Effect of climate on decomposing coarse woody debris along a north- and a south-facing elevational transect in Val di Sole (Eastern Alps, Italy)

University of Zurich[UZH]

WSL

Marta Petrillo[1,2], Paolo Cherubini[2], Giacomo Sartori[3], Samuel Abiven[1], Judith Ascher[4,5], Daniela Bertoldi[6], Alice Barbero[6], Roberto Larcher[6], Markus Egli[1]

[1] Department of Geography, University of Zurich, Switzerland (martapetrillo@geo.uzh.ch)
[2] WSL Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland
[3] Museo delle Scienze, Trento, Italy
[4] Department of Agrifood and Environmental Science, University of Florence, Italy
[5] Institute of Microbiology, University of Innsbruck, Austria
[6] IASMA, Fondazione Edmund Mach, San Michele all'Adige, Italy

Introduction

- Coarse woody debris (CWD) plays an important role in carbon and nutrient dynamics
- In the Alpine region air and soil temperature are major drivers of decomposition
- Few studies have been carried out to disentangle the different factors of CWD decay
- Global carbon models oversimplify CWD decay dynamics

Research Question & Aim

Are chemical characteristics (cellulose, lignin, carbon, $\partial^{13}C$ and nutrient content) of CWD affected by different elevation/exposition and decay stage in subalpine forests?

Our objective is to compare wood at different decay stages in Alpine forests at different sites having different elevation and exposition

Results & Conclusions

- A strong negative correlation was found between the content of cellulose and lignin
- Lignin and nutrient concentrations were higher at south-facing sites
- Biochemical differences tended to be reduced in late decay stages
- $\partial^{13}C$ is changing according to elevation/exposition but not with decay stage

Site descripton

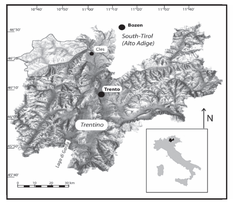


Figure 1 The study area is located in the Eastern Italian Alps

Figure 2 Val di Sole (Trentino, Italy)

- **Mean annual temperature** from 8.2 °C in the valley floor to 0 °C at 2400 m asl
- **Mean precipitation** 800-1300 mm per year
- **Geological substrate** paragneiss debris
- **Soil units** Cambisols, Umbrisols, Podzols
- **Dominant tree species** European larch and Norway spruce

Climosequence

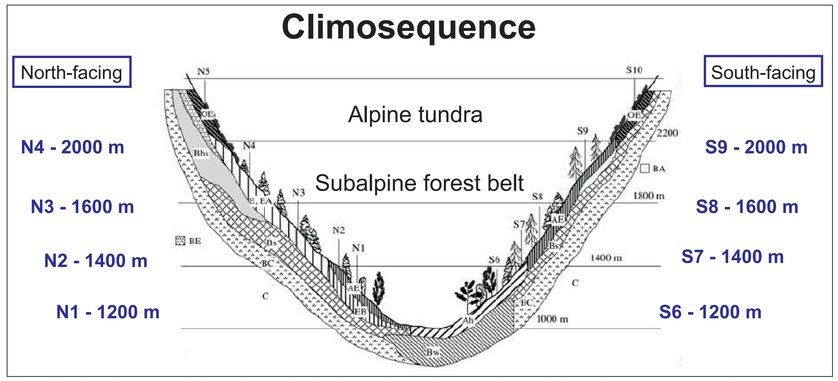


Figure 3 Schematic representation of the eight plots at different elevation/exposition. Soil physical and chemical properties were investigated in a previous study (Egli et al., 2006)

Methods

Decay classes

1 2 3 4 5

Figure 4 Logs at different decay stages, from left to right: decay class 1, 2, 3, 4, 5

Chemical characterization

- α-cellulose
- Klason lignin
- carbon
- $\partial^{13}C$ isotopic ratio
- nutrients: N-P-K-Ca-Mg

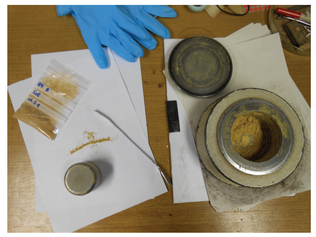
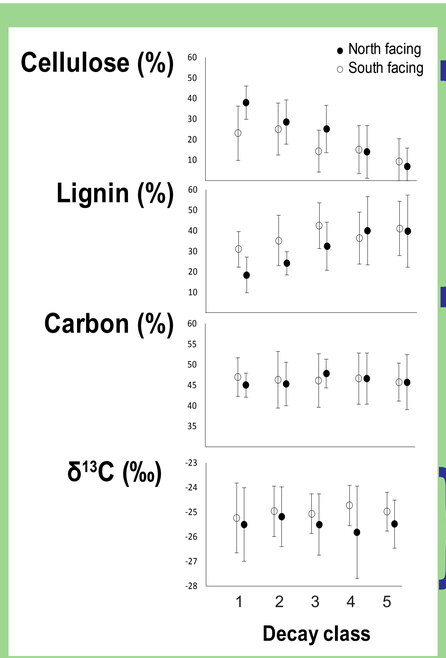
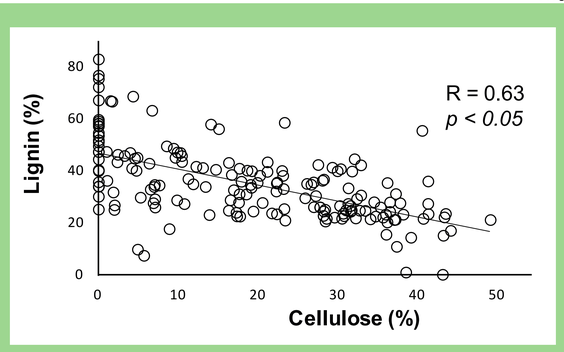
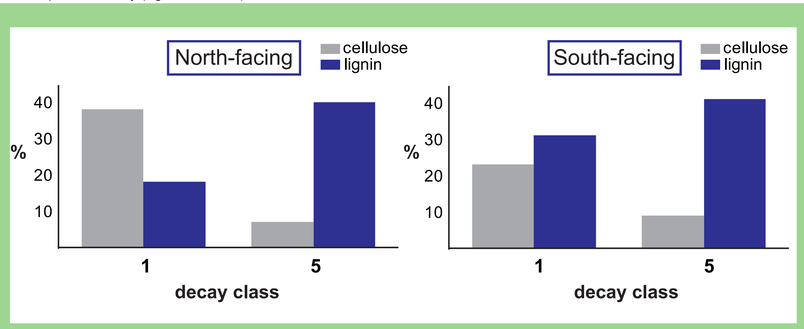
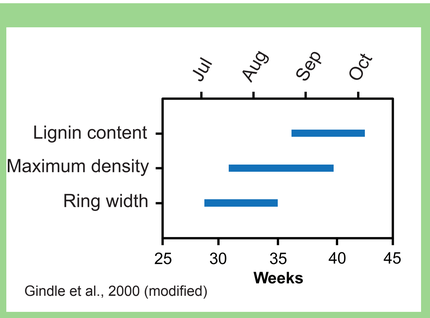


Figure 5 Sample preparation. After drying at 50°C until constant mass, samples were milled to powder using a planetary ball mill



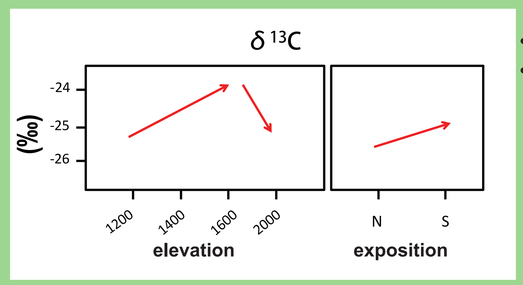






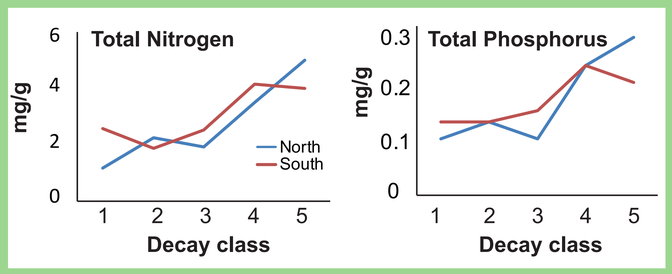
Gindle et al., 2000 (modified)

Lignin content could be mainly influenced by the temperatures of September and October



- Lignin is depleted in ^{13}C
- Microbial derived compounds can induce ^{13}C enrichment

Counteracting effect of different factors that influence $\delta^{13}C$



N and P increase with increased decay stage

Acknowledgements

This study is part of the DecAlp DACH project no. 205321L_141186.

We thank F. Angeli and his team of foresters from the "Ufficio distrettuale forestale of Malé" for their support in the field. We also thank D. Asensio for her help in performing elemental and isotopic analysis and all the laboratory technicians of the WSL and the University of Zurich.

References

Egli M., Mirabella A., Sartori G., Zanelli R., Bischof S., 2006. Effect of north and south exposure on weathering rates and clay mineral formation in Alpine soils. Catena 67, 155-174.

Gindl W., Grabner M., Wimmer R., 2000. The influence of temperature on latewood lignin content in treeline of Norway spruce compared with maximum density and ring width. Trees 14, 409-414.