TESAF Dipartimento Territorio e Sistemi Agro-Forestali Università di Padova

Webinar, 2021.2.19

WP3 - Framework for forest SES and vulnerability assessment

Emanuele Lingua, Luca Marchi, Maximiliano Costa

VAIA FRONT TESAF

2019 schedule…….

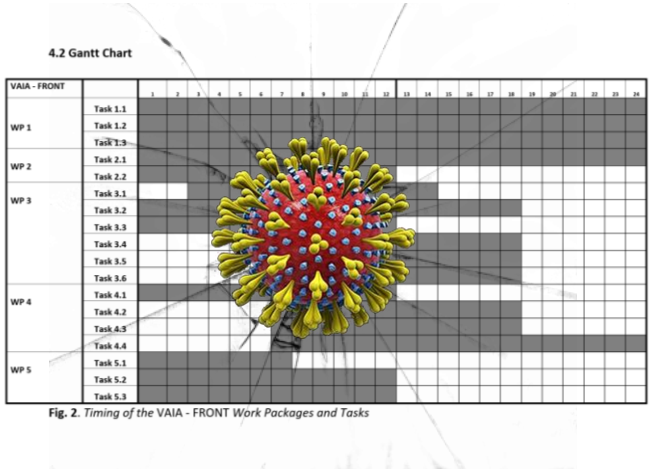


Fig. 2. *Timing of the* VAIA - FRONT *Work Packages and Tasks*

Main study site

Rocca Pietore (BL)

Elevation 1,143 m a.s.l.
Municipality area 73.29 km²
Inhabitants 1,190 (2020)

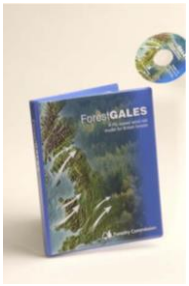
- **Task 3.1 Assessment of the vulnerability of trees and forest stands to wind forcing**
- **Task 3.2 Assessment of the vulnerability of forest Ecosystem Services (ESS) to wind disturbance**
- **Task 3.3 Assessment of the vulnerability of linear infrastructures to wind disturbances**
- **Task 3.4 Assessment of the human vulnerability during storm events**
- **Task 3.5 New susceptibility to snow avalanches after storm events**
- **Task 3.6 Vulnerability of the wood market to storm events**

Advisory Board mid-term evaluation

Task 3.1 Assessment of the vulnerability of trees and forest stands to wind forcing

Field tests

ForestGALES (fgr)



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Uprooting Resistance of large DBH Norway spruce in Eastern Prealps

Ph.D. Eng. Luca Marchi

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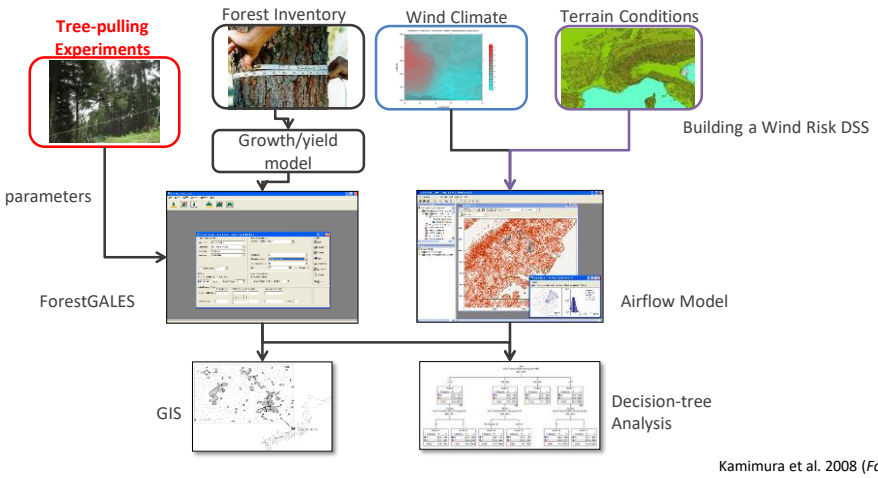
The ForestGALES approach



Kamimura et al. 2008 (*Forestry*)
Locatelli et al. EGU 2020

Need to feed it with new pulling test data

ForestGales' trees mechanical parameters are based on an impressive dataset of 2000 pulling tests

Such models includes tree species of the Italian Alps

- Resistance to overturning of the root-plate system → pulling tests → Root-plant Bending Moment

$$M_{crit_over} = C_{reg} \times Stem\ Weight$$

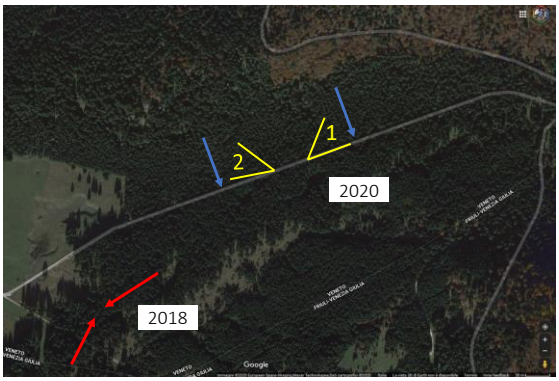
Limited to **DBH < 35cm**
for Freely-draining mineral soils

Need to feed it with new pulling test data

October 2018

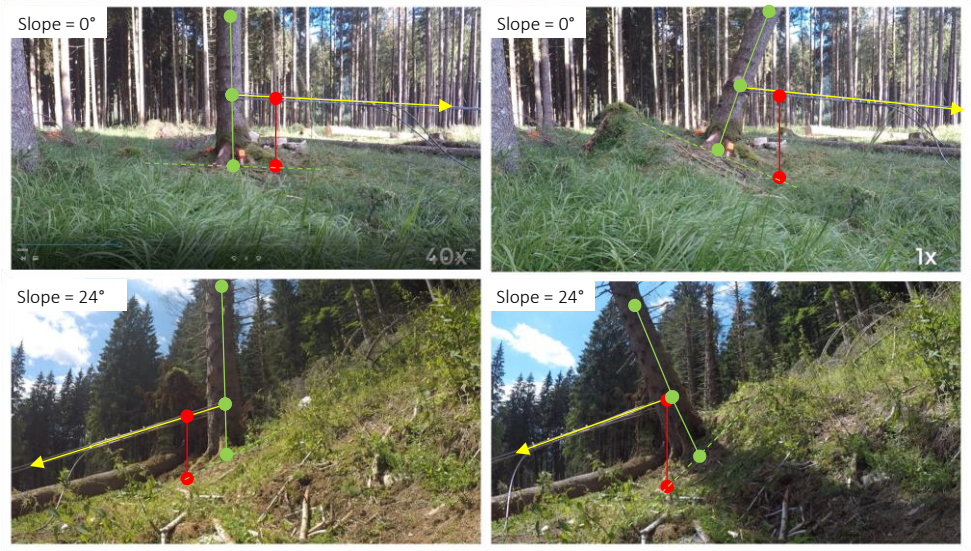
The week after

Test site: Cansiglio forest (Veneto Prealps, NE Italy)

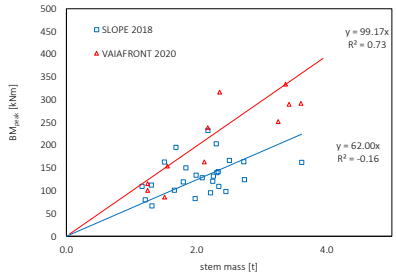


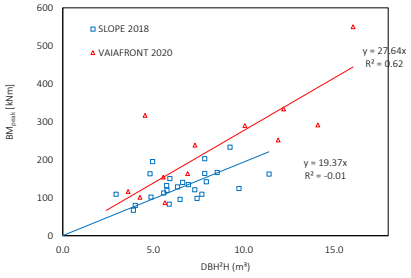
Pulling test

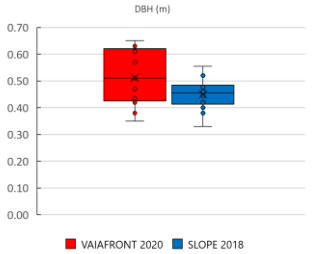
Sloped vs. plain terrain

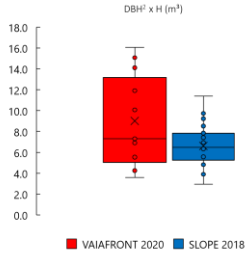


Results



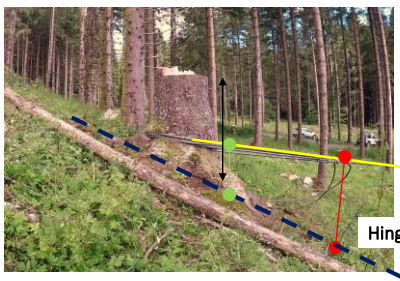


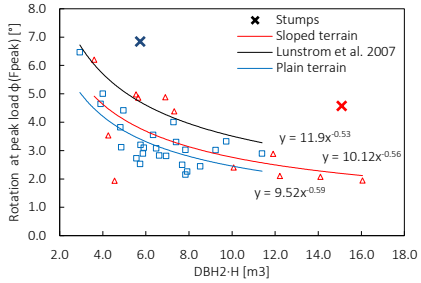




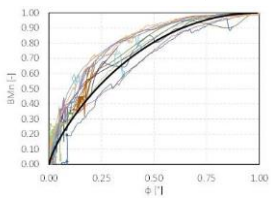
Tree stumps?

1. Root-soil strength
2. Root-soil weight
3. Tree base weight
4. ~~Stem weight~~
5. ~~Crown weight~~





$$M_0 = \theta_0^n + \alpha \cdot \theta_0 \left(1 - \theta_0^n\right)$$

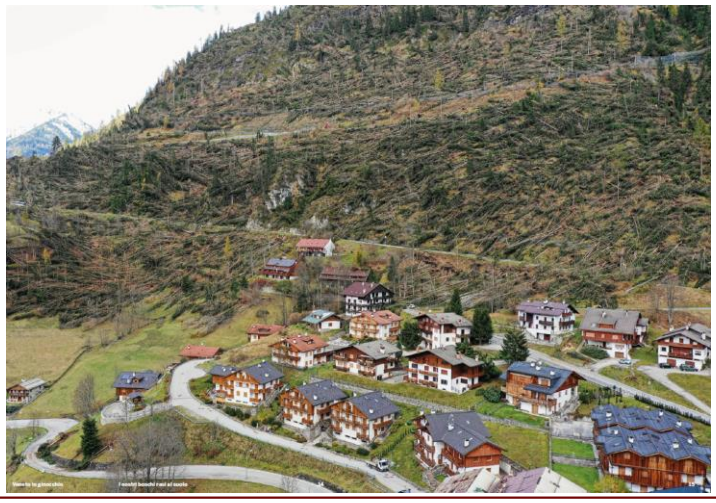


Pulling test

Task 3.2 Assessment of the vulnerability of forest Ecosystem Services (ESS) to wind disturbance

Protection function

WP4



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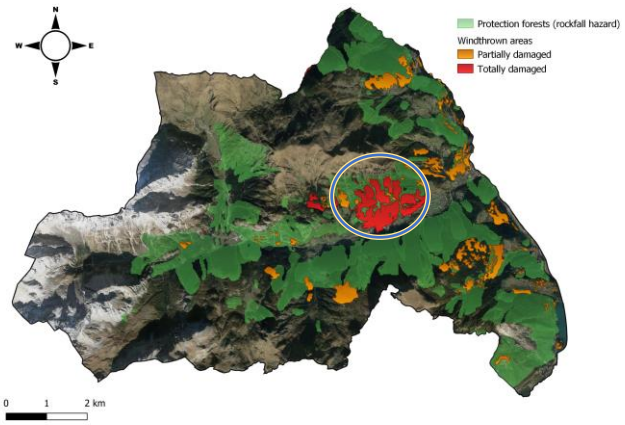
Vaia and protection forests

Ph.D. candidate Maximiliano Costa

VAIA FRONT TESAF

Rocca Pietore municipality and rockfall hazard



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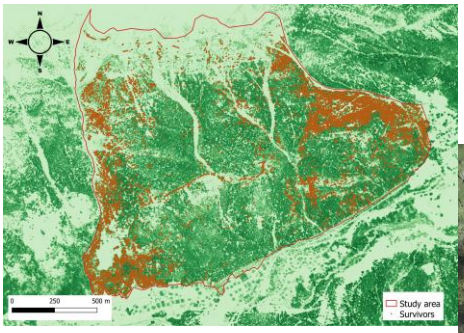
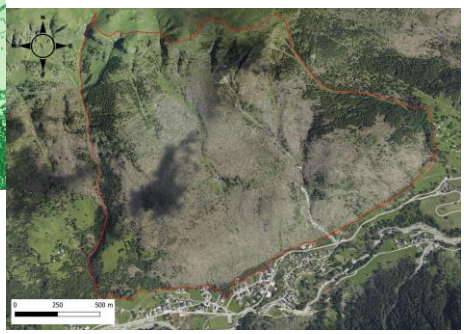
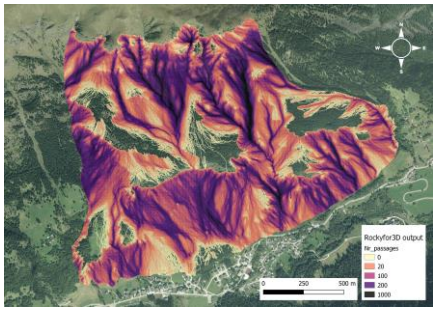
Study site - 1

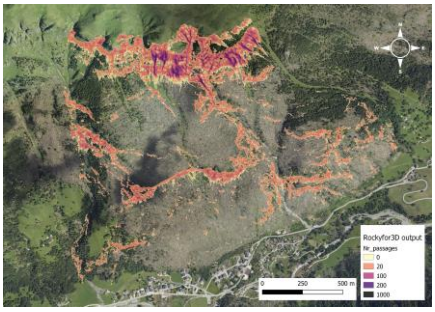




Study site - 2

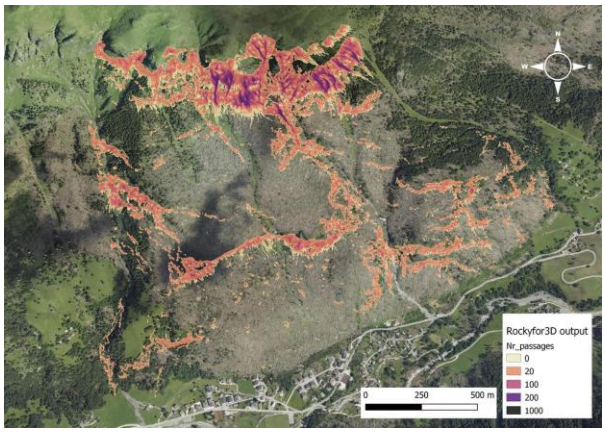
Before and after Vaia scenario



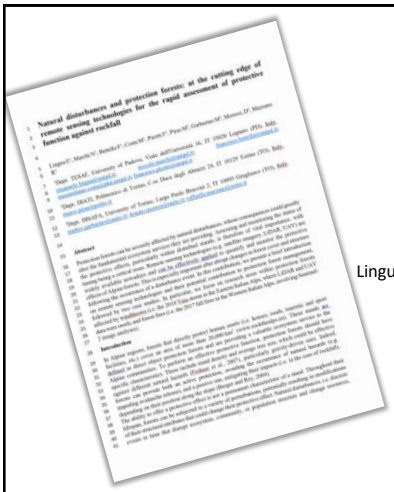


Simulations run with a 1x1x1 m spheric block

Next years scenario



Simulations run with a 1x1x1 m spheric block



Natural disturbances and protection forests: at the cutting edge of remote sensing technologies for the rapid assessment of protective function against rockfall

Lingua et al. 2021 – Book chapter

Costa et al., to be submitted next week-early March

forests

Biological legacies and rockfall: the protective effect of a windthrown forest

Marchi et al. 2021 – in prep.

Journal: International Journal of Forest Engineering

Title: Overturning resistance of large diameter Norway spruce (*Picea abies* (L.) Karst) in sloped terrain

Task 3.3 Assessment of the vulnerability of linear infrastructures to wind disturbances

Waiting results from 3.1

Database implementation

Task 3.4 Assessment of the human vulnerability during storm events

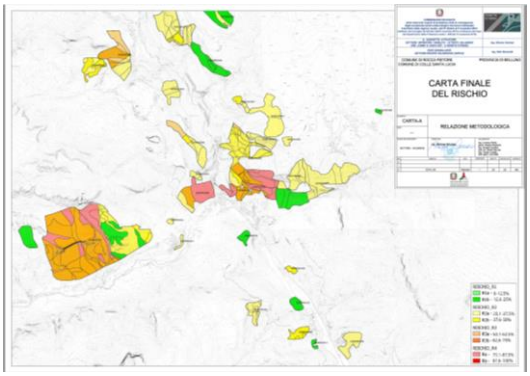
Started, main activities
postponed to the second year

Task 3.5 New susceptibility to snow avalanches after storm events

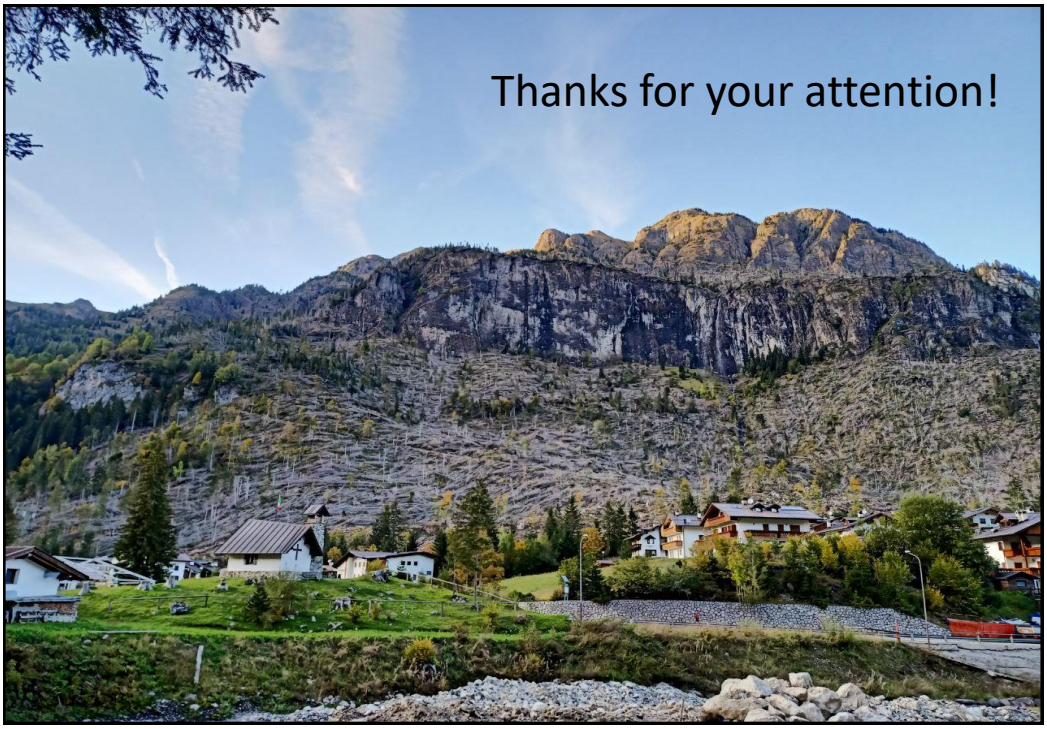
The analysis has been carried out by ARPAV

14 sites
301.57 ha

The output will be used in Task 3.2 and WP4



Task 3.6 Vulnerability of the wood market to storm events

Data collection ongoing

Main output in the second year