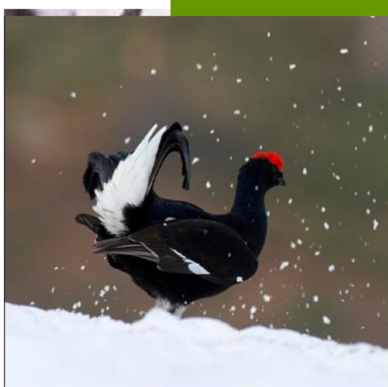

Alpine biodiversity storyline

R. Viterbi, C. Cerrato (GPNP)
A. Provenzale (CNR-IGG)

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General Assembly, 28 June 2016, Texel, NL

- Mountain habitats support some of the world's most rare and fragile ecosystems
- Mountain environments are especially sensitive to climate and environmental change (e.g., elevation dependent warming)
- Biodiversity in mountain areas can be severely affected by environmental change

Goal of the storyline: make best use of the data that describe animal biodiversity along altitudinal gradients and identify the parameters influencing species distribution

Baseline against which identify future changes

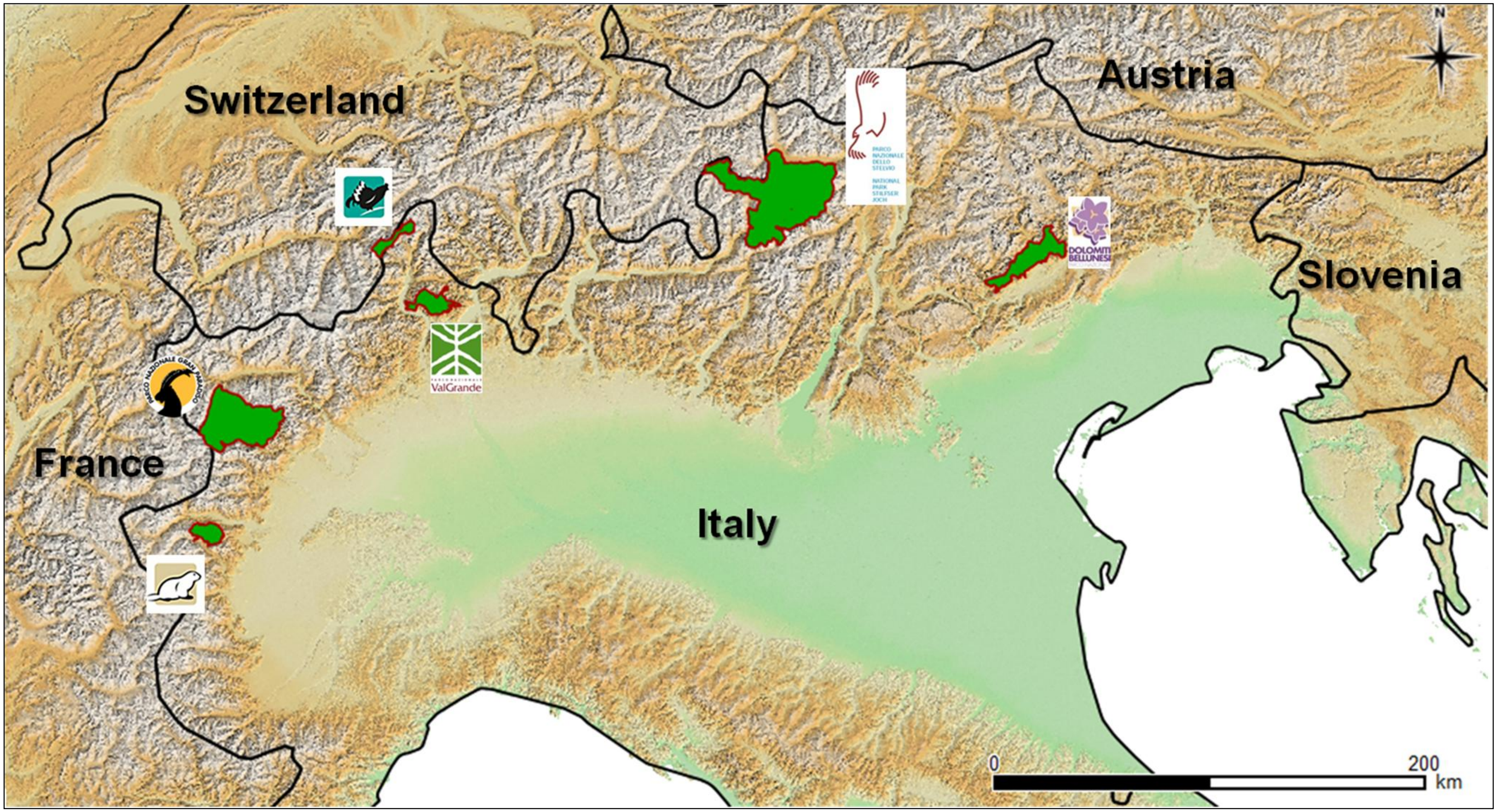
Tool for estimating conservation value

Planning highly focused conservation action

Active management to reduce environmental stressors

• <u>*Sampling design*</u>

Geographic coverage: Italian Alps, from W to E



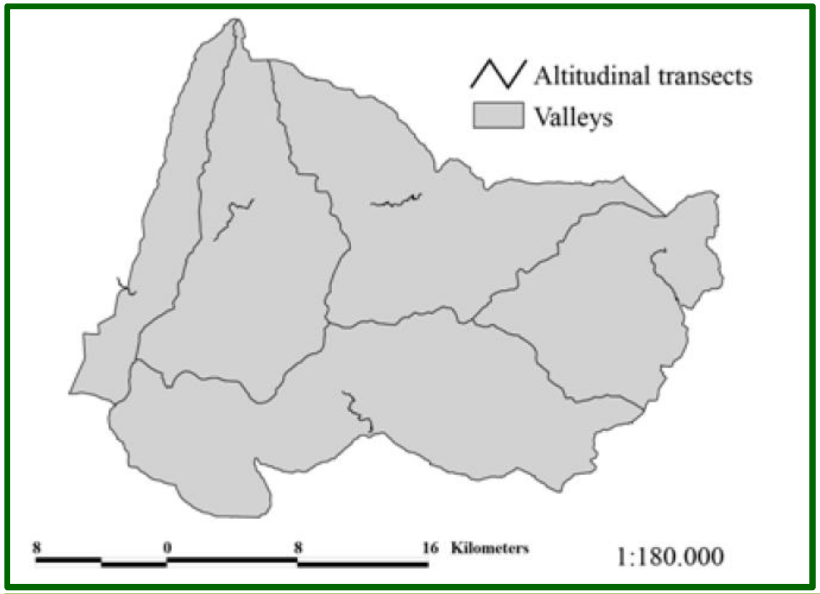
A multi taxa approach to assess pattern of congruence and diversity

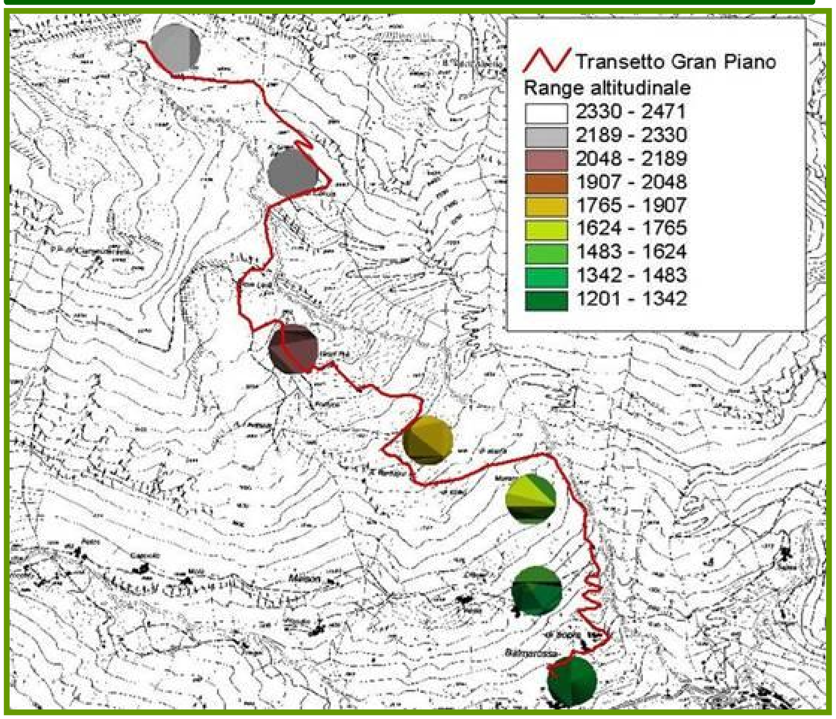
To set the basis for the development of a long term monitoring scheme, focused on multi-taxa community data sampled with easy, cheap and semi-quantitative methodologies

2006-2007 — 4 yrs stop — 2012-2013 — 4 yrs stop — 2018-2019 — – – –

MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE

• *Sampling design*





Altitudinal transect:

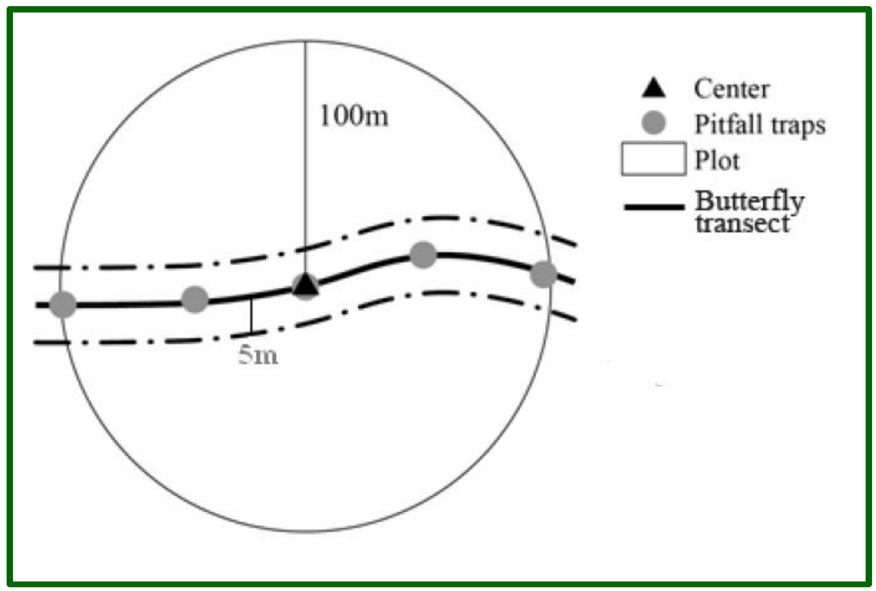
- 6-7 plots per transect

Difference in height between plots:

- 200 m
- independence

Sampling unit:

- plot with a radius of 100 m
- 1 diameter easy to walk trough

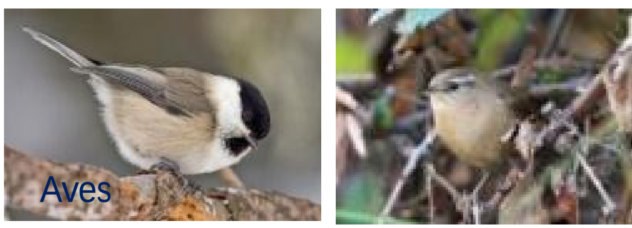


• Sampling methodology

7 taxonomic groups

Pitfall traps

9-10 samplings
May-September
every 15 days



Point counts

2 samplings
April-July

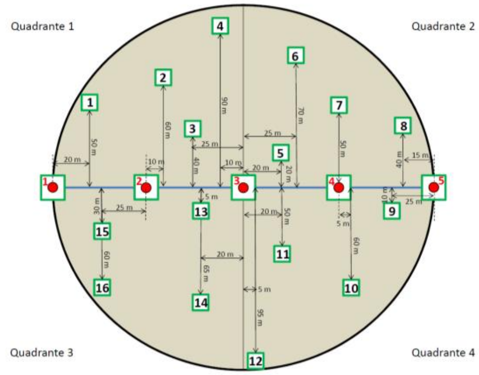
Linear transects

Butterflies:
- 5 samplings
- May-September

Grasshoppers:
- 3 samplings
- July-September

• Plot characterization

1. First Description



Dominant habitat types

Anthropic pressure

Micro-habitat

21 random points

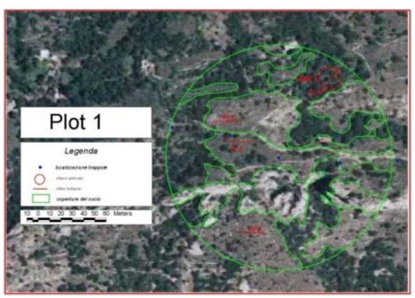
Datalogger: Thermochron iButton, DS1922L

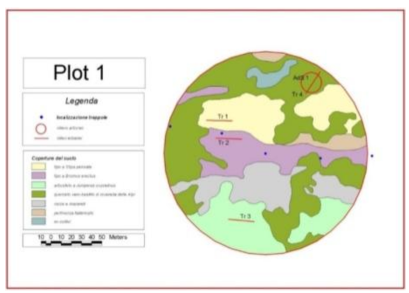
Set: data every hour, resolution of 0.5°, May-October

2. Botanical surveys

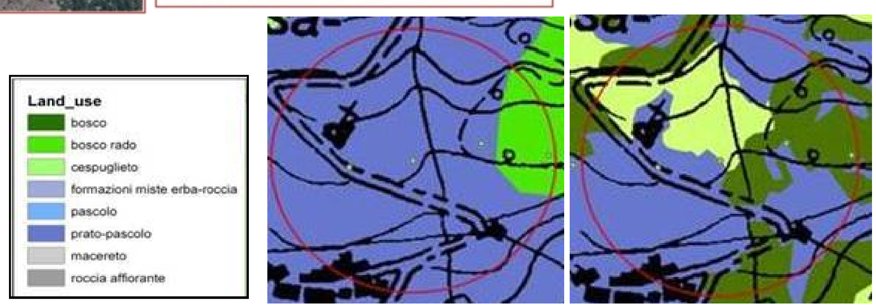
3. Quantification of habitat types

Analysis of aerial photos, satellite images (NDVI, vegetation cover, soil moisture, snow) and field-based vegetation maps





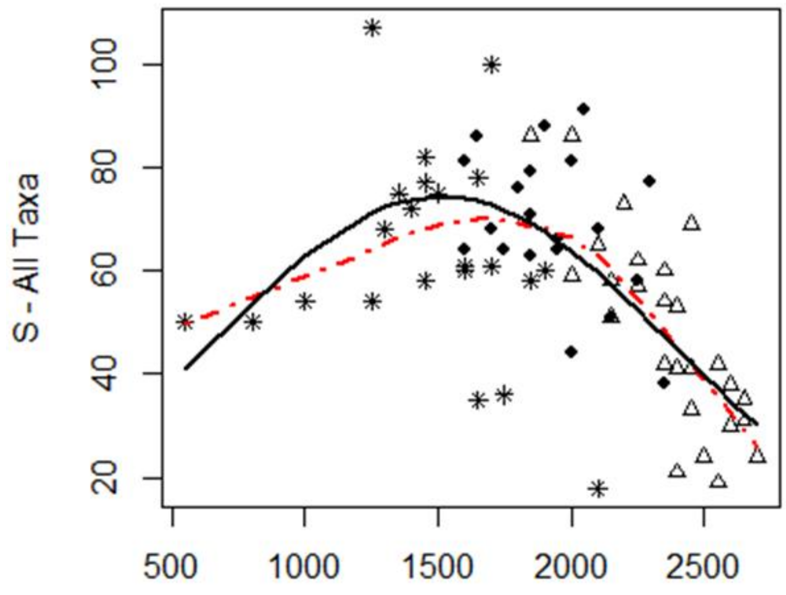
Drone mapping systems (*experimental*)



Images of plots regularly spaced in time (every 5 years)

in collaboration with theGPNP Botanical Service

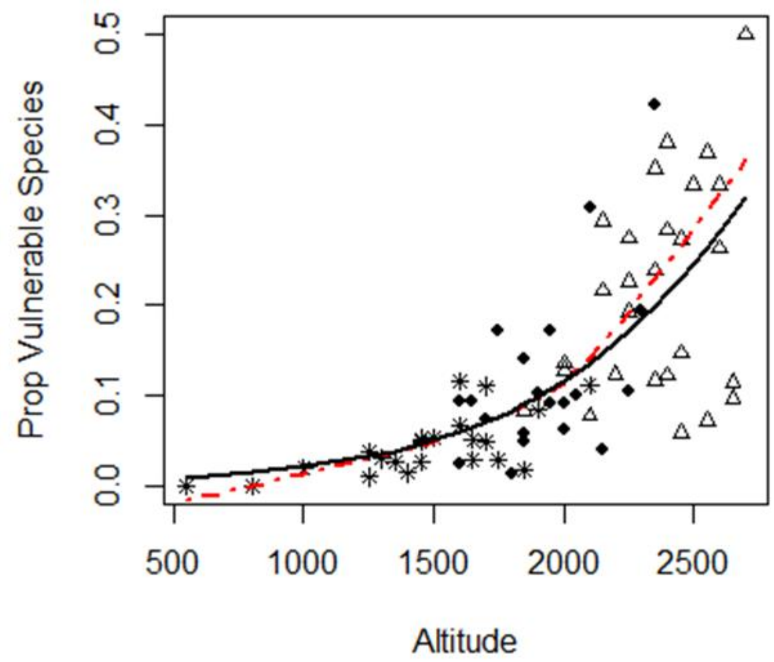
Describe animal biodiversity along altitudinal gradients and identify the parameters influencing species' distribution (Viterbi et al. 2015)



Species Richness

Hump-shaped decline

$S = exp\ (2.841 + 0.002\ Alt - 6.420e^{-07}\ Alt^2)$
$D^2_{adj} = 0.425$
$p < 0.0001$

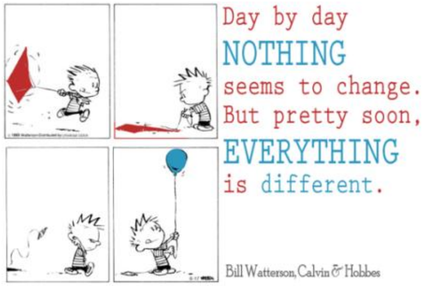


Vulnerable and Endemic Species

Increase with altitude

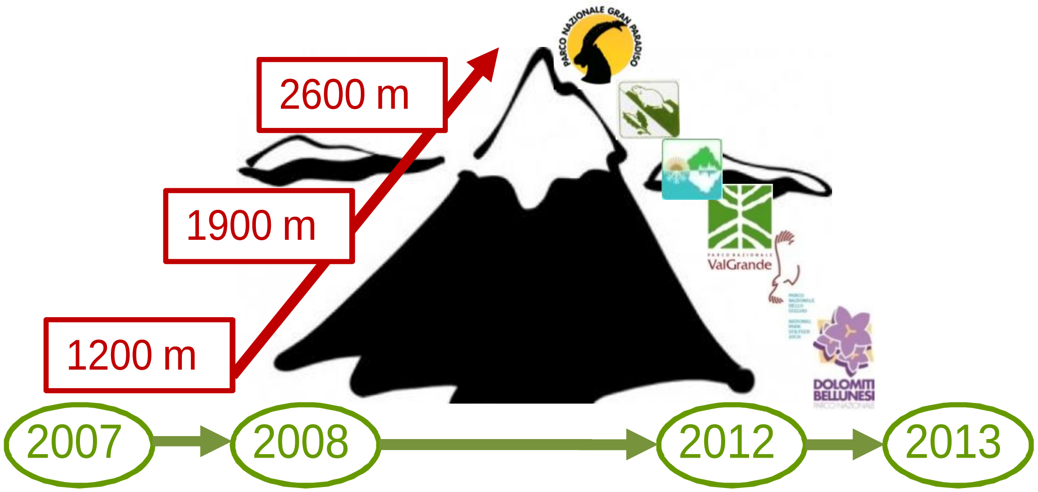
logit (proportion of vulnerable species) = –5.701 + 0.002 Alt
$D^2_{adj} = 0.535$
$p < 0.0001$

Temporal and Spatial β-diversity



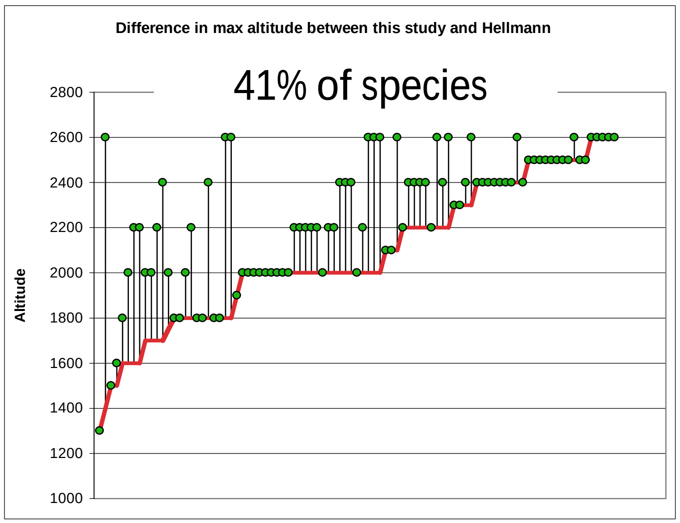
- Changes in community structure through space and time

Species or functional groups responsible of change

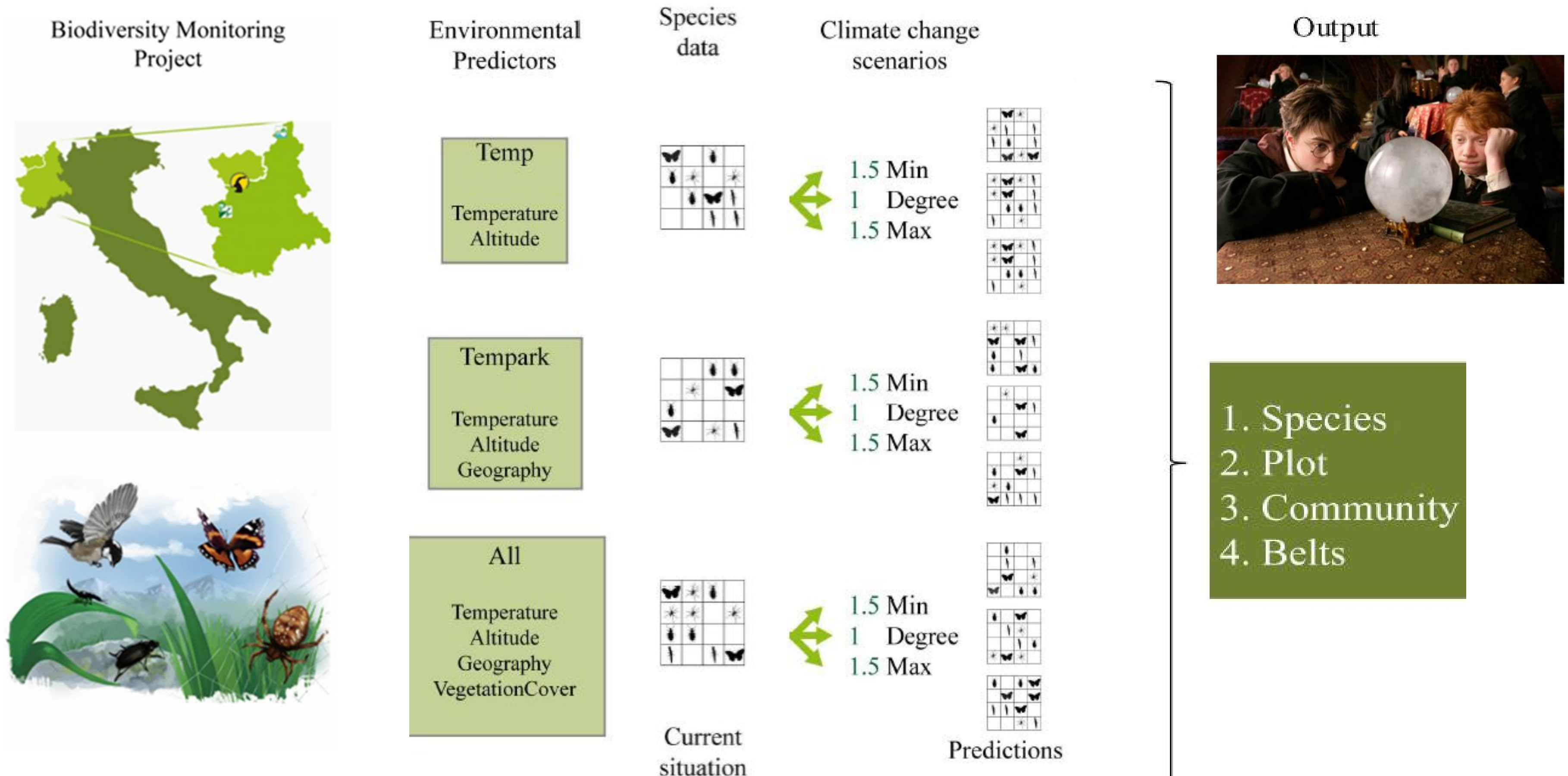


- Comparison with historical datasets

1996- 2006 Mean differences 380 m



Estimate the risk of biodiversity loss by using what-if climate change scenarios



- Increasing complexity of environmental variables
- "*What if*" temperature scenarios, based on literature data
- Stacked SDM
- Species richness and community composition
- Simulation at plot scale (69 plots)

Simulations at Species Level

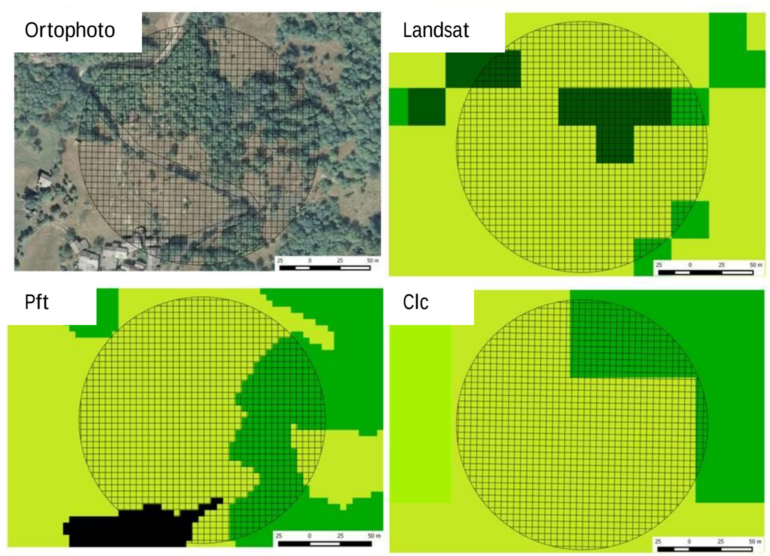
Key *indicator species*, for each taxon, selected from the field surveys

- Different functional groups
- Altitudinal specialists *vs* generalists

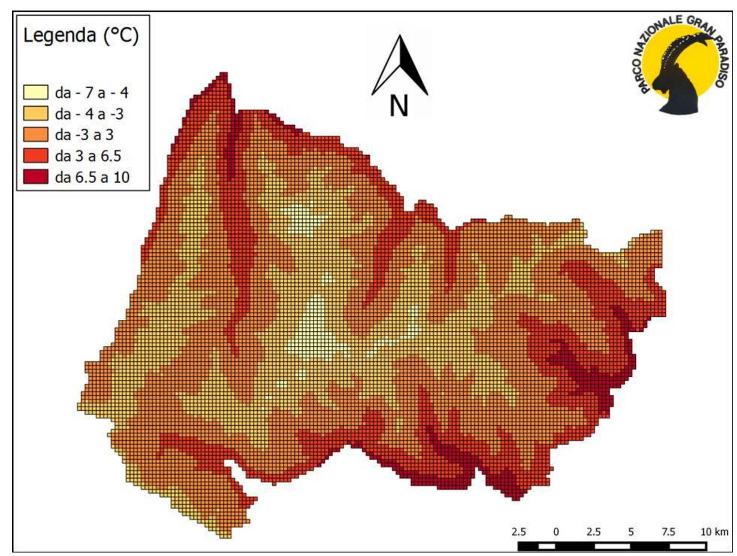
Data on *bioclimatic limits* obtained from regional data

Explanatory variables at landscape level (simulation over the whole Parks)

- Land Cover

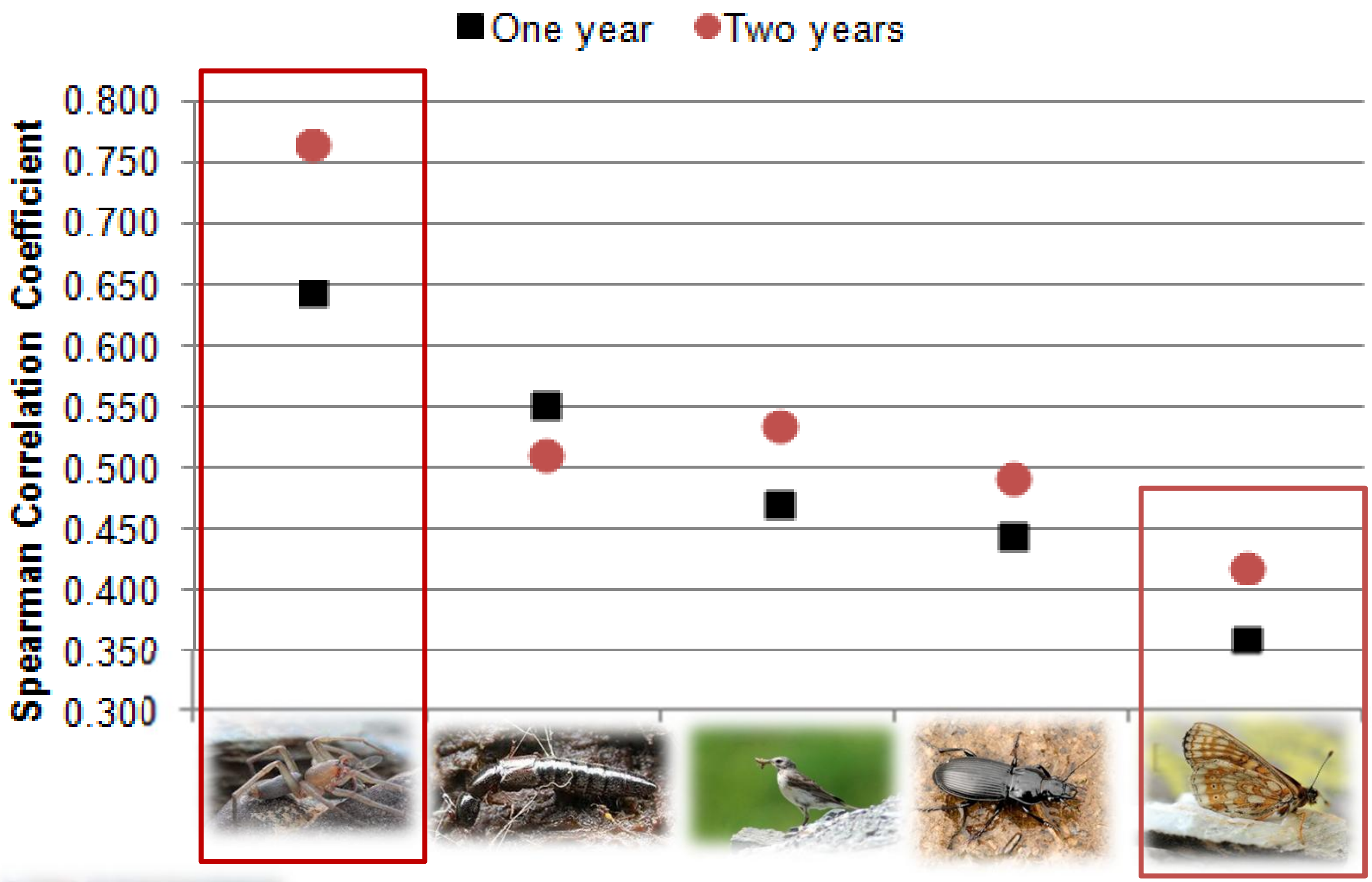


- Climatic Maps



Identify the (group of) species and the habitat type more sensitive to environmental and climatic changes, which can be used as biodiversity/ecological indicators

Biodiversity Surrogates



One year ρ=0.645, p<0.001

Two years ρ=0.765, p<0.001

Identify the (group of) species and the habitat type more sensitive to environmental and climatic chang
which can be used as biodiversity/ecological indicators

Improve mechanistic understanding of biodiversity

Not only species richness!

- Functional Diversity

Detailed ecological information

- Body size along altitudinal gradient

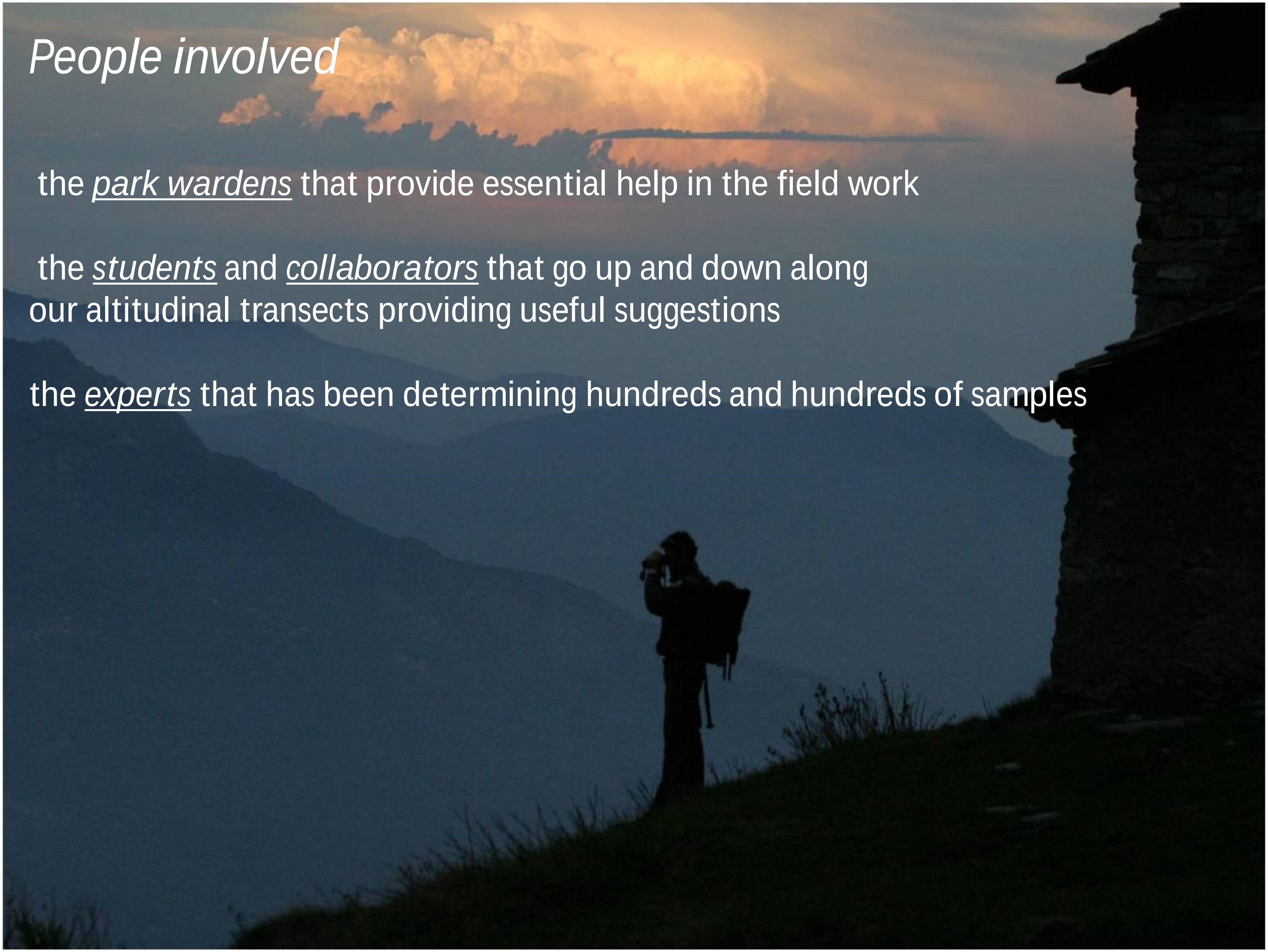
Using carabids as a model taxon

- Species and community composition estimators

- Climatic/environmental indicators

Differences between communities

Single species as indicators



People involved

the *park wardens* that provide essential help in the field work

the *students* and *collaborators* that go up and down along our altitudinal transects providing useful suggestions

the *experts* that has been determining hundreds and hundreds of samples