Regeneration Ecology of *Quercus species* in Gaurishankar Conservation Area, Nepal

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Outline

1. Introduction
2. Methods
3. Results and discussion
4. Guidelines
5. Outlook

1. Study area: Gaurishankar Conservation Area

2.179 km^2

46 % forests

1.000 to 8.000 m a.s.l.

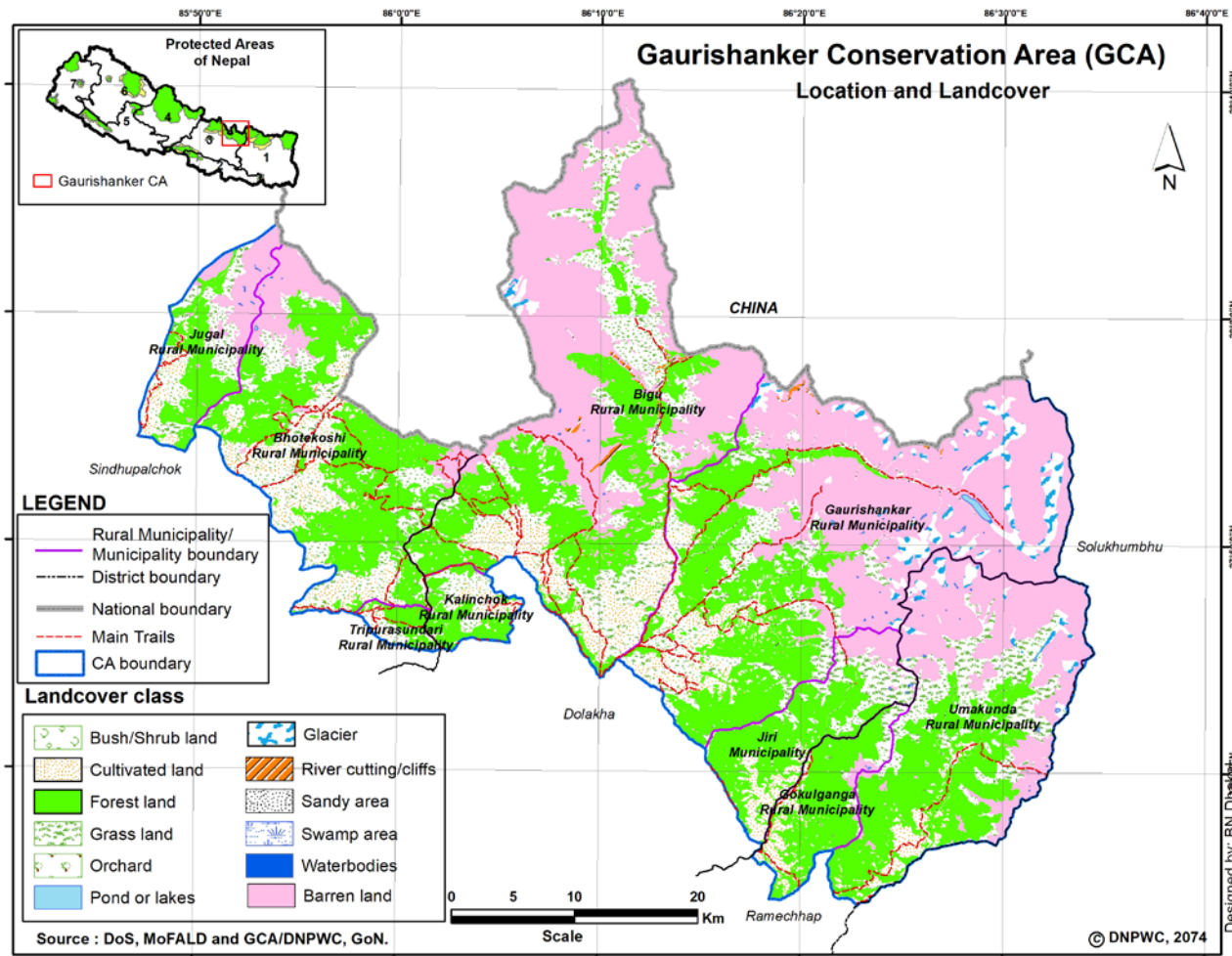Monsoon dominated **high rainfall pocket** (3.500 mm /y)

Fig 1. Location and landcover of Gaurishankar Conservation Area, DNPWC (2021)

1. Studied species

	Q. semecarpifolia	*Q. lanata*
Ecology	Evergreen, broadleaved	
Altitude (m a.s.l.)	2.400 to 3.000	1.700 to 2.400
Distribution	S-E Hindu Kush to S-W China	N-W India to S-E China
Forest community	Dominant species	Mixed forests
Reproductive strategy	Masting (2 to 10 y)	Annual
Seed ripening	June-August (monsoon)	December-January
Seed dispersal	Zoochorus	
Germination	Vivipary, no seed bank	Orthodox, seed bank
Size		
Max DBH	1.5 m	1 m
Height	25 to 30 m	15 to 25 m
Provisioning service value	Timber, fodder, firewood and leaf litter	
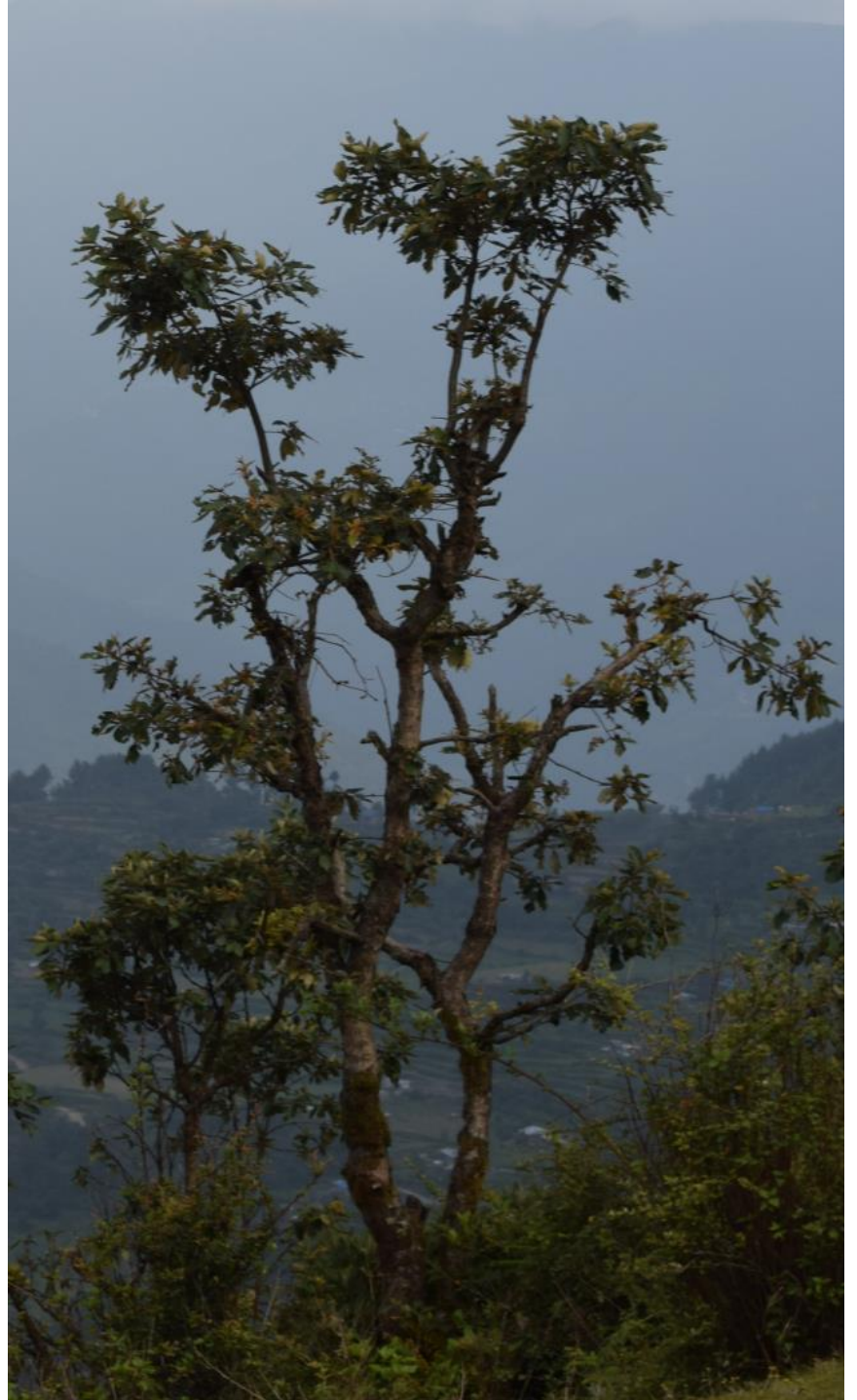
1. Research objectives

1. Increase the knowledge about their regeneration ecology

2. Asses the status of the local natural forests

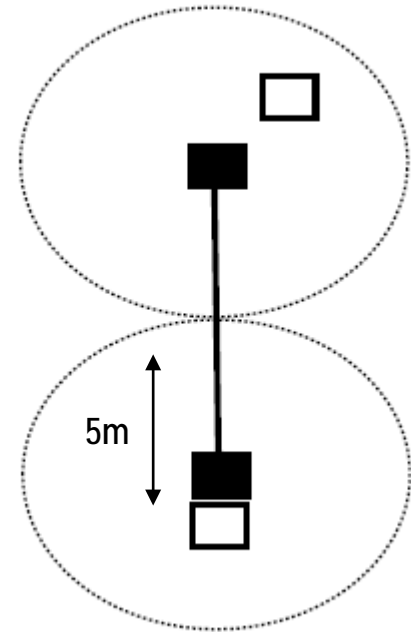3. Develop improved guidelines for SFM and ecological restoration projects

2. Methods

2. Sampling design

Land uses: Pine Plantations (PP), Degraded Forest

(DF) and Least Degraded (LD)

42 clusters of plots (168 subplots 1m²)

A)   Vegetation surveys

B)   Microsite variables studies

5m

2. Vegetation survey

5 plots least degraded & 5 plots degraded forest per species

Fixed 5m radius (H > 1.3m) - DBH

Fixed 2.5m radius (H < 1.3m) - Height

Functional vegetation groups (FG)

2. Microsite variables study

Plot cluster level:

- Topographic variables

Subplot level:

- Regeneration presence/absence and density

- 12 Microsite predictor variables:

  Vegetation variables

  Soil variables

  Light availability: Hemispherical photography → Global Site Factor

→ Generalized Mixed Models (GMMs)
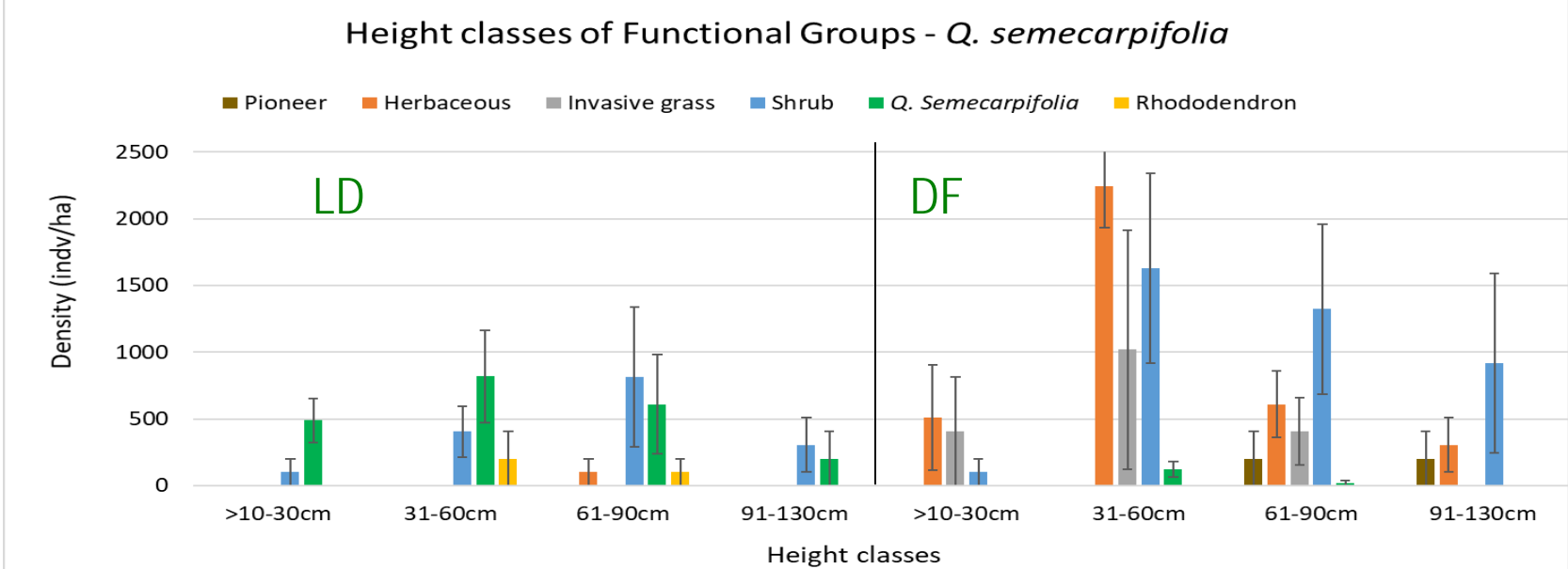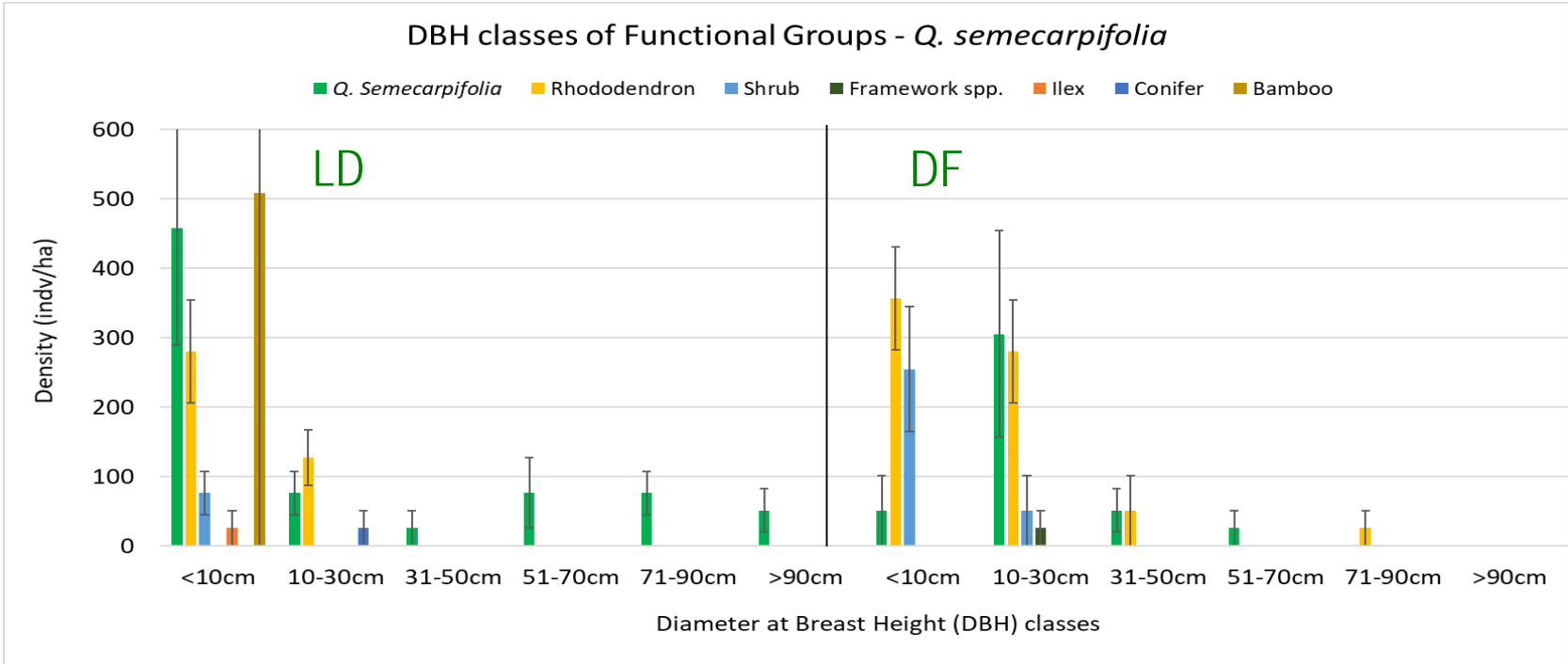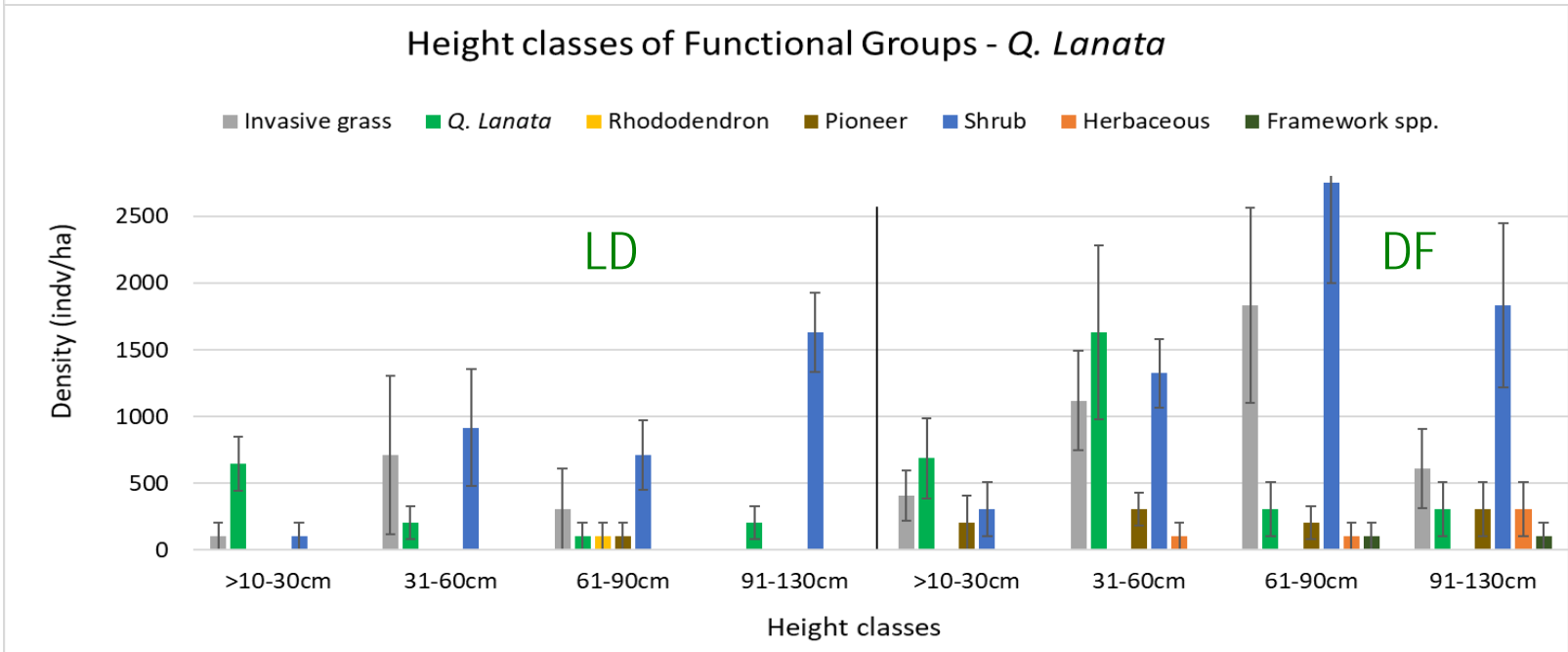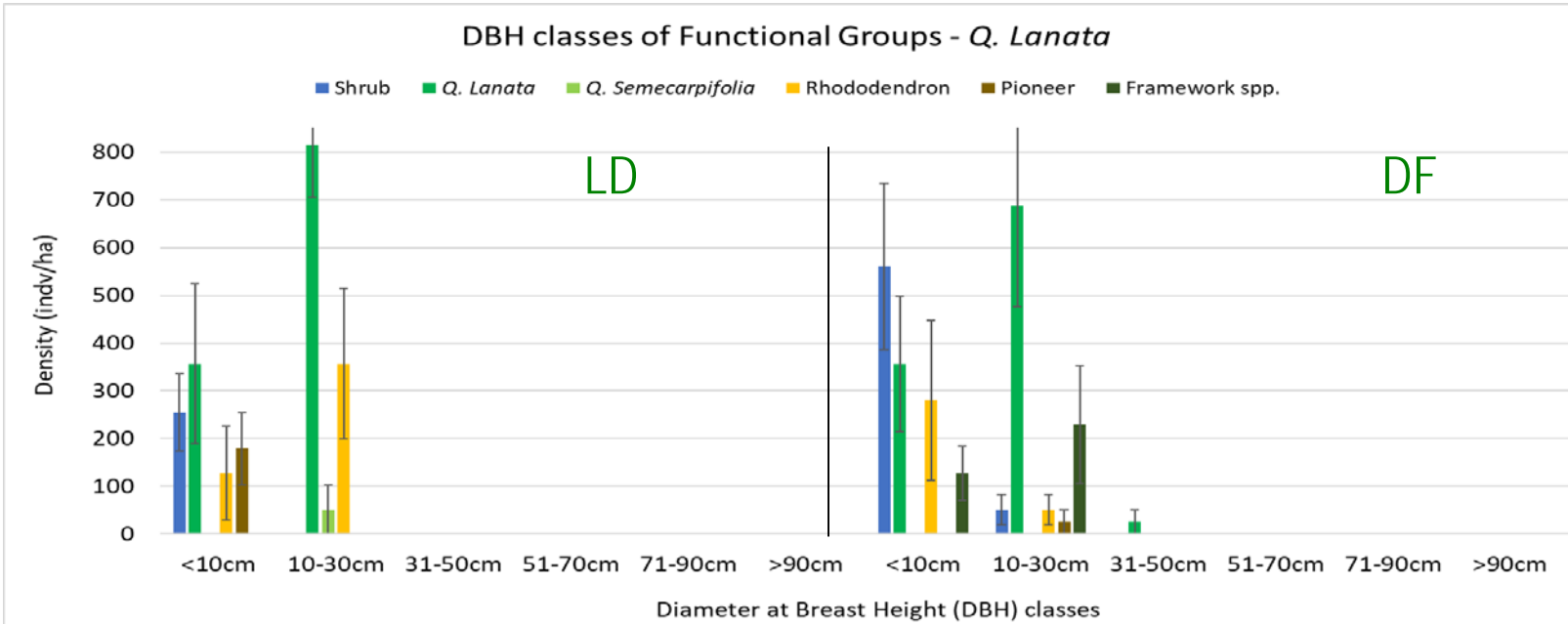
3. Results and Discussion
Vegetation surveys

3. Vegetation surveys - Q. *semecarpifolia*

DBH classes of Functional Groups - *Q. semecarpifolia*

Legend: Q. Semecarpifolia, Rhododendron, Shrub, Framework spp., Ilex, Conifer, Bamboo

LD / DF

Y-axis: Density (indv/ha)
X-axis: Diameter at Breast Height (DBH) classes — <10cm, 10-30cm, 31-50cm, 51-70cm, 71-90cm, >90cm

Height classes of Functional Groups - *Q. semecarpifolia*

Legend: Pioneer, Herbaceous, Invasive grass, Shrub, Q. Semecarpifolia, Rhododendron

LD / DF

Y-axis: Density (indv/ha)
X-axis: Height classes — >10-30cm, 31-60cm, 61-90cm, 91-130cm

3. Vegetation surveys – *Q. lanata*

4. Guidelines

4. Guidelines for restoration

Developed topsoils (manure, compost)

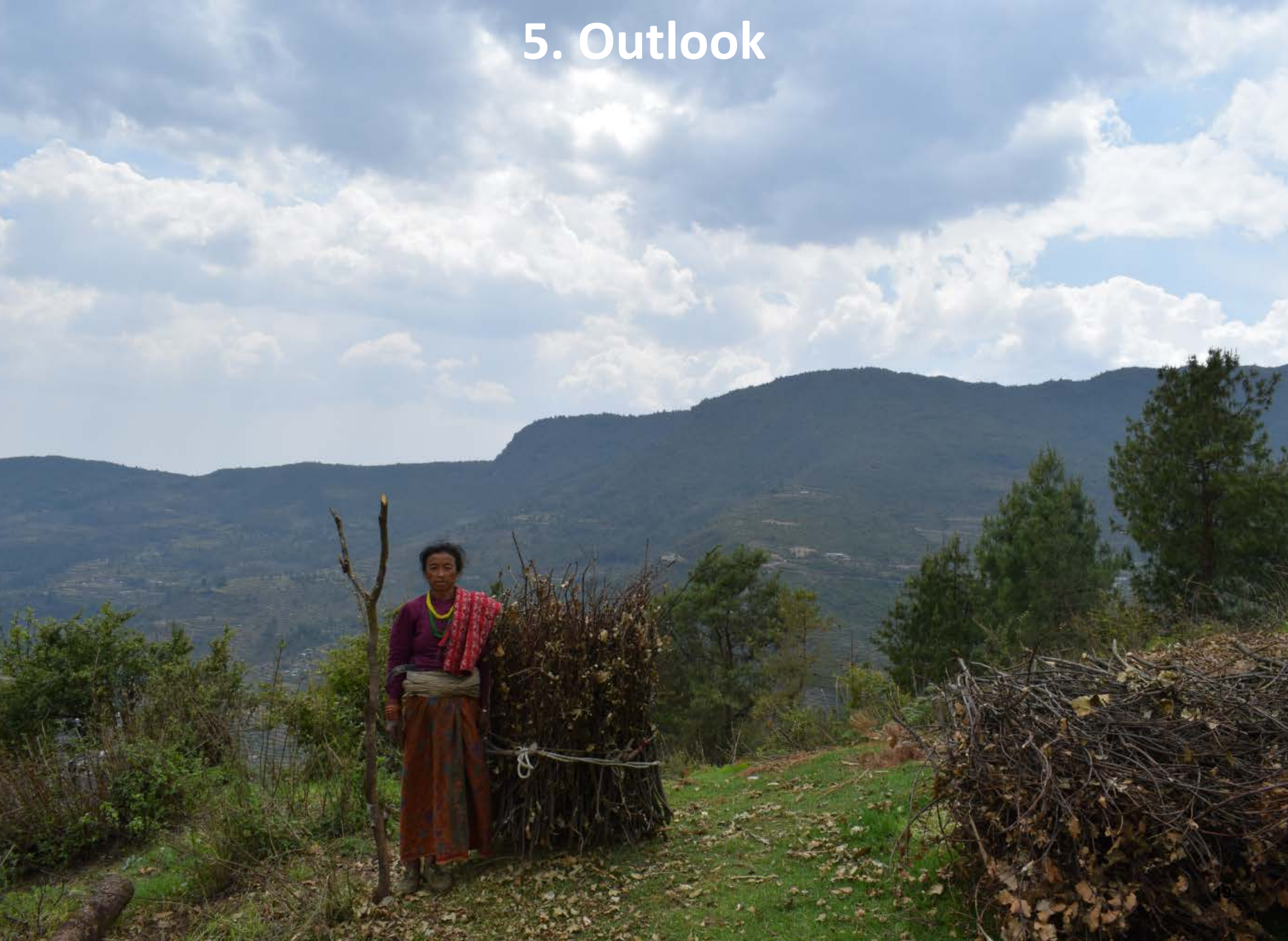Protection from livestock (tree shelters)

Q. semecarpifolia:

- Human disturbance (lopping regulations, displacement)
- Protection of potential mother trees
- Vivipary seeds

Q. lanata

- Resistant against lopping/ disturbance
- Potential for restoration in pine plantations
- Adaptive forest management (light management)

5. Management potential

- Opportunities for ecological restoration: abandoned farmlands, pine plantations
- Reduce resource pressure (e.g., fooder trees on farms)
- Community-based forest management
- Community education & awareness

- Long term monitoring forest plots
- Light demand of Quercus species in life cycle