



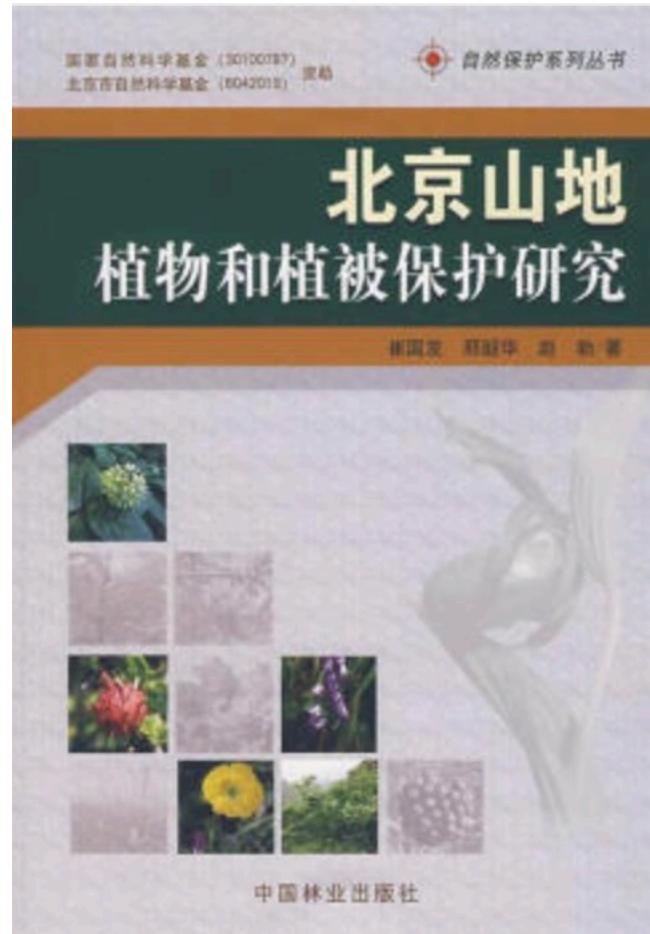
AFEC-X 2022

# Plant community comparison between primary forest and secondary forest along elevation in Mountain Aki

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# Introduction



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REVIEW



## Biodiversity and Ecosystem Functioning: Current Knowledge and Future Challenges

M. LOREAU, S. NAEEM, P. INCHAUSTI, J. BENGTSSON, J. P. GRIME, A. HECTOR, D. U. HOOPER, M. A. HUSTON, D. RAFFAELLI, [...] AND D. A. WARDLE

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SCIENCE • 26 Oct 2001 • Vol 294, Issue 5543 • pp. 804-808 • DOI: 10.1126/science.1064088

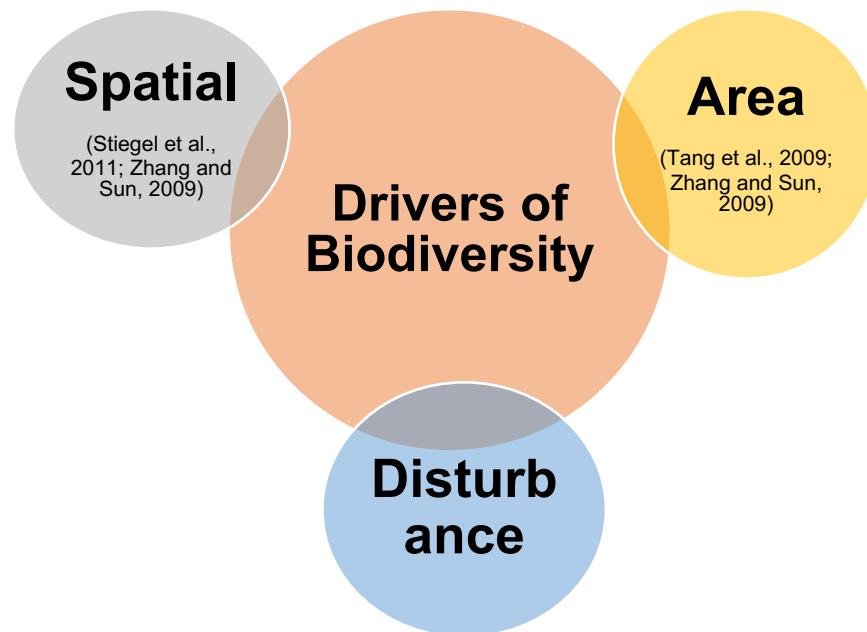
3,387 2,625



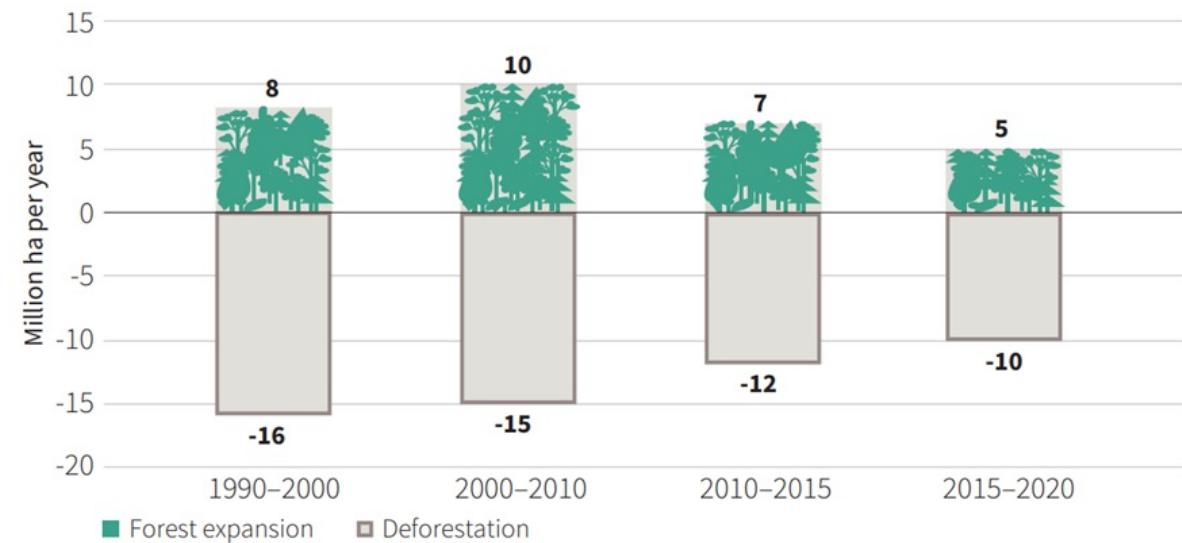
The variation patterns of plant diversity are the bases of conservation of natural reserves and have been frequently studied in ecology (Loreau et al. 2001; Fetene et al. 2006; Muhamuza and Byarugaba 2009).

# Introduction

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Annual rate of forest expansion and deforestation, 1990–2020



FAO (2020) Global Forest Resources Assessment 2020 – Key findings

# Hypothesis

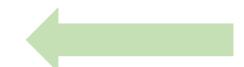
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H1: Plant diversity decreases along increasing elevation.

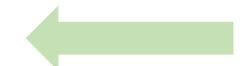
 **Pattern**

H2: Forests show mid-domain effect.

H3: The composition of plant community changes with the elevation gradient.

 **Difference**

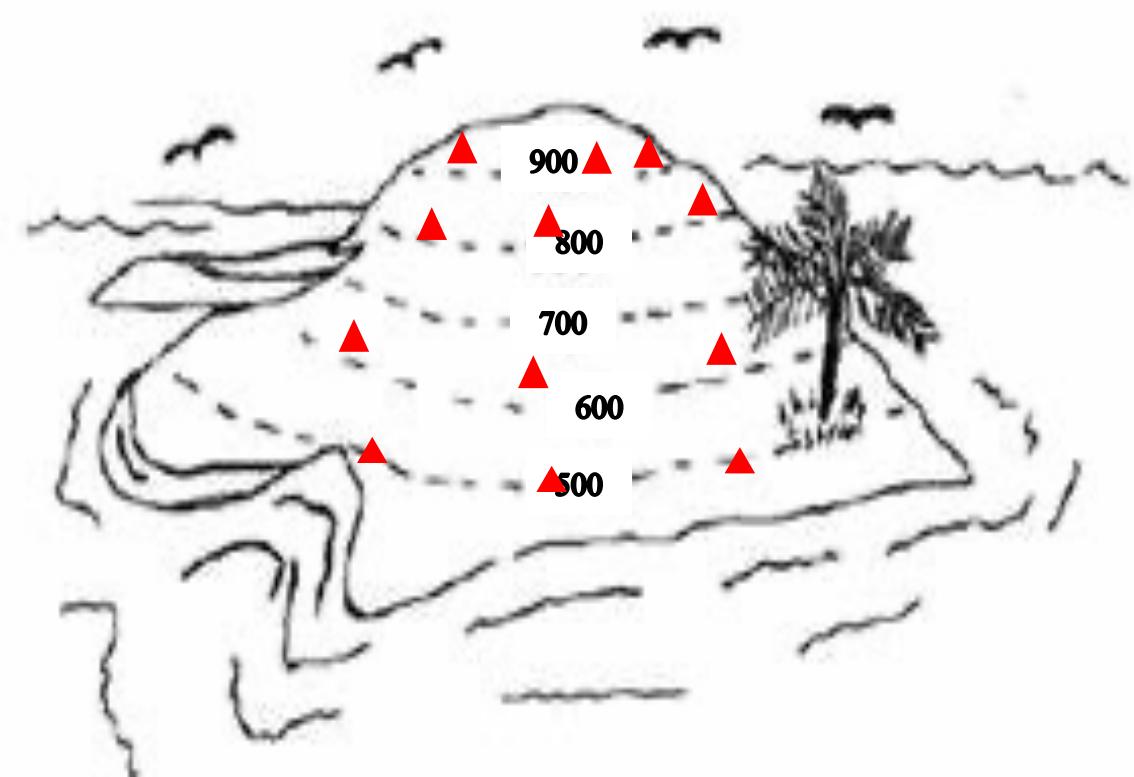
H4: Soil moisture, nitrogen, phosphorus and slope influence the species composition of plant communities.

 **Drivers**

# Sampling method

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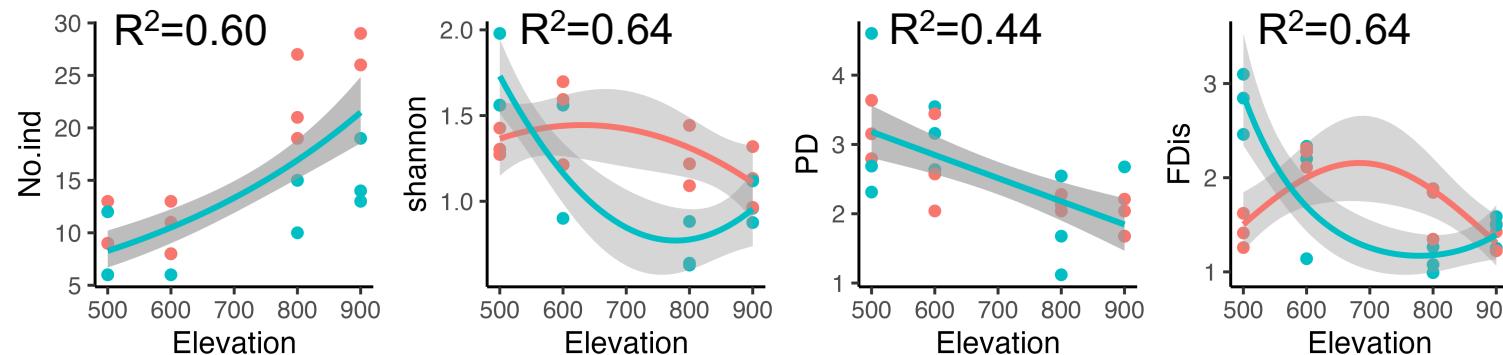
- Two types of forest: primary forest, secondary forest
- Altitudinal gradient: 500 m, 600 m, 800 m, 900 m
- 2 forest types\*4 elevations\*3replicates.
- Functional trait data: Leaf mass per area, Leaf lifespans (longevity), Amass, Rmass, Nmass, Pmass, Wood density, Seed dry mass.
- Environmental variables: soil N, soil P, soil moisture.
- Topographic variables: slope, distance from river.



## Hypothesis 1&2

Univariate analysis: (generalised) linear models for diversity indices

Diversity indices ~ Elevation+forest+Elevation:forest

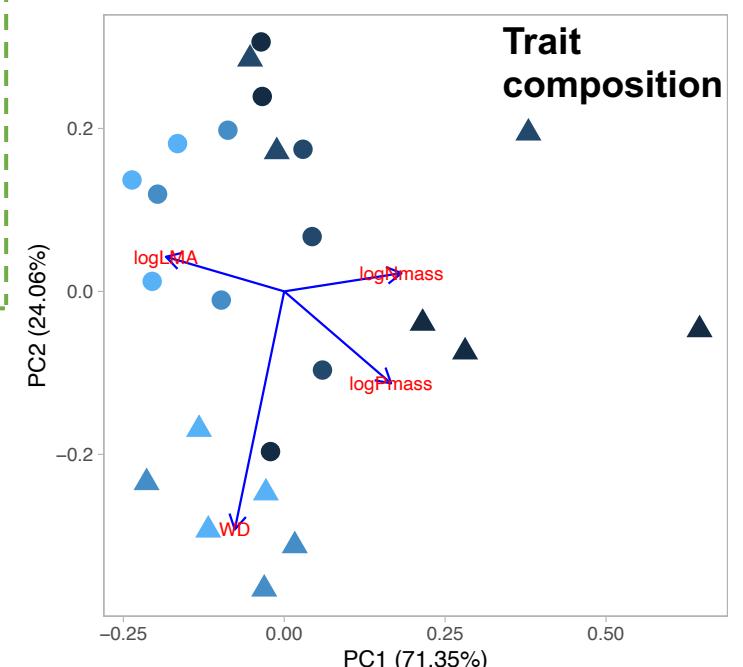
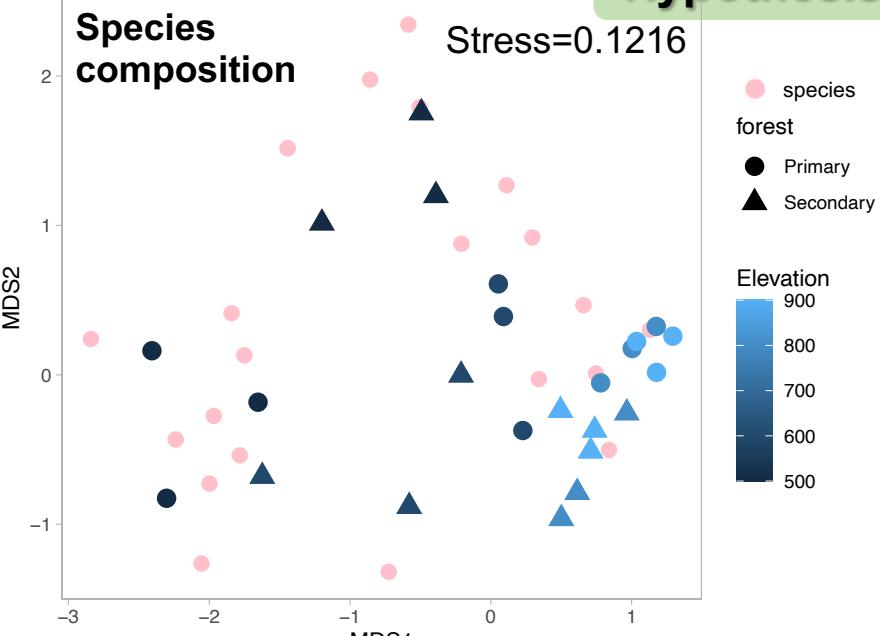


- No. individuals and phylogenetic diversity (PD) are **monotonic** along elevation.
- Shannon index and functional dispersion index (FDis) shows **humped effect** along elevation, **opposite effect** in primary/secondary forest.

Multivariate analysis: NMDS for species composition & PCA for functional trait composition

- Sites along elevation & forest types can be **distinguished by different species and trait composition**

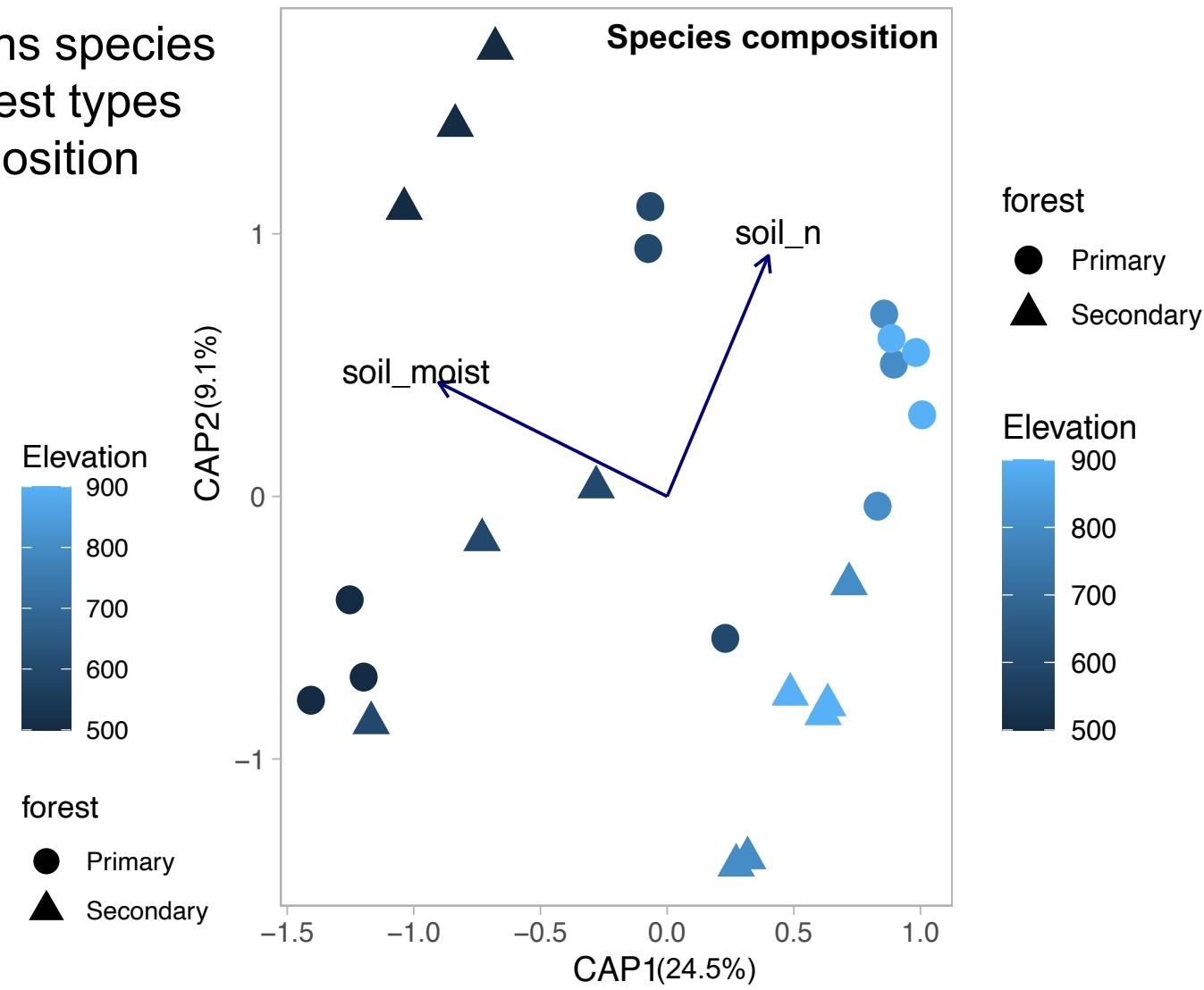
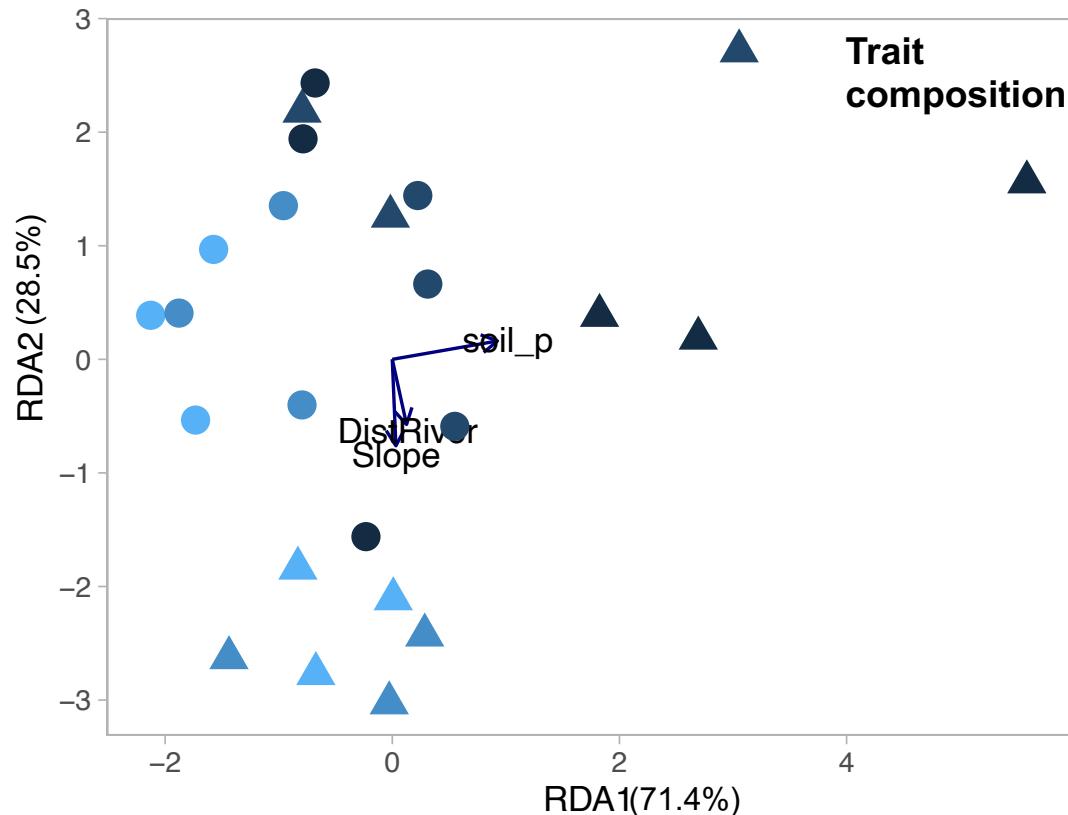
## Hypothesis 3



## Hypothesis 4

Multivariate analysis: Distance-based RDA for species composition and RDA for trait composition

- Both **soil nitrogen and soil moisture** explains species composition variation along elevation and forest types
- No factors can significantly explain trait composition variation



# Discussion

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- Primary forest showed the **mid domain effect** but secondary forest did not because of **disturbance**.
- Species composition was closely related to elevation , which was consistent with the conclusion that **elevation** was the **key environmental variable** affecting community structure, diversity, and distribution in this mountain.
- Environmental factors and topographic factors showed **no significant effect** on **trait composition** which may be due to lack in number of samples collected.
- Forest type-diversity-elevation relation needs to be further studied and tested in different mountains (Hillebrand and Matthiessen 2009).



# Thank you!

All analysis was carried out in R 4.2.2 environment  
Codes are available on: <https://github.com/Jiangyue-Wang/StupidButtons>