

# A NOVEL SOCIO-ECOLOGICAL APPROACH

for assessing the  
impacts of pastoralism  
on floral diversity

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4<sup>th</sup> Mediterranean Plant Conservation Week  
October 24, 2023



**Keywords:** grazing, pastoralism, rural communities, plant diversity, interdisciplinary research

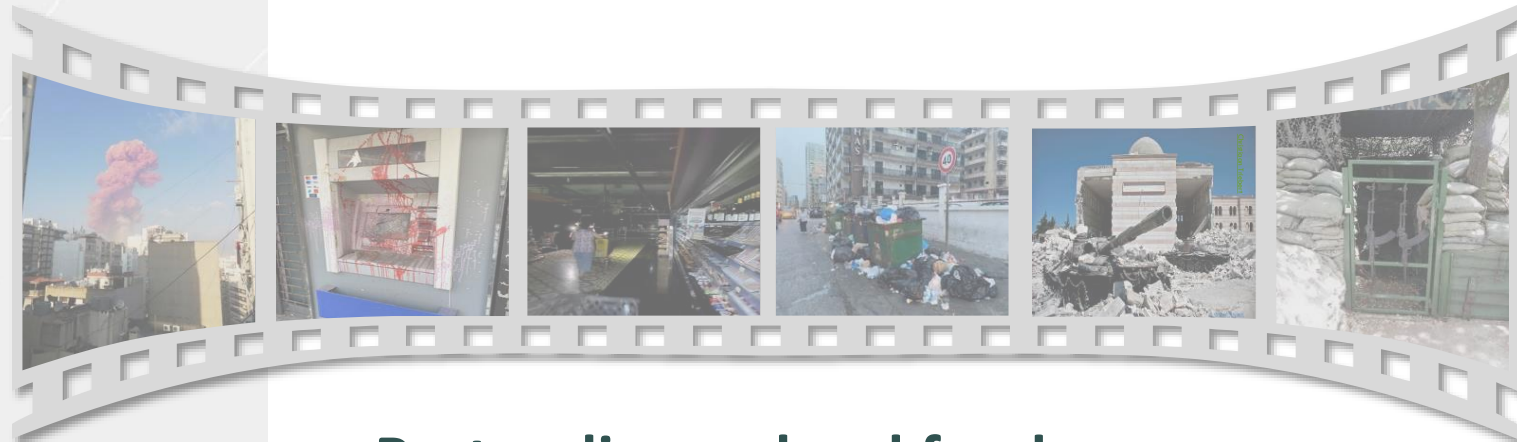
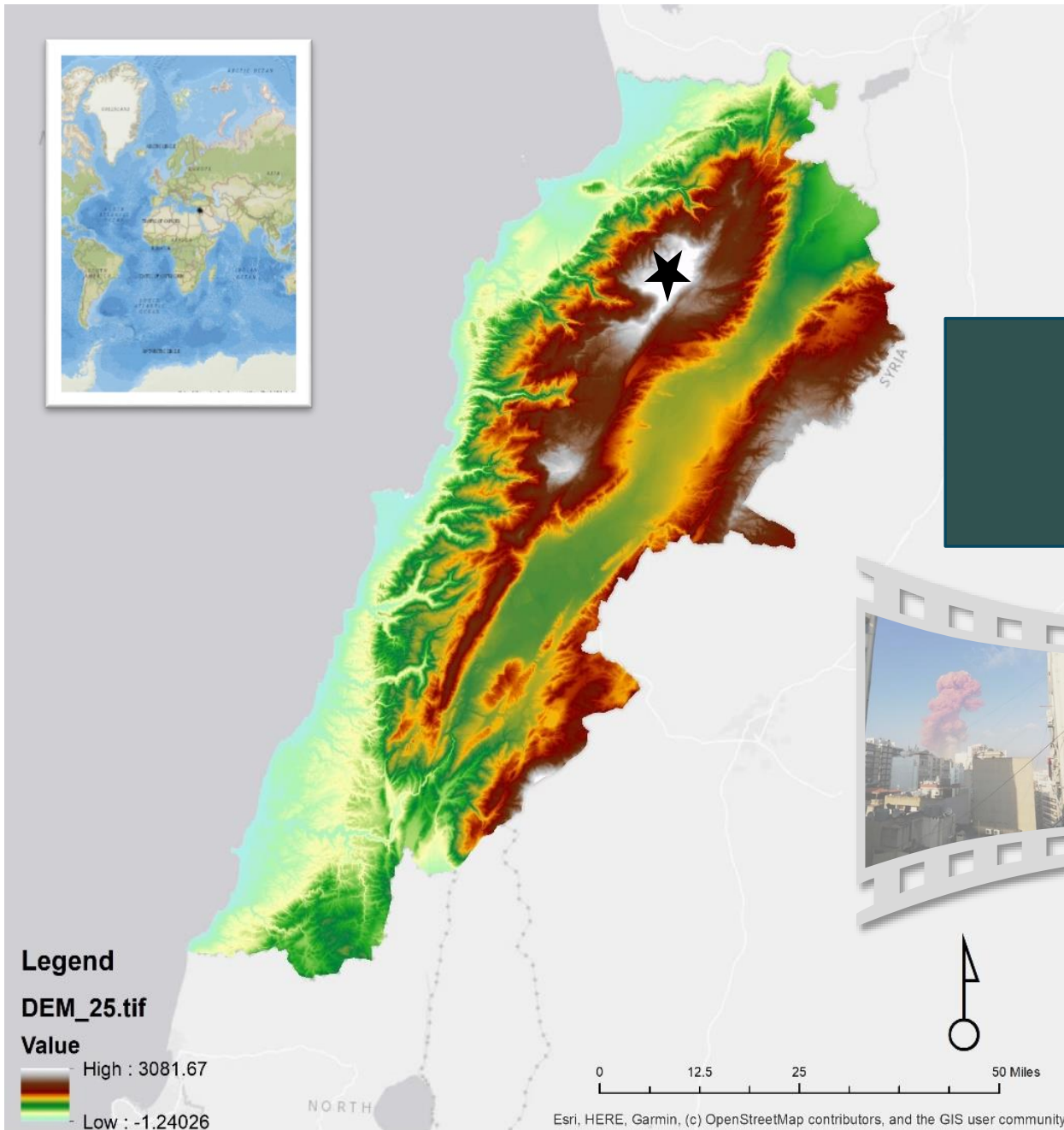


# LEBANON AND PASTORALISM

**Lebanon, a small geopolitically unstable country**  
In economic freefall  
Under threat of food insecurity

## Pastoralism, a local food source

Under-studied  
Considered a threat to green cover & plant diversity although did not lead to extinctions



# IN ECOLOGICAL ASSESSMENTS, PASTORALISM

Frequently reduced to grazing intensity

Its governance (PG) often neglected







*Examples of pastoral nodes (waterholes and encampments)*

# HYPOTHESIS

In similar environments, patches with different PG systems may have different floral characteristics.

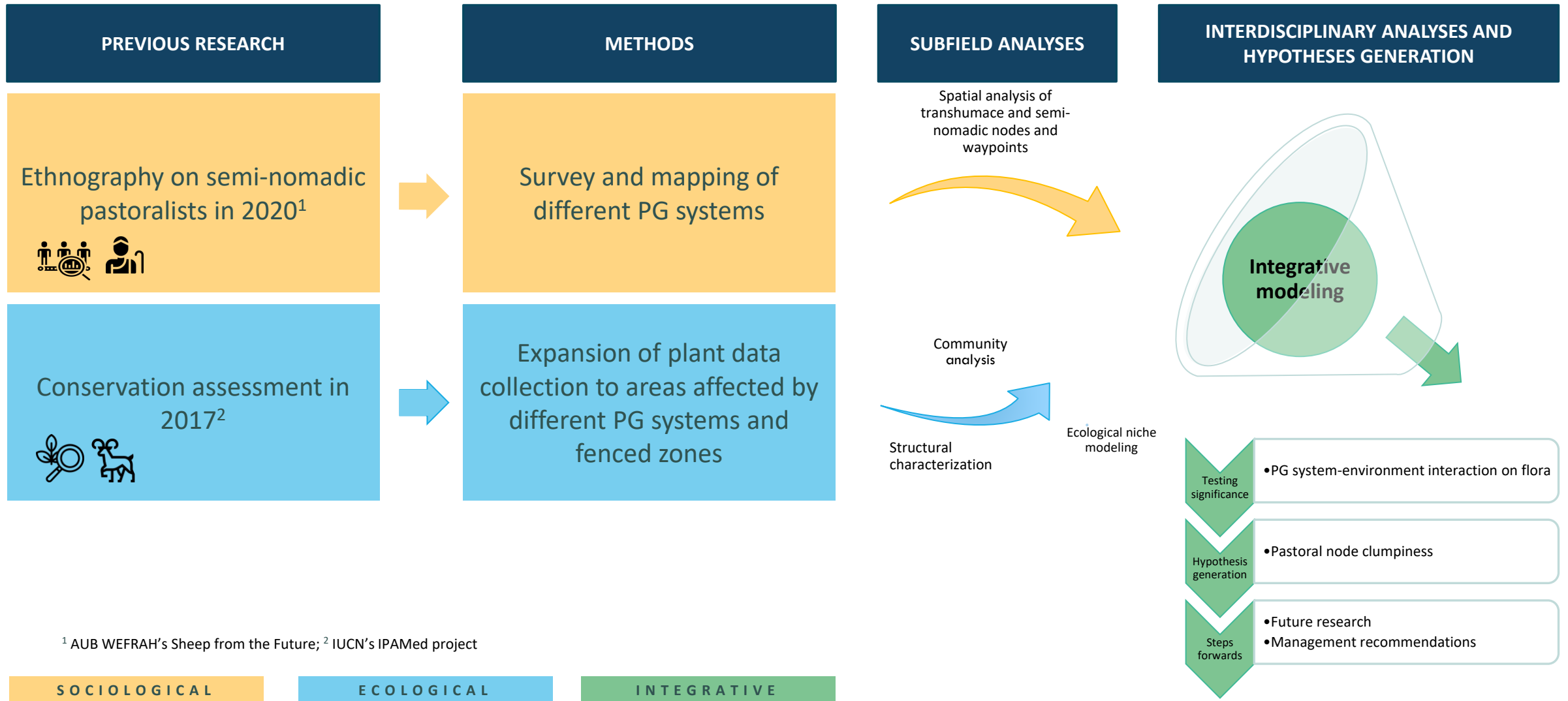
## PREDICTION:

PG systems with clumped pastoral nodes or overlapping pastures



Lower floristic richness

# RATIONAL OF METHODOLOGY



<sup>1</sup> AUB WEFRAH's Sheep from the Future; <sup>2</sup> IUCN's IPAMed project



# THE SANNINE-KNEISSEH IMPORTANT PLANT AREA



Cedar of Lebanon  
introduction attempts in  
fenced zones



Sparse stands of Greek Juniper  
naturally occur in wind shadows  
marking the treeline



Tragacanth  
vegetation dominates highest  
elevation (target vegetation)

General vegetation distribution profile from lower elevation (left ) to higher (right)

# CHARACTERIZING PASTORAL GOVERNANCE

Rapid survey based on preceding ethnographic study

## SURVEY QUESTION

Are there brokers that facilitate access of shepherds to pasture for profit?

Do landowners rent out their plots to shepherds?

Do the shepherds claim historic rights to lands which they access without having to pay anything to anyone?

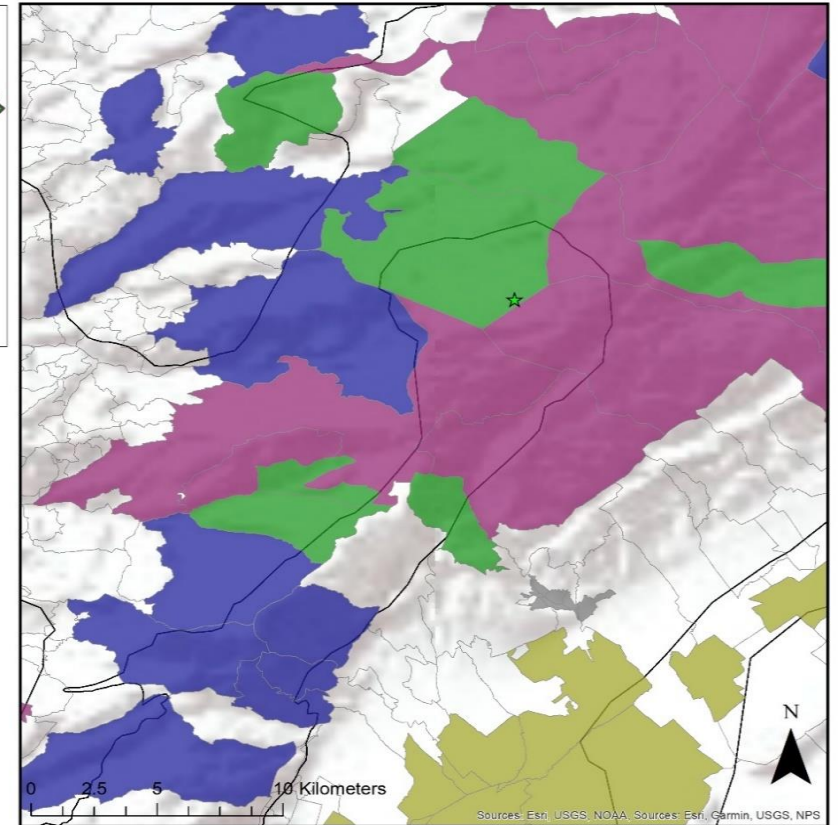
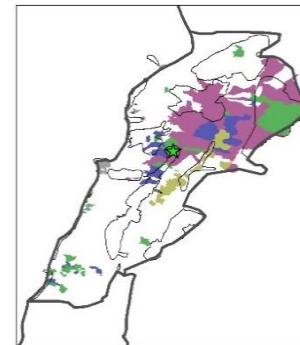
## CORRESPONDING PG SYSTEM

**Customary:** access to parcels in plots governed by broker (pastures separated; clumped nodes)

**Landlordships:** Specific parcels rented out or offered by landlords (pastures separated; nodes apart)

**Rabh'hum:** Right of access contested by local shepherds regardless of ownership (overlapping pastures; clumped nodes)

## MAP OF PRIMARY PG SYSTEMS AT CADASTRAL LEVEL



### Legend

★ Sannine Field Lab Location

### Pastoral governance

- Not characterized
- Abandoned pasture
- Customary
- Haklat
- Landlordships
- Lost pasture
- Monastic
- Orchards
- Rabh'hum
- Lebanon\_KBA

Do these different forms of PG systems have different overall impacts on floral diversity?



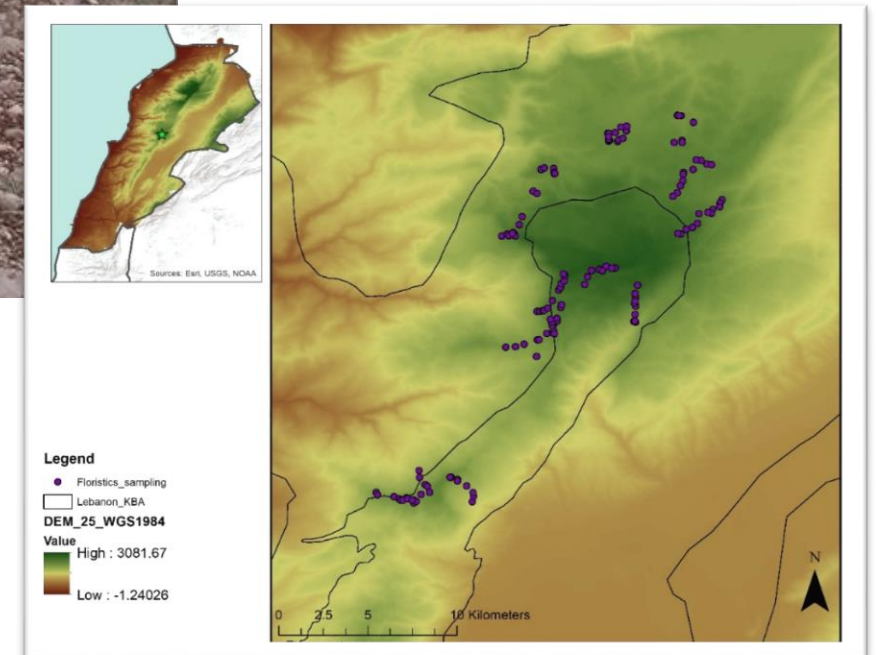




# PLANT DATA COLLECTION

Field realities and implications  
on classification

- 140 homogeneous plots (up to 25m radius circles) provided 3299 records belonging to 362 taxa and 56 families
- Abundance measures unreliable as herbivory is high and asymmetrical
- Classification methods that use abundance measures such as TWINSPLAN may not be reliable to produce consistent groupings



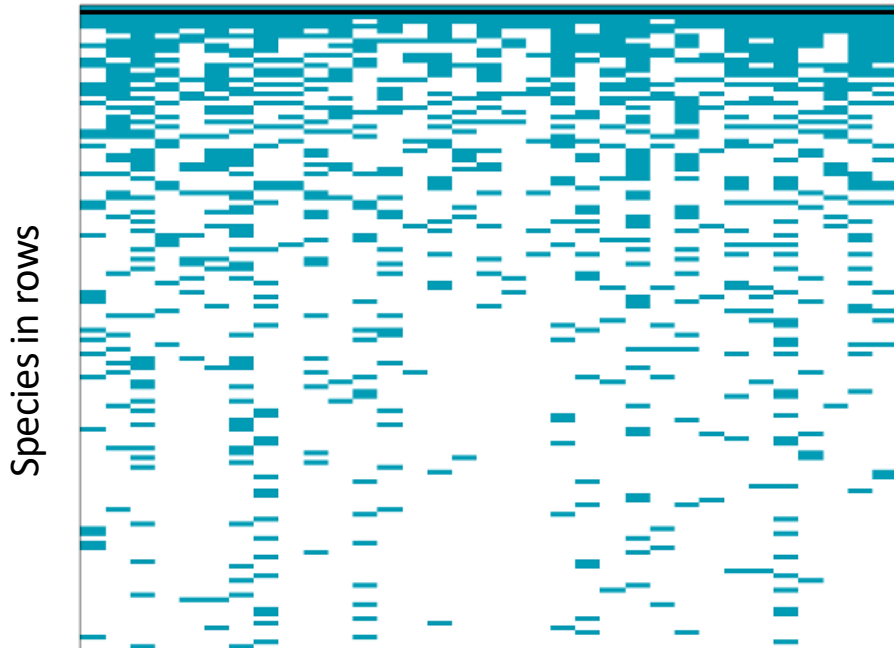


# PLANT DATA CLASSIFICATION

## Diffval package

- Grouping vegetation plots aiming at a high turnover of exclusive species
- Optimization procedure<sup>3</sup>, searching for (dense) blocks of species, exclusive to one or more groups
- We explored different number of groups (from 2 to ? groups)
- We performed 1500 optimization runs and kept all found solutions for analysis

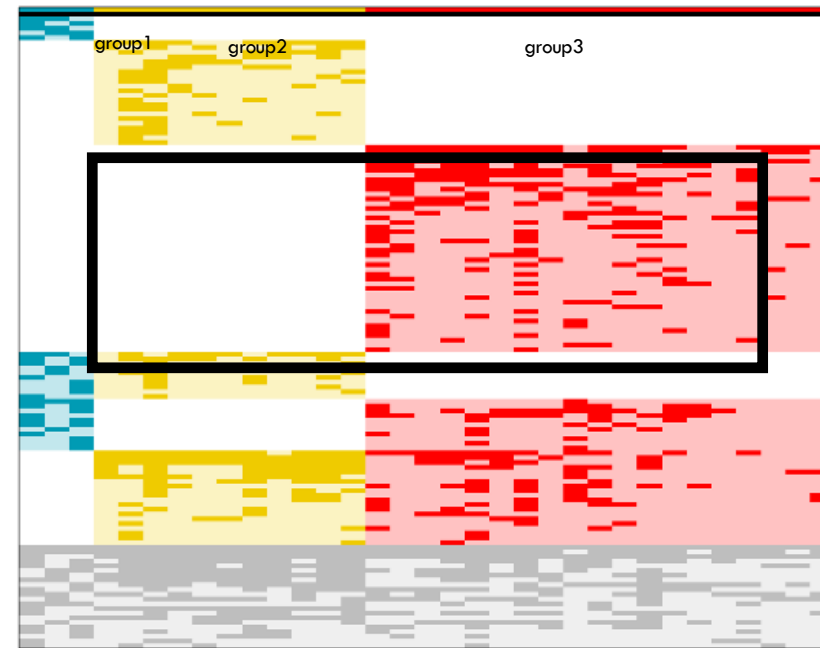
Plots in columns



Optimization  
procedure<sup>1</sup>



Rearranged columns in 3 groups

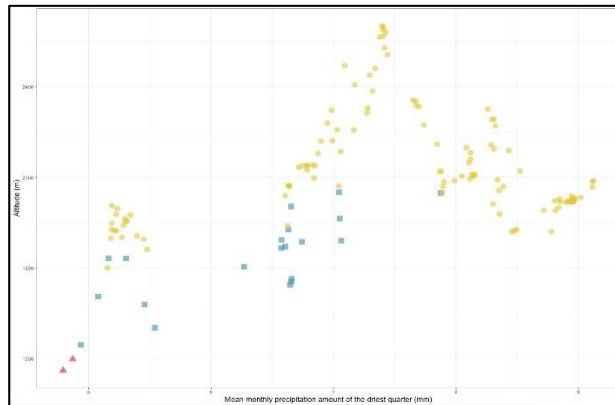


E.g.:  
exclusive  
species  
of group 3  
(absent  
from group 1  
and 2)

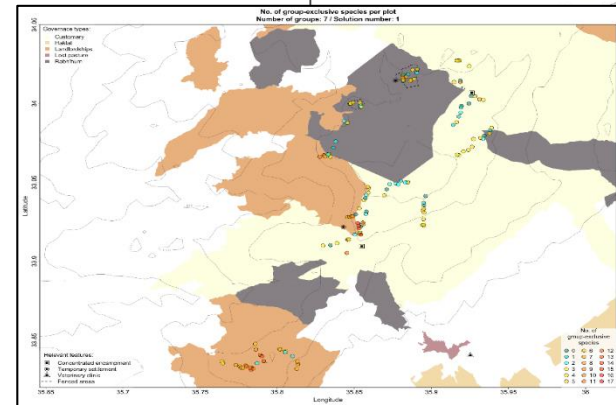
<sup>3</sup>Monteiro-Henriques T, Cerdeira J (2023). *diffval: Vegetation Patterns*. R package version 1.1.0, <https://CRAN.R-project.org/package=diffval>.

# DIFFVAL SELECT CLASSIFICATION

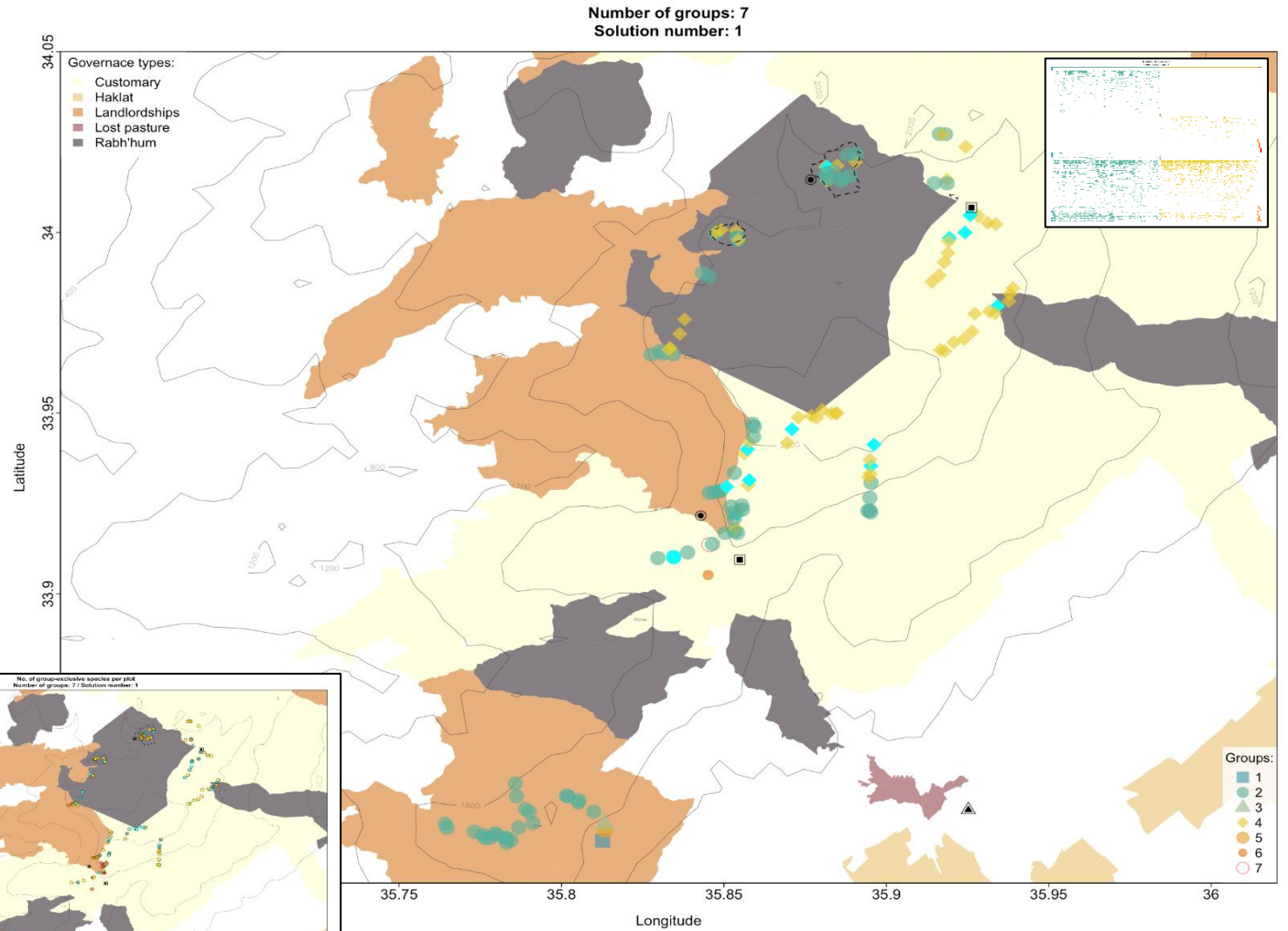
- Diffval classification for high altitude vegetation followed clear environmental gradients
- Asymmetries observed in terms of floristic richness



Community segregation by elevation



Asymmetric floristic richness



Note: 13 plot(s) without group-exclusive taxa are represented in cyan



```
Call:
MASS::glm.nb(formula = Richness ~ Bio17 * Bio6 + governance,
  data = DATA_nofence_semifenced_nona, init.theta = 17.08071146,
  link = log)
```

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.70115  -0.75835  -0.09479   0.47315   2.83814
```

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-1.36113	1.78531	-0.762	0.44582
Bio17	0.75288	0.25111	2.998	0.00272 **
Bio6	-0.72548	0.29102	-2.493	0.01267 *
governanceLandlordships	0.37400	0.12654	2.956	0.00312 **
governanceCustomary	0.24899	0.10518	2.367	0.01792 *
Bio17:Bio6	0.12235	0.04041	3.028	0.00247 **

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for Negative Binomial(17.0807) family taken to be 1)

Null deviance: 200.73 on 126 degrees of freedom  
Residual deviance: 128.84 on 121 degrees of freedom  
AIC: 878.13

Number of Fisher Scoring iterations: 1

Theta: 17.08  
Std. Err.: 3.75

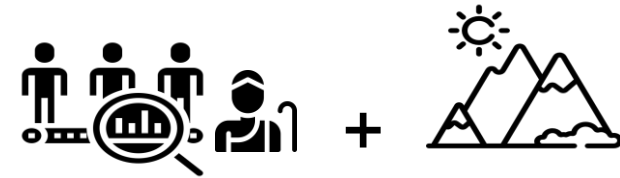
2 x log-likelihood: -864.135

Environmental

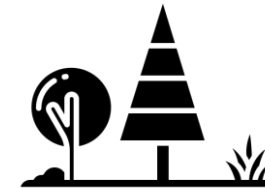
Sociological

# IMPACT OF PG SYSTEM ON FLORAL RICHNESS

images: FlatIcon.com



**floristic richness**



PG SYSTEMS AND ENVIRONMENTAL PARAMETERS TOGETHER HAVE DIFFERENT OVERALL EFFECTS ON PLANT RICHNESS

Landlordship

>>

Rabh'hum

;

Customary

>

Rabh'hum

# THANK YOU FOR YOUR ATTENTION

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## Contributors to this work

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