Tundra Dynamics: Exploring *Salix polaris* growth patterns across distinct topography in Central Spitsbergen, High Arctic

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The Arctic is undergoing rapid warming and climate change, leading to notable transitions in tundra ecosystems. A significant consequence of these changes is the observed increase in 'greenness,' while in certain regions, there is a distinct 'browning' phenomenon. However, understanding these intricate links between satellite records and on-site observations faces challenges, necessitating collaborative efforts across ecology, remote sensing, earth system science, and computer science to comprehend the complexity of Arctic greening.

This research focuses on the growth dynamics of *Salix polaris* Wahlenb. across varied altitudes in Central Spitsbergen, Svalbard. The aim is to unravel the complex interactions between soil, plants, and the atmosphere in varying landforms. Sampling took place at various locations, in the vicinity of Longyearbyen (at altitudes of 75 - 451 m a.s.l.) and Foxfonna (at altitudes of 76 - 459 m a.s.l.). Detailed anatomical analyses and measurements of *Salix polaris* highlighted distinct growth structures and varied responses among these sites. These findings contribute to a detailed understanding of recent ecological shifts in the Svalbard region, addressing gaps in dendroecological studies in environmentally sensitive high Arctic areas. Preliminary results emphasize the need for dendroecological research in diverse topo-climatic locations to accurately determine changing trends.

To gain a comprehensive understanding of circumpolar Arctic dynamics, it is crucial to explore Arctic regions in microsites scale and by using interdisciplinary techniques. This research also suggests for further investigation, to analyze the development of cell chronologies and their climate response, along with vessel size comparison. Hence, it highlights the urgency of comprehensive, interdisciplinary research to unravel the multifaceted impacts of climate change on Arctic ecosystems.

Keywords: Arctic, Climate Change, dendroecology, polar willow, tundra transition

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