Are SOC-stocks in Swiss forest soils controlled by historical land-use, climate or soil chemistry?

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Introduction

Forest cover in Switzerland has gradually increased in the last century. Although land use practices are assumed to have long-lasting impacts on soil organic carbon (SOC) stocks, our quantitative knowledge is limited due to the lack of historical soil samples and an uncertain land-history.

In this study, we reconstructed past forest cover changes for 1000 soil profiles for the last 150 years using historical and modern topographic maps. Furthermore, we investigated whether historical land-use has a larger impact on soil carbon stocks than forest species composition, climate or soil chemistry.

Objectives

I. *Determine whether historical land-use has an effect on current soil C-stocks in Swiss forests*
II. *Examine the effect of tree species composition, climate and soil chemistry on carbon stocks*

Approach

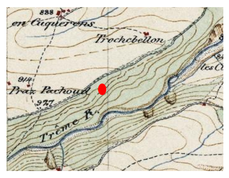
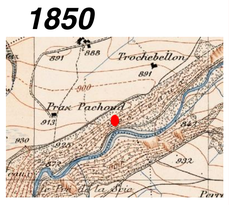
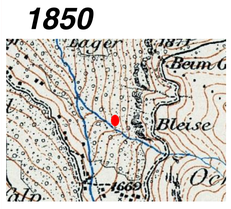
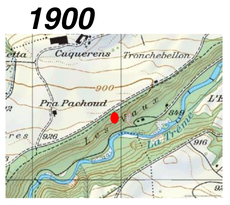
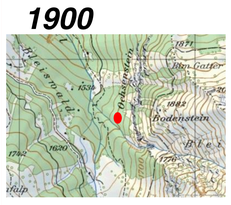
Reconstruction of historical land-use

Coordinates

Historical topographic maps | **Modern topographic maps**

Estimation of minimal forest age for all currently forested sites

Forest transformation

Permanent	*Transformed*
	
1850	*1850*
	
1900	*1900*
	
1950	*1950*

→ **Classification of forest sites into 3 forest age classes:**
- **Youngest: ≤ 60 years old**
- **Mid-aged: 60-150 years old**
- **Permanent: ≥ 150 years old**

→ **SOC-stocks calculated for:**

- **Organic layer**
- **Mineral soil at 0-120cm depth**

Formula:

SOC-stocks = C concentration x Bulk Density x Depth

Acknowledgements

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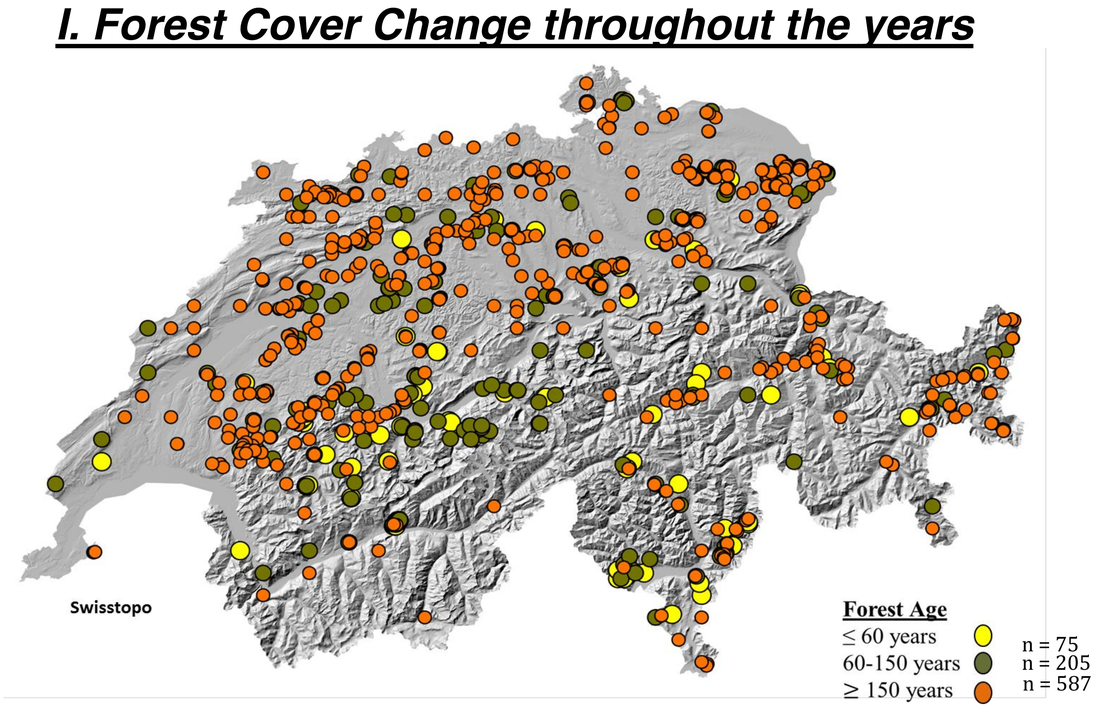
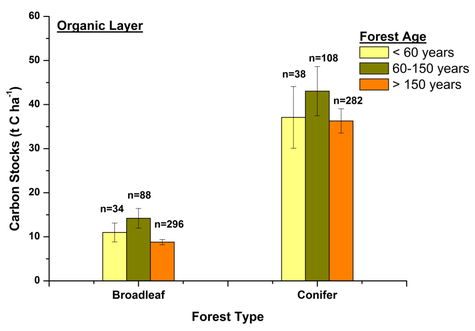
Results

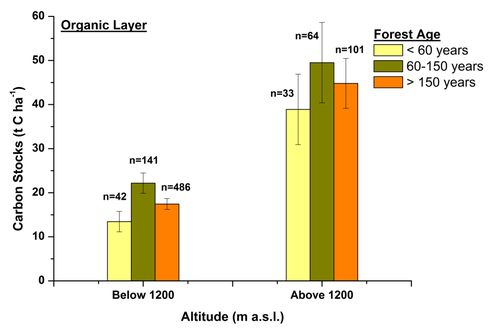
I. Forest Cover Change throughout the years



II. Effect on Carbon Stocks in Organic Layer



Mean ± standard error



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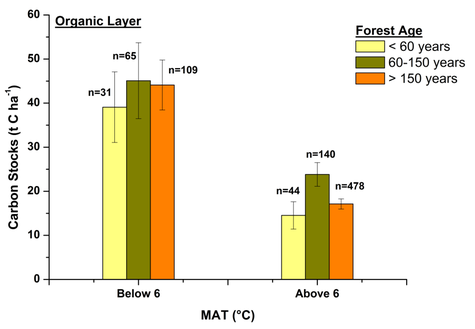
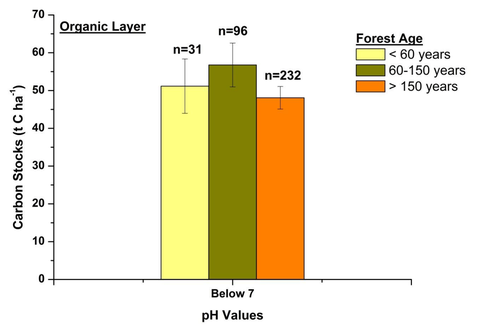
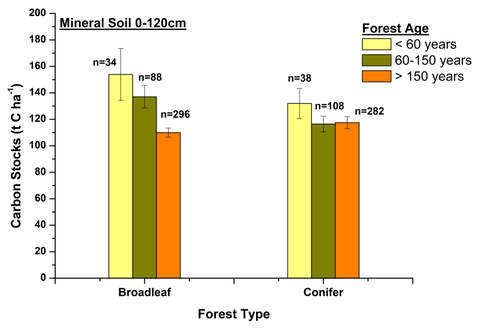


Mean ± standard error

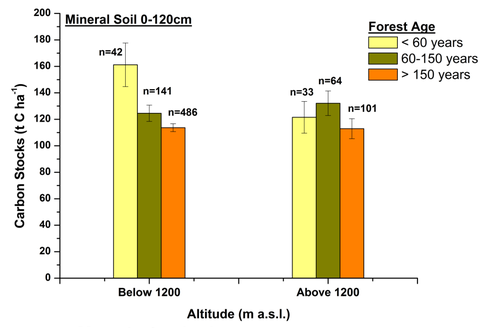


Mean ± standard error

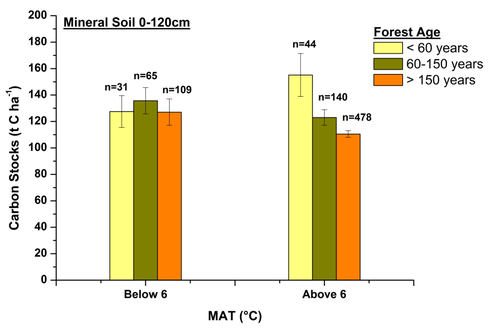
III. Effect on Carbon Stocks in Mineral Soil



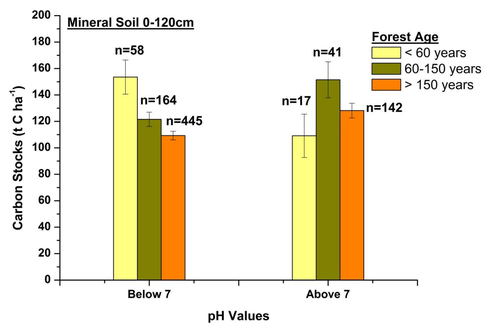
Mean ± standard error



Mean ± standard error



Mean ± standard error



Mean ± standard error

Conclusions

→ ***Forest age has only a limited effect on SOC stocks***
- ***Organic layer: Dominating effects of forest type, altitude, & temperature***
- ***Mineral soil: Strongest effect by pH***

→ ***None of the potential drivers explains the higher SOC stocks in the new forests. Probably, new forests are growing on soils with higher inherent C-stocks. This could be more favorable land previously used for grassland.***

Soil as a Resource
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