

S P Singh  
Zafar Ahmad Reshi  
Rajesh Joshi *Editors*

# Ecology of Himalayan Treeline Ecotone

 Springer

---

S P Singh • Zafar Ahmad Reshi •  
Rajesh Joshi  
Editors

# Ecology of Himalayan Treeline Ecotone

 Springer

*Editors*

S P Singh  
Central Himalayan Environment  
Association  
Dehradun, Uttarakhand, India

Zafar Ahmad Reshi  
Department of Botany  
University of Kashmir  
Srinagar, Jammu and Kashmir, India

Rajesh Joshi  
G B Pant National Institute of Himalayan  
Environment  
Sikkim Regional Centre, Pangthang  
Gangtok, Sikkim, India

ISBN 978-981-19-4475-8

ISBN 978-981-19-4476-5 (eBook)

<https://doi.org/10.1007/978-981-19-4476-5>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.  
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore



# Water Relations of the Indian Himalayan Treeline Species

# 16

Ashish Tewari, Shruti Shah, Nandan Singh, Amit Mittal,  
and Krishna Kumar Tamta

## Abstract

This chapter deals with study the variation in water relation and drought-adaptive mechanisms of five Himalayan treeline species *Quercus semecarpifolia* Sm., *Abies spectabilis* D. Don., *Betula utilis* D. Don and *Rhododendron campanulatum* D. Don and *R. arboreum* Wall. growing at elevation ranging from 3200 to 3450 masl. Soil water potential, tree water potential, water potential components and leaf conductance were measured for 3 years (2016 to 2018). Across all seasons and years, the soils were mostly moist. Moderate stress was observed in summer and winter seasons. The treeline species were never severely stressed during the study period and the  $\Psi_{PD}$  was generally above  $-0.99$  MPa. The magnitude of diurnal change across all species was maximum during the rainy season ( $-0.72$  MPa to  $-0.82$  MPa) except in *Q. semecarpifolia*. The diurnal pattern of water potential during winter seasons indicated that water potential can become severely low during 8.30 a.m. and 10.30 a.m. and ranged between  $-1.62 \pm 0.09$  MPa in *R. campanulatum* and  $-2.10 \pm 0.03$  MPa in *R. arboreum*. All treeline species showed osmotic adjustment between winters and spring season which coincided with the commencement of the phenological activities in majority of tree species. A smaller adjustment occurred in all species during rainy to winter season also.

A. Tewari (✉) · S. Shah · N. Singh

Department of Forestry & Environmental Science, D.S.B. Campus, Kumaun University, Nainital, Uttarakhand, India

A. Mittal

Department of Allied Sciences, Graphic Era Hill University, Bhimtal Campus, Nainital, Uttarakhand, India

K. K. Tamta

Central Himalayan Environment Association (CHEA), Nainital, Uttarakhand, India