**REGIONAL AND SPECIES FEATURES OF TREES' RESPONSE TO CLIMATE CHANGE IN THE FOREST-TUNDRA OF NORTHERN EURASIA**

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**Региональные и видовые особенности реакции деревьев на климатические изменения в лесотундре Северной ЕвразиИ**

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The forest-tundra ecotone of Northern Eurasia, stretching from the western borders of Russia to its far northeast, is undergoing significant transformations due to accelerated Arctic warming. This process, occurring nearly four times faster than the global average, is driving shifts in the distribution, structure, and functioning of woody vegetation, impacting regional biodiversity and the carbon cycle. Changes are particularly pronounced in the continuous permafrost zone, where trees face extreme conditions such as a short growing season, low temperatures, and variable soil active layer depths. Understanding how different conifer species respond to these challening conditions is crucial for assessing their resilience and predicting future ecological transformations.

This study aimed to investigate the regional and species-specific responses of radial tree growth to climatic factors along a longitudinal gradient in the forest–tundra ecotone of Northern Russia. The focus was on identify differences in tree sensitivity to temperature and precipitation and to evaluate how these variations might influence their distribution under warming conditions. The analysis spanned the period from 1966 to 2021, allowing for the assessment of long-term trends.

The study focused on four conifer species: *Pinus sylvestris L., Larix sibirica Ledeb, Larix gmelinii (Rupr.) Kuzen, and Larix cajanderi Mayr.*, across five sites within the continuous permafrost zone. Sampling sites included Apatity (**APA**, Kola Peninsula) for *P. sylvestris*; Polar Urals (**PUR**) for *L. sibirica*; Khatanga (**KHA**) for *L. gmelinii*; and Chokurdakh (**CHO**) and Bilibino (**BIL**) for *L. cajanderi*. A total of 137 trees were sampled using a 5 - mm increment borer. Tree-ring width (TRW) was measured using CooRecorder, and chronologies were constructed using ARSTAN. Correlation analyses were performed between TRW and monthly temperature and precipitation data from nearby weather stations (Kandalaksha, Salekhard, Khatanga, Chokurdakh, Ostrovnoye), while 25-year moving correlations were applied to assess temporal dynamics in the climate signals.

The results revealed distinct regional and species-specific responses to climate. At the western site **APA**, *P. sylvestris* exhibited a strong dependence on July temperatures (r = 0.41, *p <* 0.01), likely due to milder climatic conditions, the absence of continuous permafrost, and a deeper active layer (1–2 m). In the central and eastern regions (**PUR**, **KHA**, **CHO**, **BIL**), *Larix* species responded predominantly to June temperatures, with the highest correlations at **PUR** (r = 0.54, *p <* 0.01) and **KHA** (r = 0.43, *p <* 0.01), reflecting their adaptation to a short growing season and rapid foliage deployment. At **CHO** and **BIL**, the June effect was slightly weaker (r = 0.24–0.41, *p <* 0.01), possibly due to extreme continentality. Precipitation had a minor influence, though positive effects were noted at **APA** and **BIL**, potentially related to local hydrology. Moving correlations indicated instability in climatic sensitivity icer time. At **CHO**, the temperature signal weakened after the 1980s (r < 0.20), while at **BIL** it strengthened (r = 0.55 by 2021), suggesting adaptive shifts to warming conditions.

These findings highlight the role of species physiology in shaping climatic sensitivity. As an evergreen, *P. sylvestris* benefits from an extended growing season, explaining its response to July temperatures [1]. In contrast, the deciduous *Larix* species rely on early summer temperatures, critical in regions under permafrost conditions [2]. The generally weak effect of precipitations aligns with the availability of moisture from snowmelt, though localized effects at **APA** and **BIL** suggest that permafrost thaw may be altering hydrological regimes . These differences underscore the diversity of adaptive strategies among conifers and the potential for shifts in species distribution under continued warming.

In conclusion, the climatic responses of conifers in the forest-tundra ecotone vary by region and species, with *P. sylvestris* showing sensitivity to July temperatures, while *Larix* species responding to June temperatures. These patterns reflect their ecological niches and may lead to changes in competition and community structure as Arctic warming progress.

**Key words:** warming, coniferous species, permafrost, forest - tundra, radial growth.

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