







Monitoring animal biodiversity in Italian Alps

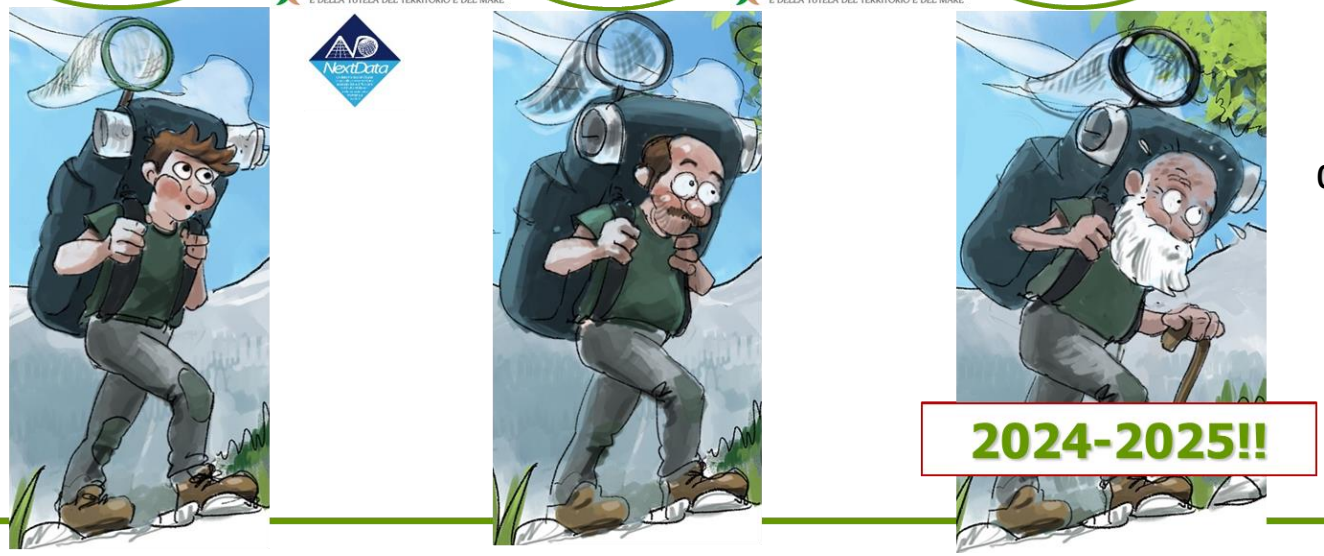
Cogne, 20 gennaio 2023

Aims

A multi taxa approach to assess pattern of congruence and diversity

2006-2008 — 4 yrs stop — **2012-2014** — 4 yrs stop — **2018-2019**

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



2024-2025!!

To set the basis for the development of a long term monitoring scheme, focused on multi-taxa community data

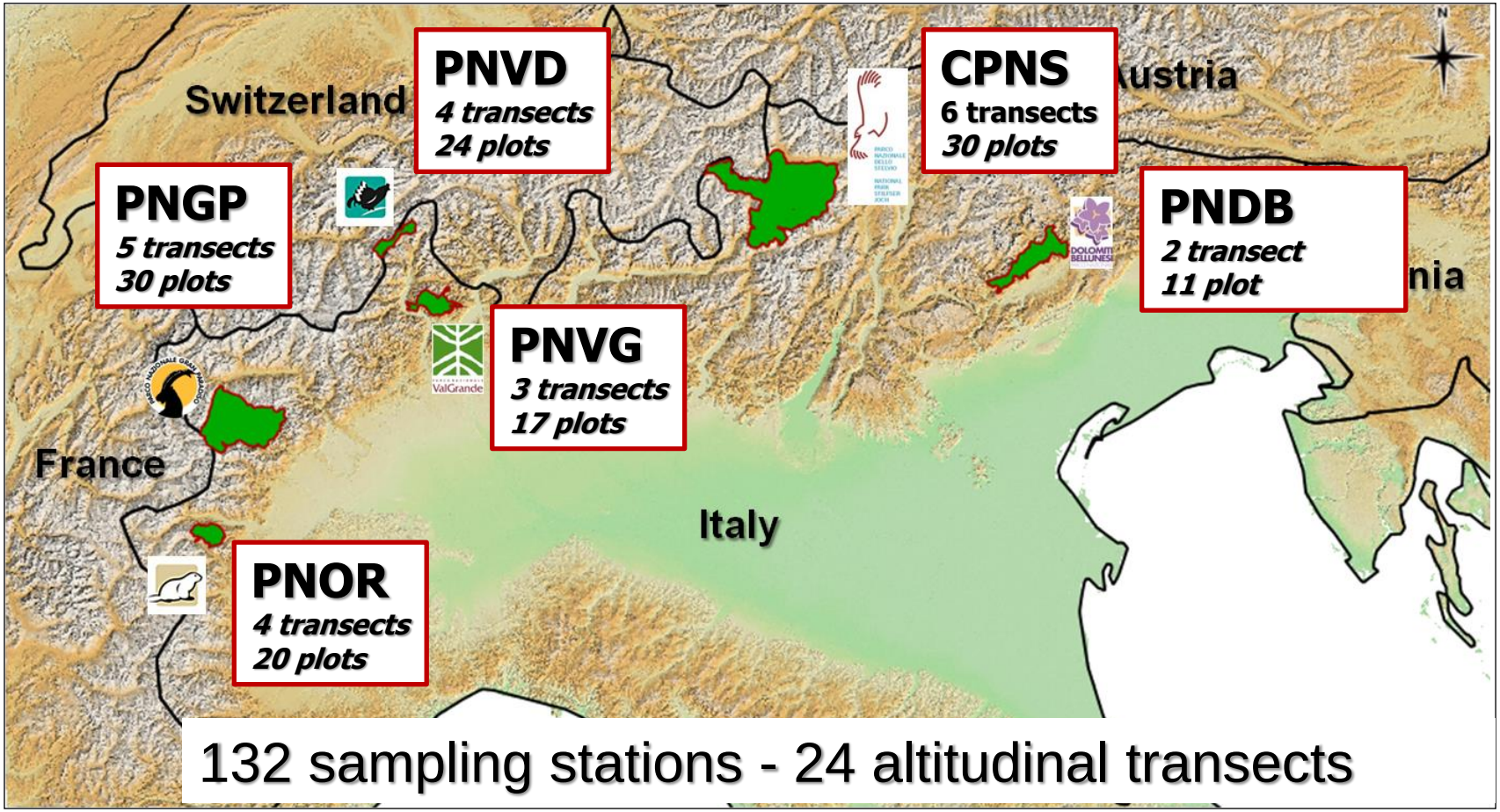
1. To describe animal biodiversity along altitudinal gradients and identify the parameters influencing species' distribution

2. To estimate the risk of biodiversity loss,
also through the application of climate change scenarios

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

Protocol

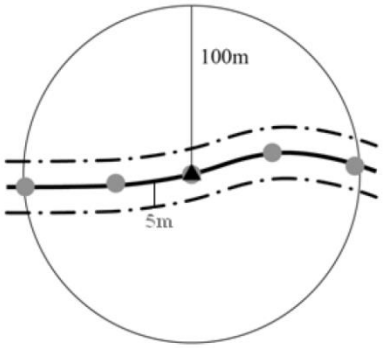
MINISTERO DELL'AMBIENTE
E DELLA TUTELA DEL TERRITORIO E DEL MARE



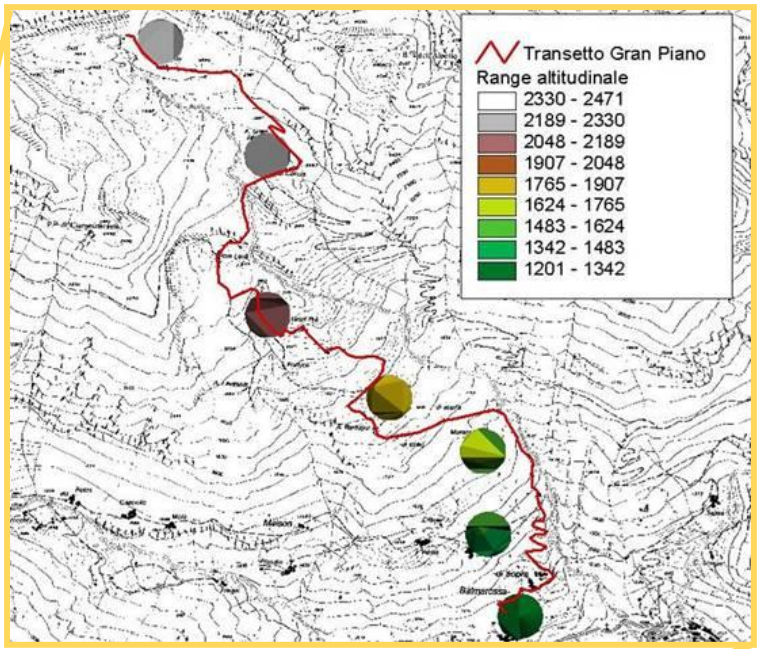
First monitoring sessions– 3 parks: 2006-2008
Second monitoring sessions– 6 parks: 2012-2014
Third monitoring sessions – 6 parks: 2018-2019

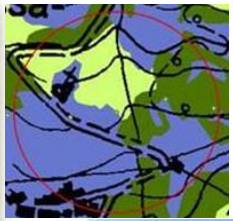
Protocol

Altitudinal gradients



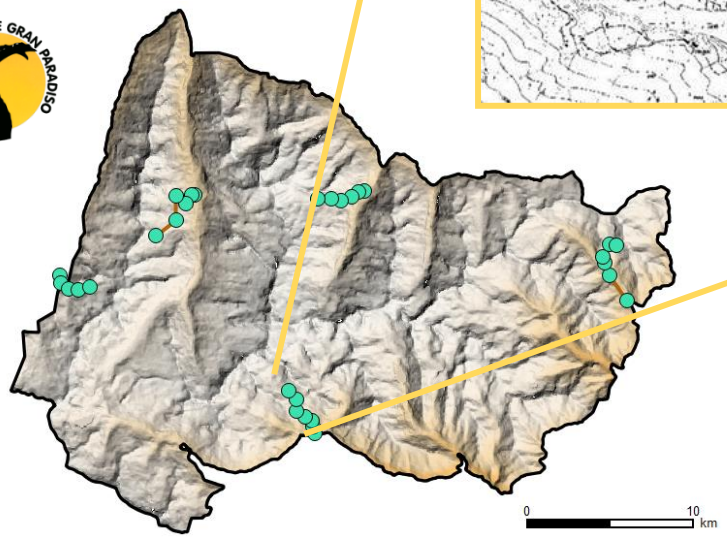
Natural laboratories to study ecosystem dynamics, biodiversity, and species' distribution response to climate gradients





PNGP

30 plots
5 valleys
6-7 plots for each valley
Altitudinal range: 1200-2700 m a.s.l.



Carabidae
Araneae
Staphylinidae
Formicidae
Lepidoptera: Papilionoidea, Hesperioidea
Ortopthera
Aves

Because of the complexity of biodiversity, surrogates such as subsets of species, species assemblages and habitat types have to be used as measures of biodiversity

Margules and Pressey (2000) Systematic conservation planning. Nature 405

Organism that shows the overall health of an environment

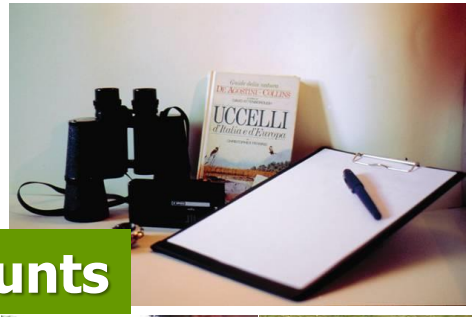
Sentinels of climate change!!!

Indicator species: One or more taxa selected based on its sensitivity to a particular environmental attribute, and then assessed to make inferences about that attribute. Commonly used in the context of wildlife conservation, habitat management and ecosystem restoration (Simberloff, 1998; Morrison, 2009; Caro, 2010, Siddig et al., 2015).




Pitfall traps

Point counts

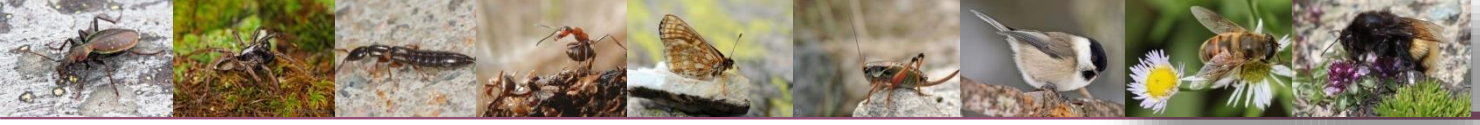



Line transect


Census techniques as much as possible

- Easy to apply
- Standardized
- Cheap

Repeatability over time and space



Methods

- Continuous monitoring over time (butterflies, birds, microclimate)




4 years stop

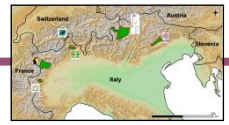
4 years stop

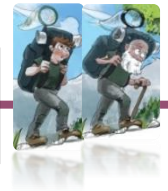

- Test the capability of new taxa to act as biodiversity indicator and test the best method to census

Bumblebees (Hymenoptera Apoidea, gen. *Bombus*)

Sirphids (Diptera Syrphidae)

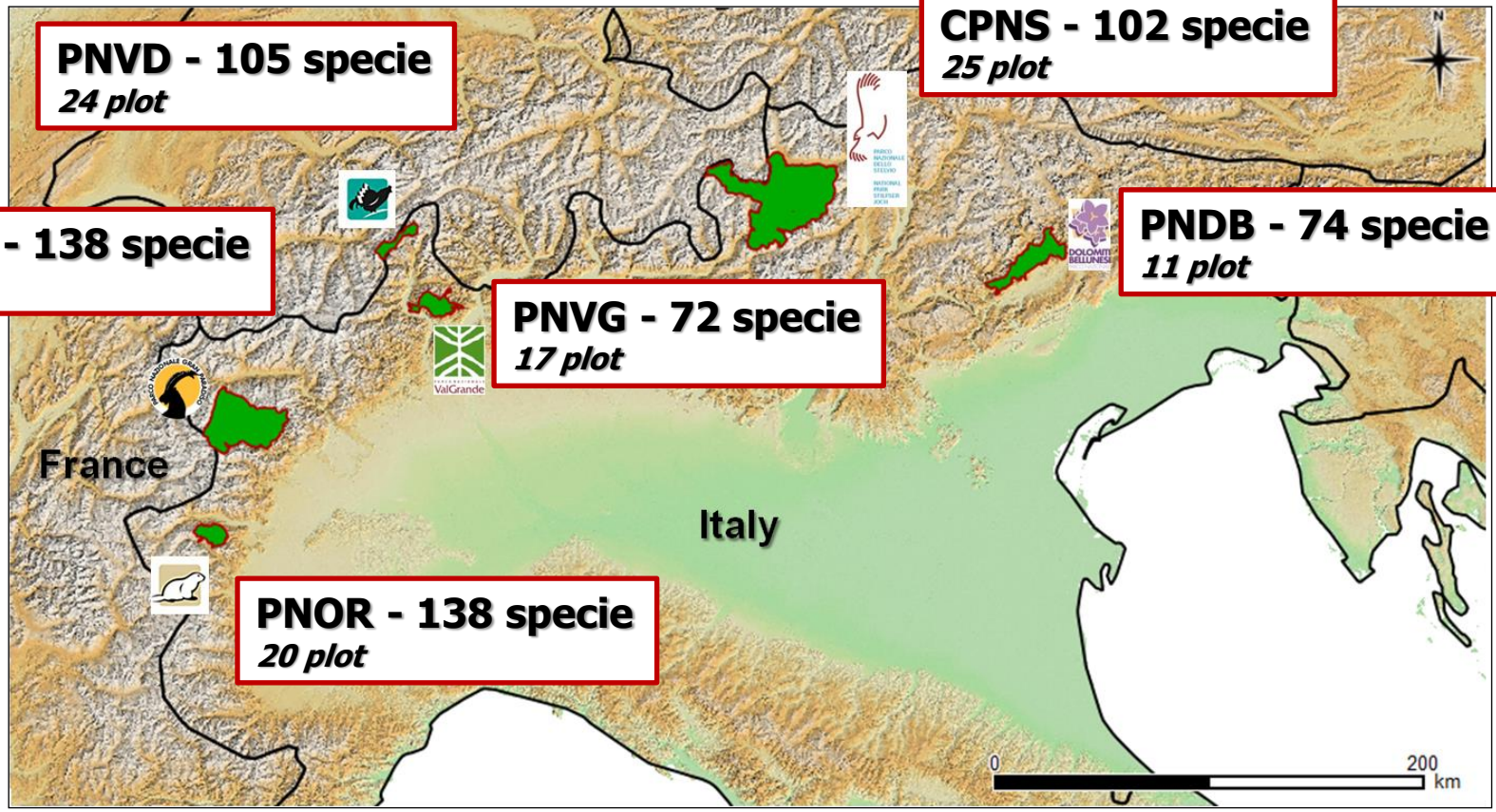

- Data storage, harmonization and analysis





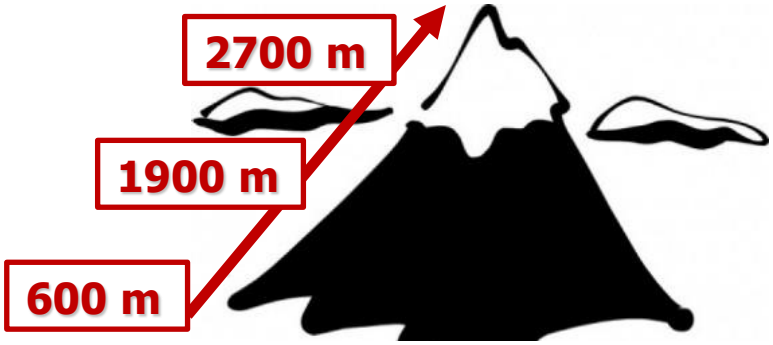
Butterflies species richness over space and time

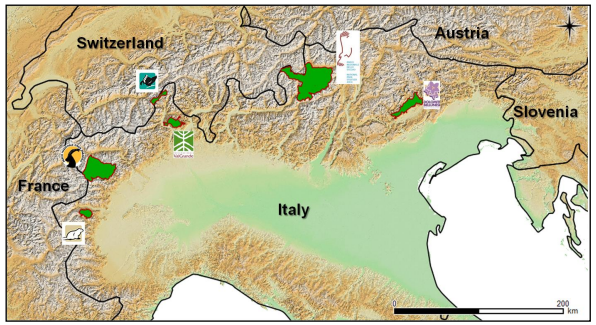
Total species in the two monitoring sessions(2012-2013 vs 2018-2019): ***169 =*** **58%** of the Italian species *(290 species, Balletto et al. 2014)*



Variables influencing the plot's species richness

First results





All the variables considered significantly influence the distribution of species richness per plot

In both the sampling session (two years monitoring)

Ricchezza specifica ~ Area Protetta***

+ Altitudine*** + Altitudine^2**

+ Habitat dominante**

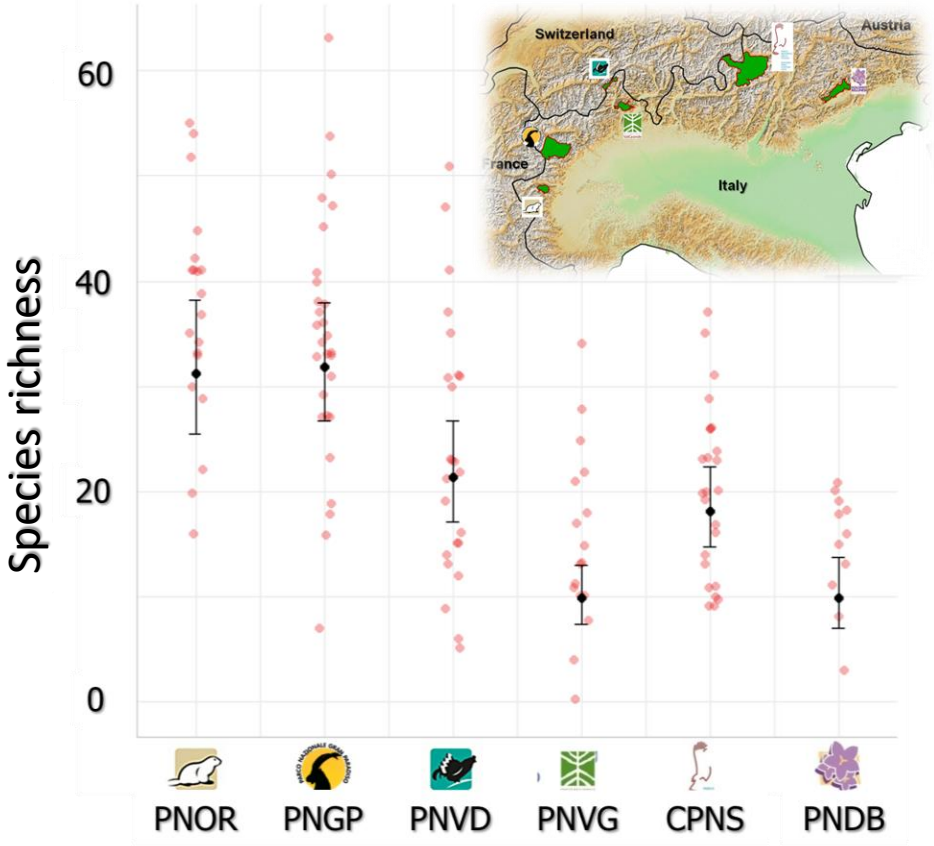
Primo biennio

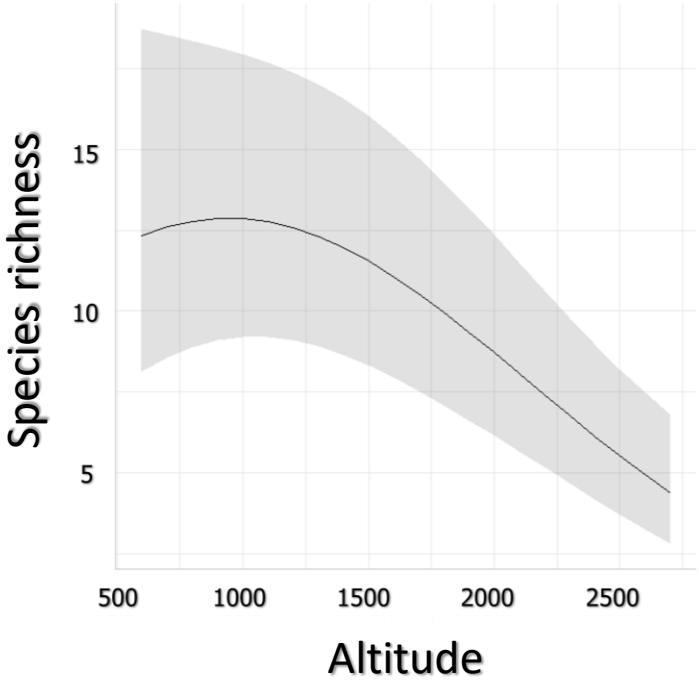
R^2marginal = 0.91

R^2conditional = 0.97

GLMM (Modelli Lineari Generalizzati), fattore random "Valle" (ovvero Transetto altitudinale)
Distribuzione della variabile di risposta (Ricchezza Specifica): Binomiale Negativa
Selezione del modello migliore tramite AICc
Software R; pacchetti *glmmTMB*, *MuMIn*, *car*

Variables influencing the plot's species richness





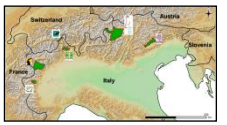
Longitudinal gradient?

Pink: Observed species richness per plot
Black: Medium value model estimated (with confidence interval 95%)

PNOR	PNGP	PNVD	PNVG	CPNS	PNDB
37.2 ± 2.3	34.4 ± 2.2	23.8 ± 2.5	15.3 ± 2.1	20.1 ± 1.6	14.7± 1.7

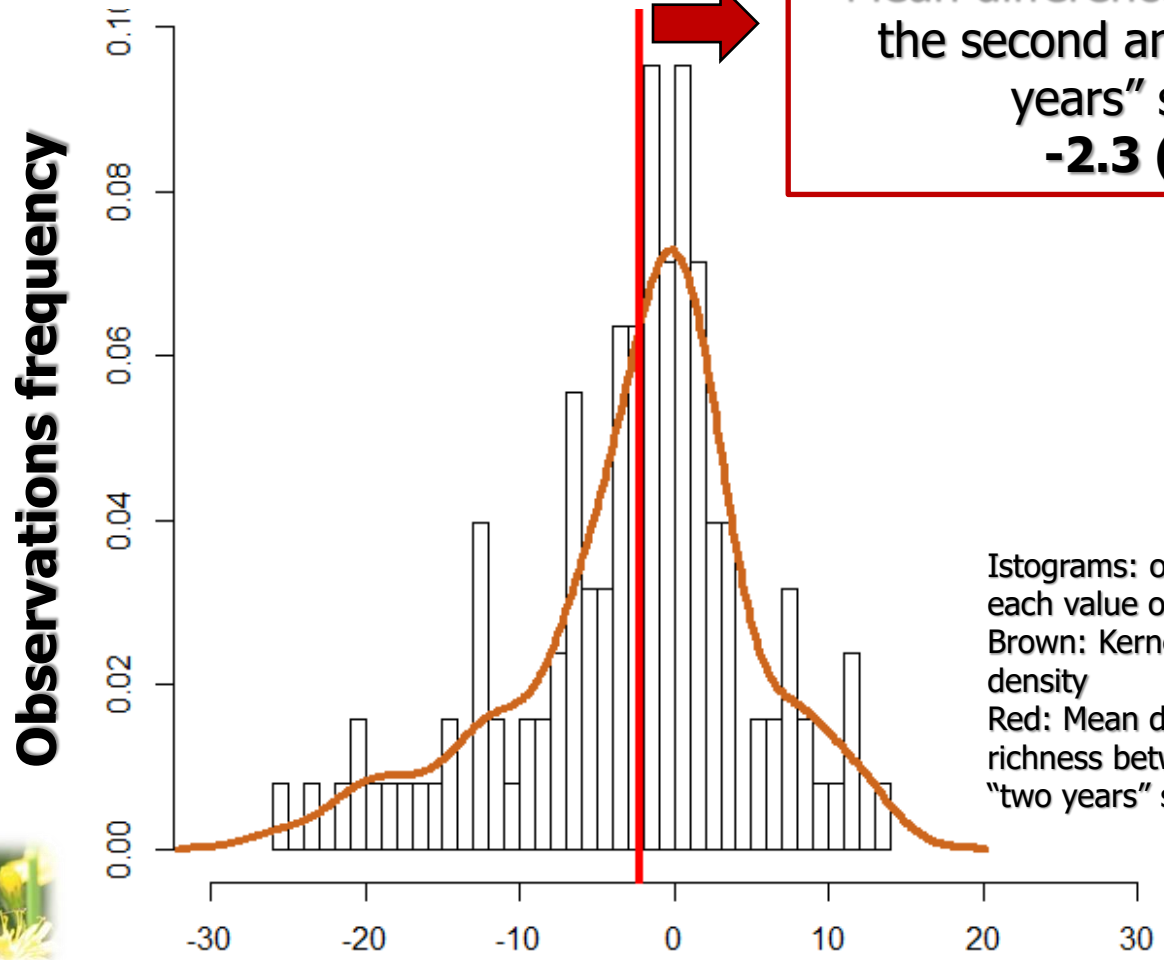
Mean species richness (± es) per plot

Species richness per plot over time



Slight, but significant decrease

T-test for paired, 126 plot, 999 permutationi
t = -3.36, p = 0.003

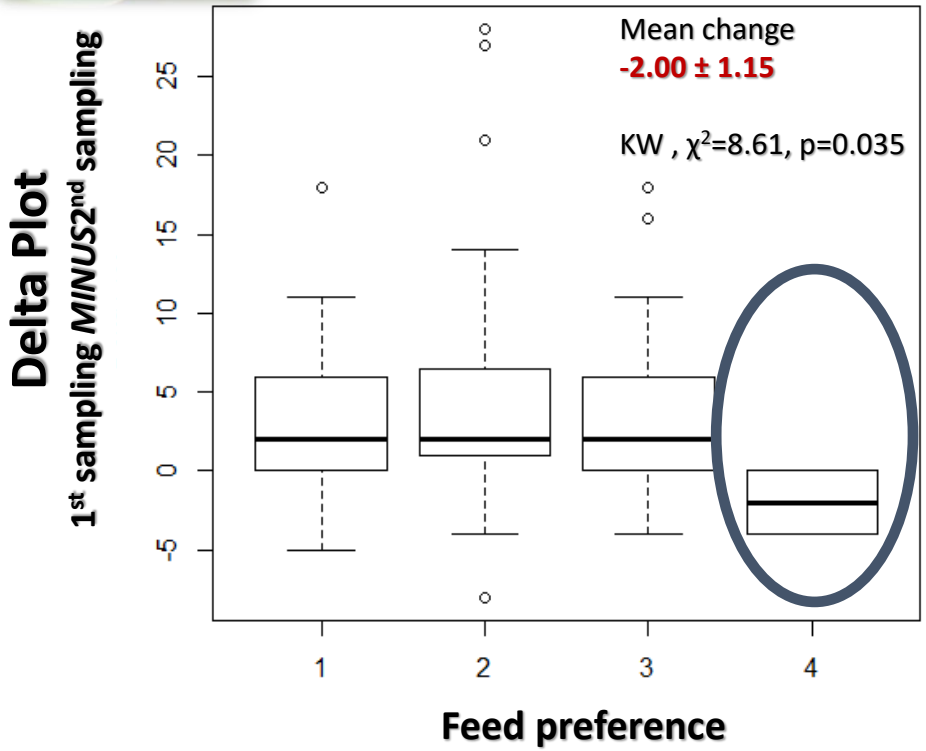


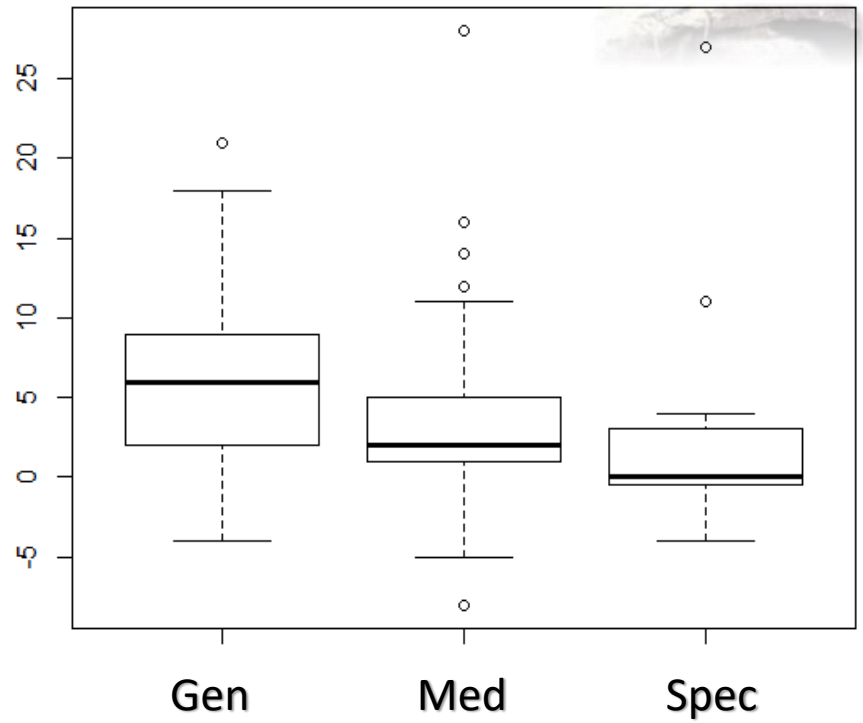
Mean difference (± es) between the second and the first "two years" session =
-2.3 (± 0.7)

Istograms: observations frequency for each value of SII - SI
Brown: Kernel estimate of observations' density
Red: Mean difference (± es) of species richness between the second and the first "two years" session

First results

Monofagus species and altitudinal specialist significant differ

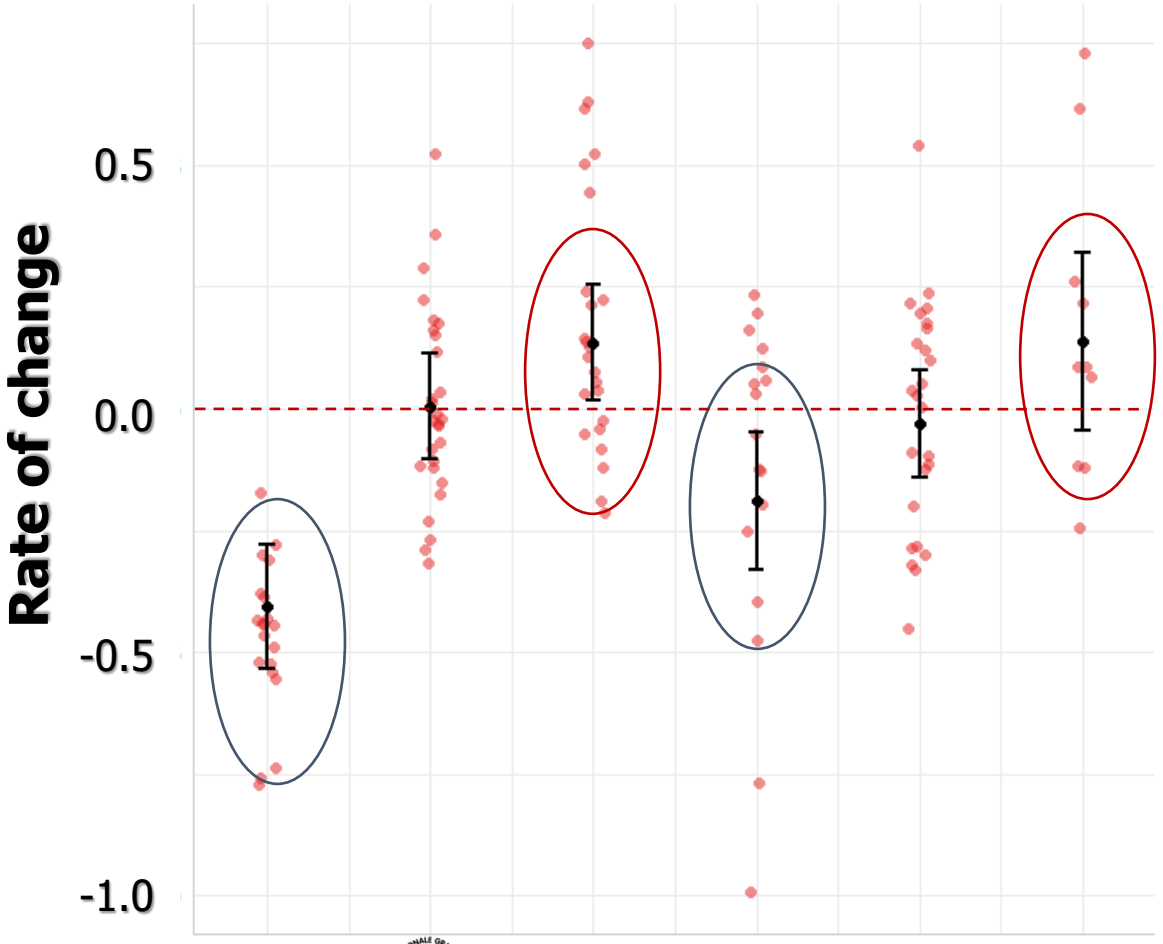




Gen: generalist (all the gradient)
Med: medium (2-3 belt)
Spec: specialist (1 belt)

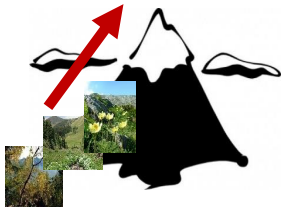
Ecological classification from Balletto et al. (2015)

Pattern in the rate of change?



PNOR	PNGP	PNVD	PNVG	CPNS	PNDB
-0.4 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	-0.2 ± 0.1	0.0 ± 0.0	0.3 ± 0.2

This project provides to the parks useful instruments:



In the ***short time***:

-better knowledge of the protected area

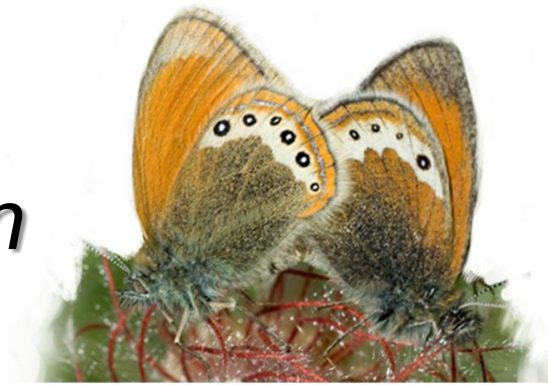
-adress the management actions and conservation plans

In the ***long time and space***:

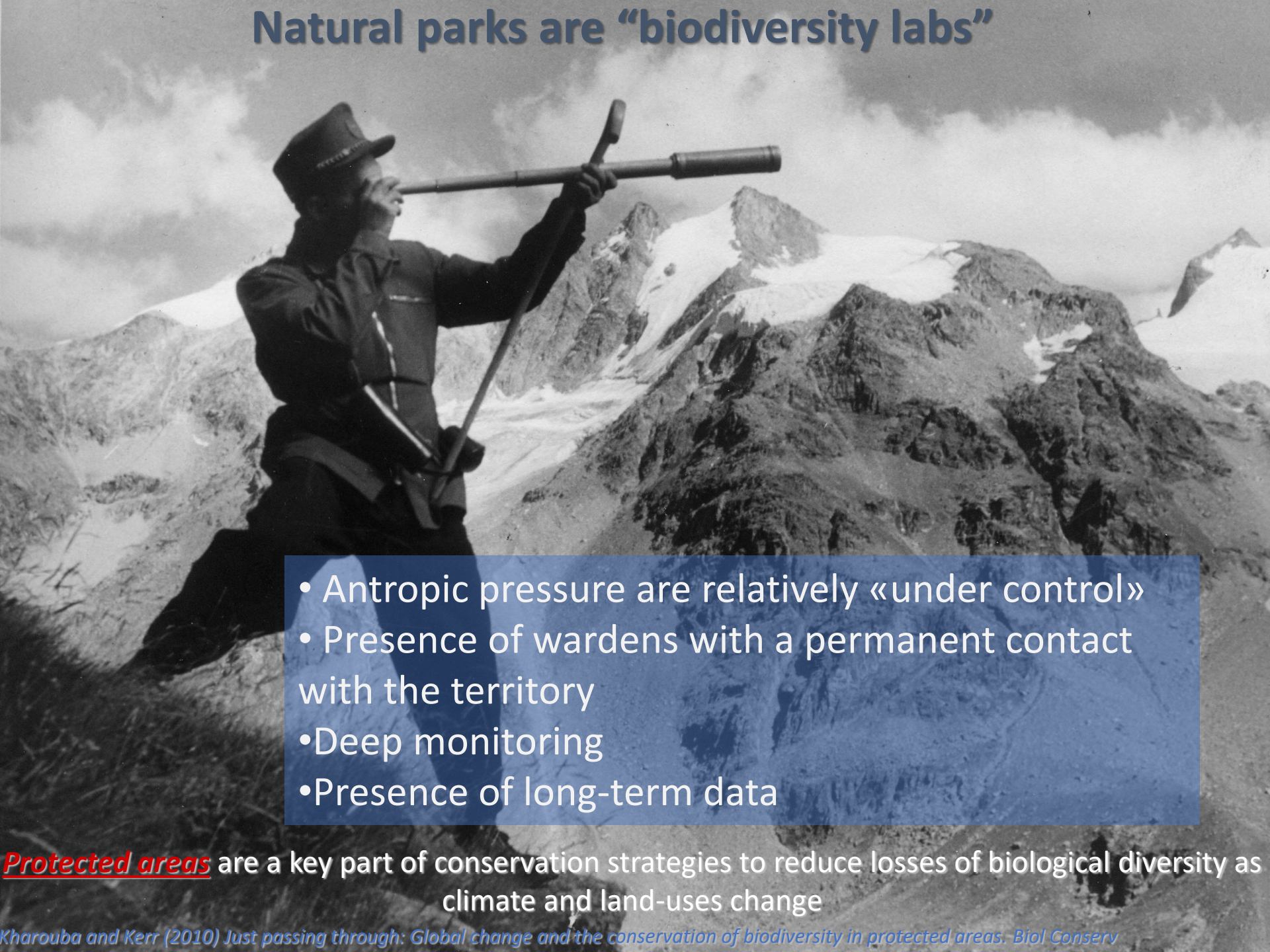
-litmus test of any change

-effectiveness of management action

Parks should act as test for non protected areas



Natural parks are “biodiversity labs”



- Antropic pressure are relatively «under control»
- Presence of wardens with a permanent contact with the territory
- Deep monitoring
- Presence of long-term data

Protected areas are a key part of conservation strategies to reduce losses of biological diversity as climate and land-uses change

Kharouba and Kerr (2010) Just passing through: Global change and the conservation of biodiversity in protected areas. Biol Conserv

Thanks specially to:

all the ***parks*** (Directors, technicians and wardens) that enthusiastically join the project

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

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

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

Thanks for your attention !!