

Detecting climate change impacts on mycorrhizal communities in the Indian Himalayan region

Pamela Bhattacharya, Sonam Priyadarshani, Devendra Kumar, Gautam Talukdar, Samrat Mondol, Gopal S. Rawat *

Wildlife Institute of India, Dehradun 248001
* rawatg@wii.gov.in

Introduction

Mycorrhizal fungi are the most abundant and diverse microbial community present in the soil. They play important role in nutrient cycling and carbon sequestration. Community structure and activity of these fungal groups are strongly influenced by climate change leading to alteration in ecosystem functions. Rapid changes in temperature and precipitation are expected to stimulate soil microbial respiration, including mycorrhizal fungi, and large-scale destabilization of soil organic matter leading to enhanced CO₂ release from the soil. Since soil is the largest sink for carbon, this might have substantial influence on atmospheric CO₂ levels. The Himalayan ecosystem represents one of the most fragile natural, high-altitude ecosystems of the world. Through its large carbon stock, it plays an important role in the global carbon cycle. Climate change impacts on this ecosystem and its resources are of critical concern as they have a higher footprint across the Indian subcontinent and surrounding. However, in-depth studies on response of mycorrhizal community to climate change have not been conducted in the Indian Himalayan region (IHR). Our goal is to examine the relationship between mycorrhizal community structure and organic carbon decomposition of high altitude ecosystems in response to climate change in IHR.

National Mission for Sustaining the Himalayan Ecosystem (NMSHE)

Realizing the need for developing science based action plans to address both the existing as well as emerging threats of climate change in the fragile mountain ecosystems of the IHR, the National Mission for Sustaining the Himalayan Ecosystem (NMSHE) has been conceived as part of the National Action Plan on Climate Change (NAPCC) under the coordination of the Department of Science & Technology (DST) and is expected to offer practical adaptation strategies.

Background

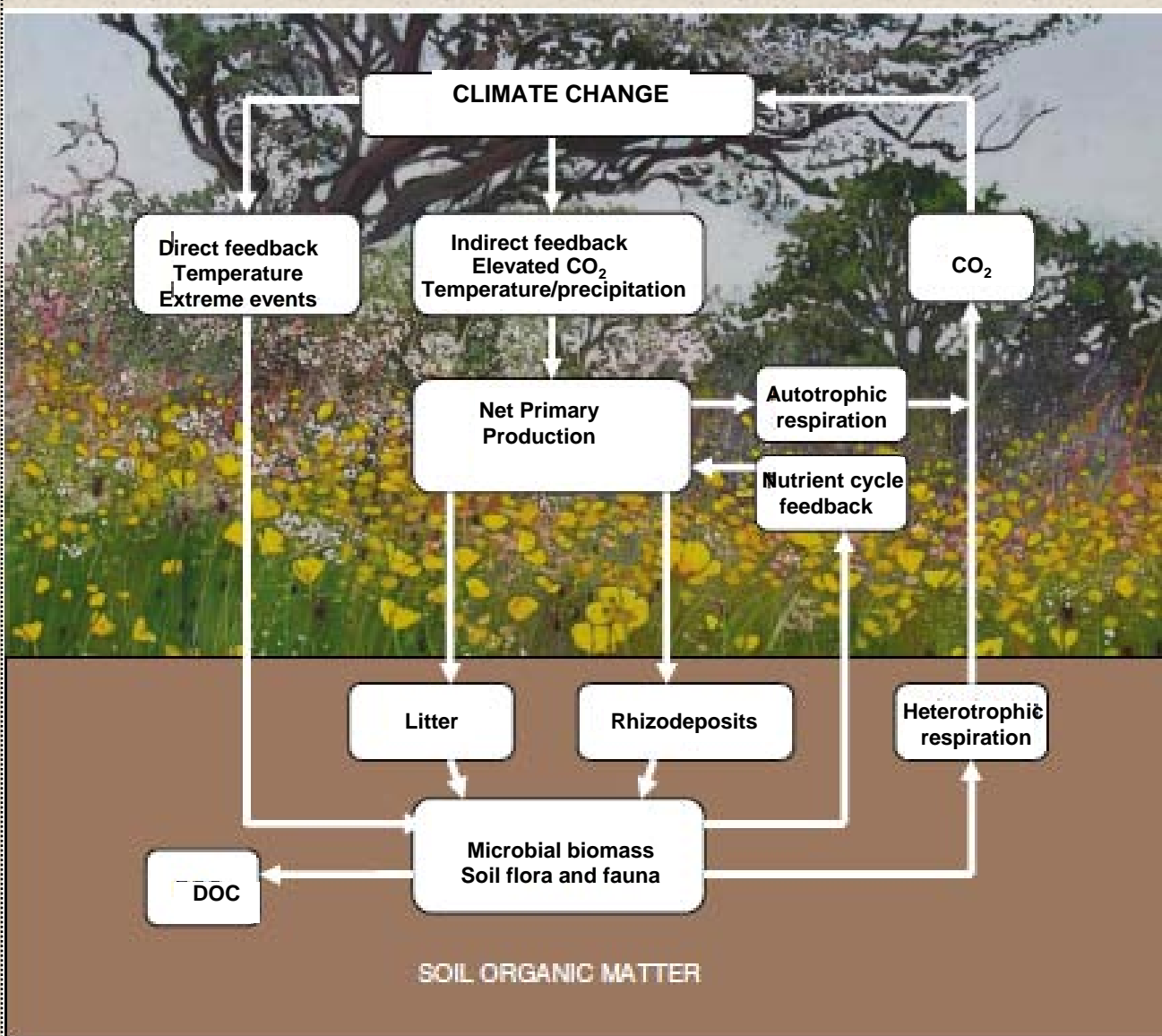
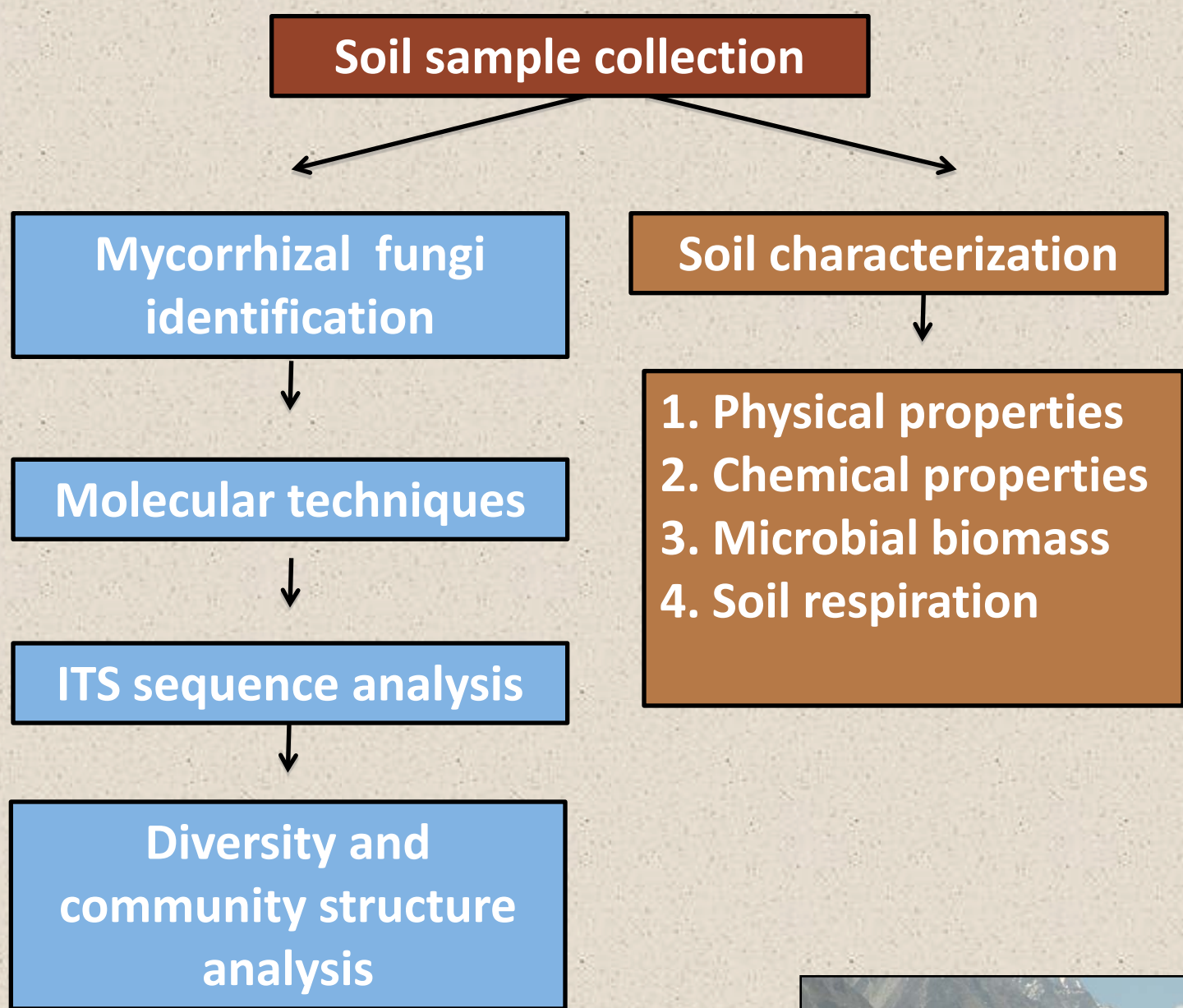


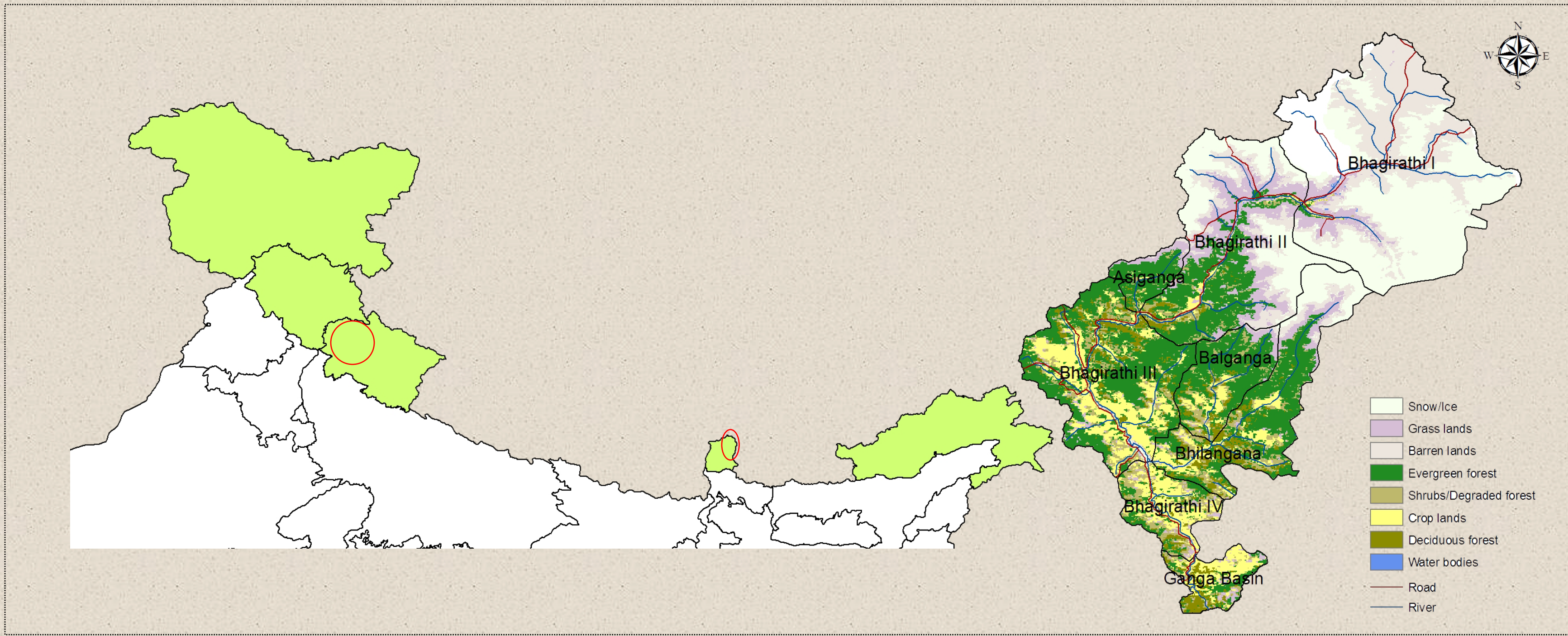
Fig 1. Source ref 5

- ❖ Mycorrhizal communities facilitate soil organic carbon assimilation and stabilization (1)
- ❖ Elevated atmospheric CO₂ increases mycorrhizal fungi respiration leading to soil carbon loss (2)
- ❖ Enhanced precipitation and nitrogen deposition alters mycorrhizal composition (3, 4)

Work plan



Study area



Objective

- ❖ Determine diversity, spatial distribution and structure of soil mycorrhizal communities along temperature/altitudinal gradients in different ecosystems of Bhagirathi and Teesta river basin
- ❖ Characterize the variability of soil physicochemical property with special emphasis to soil organic carbon content along altitudinal gradients.
- ❖ Determine the relationship between soil biotic properties and distribution of mycorrhizal communities.

Expected outcome

- ❖ Baseline data on spatial distribution patterns, diversity and structure of soil mycorrhizal communities along altitudinal gradients in major ecosystems spanning Bhagirathi basin and Teesta basin of IHR
- ❖ Baseline data on soil physical and chemical properties in both regions.
- ❖ Influence of climatic factors along altitudinal gradients on soil health and mycorrhizal community distribution, structure and function of Indian Himalayan region .

References

1. Rillig MC *et al* (2006) *New Phytol* 171: 41–53
2. Cheng L *et al* (2012) *Science* 337: 1084-1087
3. Egerton-Warburton LM *et al* (2000) *Ecol Appl* 10:484–496
4. Castro, H. F., *et al* (2010) *Appl environ microbiol* 76(4): 999-1007
5. Bardgett RD *et al* (2008) *The ISME Journal* 2(8): 805-814.

Acknowledgements

- Funding agency Department of Science and Technology (DST), new Delhi (Grant#DST/SPLICE/CCP/NMSHE/TF-2/WII/2014[G] dated 26.08.2014).
- Dean and Director of Wildlife Institute of India, Dehradun.
- Director, CSIR-NBRI, Lucknow
- Supervisors and researchers of team NMSHE

