Coesistenza e segregazione spazio-temporale di cervo (*Cervus elaphus*), capriolo (*Capreolus capreolus*) e camoscio (*Rupicapra rupicapra*) in una comunità di mammiferi alpini caratterizzata da disturbo antropico

Limonciello Laura

Università La Sapienza (RM)
Fondazione Edmund Mach (TN)

Relatori:
Prof. Ciucci Paolo
Dr. Cagnacci Francesca
Dr. Ossi Federico

Comunità

“[…] gruppo di specie **interagente** tra loro, che vivono nella **stessa area** nello **stesso momento**. Le interazioni tra diverse specie ed il loro ambiente conferiscono alla comunità le sue funzioni e caratteristiche“ (Cain, Bowman and Hacker, 2014)

Tassonomia

Gilda trofica

Caso studio: la comunità di mammiferi terrestri nelle Alpi…

Ambiente

Presenza antropica

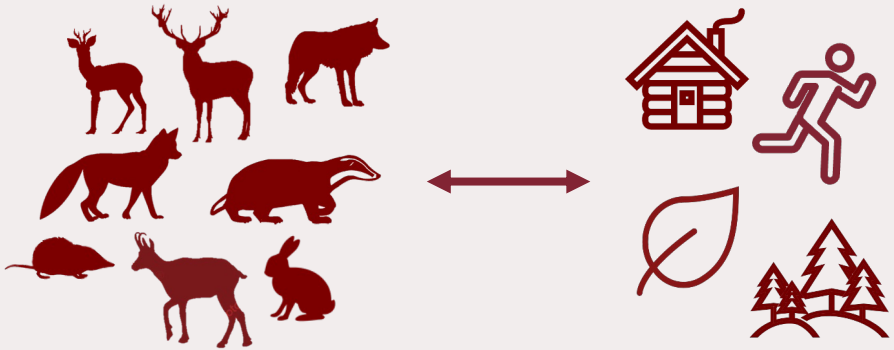
…con un focus sugli ungulati!

Grande gruppo di consumatori primari→ Hanno influenza sulla struttura ed il funzionamento degli ecosistemi(Scogings et al., 2020)

Nel contesto alpino dello studio:

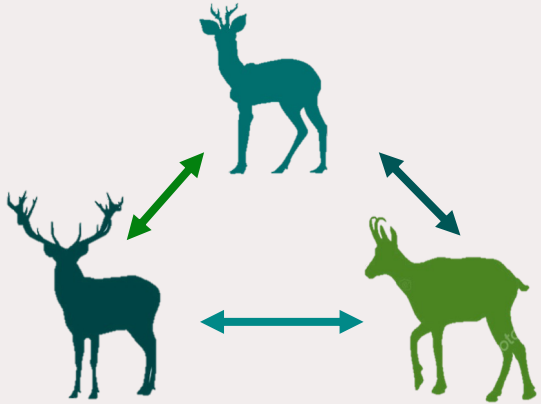
OBIETTIVO 1

Stabilire **quali** specie compongono la comunità di mammiferi terrestri di taglia media e grande nelle Alpi e capire la loro **relazione** con alcuni fattori **ambientali** ed **antropici**



OBIETTIVO 2

Valutare **l'associazione** spaziotemporale all'interno del gruppo degli **ungulati**



METODI

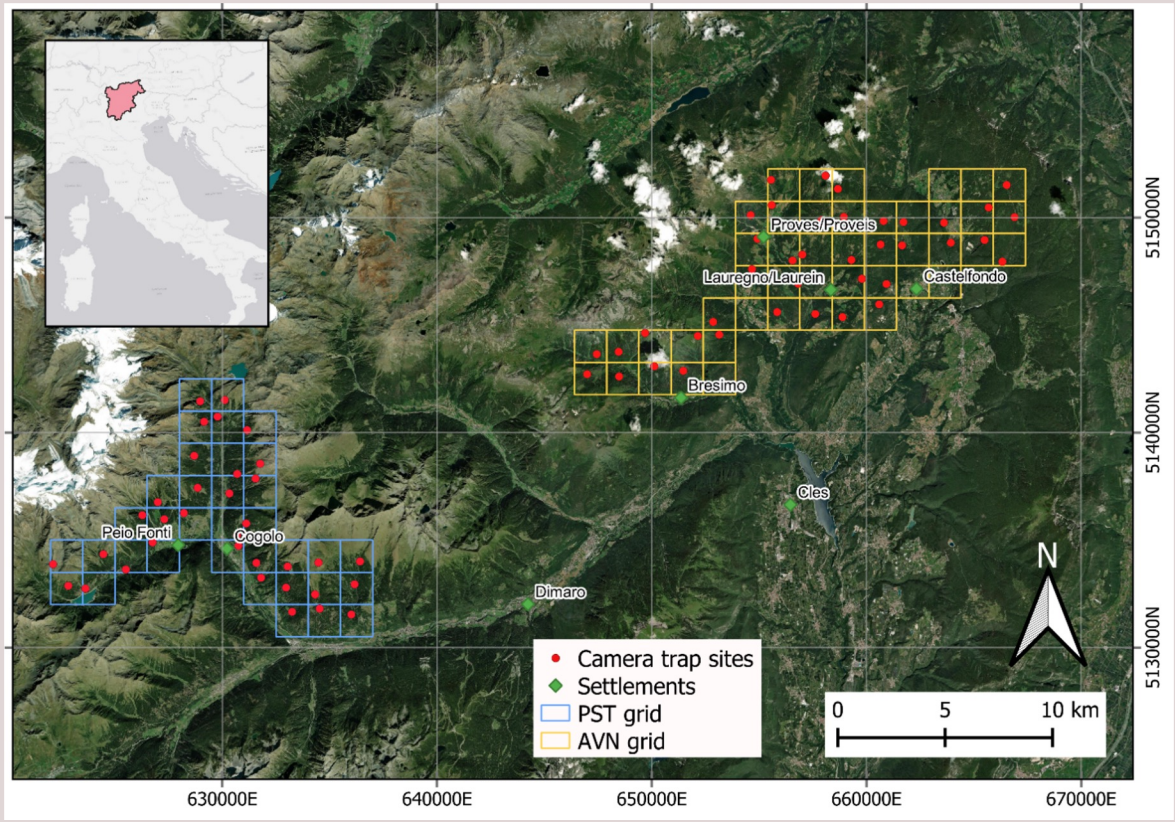
Periodo di campionamento: da maggio ad ottobre 2022
CT = 77

Le specie nei video/foto sono identificate visualmente e singolarmente

Osservazioni indipendenti: 10 minuti
N= 12284 (4775 in AVN e 7509 in PST)

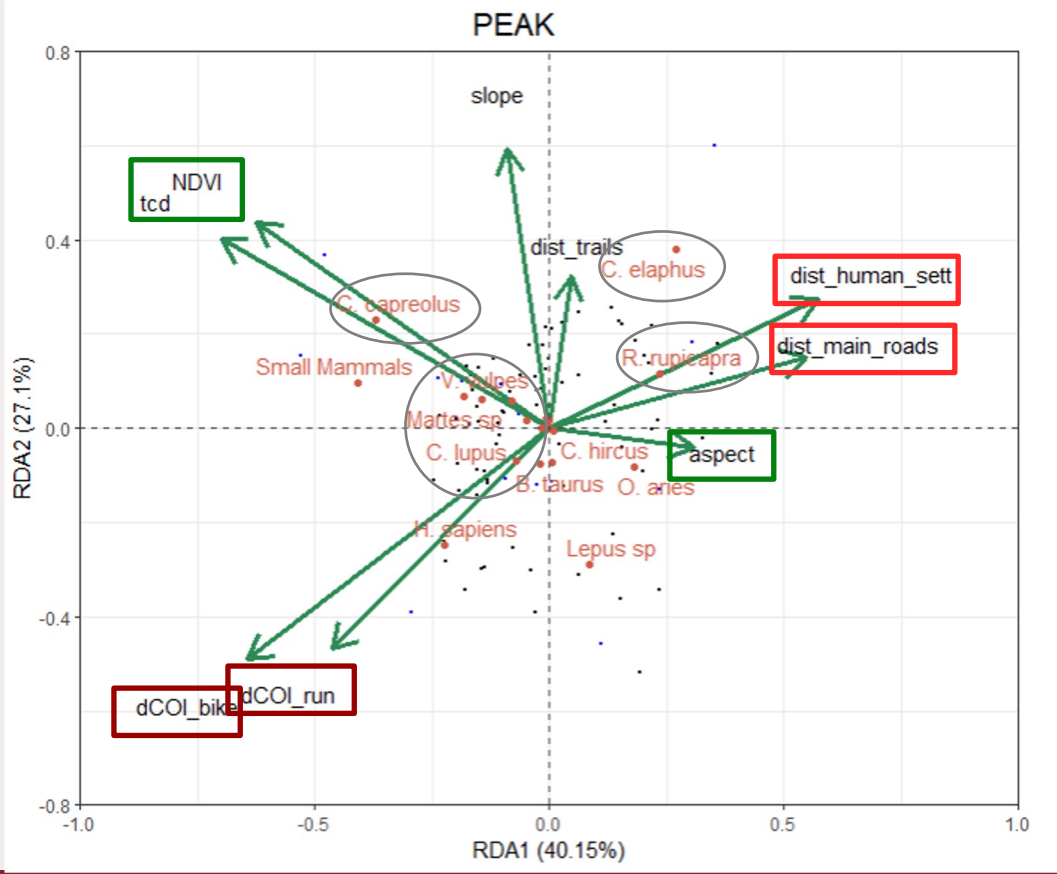
Redundancy Analysis (RDA)

(ter Braak, 1995)



Comunità alpina di mammiferi → ***25 specie osservate!***

Le specie di mammiferi terrestri nel periodo estivo...

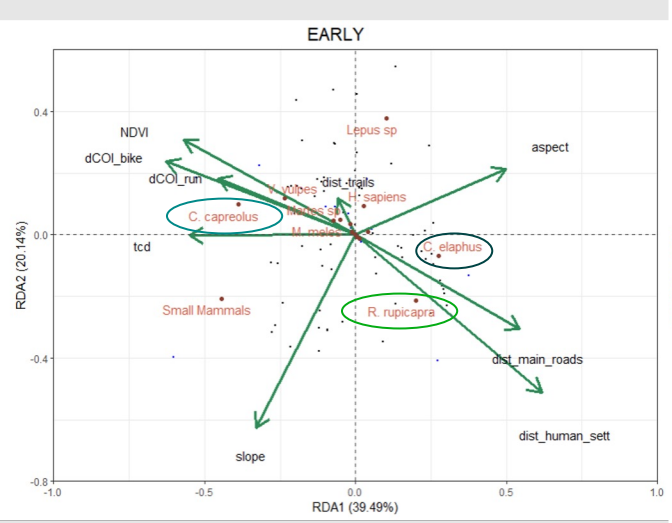


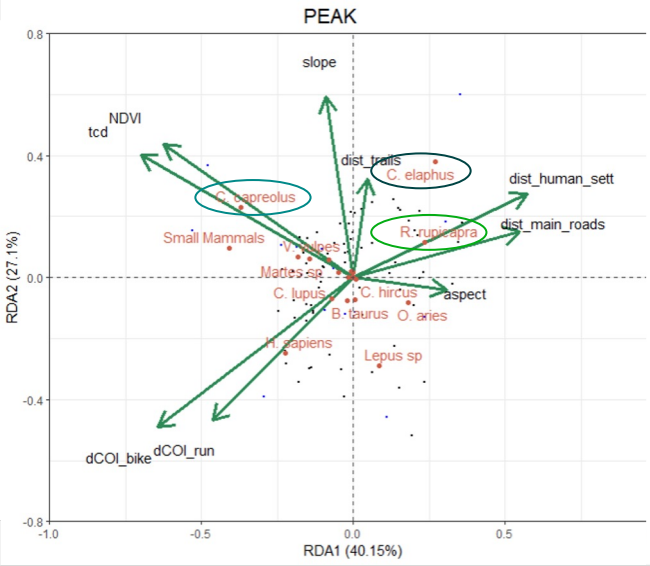
- **Le specie di taglia maggiore** si dissociano da attività e infrastrutture umane: habitat più ampi? (Lindstedt et al., 1986; Salvatori, 2022)
- **Cervo** e **camoscio**: dissociati da produttività primaria
- **Camoscio** associato con pendii esposti a nord (termoregolazione)

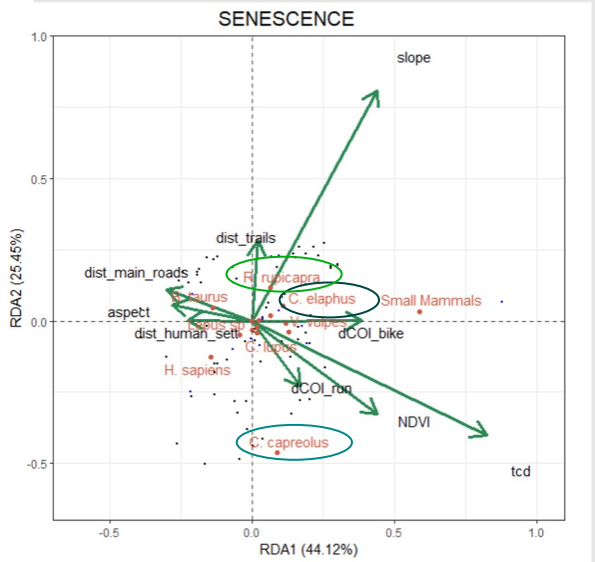
- In generale, specie **specialiste** associate più fortemente a covariate rispetto a **generalisti** (carnivori, evitamento temporale?)

- Il **capriolo** è l'unico **erbivoro** associato alla produttività primaria, alla copertura e non dissociato da att. umane!

E riguardo l'associazione tra ungulati?







- **Cervo** e **camoscio** sono associati in **tutti** i periodi (migrazione altitudinale precoce del cervo) → ciò che varia **stagionalmente** è la loro associazione con le variabili considerate
- **Cervo** e **capriolo** sono dissociati durante tutta la stagione di campionamento → segregazione di altitudine e ambienti? (Salvatori et al. 2022)

Conclusioni

- I risultati di questo studio indicano associazioni **coerenti** con ciò che è già noto in **letteratura** sulle specie di mammiferi ed il loro ruolo funzionale
- I **pattern** di associazione/dissociazione tra ungulati sono interessanti: bisogno di ulteriori approfondimenti
- **Fototrappole**: ottimo strumento per uno sguardo ampio sulla comunità → per comprendere i processi che sottostanno alle associazioni osservate c'è bisogno di altri metodi (analisi reti trofiche, collari GPS…)

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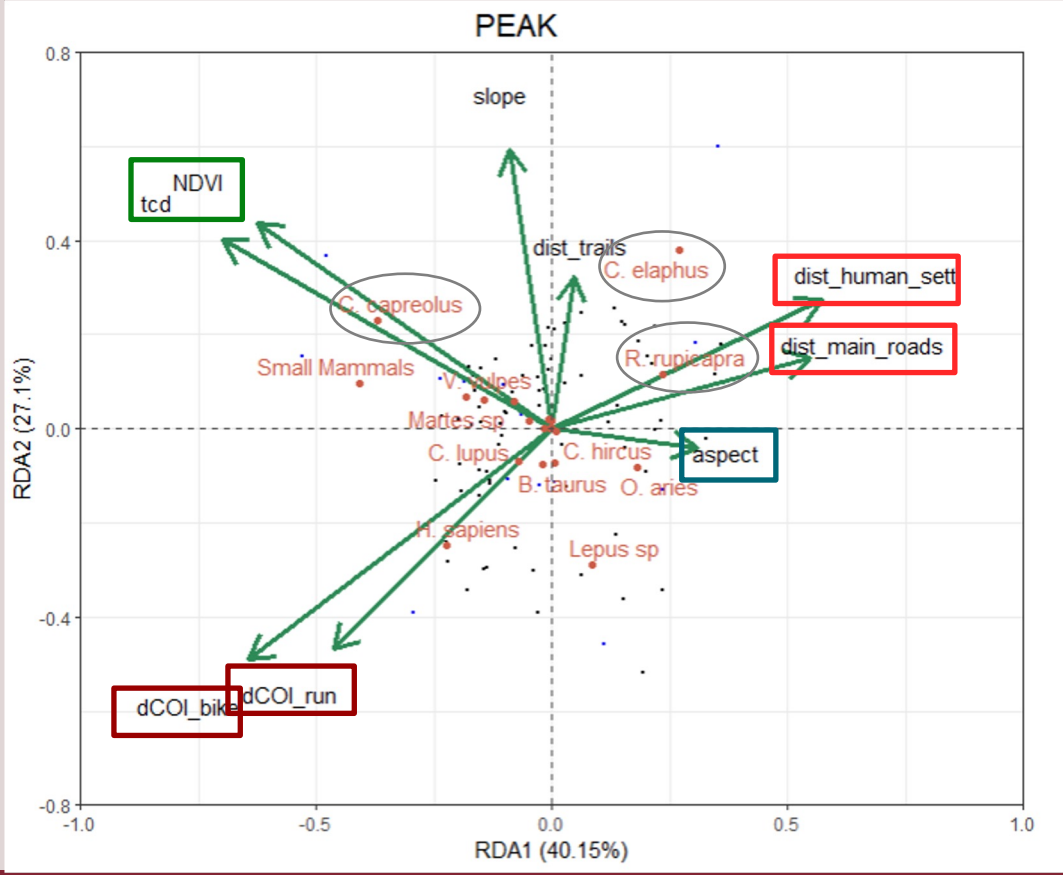
Davide **Righetti**
Luca **Corlatti**
Ivo **Ungerer**

PARCO
NAZIONALE
DELLO
STELVIO

NATIONAL
PARK
STILFSER
JOCH


Grazie per l'attenzione!
Limonciello Laura
21/07/2023
STEALTH CAM
07:17
09/23/21
2 C
12
C19

...ed un zoom sugli ungulati!

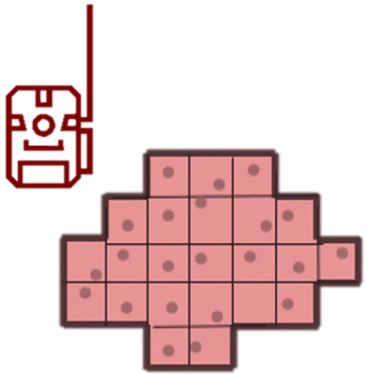


Il **capriolo** è associato con
1. NDVI (alta qualità di foraggio),
2. copertura arborea (rifugio)
3. attività antropiche (human shield?)

Red deer & Chamois dissociated from primary productivity (**P2.1, P2.5**) and associated with distance to human infrastructure (**P2.2, P2.7**) (migration in summer to higher elevations; Peters et al., 2019)

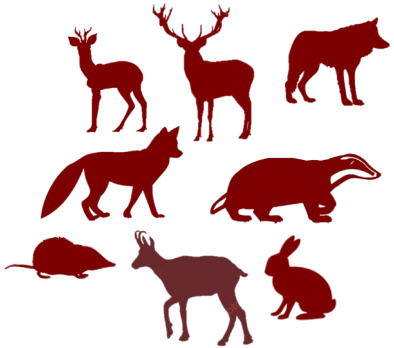
Chamois associated with north-facing slopes (**P2.6**) (thermoregulatory strategy and forage quality; Albon and Langvatn, 1992)

METHODS



Redundancy Analysis (RDA)

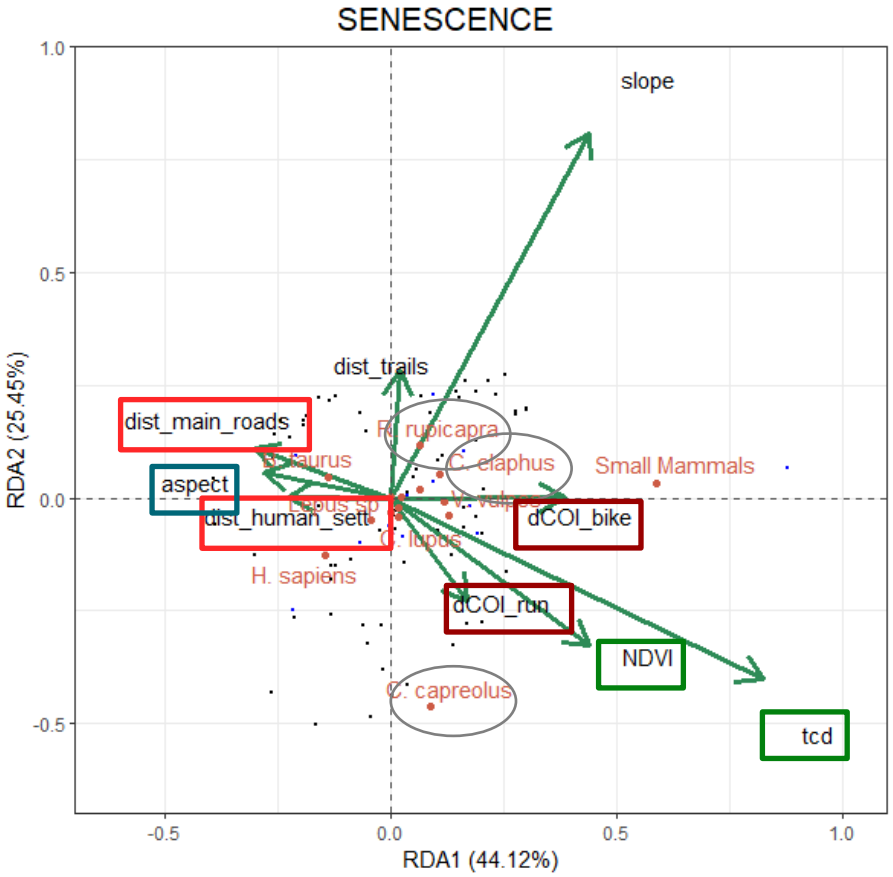
(ter Braak, 1995)



3 PERIODS

Based on NDVI curves of 2022

In autumn, something changes (H1/H2)…



Red deer & Chamois less dissociated from human infrastructures (**P2.2**, **P2.7**) (Fall migration towards winter ranges which are closer to human settlements)

Chamois moves away from North-facing slopes (**P2.6**) for thermoregulation and escape snowy terrain

Roe deer maintains association with primary productivity and tree cover (**P2.3**) as well as with human activities (**P2.4**)

NO major modifications detected in other species

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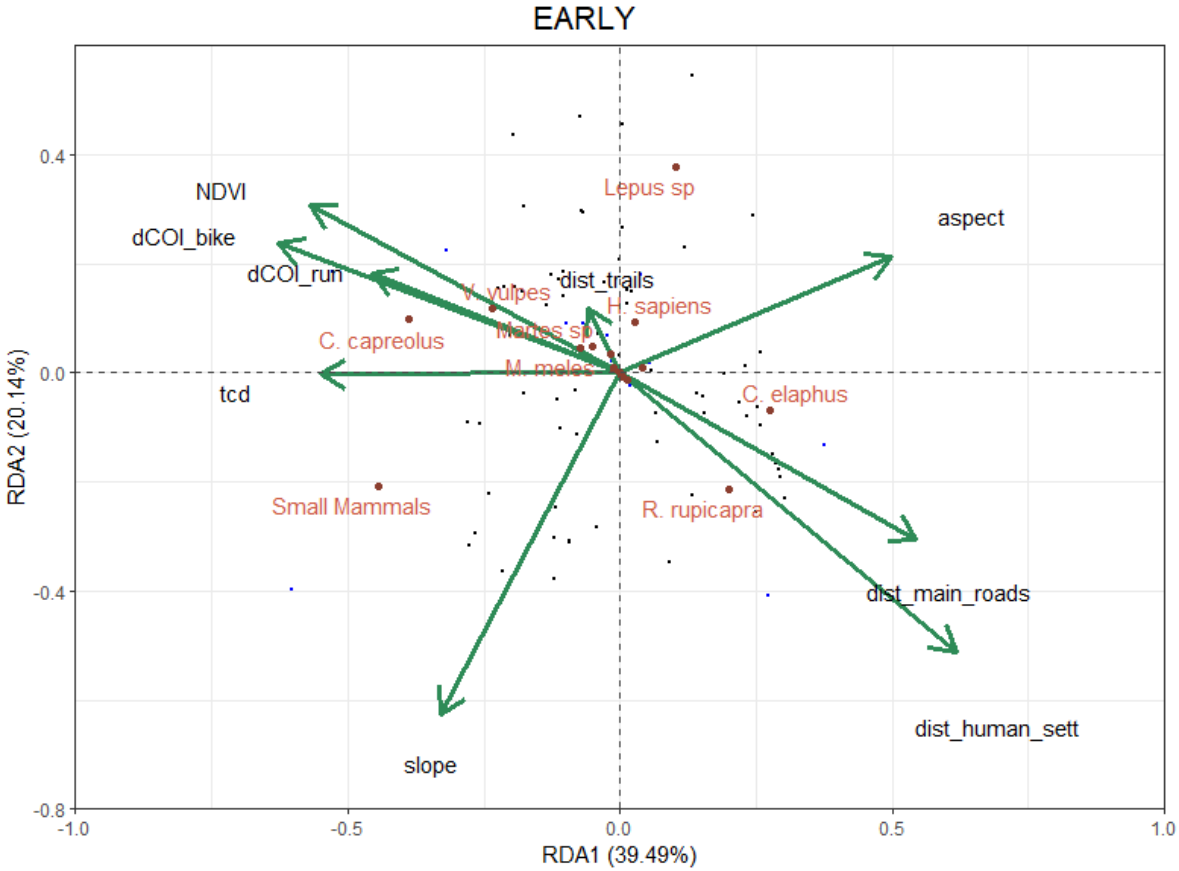
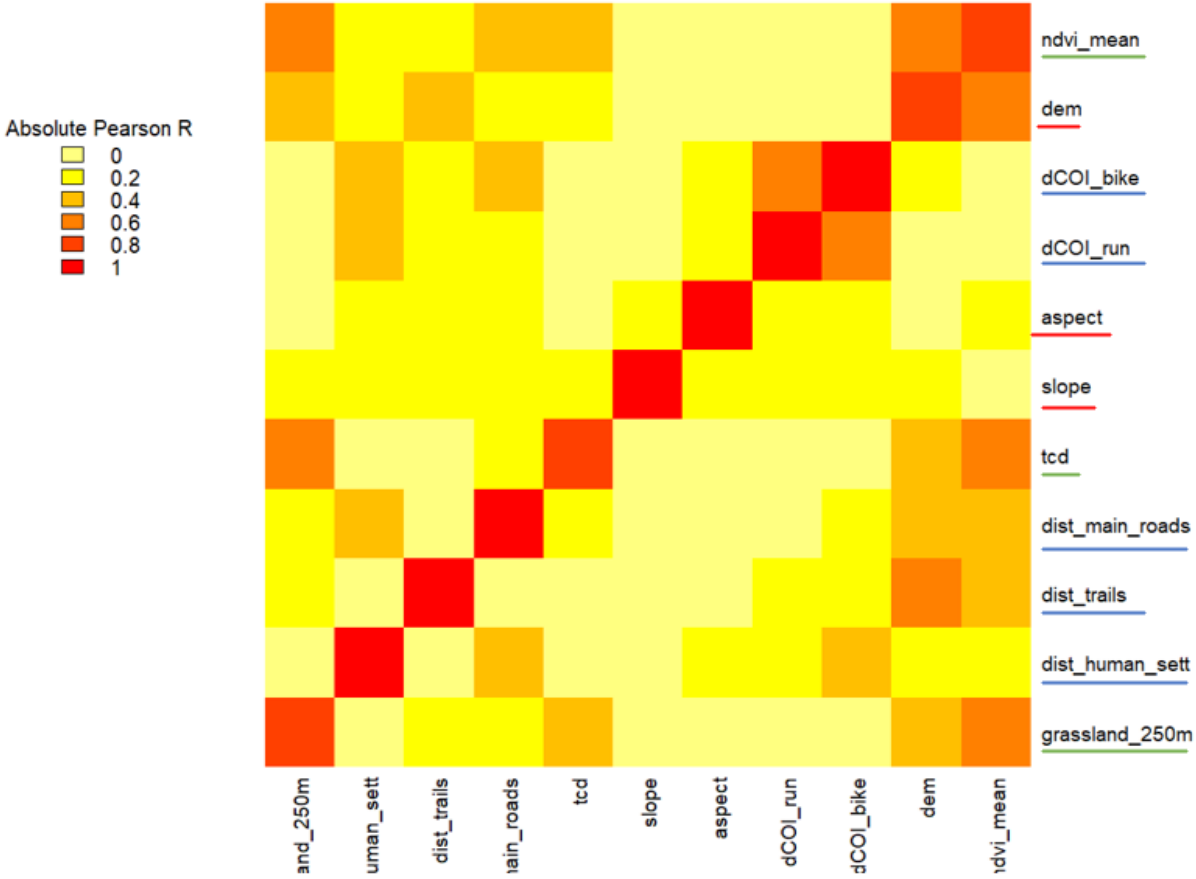
ter Braak, C. (1995). Chapter 5: ordination. – In: Jongman, R. et al. (eds), Data analysis in community and landscape ecology. *Cambridge Univ. Press*, pp. 91–173.

# **EARLY**: from 2/05 to 14/06
N= 1509 observations



- Large-sized species dissociated from human infrastructures and activities.
- Strength of association: generalist vs specialist
- Herbivores: roe deer associated with NDVI; hares slightly associated with open areas.
- Carnivores did not exhibit any evident dissociation from anthropogenic disturbance (case of the red fox)

Environmental variables and their correlation



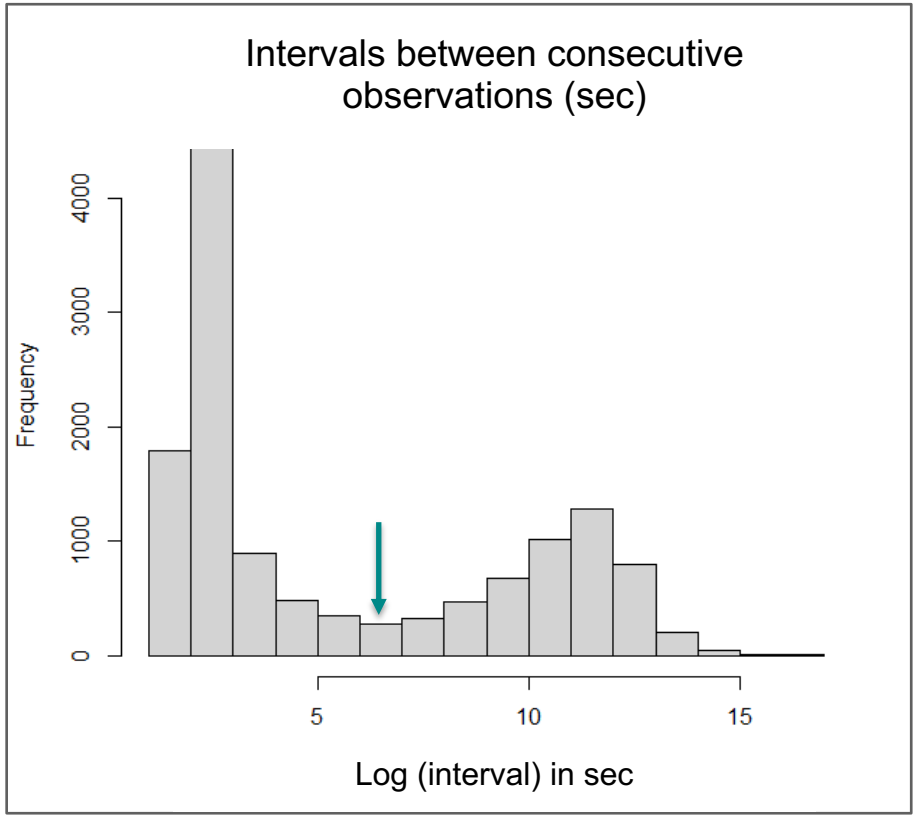
LEGEND:

Vegetation

Topography

Human structures and activities

Temporal independence of observations



to minimise the risk to double count a same individual that paused in front of the camera

It has been found that a few minutes generally suffice (Kays & Parsons, 2014;Kolowski and Forrester, 2017; Oberosler et al., 2017)

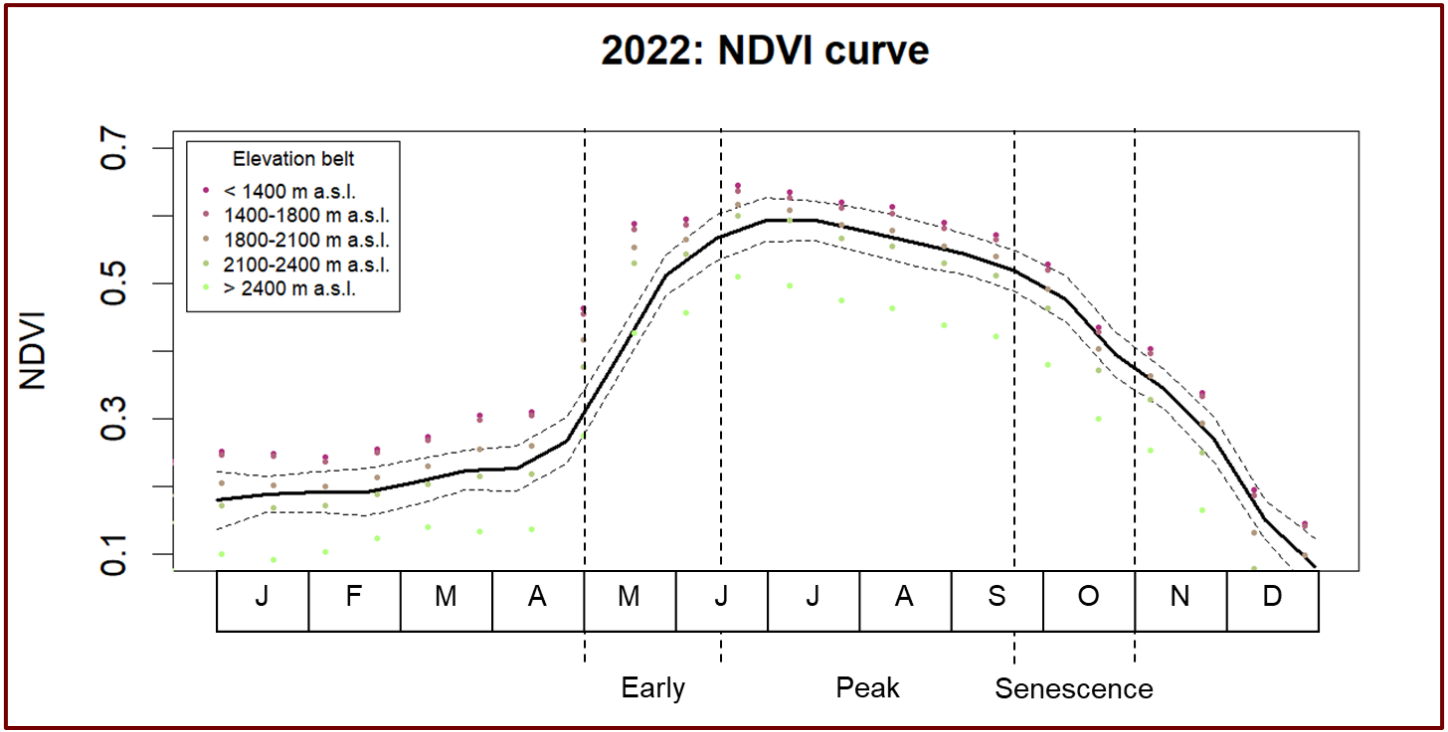
Variables implemented in the RDA

Variable name	Brief description	Category
dem	Elevation (m)	Topography
slope	slope inclination (%)	Topography
aspect	slope orientation (°)	Topography
NDVI	vegetation productivity index	Vegetation
tcd	tree cover percentage	Vegetation
grassland_250m	perc. of grass in a 250m buffer around the camera trap	Vegetation
dist_main_roads	distance to paved and secondary roads (m)	Anthropic (infrastruct.)
dist_trails	distance to hiking trails and footways (m)	Anthropic (infrastruct.)
dist_human_sett	distance to human settlements (m)	Anthropic (infrastruct.)
dCOI_run	outdoor running activity index	Anthropic (activity)
dCOI_bike	outdoor biking activity index	Anthropic (activity)

CAMERA TRAPS

Non-invasive observation and recording of wildlife

- Species composing a community in an area of interest
- Partial definition of ecological niche (Lovell et al., 2022)
- Co-occurrence → niche segregation? (Andrade-Ponce et al., 2022)



Locally estimated scatterplot smoothing (loess) of NDVI (black solid line) for the year 2022 with 90% confidence intervals (dashed lines). The curve is smoothed with a span corresponding to 16 days, i.e. the temporal resolution of the NDVI data (MODIS). The coloured dots represent the raw NDVI data extracted at five elevations belts.

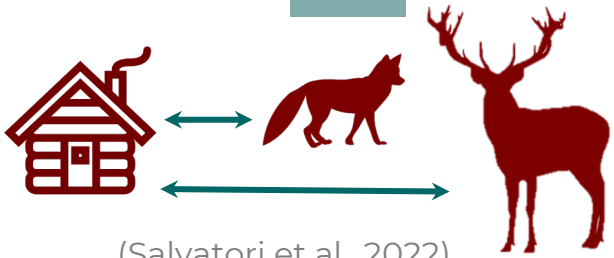
OBJECTIVE 1

To assess the **assemblage** of medium- to large- sized Alpine terrestrial mammals in relation with a set of **environmental** and **anthropic** drivers

HYPOTHESIS 1

Both environmental heterogeneity and anthropogenic pressures significantly affect species **occurrence** and community **assemblage** (Tews et al, 2004; Nickel et al., 2020)

P1.1



(Salvatori et al., 2022)

P1.2

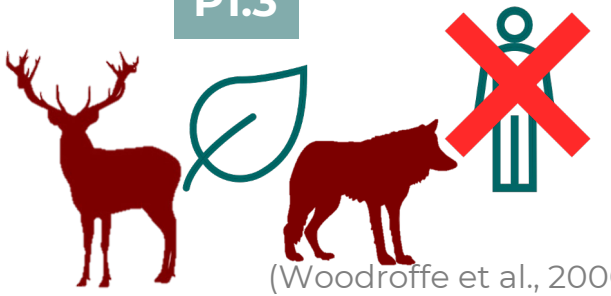
Generalists

VS

Specialists

(Kassen et al., 2002)

P1.3



(Woodroffe et al., 2000)

OBJECTIVE 2

To evaluate the spatiotemporal **association** and potential niche overlaps within the guild of **ungulates**

HYPOTHESIS 2

Red deer, roe deer and chamois **associate differently** with environmental and anthropogenic drivers

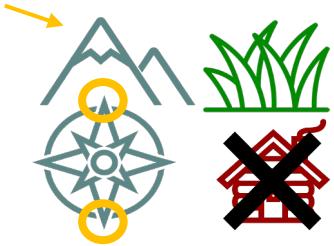
P2.1, P2.2

(Rivrud et al., 2016; Salvatori et al., 2022)

P2.3, P2.4

(Cagnacci et al., 2011; Andersen et al., 1998 Salvatori et al., 2022)

P2.5, P2.6, P2.7



(Kati et al., 2020; Salvatori et al., 2022)

OBJECTIVE 2

To evaluate the spatiotemporal **association** and potential niche overlaps within the guild of **ungulates**

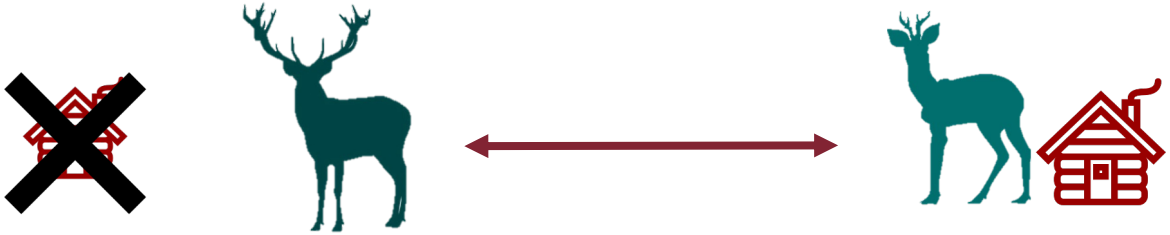
HYPOTHESIS 3

Seasonally-varying association between the species of the Ungulate guild

P3.1

(Rivrud et al., 2016)

P3.2

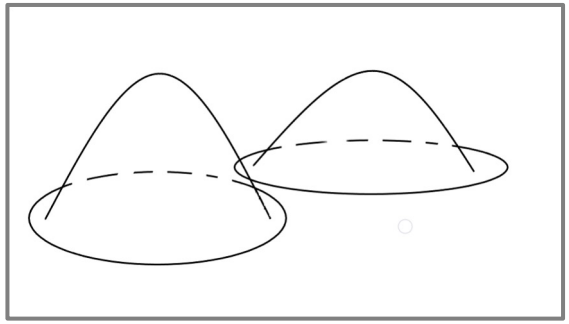


(Salvatori et al., 2022)

Ecological niche theory (Hutchinson, 1957)

CO-OCCURRENCE

Niche segregation in: time - space - resources



SYMPATRY

Competition

- Exploitation → resources
- Interference → behaviour

EXCLUSION