SELECTING CLIMATE RESILIENT TREE SPECIES FOR FOREST RESTORATION IN THE HIMALAYAN REGION OF NEPAL

4th International Climate Change Adaptation Conference
Rotterdam, The Netherlands
May 2016

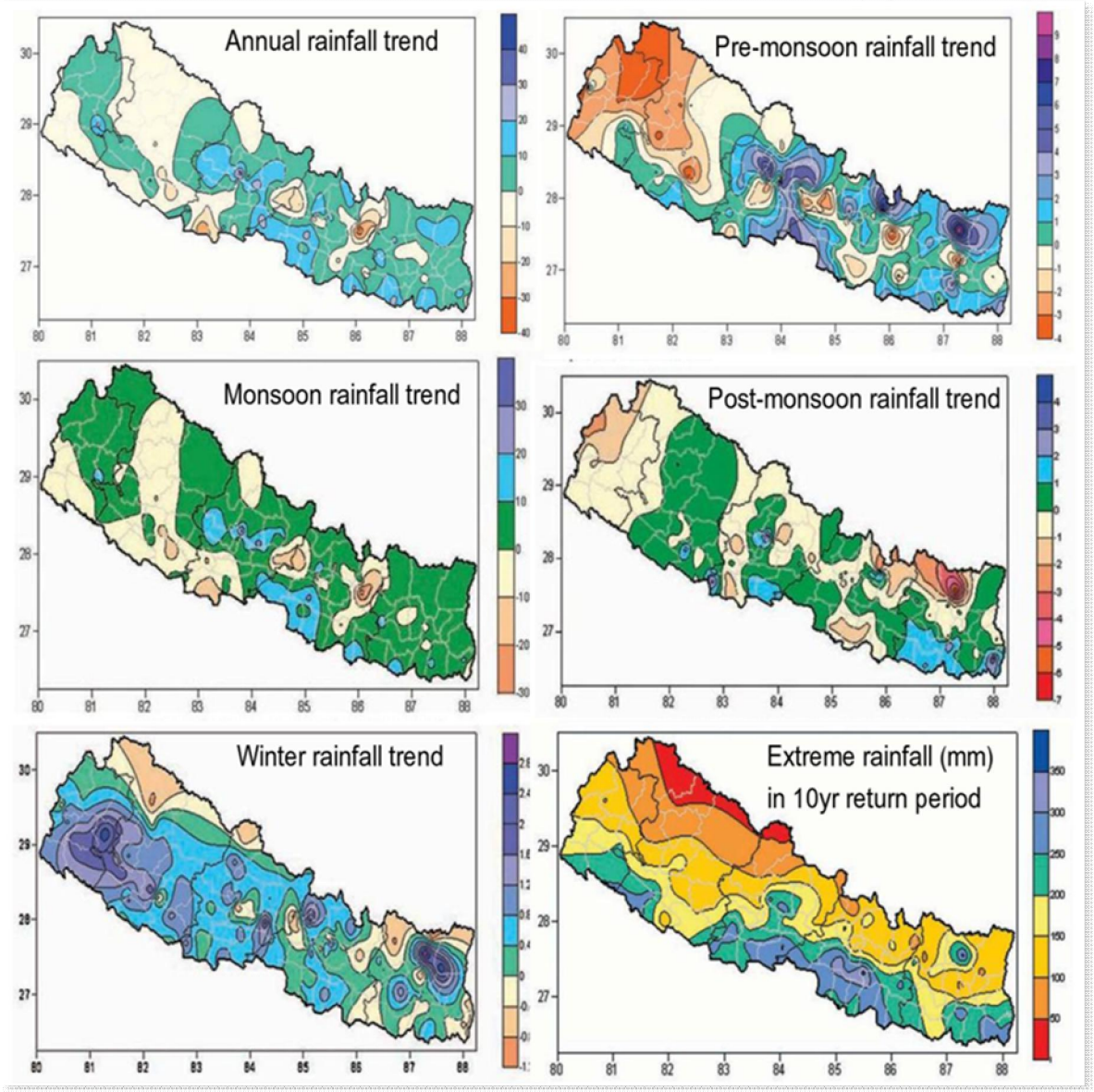
K. P. Khanal, S. K. Regmi, E. Wikramanayake, G. Thapa, D. Rawal and J. Oglethorpe

Contact Email: keshav.khanal@wwfnepal.org

Hariyo Ban Program

CLIMATE CHANGE AND MOUNTAIN FORESTS

- Global climate change is expected to cause warmer, wetter conditions in the Himalaya.
- There is uncertainty in timing, frequency, and duration.
- Climate change affects the environmental parameters that trigger various life stages of tree species (germination, recruitment, growth, and spatial distributions).
- This results in changes to forest vegetation communities.
- But the complex mountain terrain overlays another spatial layer of complexity and uncertainty from meso- and micro-climates



FOREST AND LIVELIHOODS

- Forests contribute to the national economy by:
  - ✓improving livelihoods
  - ✓protecting watersheds
  - ✓sustaining water-based resources
  - ✓providing sustainable timber and Non-timber Forest Products (NTFPs)
- Nepal's forests harbour globally important biodiversity
- In order to maintain these services, forest restoration and management must consider long term survivorship of tree species selected for reforestation in light of climate change

SELECTING TREE SPECIES FOR REFORESTATION

- Climate models can help with selection of trees for reforestation and forestry.
- But inherent uncertainties are associated with climate projections.
- Triangulation of approaches using coarse-scale models based on regional data (GCMs) with mechanistic models that use eco-physiological species information can improve accuracy, and enable better interpretation of the results.

METHODS USED

We used:

1. Global Climate Model (GCM)-based climate envelope models to project the future distribution of selected dominant tree species under the IPCC A2A GHG scenario
2. Seed germination and seedling survival trials under the IPCC A1B GHG scenario using the TACA-GEM mechanistic model

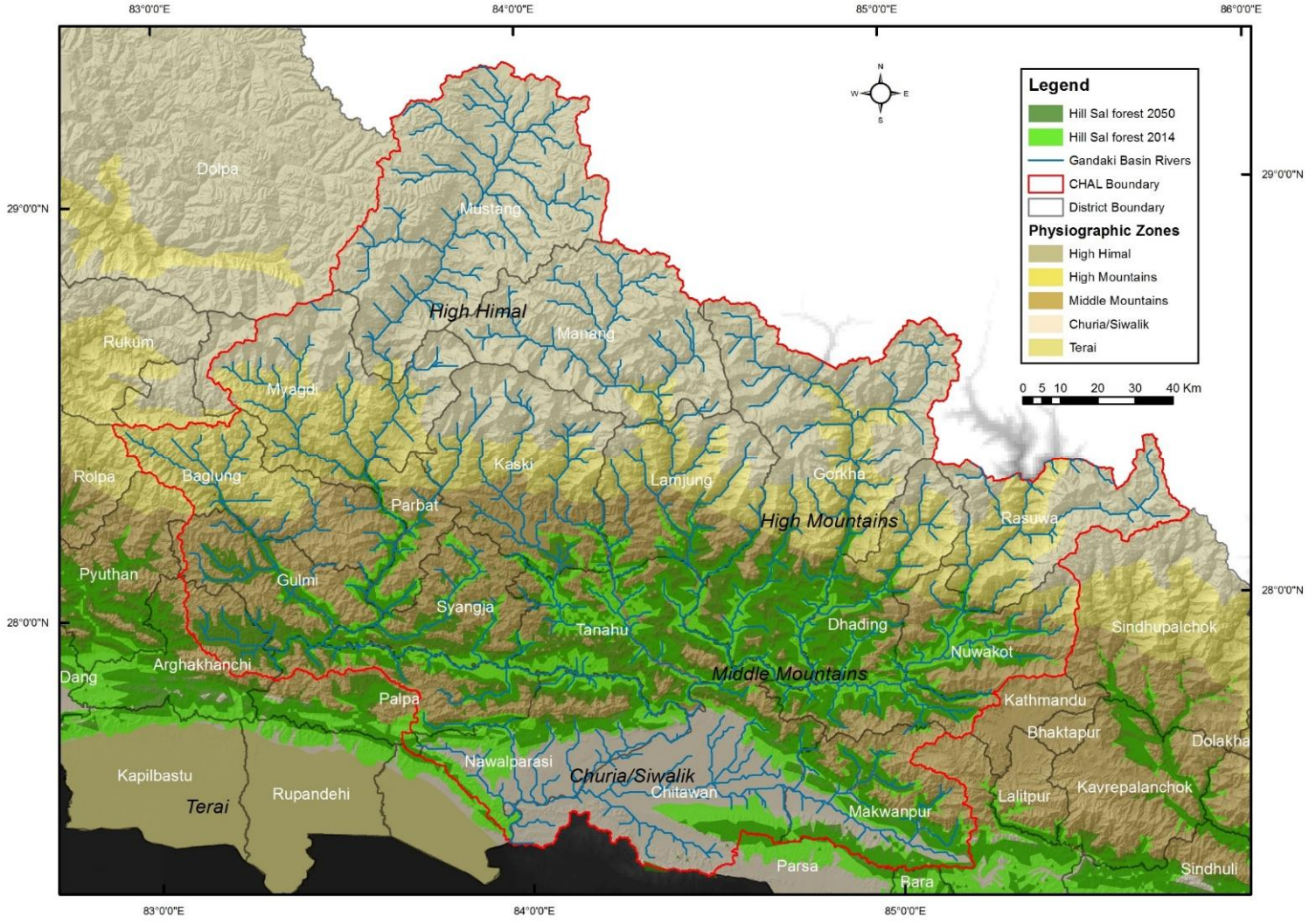
- The projections were for 2050 and 2060, respectively.

Results of GCM - Climate envelope models

- Overall trend is for tree species in the lower elevations-especially in the lower and middle mountains- to shift northwards or up slopes within the current range.

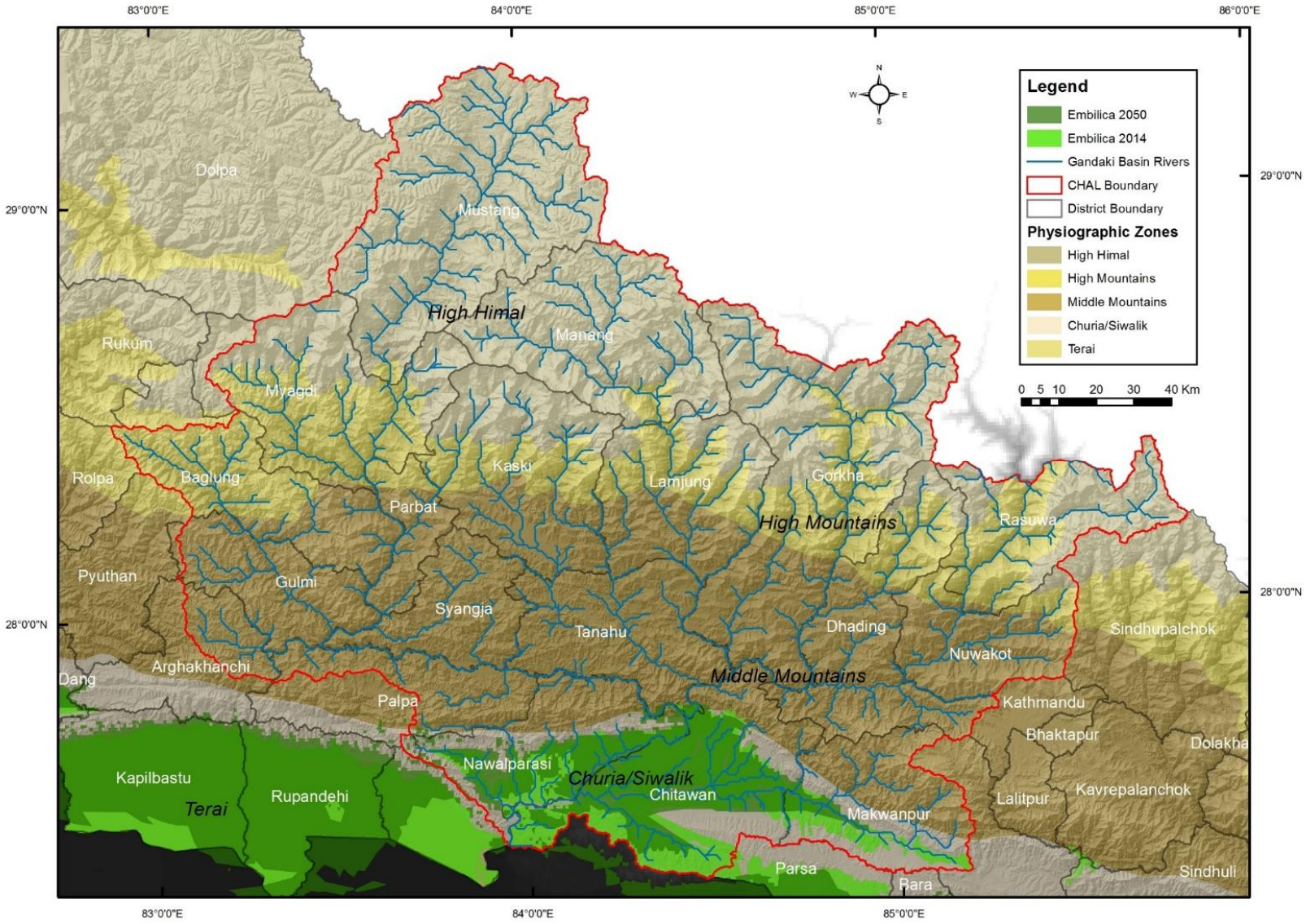
Example:

- *Shorea robusta* showed a northward shift following the river valleys and up the surrounding slopes.



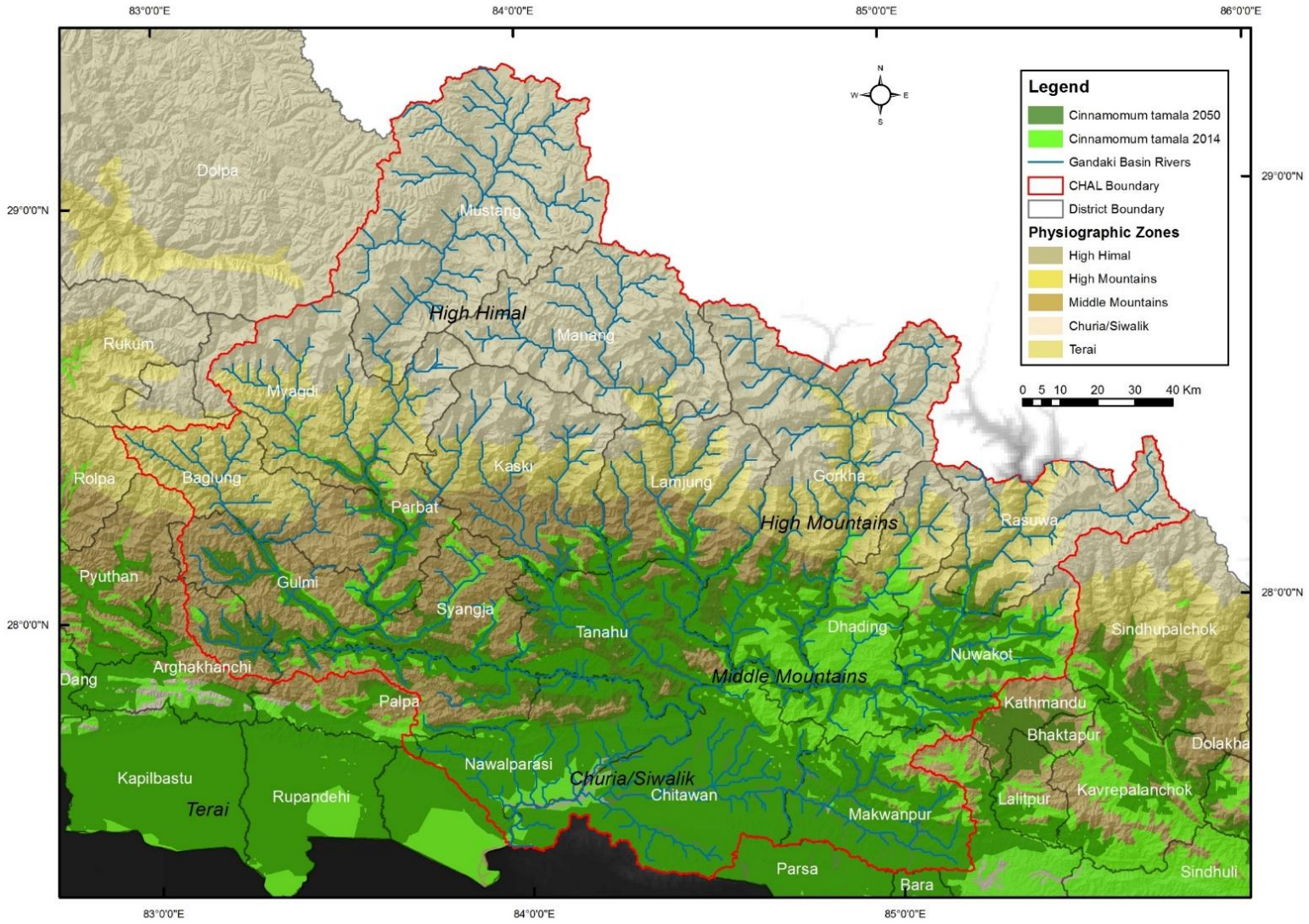
Results of GCM - Climate envelope models

- But not all species show this overall trend.
- *Emblica officinalis* does not show any range shifts
- It is likely intolerant of montane conditions.



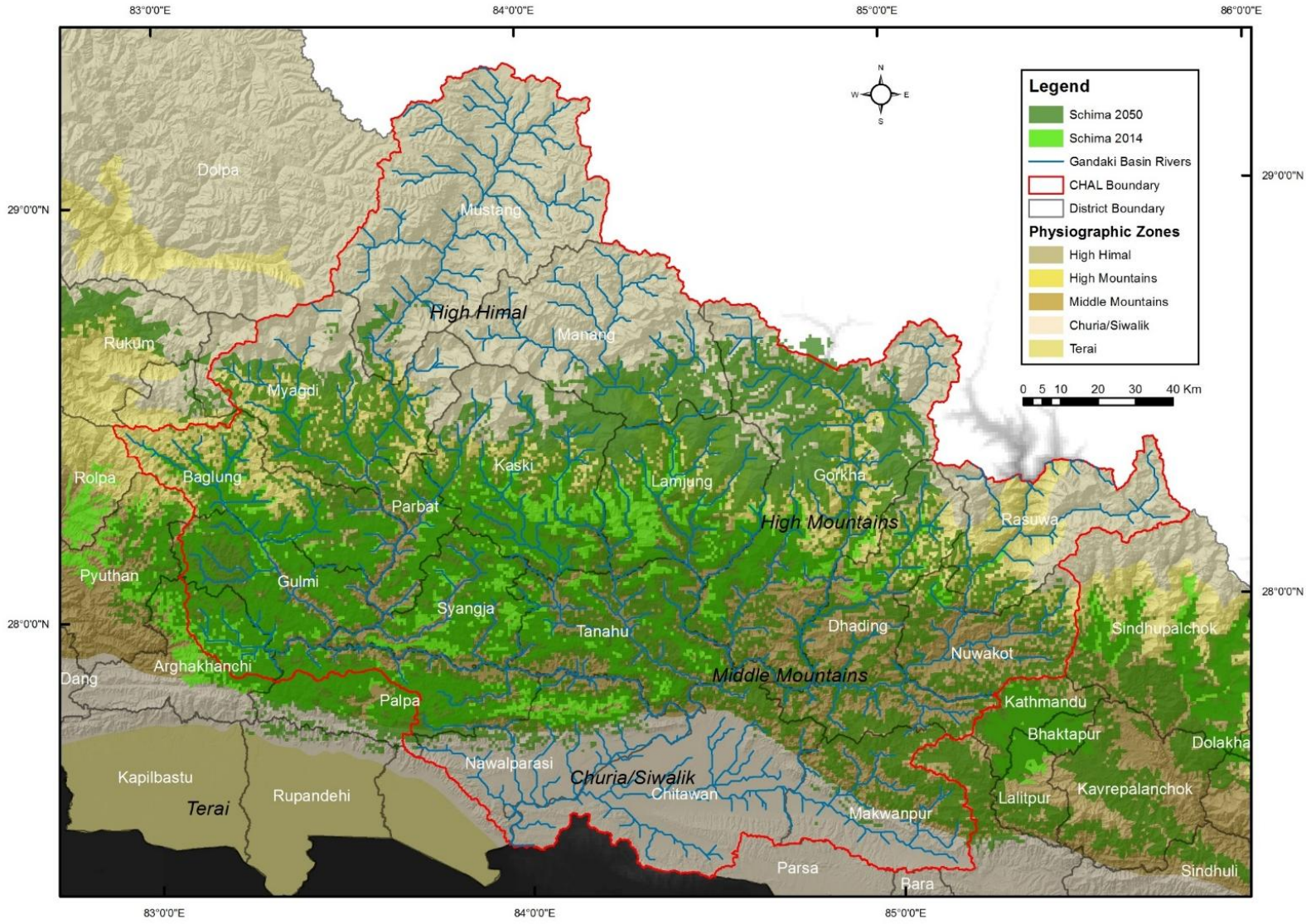
Results of GCM - Climate envelope models

- *Cinnamomum tamala* is widespread in the middle mountain region but did not exhibit additional northward shifts
- but there could be upslope shifts within the current distribution range.



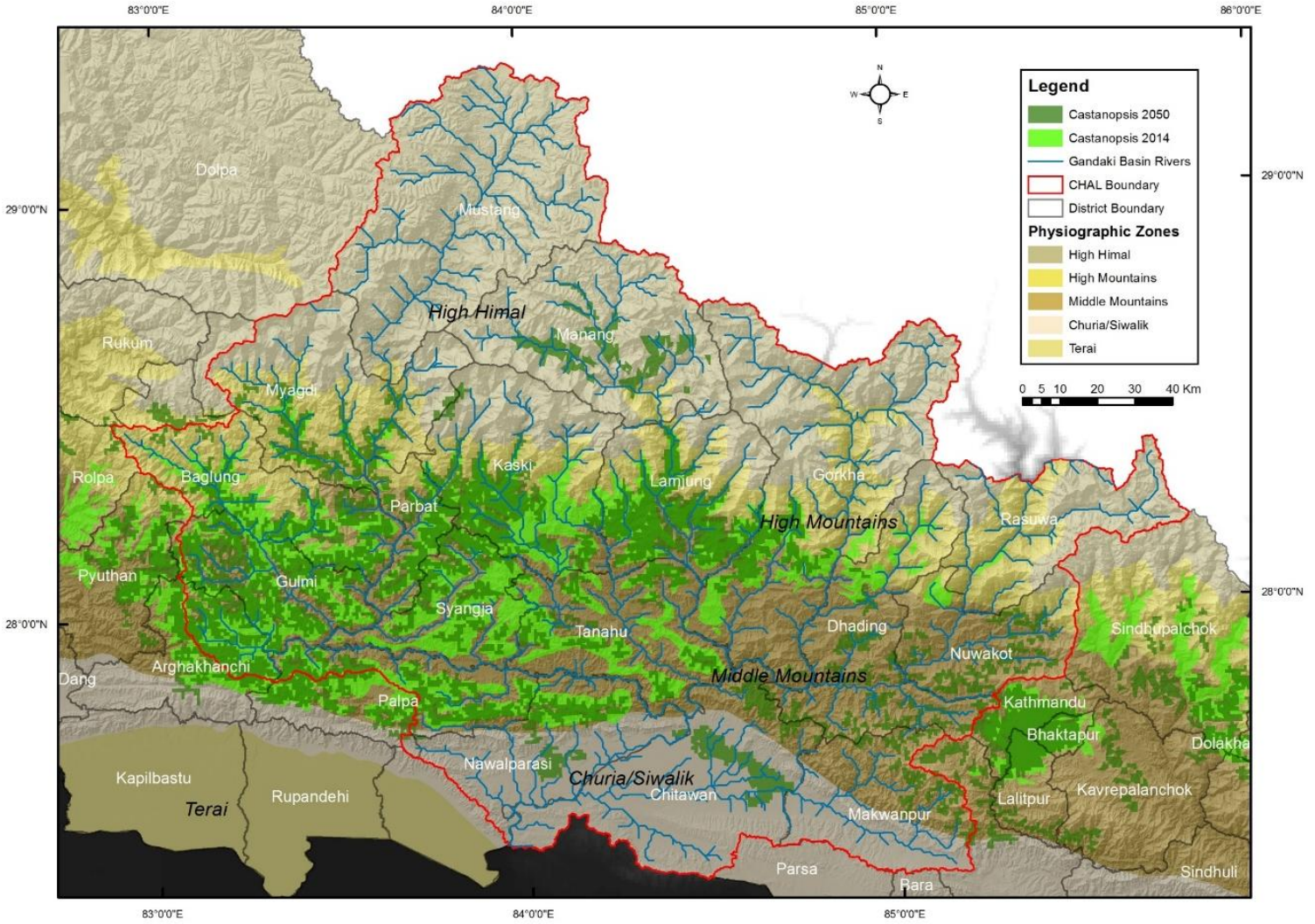
Results of GCM- Climate envelope models

- *Schima wallichii* grows to the north or above *Cinnamomum tamala* and exhibited a considerable northward shift.



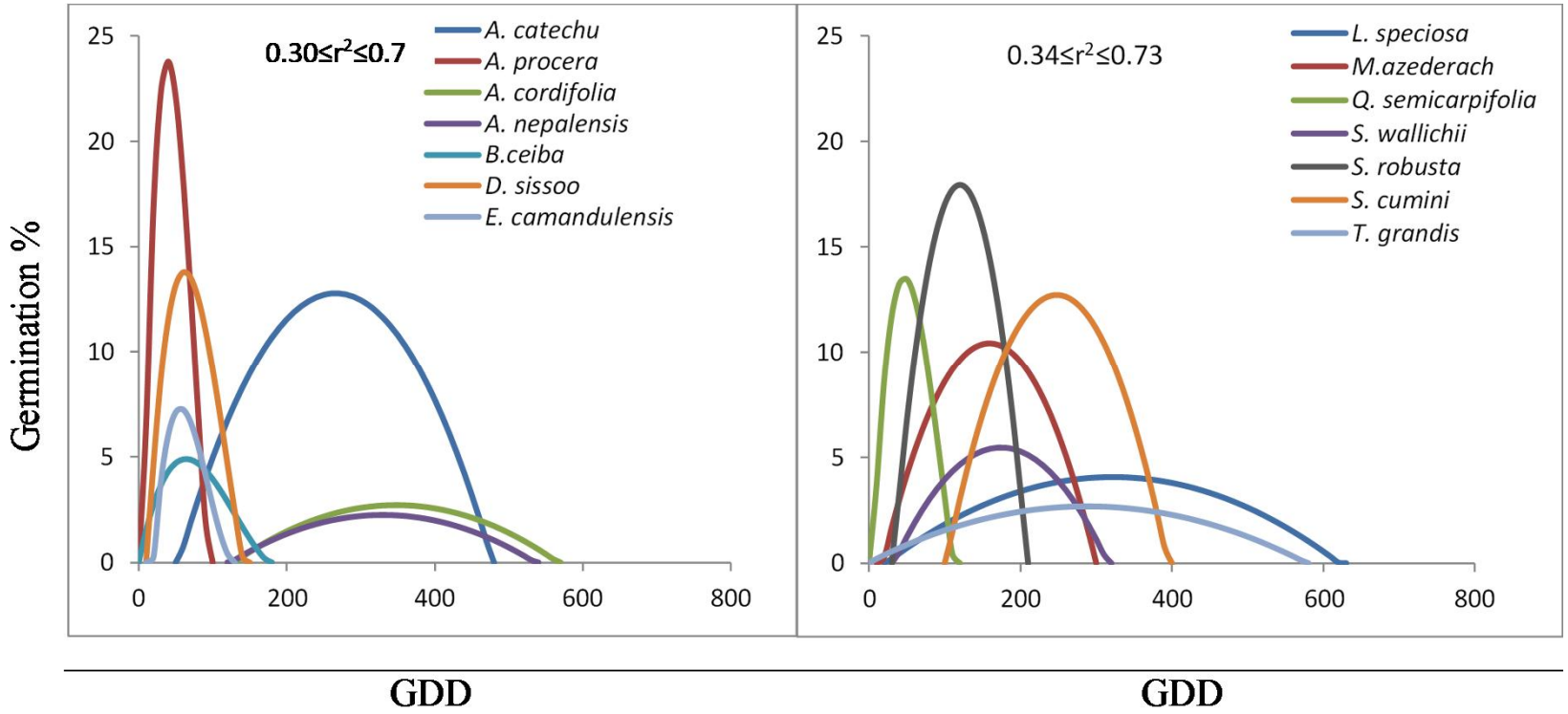
Results of GCM- Climate envelope models

- *Castanopsis tribuloides* and *C. indica* grow with *S. wallichii*
- Distribution of *Castanopsis* spp. in the Chitwan Annapurna Landscape (CHAL) will become more fragmented.



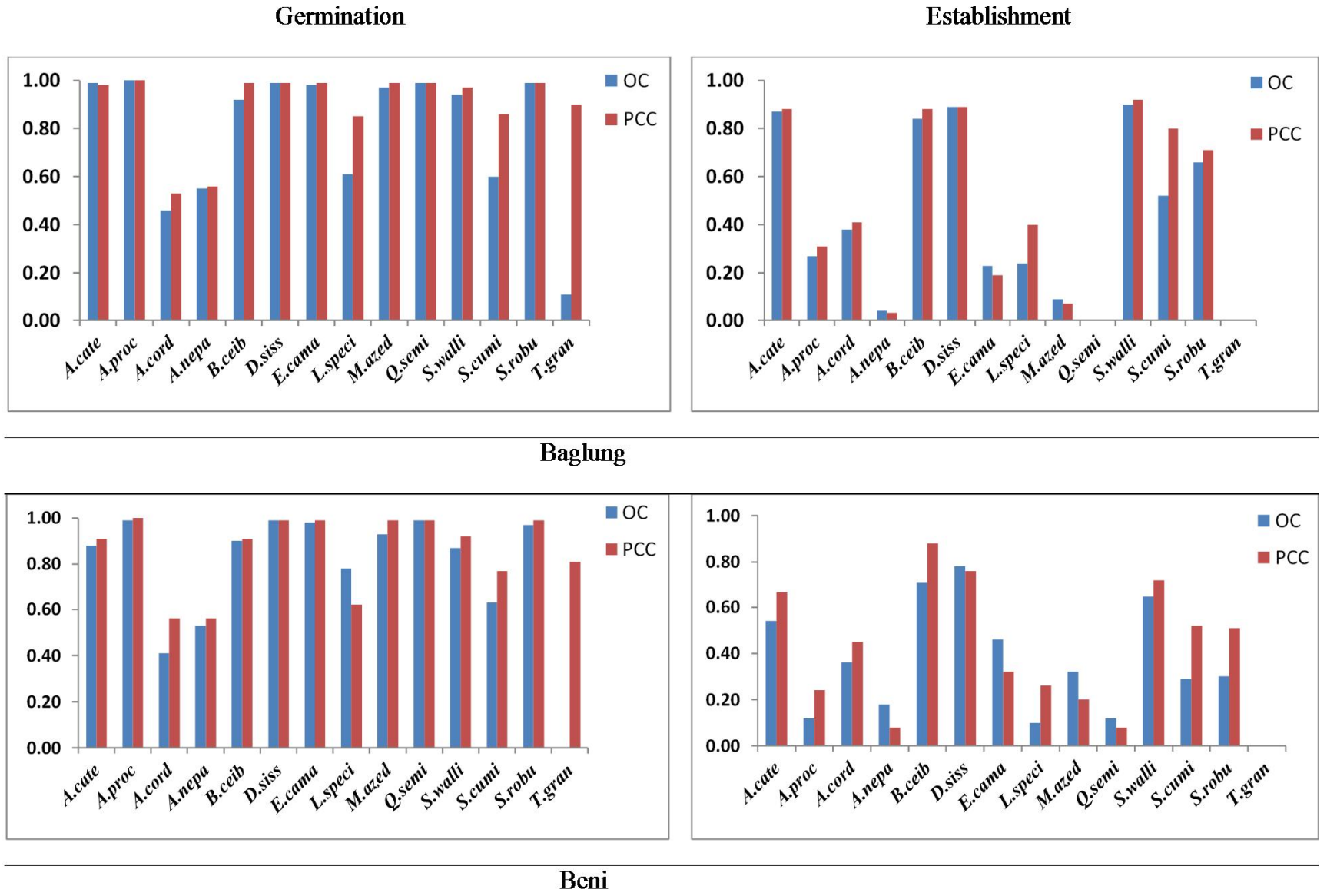
Seed Germination Trials

- *Albizzia procera*, *Dalbergia sissoo*, *Quercus semicarpifolia* and *Shorea robusta* have narrow germination windows, but good germination success
- *Adina cordifolia*, *Alnus nepalensis*, *Lagerstroemia speciosa*, *T. grandis* have wide germination windows, but low germination success
- Overall results indicate that germination may not be affected much by climate change, but establishment of seedlings could be compromised.



Seed Germination Trials

- Also, there was considerable spatial variation in germination and establishment success based on the projected climates for different districts.



CONCLUSION

- Forestry and forest restoration are long-term programs.
- Hence they must consider climate change impacts.
- The GCM-based models and mechanistic models can provide useful information to select tree species in climate change integrated forestry programs.
- Getting it right now is important, especially considering international covenants such as REDD+.
- Results from this research will be used to help select forest species for plantations and enriching forest cover, contributing to longer term sequestration of CO_2.

Hariyo Ban Program

http://www.wwfnepal.org/hariyobanprogram/

The Hariyo Ban Program is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this presentation are the responsibility of WWF Nepal and do not necessarily reflect the views of USAID or the United States Government.