CHAPTER

11

Potential utility of Himalayan tree-ring $\delta^{18}O$ to reveal spatial patterns of past drought variability—Its assessments and implications

Santosh K. Shah[a], Nivedita Mehrotra[a], Narayan P. Gaire[b,c], Lamginsang Thomte[a,d], Bimal Sharma[b], Uttam Pandey[a], Om Katel[e]

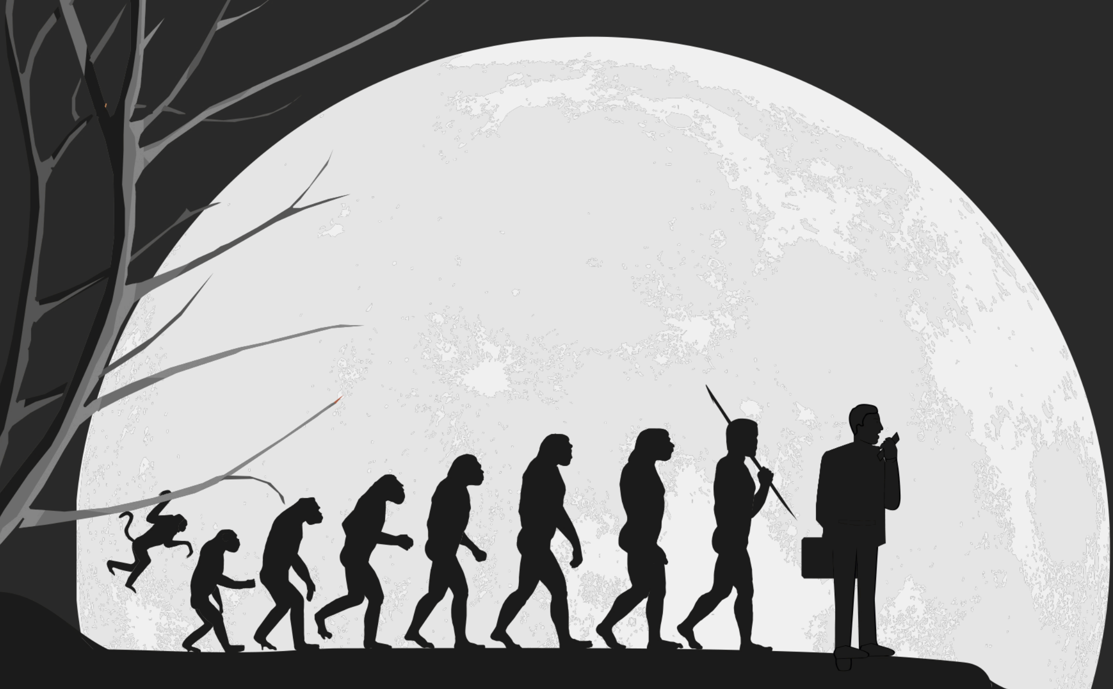
[a] *Birbal Sahni Institute of Palaeosciences, Lucknow, India.* [b] *Key Laboratory of Tropical Forest Ecology, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences Menglun, Mengla, Yunnan, China.* [c] *Central Department of Environmental Science, Tribhuvan University, Kirtipur, Kathmandu, Nepal.* [d] *Department of Geography, Gauhati University, Guwahati, India.* [e] *College of Natural Resources, Royal University of Bhutan, Lobesa, Punakha, Bhutan*

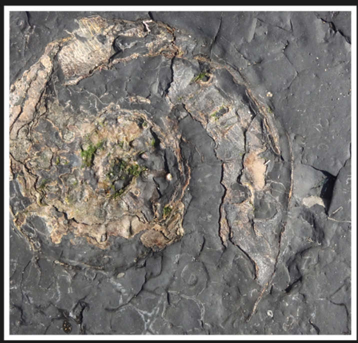
11.1 Introduction

The Indian Summer Monsoon (ISM) rainfall contributes about 80% of the annual rainfall of South Asia. A change in the timing and amount of rainfall consequently impact the society, water security, and economy of the region (Gadgil and Gadgil, 2006; Asoka et al., 2017; Mishra et al., 2020). The ISM is known as a large-scale atmospheric pattern controlled by its variability on a spatial and temporal scale (Goswami, 2012; Sinha et al., 2018). This ISM system exists through two main branches, namely the Bay of Bengal branch and the Arabian Sea branch. The former has been considered as isotopically depleted, whereas the latter is observed as isotopically enriched branch in the ISM system (Sinha et al., 2015). Within the ISM system the origins of the relative contribution of source water from the Bay of Bengal and the Arabian Sea to the Himalaya is variable from west to east (Medina et al., 2010). The sparse spatio-temporal coverage of instrumental observations has limited our understanding of such monsoon variability patterns. The future trends of monsoon variability can be interpreted through conclusive evidences from longer past records.

Annually formed tree-rings are a suitable proxy archive for past hydroclimate variability due to its relative abundance and precise dating (Fritts, 1976). Trees from the Himalaya have been used to reconstruct past climatic conditions beyond existing meteorological records in the region (Cook et al., 2003; Bhattacharyya and Shah, 2009; Shah et al., 2014; Pandey et al., 2016; Gaire et al., 2017, 2019, 2020; Shah et al., 2017, 2019). The Monsoon Asia Drought Atlas (MADA) developed by Cook et al. (2010), based on seasonally resolved gridded spatial reconstruction of Asian monsoon droughts and pluvials during the last Millennium was based on a network of tree-ring width records in Asia. The Palmer Drought Severity Index (PDSI) for the summer season (June–August) was reconstructed spatially using

Holocene Climate Change and Environment. DOI: https://doi.org/10.1016/B978-0-323-90085-0.00003-6





Holocene Climate Change and Environment

Edited By
Navnith Kumaran
Damodaran Padmalal

ELSEVIER

Elsevier
Radarweg 29, PO Box 211, 1000 AE Amsterdam, Netherlands
The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, United Kingdom
50 Hampshire Street, 5th Floor, Cambridge, MA 02139, United States

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book is available from the Library of Congress

ISBN: 978-0-323-90085-0

For Information on all Elsevier publications visit our website at
https://www.elsevier.com/books-and-journals

Publisher: Candice Janco
Acquisitions Editor: Marisa LaFleur
Editorial Project Manager: Ruby Gammell
Production Project Manager: Kumar Anbazhagan
Cover Designer: Greg Harris

Typeset by Aptara, New Delhi, India