ANNUAL RING WIDTH IN THE ARCTIC-ALPINE DWARF-SHRUB SPECIES *SALIX HERBACEA* - DATASET FROM LONG-TERM ALPINE ECOSYSTEM RESEARCH IN CENTRAL NORWAY (LTAER-NO)

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With 2 figures and 1 data supplement
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Summary: Here, we present a datapaper containing microscopically measured data of annual ring widths in the arctic-alpine dwarf-shrub species *Salix herbacea* (central Norway). The dataset will be updated with future measurements.

Zusammenfassung: Dies ist eine Datenpublikation mikroskopischer Jahrringbreitenmessungen der arktisch-alpinen Zwergstrauchart *Salix herbacea* (Zentralnorwegen). Der Datensatz wird mit zukünftigen Messungen aktualisiert.

Keywords: Dendrochronology, wood anatomy, intra-plant growth patterns

1 Background, aims, and objectives

Arctic and alpine ecosystems are strongly impacted by environmental change with temperatures rising faster than the global average (IPCC 2021). This intense warming trend has enhanced shrub growth and promoted shrub encroachment at the uppermost distribution limit, leading to a widespread increase in biomass and coverage of dwarf shrubs (Elmendorf et al. 2012, Bjorkman et al. 2018, Post et al. 2019, AMAP 2021, Dobbert et al. 2022a). Since 2006 there have been a number of dendroecological studies from the Norwegian alpine, focusing on shrub growth to gain better insights into potential future vegetation shifts and site-specific adaptations (Bär et al. 2006, 2007, 2008, Weijers et al. 2018, Dobbert et al. 2021a, 2021b, 2022b, 2022c).

Here, we present annual ring width data of the arctic-alpine dwarf shrub *Salix herbacea*, which is a vascular species that commonly colonizes late snow beds across Northern Europe and is abundant in the Scandinavian mountains (Gjærevoll 1956). In contrast to other deciduous alpine shrubs, which are promoted by thermal conditions above 0°C, *S. herbacea* has been shown to be significantly impeded by above-zero temperatures during summer. In addition, as to its low stature, *S. herbacea* is generally restricted to sites affected by long-lasting snow cover, where this species, as a poor competitor, exploits the absence of more vigorous species (Birks 1993, Beerling 1998). As such, the only promotion by thermal conditions ≤0°C has been shown to express the species' restriction to these extreme snowbeds (Löffler & Pape 2020).

2 Methods and techniques

Embedded in our long-term alpine ecosystem research program in central Norway (LTAER-NO; Löffler et al. 2021), we collected entire *S. herbacea* specimens for intra-annual and intra-plant ring width measurements. We collected the first specimens in 2020 and will update further specimens in the future. Corresponding to the micro-topographic variations in the study area, we collected specimens from different micro-topographical positions (see Löffler et al. 2021).

In order to determine the specimens' age, we performed serial sectioning (Kolishchuk 1990). Here, we assessed intra-plant growth patterns (cf. Buchwal et al. 2013) and differences in climate sensitivity along the main sprout axis (cf. Ropars et al. 2017), cross-cutting multi-stemmed specimens at multiple intra-plant segments (stem, base, root) (Fig. 1). To obtain permanent histological preparations, we cut thin sections of 10 to 15 µm from all our samples. Following the standardized protocols (Schweingruber & Poschlod 2005, Gärtner & Schweingruber 2013), we stained the sections with Safranin and Astra Blue and embedded them in Euparal. We captured images of each section with an

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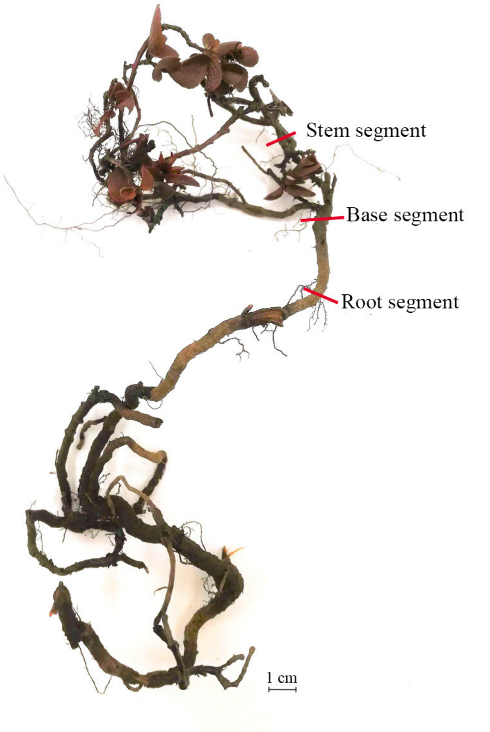

Fig. 1. Stem, base, and root segments along the main sprout axis of a *S. herbacea* specimen.

optical microscope (Keyence VHX-5000), using 100 x magnification.

The xylem of *S. herbacea* is semi-ring porous, and annual rings are comparatively narrow (mean: 57 µm/year). The species´ xylem is paratracheal, i.e., parenchyma cells are associated with vessels, which are arranged concentrically and helped to identify and distinguish the annual rings. The one to three cell-width rays are uniseriate in the vertical direction, and their architecture is homocellular and consists of parenchyma cells (cf., Crang et al. 2018). Moreover, both, pith, and the root stele, are round in shape and usually located in the centre of the cross-section.

We measured annual ring widths along four radii up to the pith, and to the root stele, respectively (cf., Dee & Palmer 2019), evenly distributed across each entire section (Fig. 2). As such, we obtained individual time series along the four radii, which we visually cross-dated. For detected missing rings and wedging rings, we inserted 13.829 µm into the time series, which was the smallest measured value of the entire dataset (Buchwal et al. 2013).

3 Data structure

Our dataset is organised according to the following attributes:

id
Unique identifier given to each specimen. Form: Elevation [m a.s.l.], abbreviation for position, number representing the sampled stem, intra-plant segment (stem, base, root).

elevation
Elevation in meters above sea level [m a.s.l.].

species
Monitored shrub species: *Salix herbacea* (Linné).

position
For description of topographical positions see Löffler et al. (2021).

segment
Intra-plant segment (stem, base, root).

year
Year of ring formation (after visual cross-dating).

ring width
Ring width [µm], measured along four radii and subsequently averaged.

4 Dataset

Here, we publish a current dataset as part of an ongoing long-term project. This dataset will be updated, and is available online as a dataset supplement via: https://doi.org/10.3112/erdkunde.2023.dp.02

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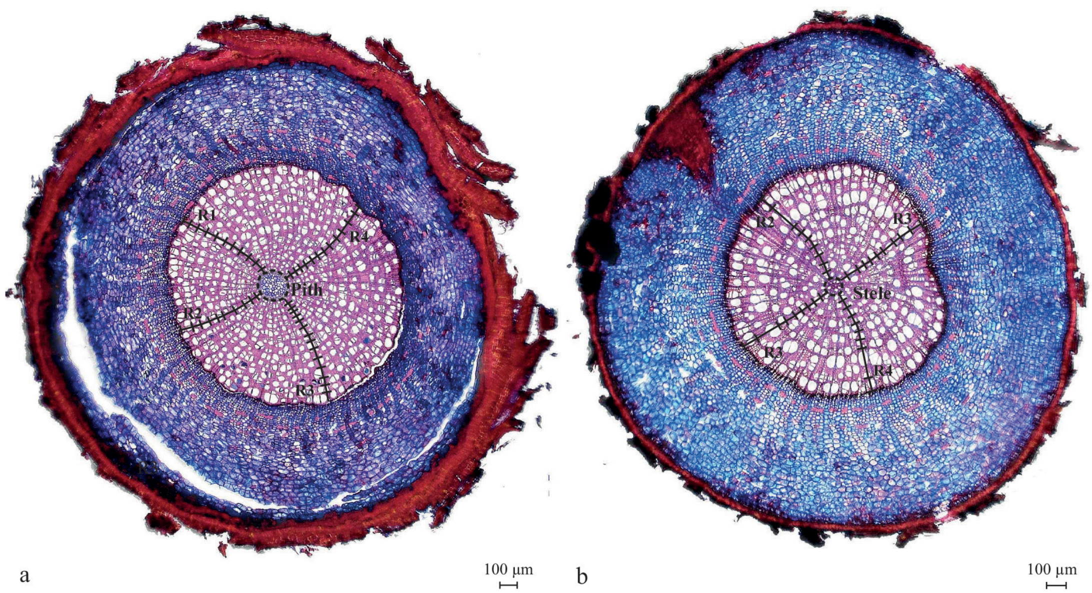

Fig. 2. a) Cross section of a stem segment with measurements of four radii (R 1,2,3,4) and marked pith, which was excluded from the dataset before analysis. Bases were treated the same. b) Cross section of a root segment with measurements of four radii (R 1,2,3,4) and marked root stele.

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