



Segmentation-Based Standing Deadwood Mapping

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1 Introduction

Climate-driven forest mortality in Switzerland is rapidly increasing. Yet high-resolution spatial data for comprehensive, wall-to-wall assessments is still lacking. To close this gap, we apply a transformer-based semantic segmentation model trained on RGB imagery to assess and map forest mortality on the SWISSIMAGE 10cm dataset, covering Switzerland in the years 2018 - 2023.

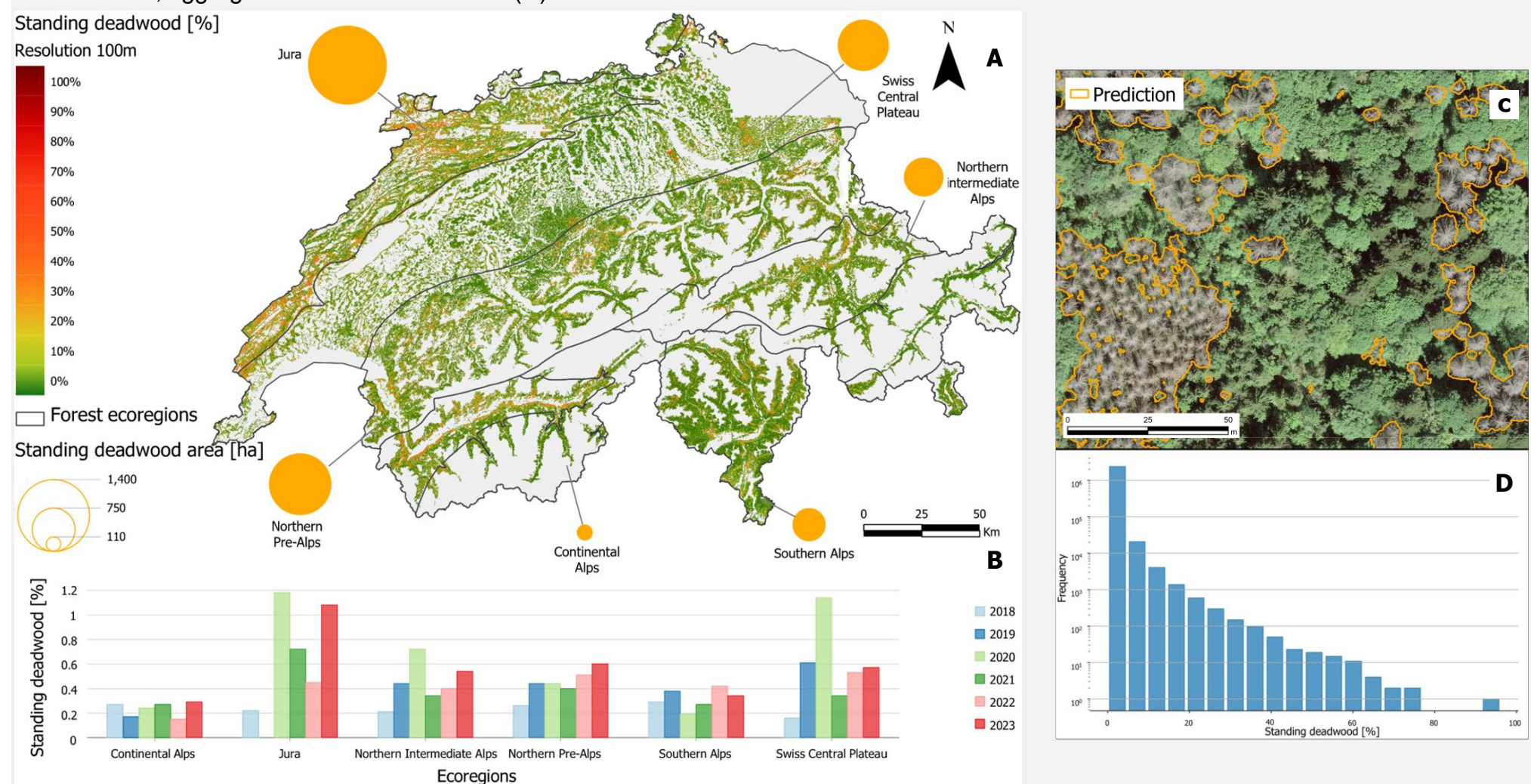
We test model performance on an independent region, then use the segmentation output to detect standing deadwood and assess forest mortality using yearly available aerial images.

2 Materials and methods

- **Model:** We applied a transformer-based architecture for image segmentation trained by Möhring et al. (2025) on the *deadtrees.earth* database (Mosig et al, 2024).
- **Data:** High-resolution (10 cm) RGB aerial images from spring/summer from 2018 to 2023 (Swisstopo, 2024), covering Switzerland.
- **Test site:** 4 km² of fully labeled forest area with 1,626 manually delineated dead trees.

3 Results

Standing deadwood map, reference years 2018-2023 (A), yearly share of standing deadwood by forest ecoregion (B), example of dead tree segmentation in the Sihlwald Nature Discovery Park, Zurich, reference year 2022 (C), and standing deadwood distribution, reference years 2018-2023, aggregation at 100 m resolution (D).



4 Conclusion & future work

- We performed an independent test achieving a precision of 0.65, recall of 0.96, and a F1 score of 0.71.
- For each ecoregion, the model identifies areas from 107 to 1,388 hectares covered by dead trees; mortality rates ranged from 0.15 to 1.18% of the forested areas covered in the yearly aerial images.
- The segmentation model is suitable to assess forest mortality over continuous, large regions.

Next steps:

- Assess forest mortality over forest reserves and protected areas.
- Identify leading drivers of forest mortality by fitting random forest models using standing deadwood as response and climate and environmental variables as predictors.

References

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- Mosig, Clemens, Janusch Vajna-Jehle, Miguel D. Mahecha, Yan Cheng, Henrik Hartmann, David Montero, Samuli Junntila et al. "Deadtrees. earth-an open-access and interactive database for centimeter-scale aerial imagery to uncover global tree mortality dynamics." *bioRxiv* (2024): 2024-10.
- Swisstopo, "Swisstopo SWISSIMAGE 10 Cm", 2024.