Monitoring snowbed vegetation in the Pyrenees: FloraPyr Interreg project

Estela Illa[1,2,3], Benjamin Komac[4], Ludovic Olicard[5], Empar Carrillo[1,2] & Olivier Argagnon[6]

[1] Department of Evolutionary Biology, Ecology and Environmental Sciences. University of Barcelona. [2] Institute for Research on Biodiversity (IRBio). [3] Institut Botànic de Barcelona (CSIC-Ajuntament de Barcelona).
[4]CENMA-Institut d'Estudis Andorrans. [5] Conservatioire botanique national des Pyreneés et Midi-Pyrenées. [6] Conservatoire botanique national méditerranéen de Porquerolles.

Objectives

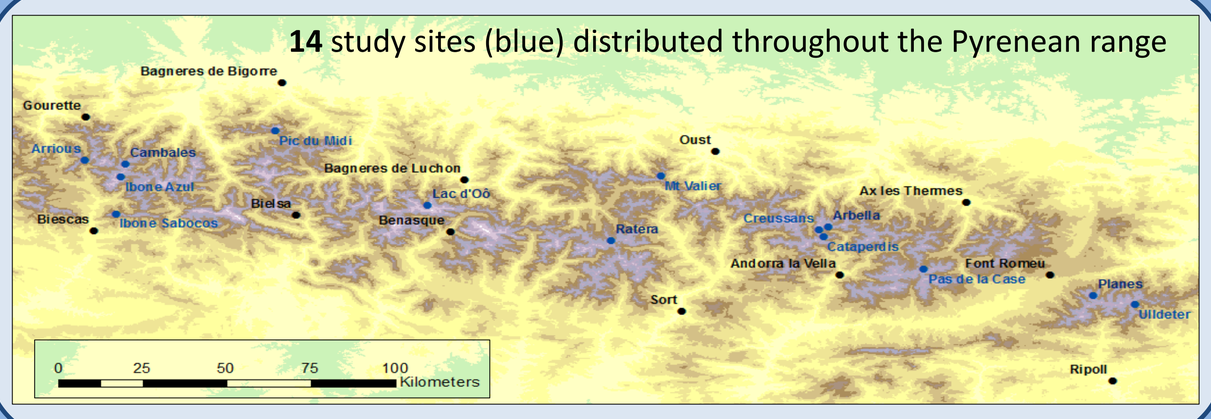
Since year 2012 (project EFA235/11 OPCC), some permanent plots in *Salix herbacea* snowbeds along the Pyrenean range were established, with the main objective of monitoring vegetation. Since year 2016, the project FloraPyr continues the precedent, with the aims of:

Monitoring:
- Floristic composition
- Phenology
- Microclimatic conditions

Characterize soil properties

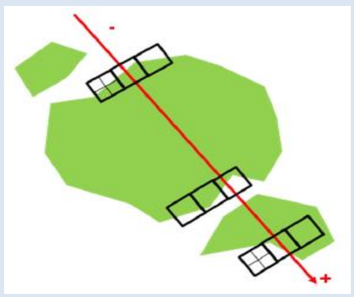
Simulate temperature rising (in 4 study sites)

Study sites



Methods

- Establishment of three permanent plots of 3 x 1 m along the snowmelt gradient including the centre and the edges of a *Salix herbacea* population. Plots divided into twelve 0.5 x 0.5 subplots.
- Monitoring of the **microclimatic** conditions (i-buttons) of the different plots every three hours.
- Characterisation of the **species richness and abundance** at each subplot.
  - Evaluation of species composition and adscription to different syntaxonomical units.
  - Comparison of species richness spectra through time.
- Monitoring of the **phenological stage** of all species present at each subplot, through 4 visits during the summer.

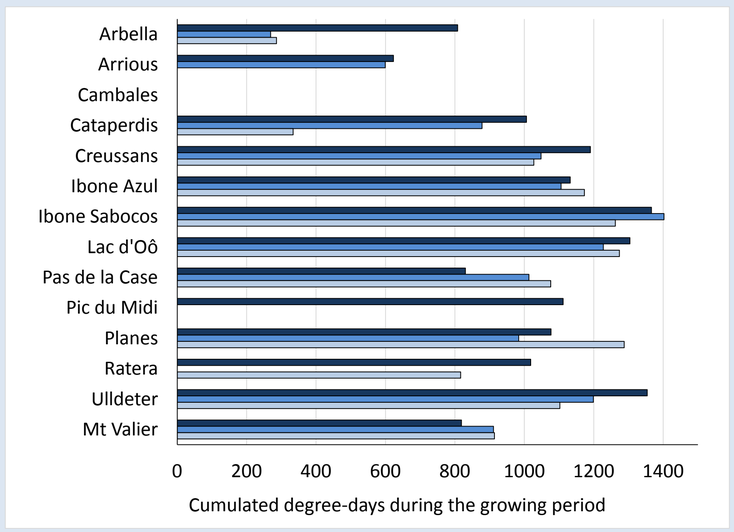


0- Buds
1- First leaves beginning their development
2- Vegetative stage
3- Flowering
4- Fruiting
5- Diaspore dissemination
6- Vegetative stage after reproduction
7- Senescence

→ Determination of the phenological stage at plot level (computing the mean phenological stage per date) and at individual level (considering the most rapid individuals per plot)

Preliminary results

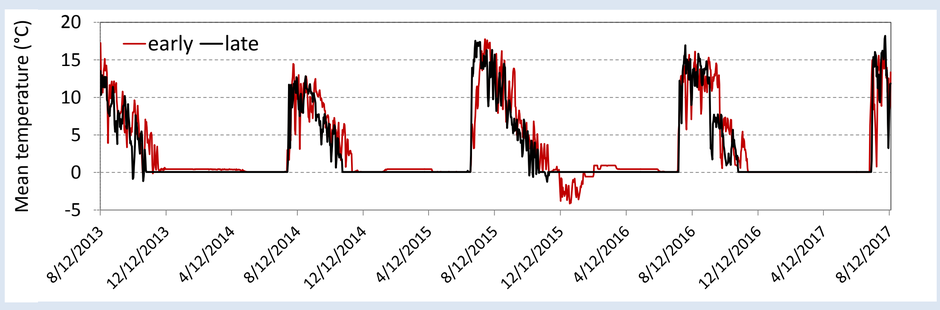
Microclimatic characterisation



Mean of the cumulated degree-days per plot and site between 2013 and 2016.

HIGH MICROCLIMATIC HETEROGENEITY BETWEEN SITES, PLOTS AND YEARS

Case example: Ratera site



	growing-season length		growing-season mean temperature		cumulated growing-season degree-days	
	early	late	early	late	early	late
2014	102	82	8.1	8.5	830.1	696.9
2015	126	107	9.7	10.2	1206.1	1109.4
2016	109	90	9.9	10.1	1078.4	911.7

Growing degree-days (gdd) can be **important indicators** of snowbed species perfomance.

NEED TO KNOW SPECIES RANGES

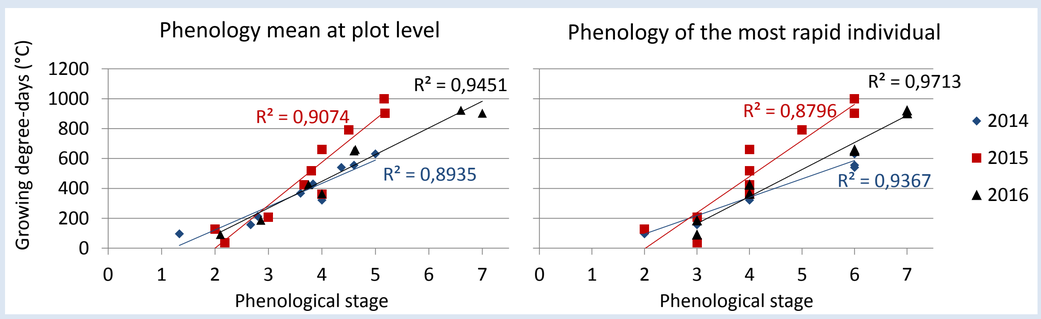
Phenological stage of snowbed species

Case example: *Salix herbacea* (female) at Pas de la Casa site

	PLOT EARLY												PLOT INERMEDIATE												PLOT LATE											
	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	E1	E2	E3	E4	E5	E6	F1	F2	F3	F4	F5	F6
21/7/2014	0	0	0	2	2	2	2	2	2	2	2	0	2	3				3							2	3	3				3	3				
11/8/2014	4	4	4	4	4	4	4	4	4	4	4	4	4	4				4	3					3	3	4	4	4			4	4				
01/9/2014	4	4		4	4	4	4	4		4	4	6	4											4	4	4					5	5				
01/7/2015	0	3	3	2	2	2	3	3		2	2	2	2	2					2							3	3	3				3				
20/7/2015	4	4	4	4	4	4	4	4		4	4	4	4	4					3						4	4	3				4	4				
10/8/2015	4	4	4	4	4	4	4	4		4	4	4	4	4					4						5	5	4	4			5	4				
31/8/2015	5	5	5	5	6	6	5	5		6	4	5	5	5					6						5	5	5	6			5	5				
05/7/2016	2	3		2	2	2	2	2		2	2	2	2	2	2										3	3	3	2			3	3	3			
26/7/2016	4	4		4	4	4	4	4		4	4	4	4	4	4	4									4	4	4	4			4	4	4	2		
16/8/2016	6	4		4	4	6	4	4		4	4	6	4	4	4	6									6	4	4	6			4	4	4	5		
07/9/2016	6	7		5	7	7	7	7		7	6	7	7	7	7	6									7	7	7	7			7	7	7	7		

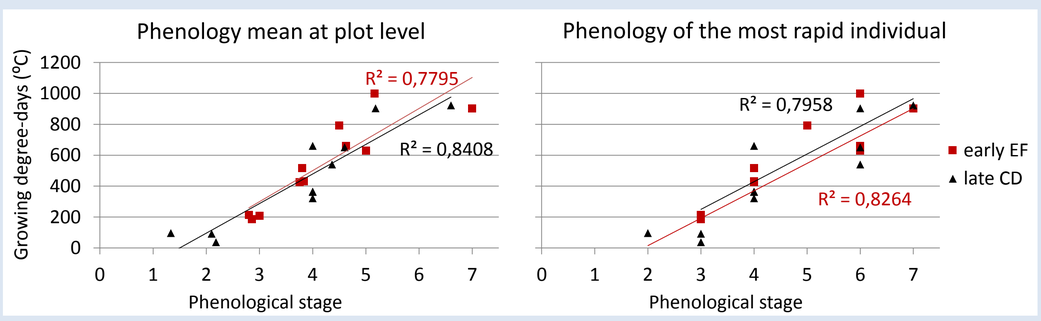
Phenological stages of the female individuals of *Salix herbacea* at the 12 different subsamples per plot in the different dates of survey from 2014 to 2016.

Phenological evolution by year



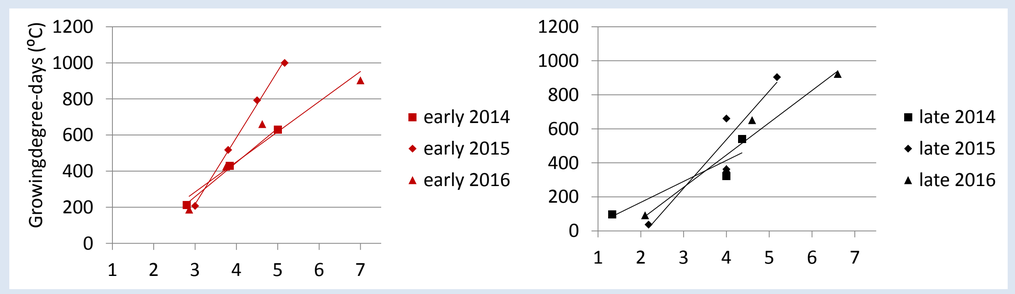
The longer the growing-season length, the higher need of growing-degree days to reach each penological stage.

Phenological evolution by the situation on the snowmelt gradient



Similar amount of global degree-days between plots, without considering the year.

Phenological evolution by the situation on the snowmelt gradient and the year



The growing-season length determines the length of each phenological stage more than the situation along the snowmelt gradient.

Depending on the phenological stage considered, there are important differences in the range of growing degree-days between the mean stage at plot level and the most rapid individual per plot.

NEED TO CHOOSE THE MOST APPROPIATE INDICATOR

Species richness

Case example: Creussans site

Only slight reduction of diversity in the late snowmelting plot.

NEED OF LONG MONITORING PERIODS TO DETECT CHANGES IN SPECIES COMPOSITION