forest mitigation potential at national level, including the effect of fire disturbances**

Modelling framework

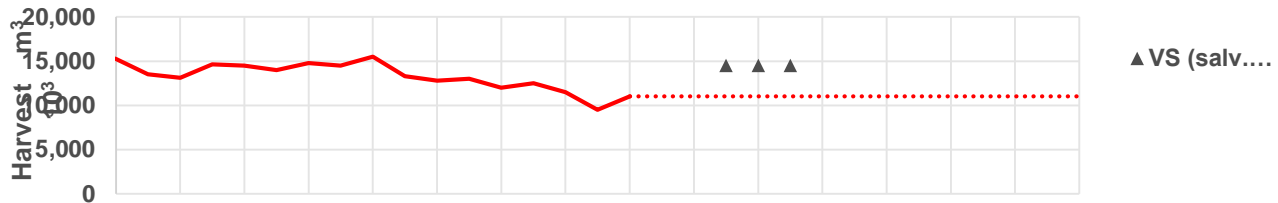
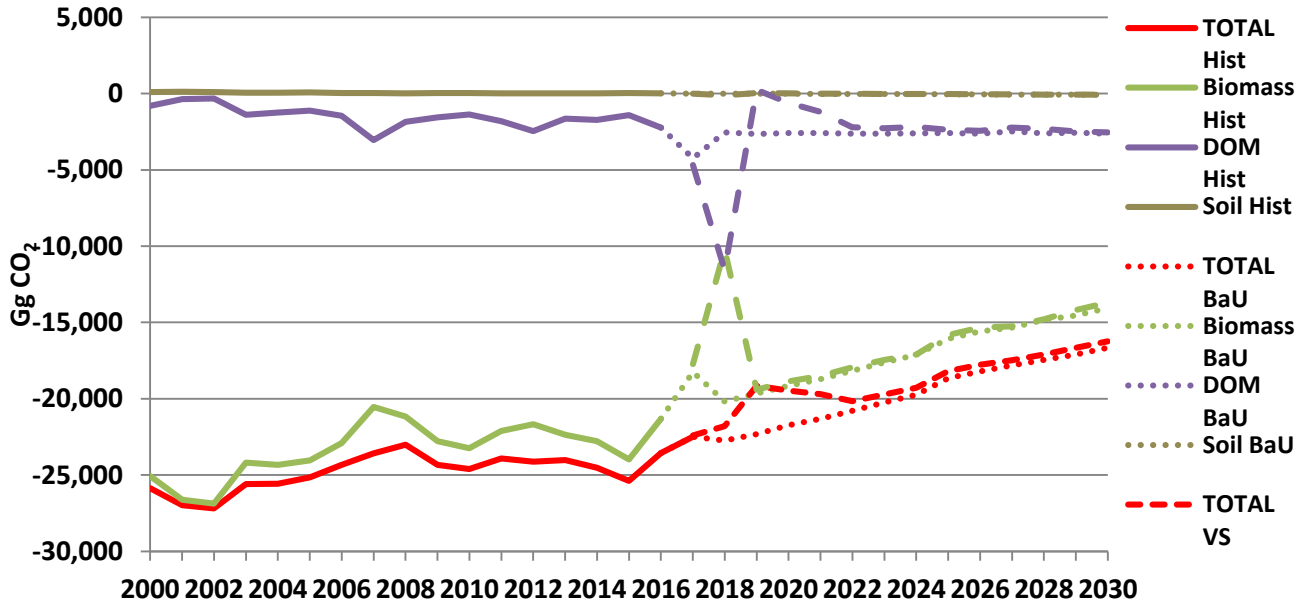


Carbon Budget Model (CBM) + HWP module (IPCC Tier 2)

Results: forest C sink excluding HWP

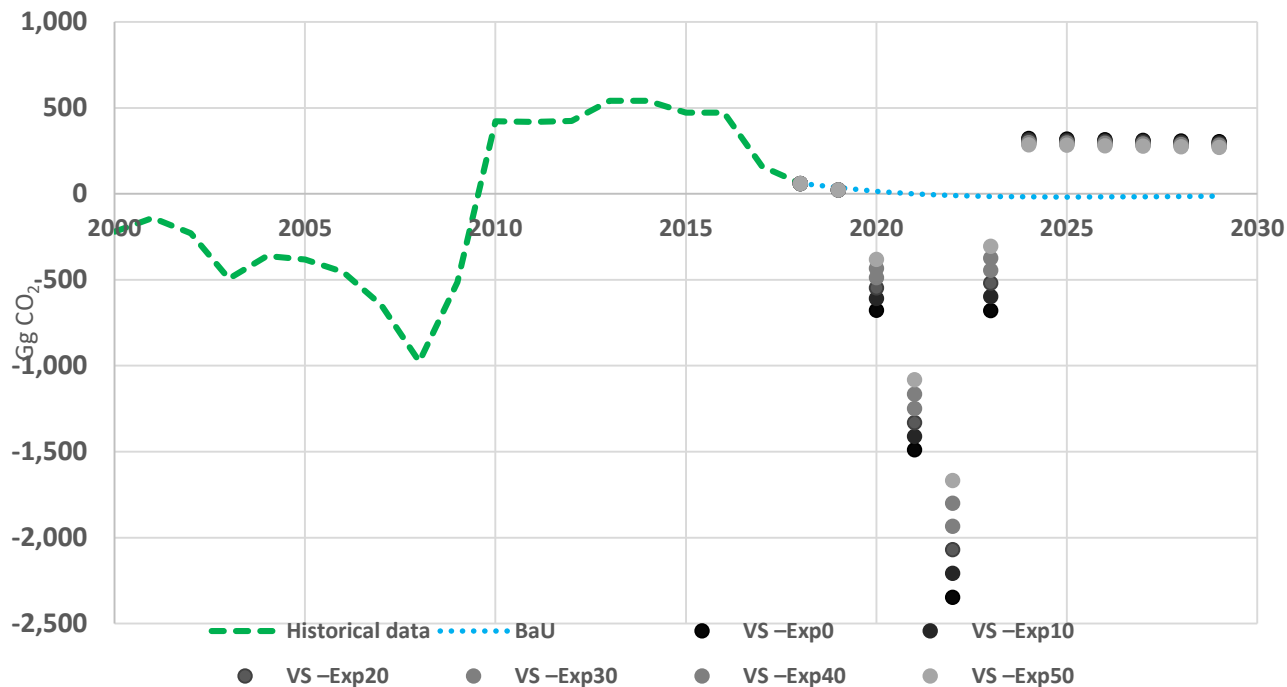
Total forest C sink:

2018 → -4%
 2019 → -14%
 2020 → -10%



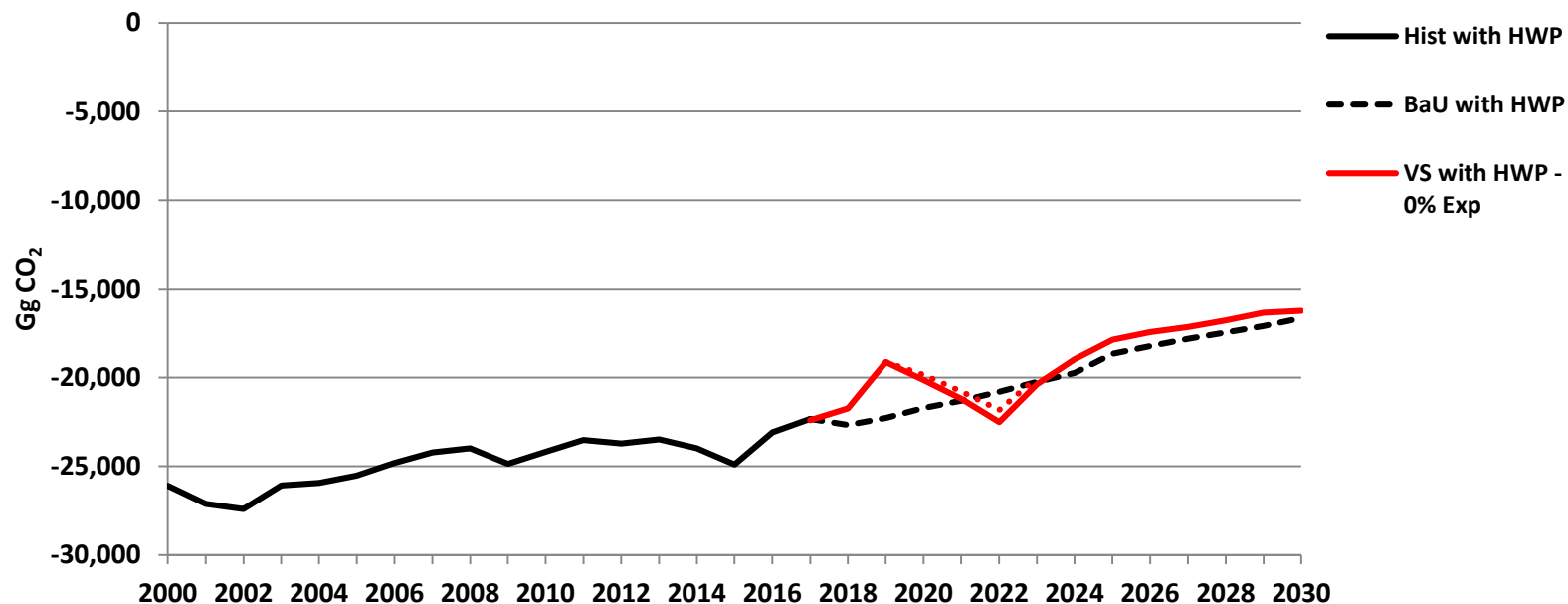
Results: HWP mitigation potential

Increasing share of raw wood removed through salvage logging and directly exported to other countries from 0% (Exp0) to 50% (Exp50)



Results: total forest C sink including HWP

- HWP compensate the decreasing C sink accounted under the forest pools
- In 2022, the final C sink estimated at national level including HWP mitigation potential is higher than the values attributed to VS excluding HWP, and to BaU including HWP contribution



Challenges & methodological issues (i): full accounting of cascade effects

- We demonstrate the **cascading effect induced by forest windstorms on different C pools**: carbon in living biomass moves to DOM—partially compensating the decrease in living biomass C sink—and through salvage logging to HWP — partially compensating a decrease in C sink in DOM
- When **fully accounted, the overall effect of this flux is a stabilization of the total C sink**, which may slightly decrease, or increase compared with the BaU scenario.
- The overall estimate of the historical and future C sink is also linked to the total amount of harvest at national level. We assessed this last figure according to the best available data reported in literature. However, because of the lack of reliable statistics, especially for the last years, **these data sources are highly uncertain** and likely underestimated

Vaia storm facing the unbearable lightness of forest reporting

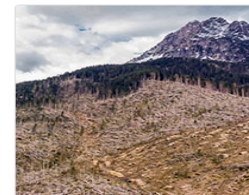
Davide Pettenella ⁽¹⁾ ✉, Marco Marchetti ⁽²⁾, Renzo Motta ⁽³⁾, Giorgio Vacchiano ⁽⁴⁾

Forest@ - Journal of Silviculture and Forest Ecology, Volume 18, Pages 1-4 (2021)

doi: <https://doi.org/10.3832/efor3733-017>

Published: Jan 09, 2021 - Copyright © 2021 SISEF

COMMENTARIES & PERSPECTIVES



Challenges & methodological issues (ii): new tools to integrate national statistics

- **Remote sensing information can complement data collected at national level**, to analyze interannual variations, especially where detailed statistics are not available:

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

Emergent vulnerability to climate-driven disturbances in European forests

Giovanni Forzieri¹, Marco Girardello¹, Guido Ceccherini¹, Jonathan Spinoni¹, Luc Feyen¹, Henrik Hartmann², Pieter S. A. Beck¹, Gustau Camps-Valls³, Gherardo Chirici⁴, Achille Mauri⁵, Alessandra Cescatti¹

Check for updates

forests

Article

Estimating VAIA Windstorm Damaged Forest Area in Italy Using Time Series Sentinel-2 Imagery and Continuous Change Detection Algorithms

Francesca Giannetti^{1,2,*}, Matteo Pecchi¹, Davide Travaglini^{1,2}, Saverio Francini^{1,3,4}, Giovanni D'Amico¹, Elia Vangi^{1,3}, Claudia Coccozza¹, and Gherardo Chirici^{1,2,5}

MDPI

Article

Abrupt increase in harvested forest area over Europe after 2015

<https://doi.org/10.1038/s41586-020-2438-y> Guido Ceccherini^{1,2}, Gregory Duveiller¹, Giacomo Grassi¹, Guido Lemoine², Valerio Avitabile¹, Roberto Pilli¹ & Alessandro Cescatti¹

Received: 17 May 2019

Challenges & methodological issues (iii): the contribution of HWPs

- We showed that **the relative contribution of the HWP to the total C sink can compensate the negative C balance attributed to DOM pool, due to salvage logging.**
- The annual inflow to the HWP pool depends on (i) the **total amount of removals** (salvage logging included), (ii) the **relative share of industrial round wood** (i.e. the fraction of removals used for material products), further distinguished by commodity, and (iii) on the **fraction of domestic production attributed to each commodity.**
- The **sensitivity analysis on different level of harvest provided by salvage logging and directly exported to other countries, highlights the need to carefully assess all these quantities.** Due to the assumptions behind the IPCC methods (Tier 2 Approach), **the traded feedstock** (i.e. the amount of raw wood directly exported to other countries) **will not be accounted within the HWP mitigation potential reported at country level** (neither within the country exporting nor importing this material).

Challenges & methodological issues (iv): missing components ...

- Although not considered in our modelling exercise, assessing the indirect consequences of probable **insect outbreaks** following wildfires or windstorms on the vitality of survived trees is extremely important.
- The magnitude of these attacks, however, is highly uncertain and usually driven by local climatic conditions during the next spring and summer seasons and by the amount of dead biomass left on site.
- **Disturbance management approaches and high-intensity salvage logging may prevent future insect outbreaks** and preserve the C sink in living biomass.
- Apart from the C sink in HWP, the merchantable biomass removed through salvage logging also provides an additional mitigation potential, due to the **substitution benefits** realized by using wood products instead of other GHG-intensive materials.
- Apart from the carbon balance and wood supply, windstorms also affects **other ecosystem services**, such as soil protection from water erosion, biodiversity, and overall socio and recreational functions ...



SelvArt



Marco Martalar, 2020

