Analysis of the effect of forest canopy on snow distribution

a snow monitoring initiative in the Spanish Pyrenees based on ground data

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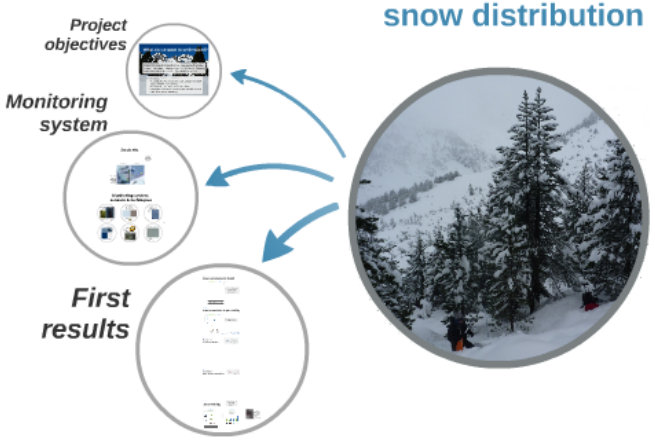

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WORKSHOP: Snow monitoring and modeling initiatives in Spain based on ground and satellite data, in collaboration with the COST ES1404 Action.

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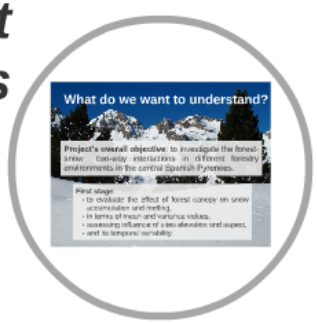
Project objectives



Monitoring system

First results

What do we want to understand?

Project's overall objective: to investigate the forest-snow two-way interactions in different forestry environments in the central Spanish Pyrenees.

First stage:

- to evaluate the effect of forest canopy on snow accumulation and melting,
- in terms of mean and variance values,
- assessing influence of sites elevation and aspect,
- and its temporal variability.

Analysis of the effect of forest canopy on snow distribution

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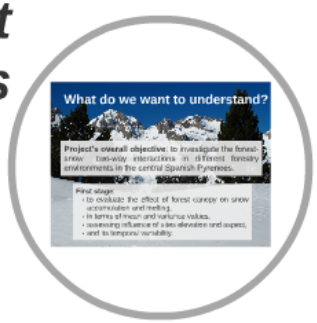
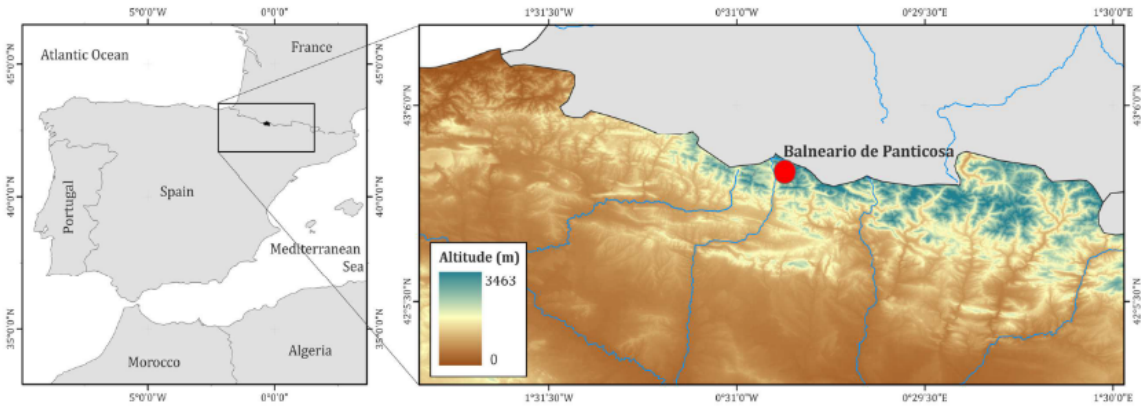


Monitoring system

First results

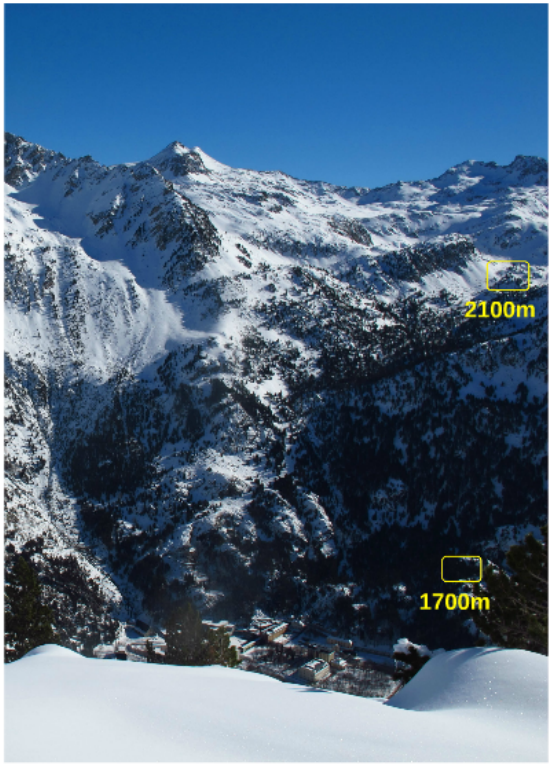
Study site

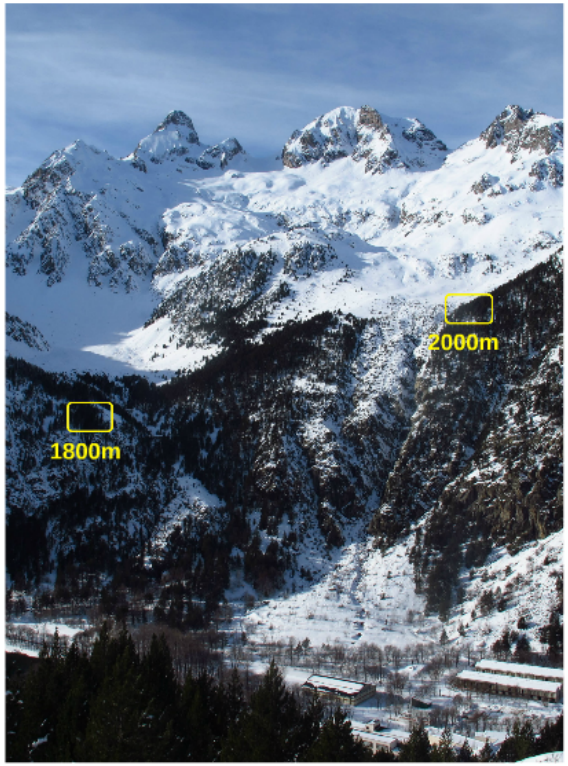


In the Pyrenees mountain range, Spanish side, central area, Caldarés River headwaters.

North slope

South slope



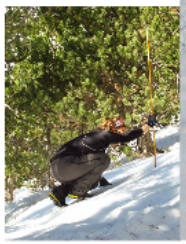


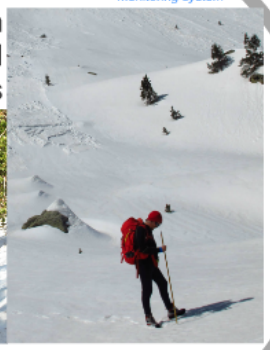
Experimental plots: Four *Pinus uncinata* forest stands located at different elevation and aspect

Monitoring system: sensors & techniques

Monitoring system

Snow depth manual measures



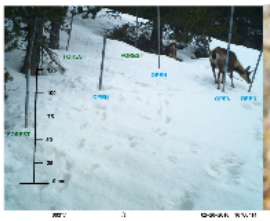


Biweekly surveys.
Twenty sites per plot. Ten replicates per site.

Monitoring system

Time-lapse photography

Daily snow depth at each plot.



Snow poles

Cameras

Monitoring system

Hemispherical photography

In order to estimate the density of forest canopy

Monitoring system

Snow SWE & density manual measures

Biweekly surveys.
Two sites per plot. Two replicates.

Monitoring system

Tinytag data loggers

Air humidity and temperature

Monitoring system

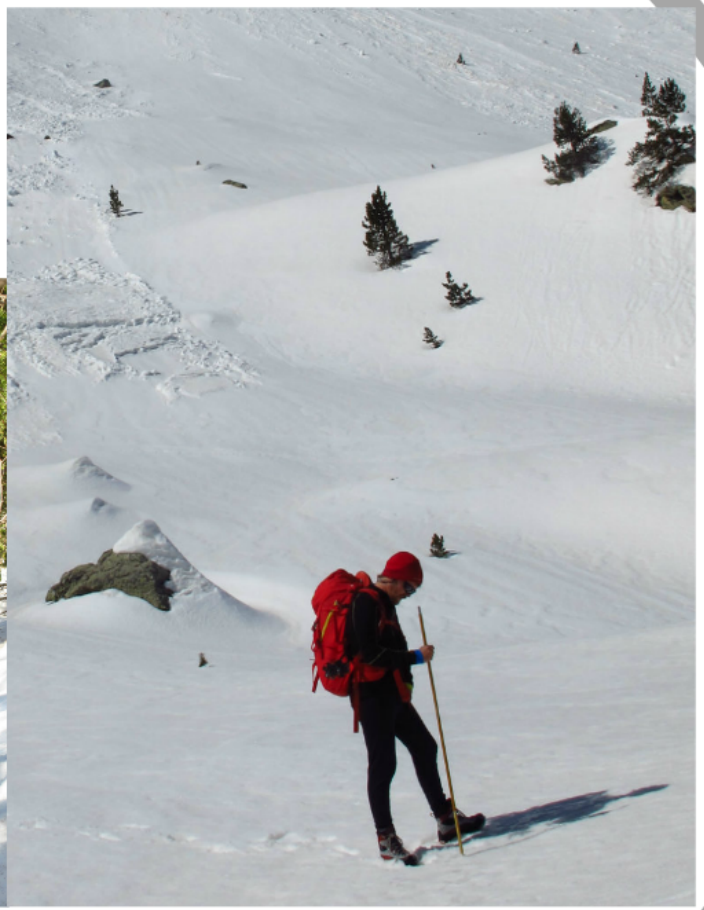
The mini-Weather Station

is measuring...

- air relative humidity
- air temperature
- wind direction, speed and gust
- dew point
- incoming solar radiation

Monitoring system

Snow depth manual measures



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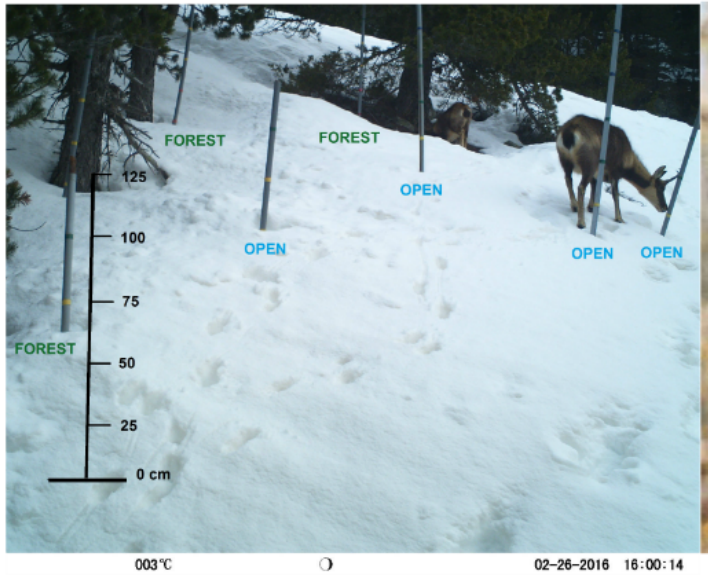

Snow poles

Cameras


Bushnell
007°C
11-06-2015 11:00:16

Monitoring system

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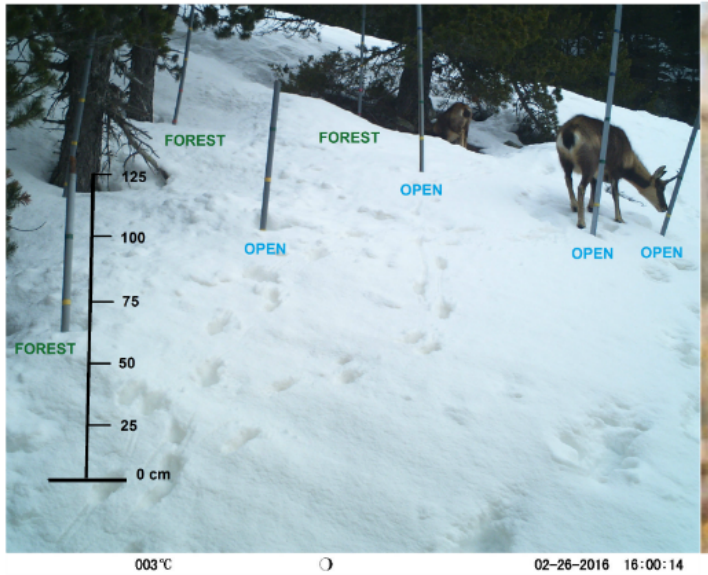

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Collecting data for the project's next stages...

tree stem circumference,
mini-cores,
phenology,
carbohydrates

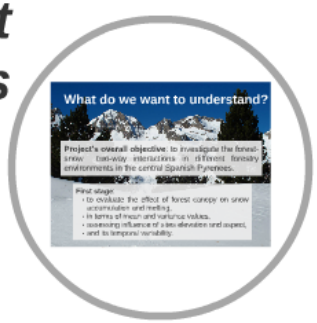
Tree monitoring

Soil monitoring

soil humidity
& temperature

Analysis of the effect of forest canopy on snow distribution

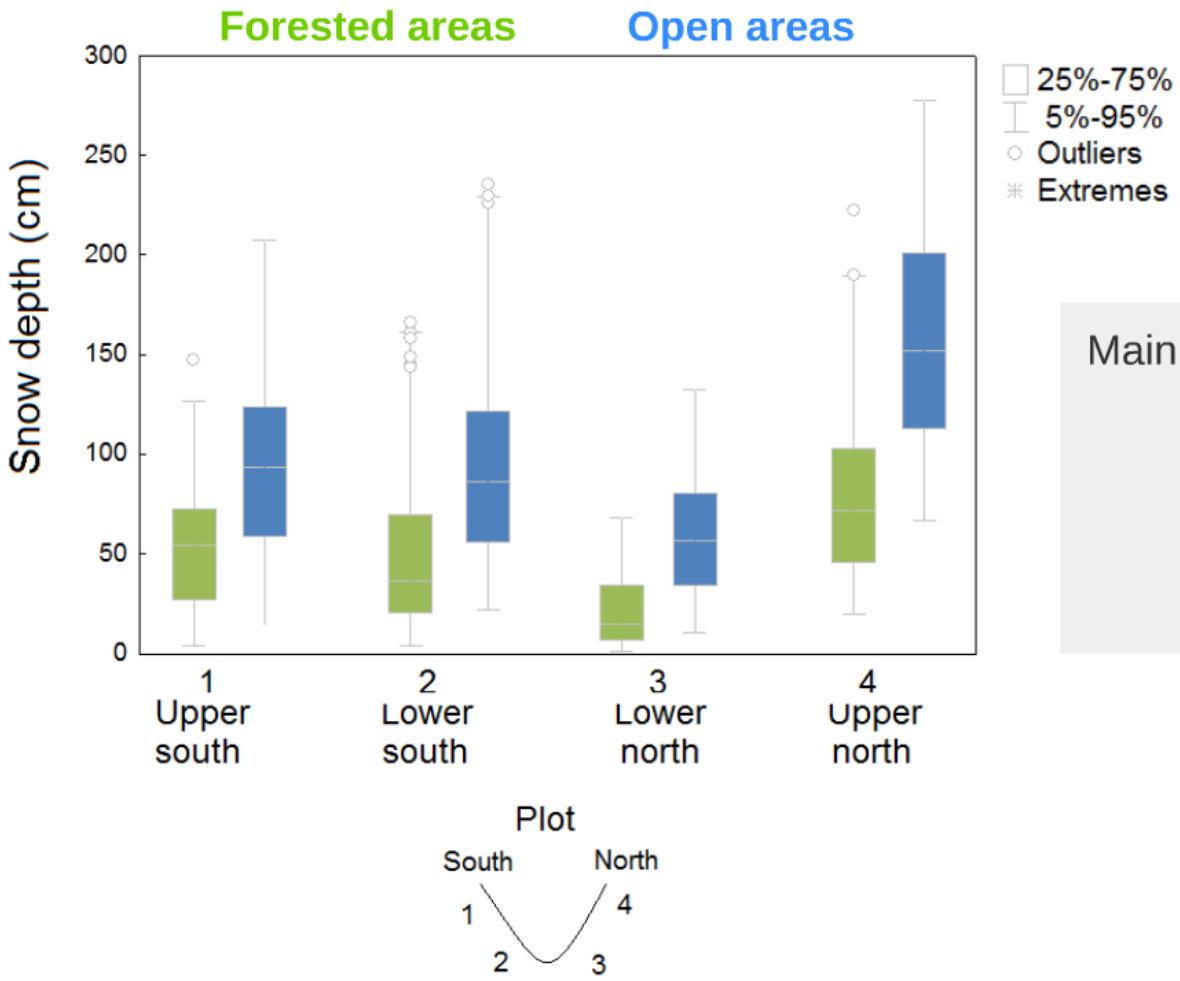
Project objectives



Monitoring system

First results

Snow accumulation: depth



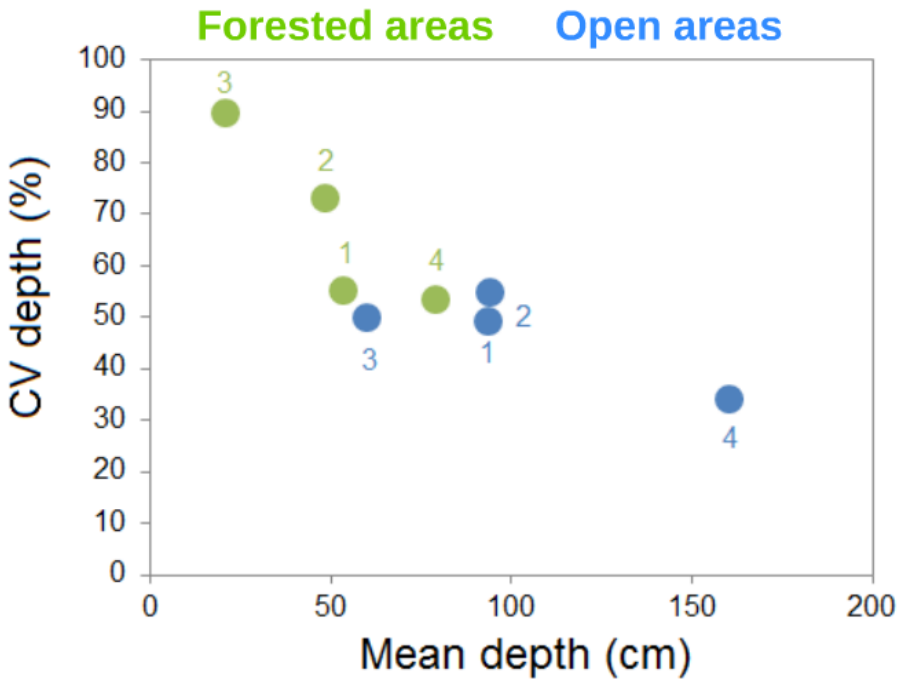
Forest reduction of snow depth (%):			
41	46	75	53

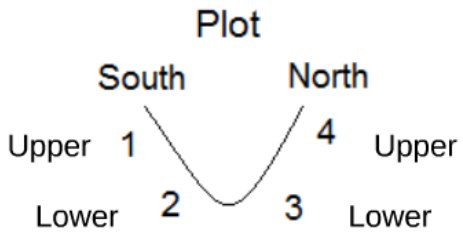
Main factor of variability among plots:
forest canopy,
not elevation or aspect.

Thinner snowpacks
inside the forested areas

First results

Snow accumulation: depth variability





Heterogeneous snowpacks inside the forests

...what was the temporal variability of the forest canopy effects on snowpack distribution?

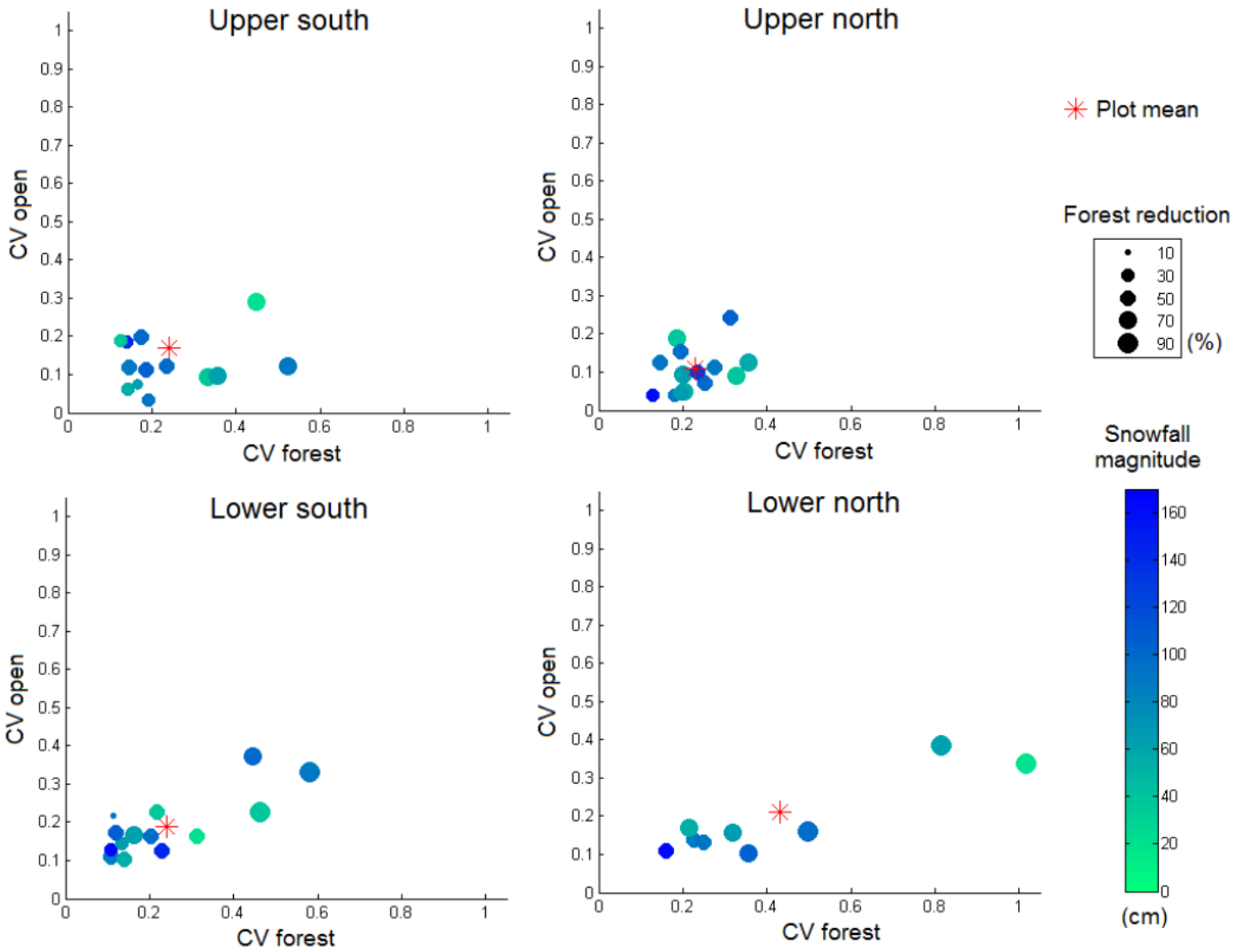
First results

The role of snowfall magnitude

snowfall magnitude

R = -0.15, p > 0.05
forest reduction

R = -0.03, p > 0.05
coefficient of variance inside forests



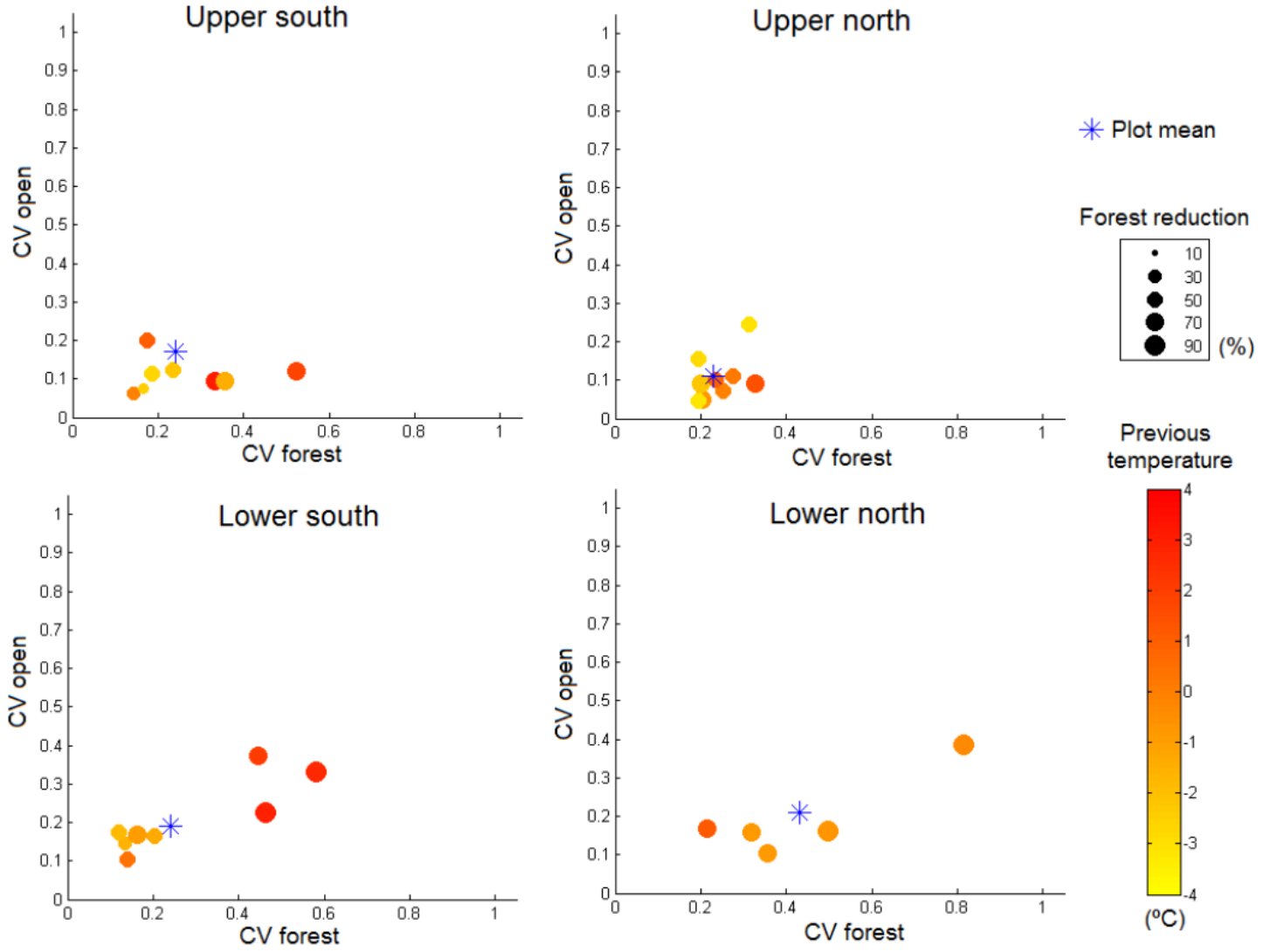
First results

The role of the previous temperature

previous temperature

R = 0.42, $p < 0.05$
forest reduction

R = 0.44, $p < 0.05$
coefficient of variance inside forests

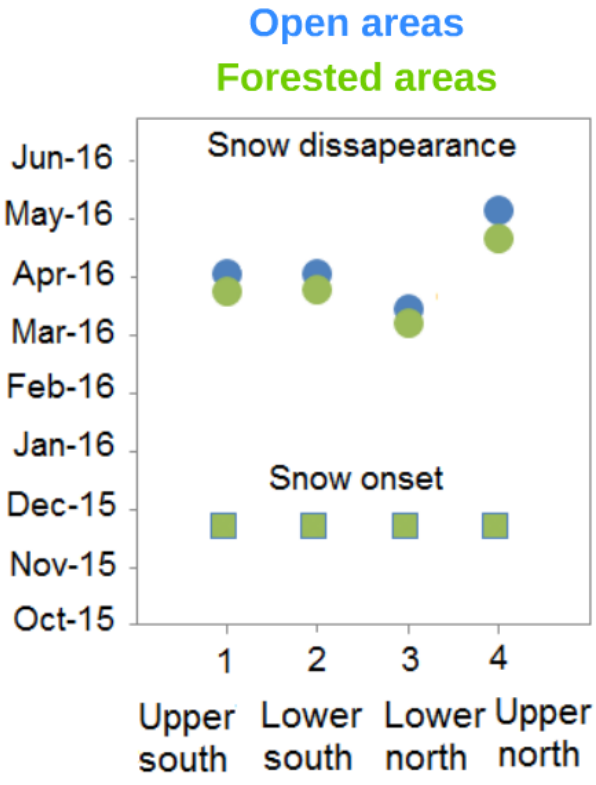


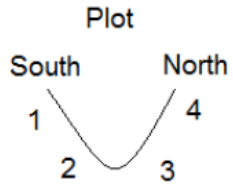
First results

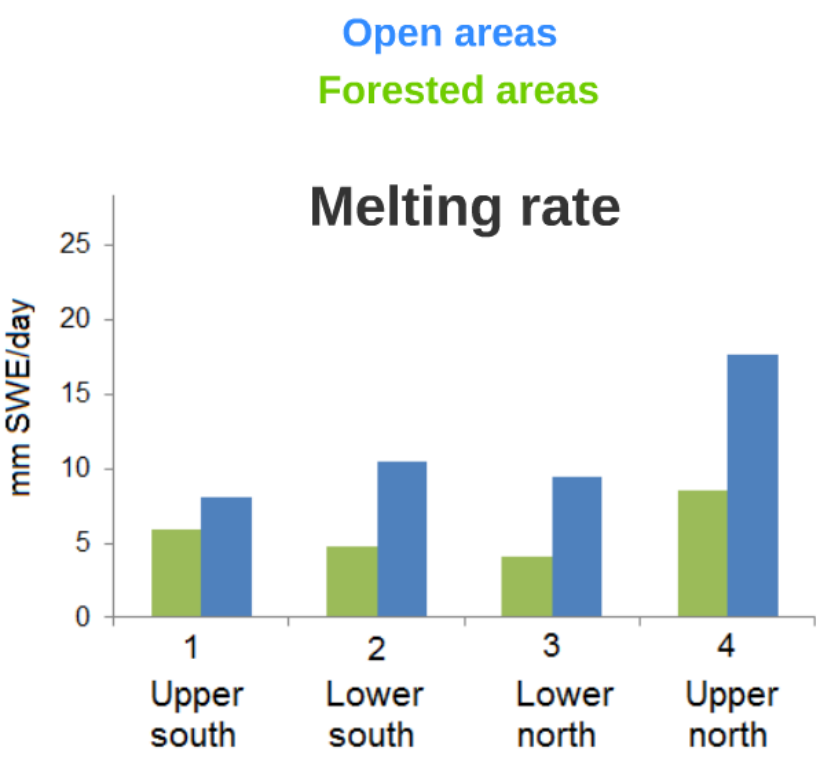
Snowmelting

Snowpack dissapeared earlier inside the forests.

But melted faster in the open areas.







Nº days snow remains longer in open areas:			
9	8	8	15

In conclusion...

- Forest canopy was the main factor of variability in snowpack distribution, in comparison with the elevation and aspect of plots.

- Forest canopy reduced the snow accumulation and produced a patchy snowpack. Differences among plots were found.

- Big snowfalls slightly reduced the forest canopy influence on snowpack distribution.

- Preceding temperature has the strongest effect on the intensity in which snowpack is reduced under canopy.

- Forests seemed to slow the melting, showing a lower melting rate than open areas. But snowpack disappeared earlier beneath forest canopy.

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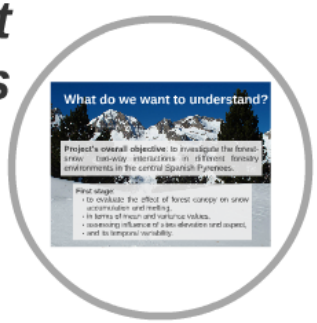

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