

Climbing to survive: an alpine rodent's challenge against climate change

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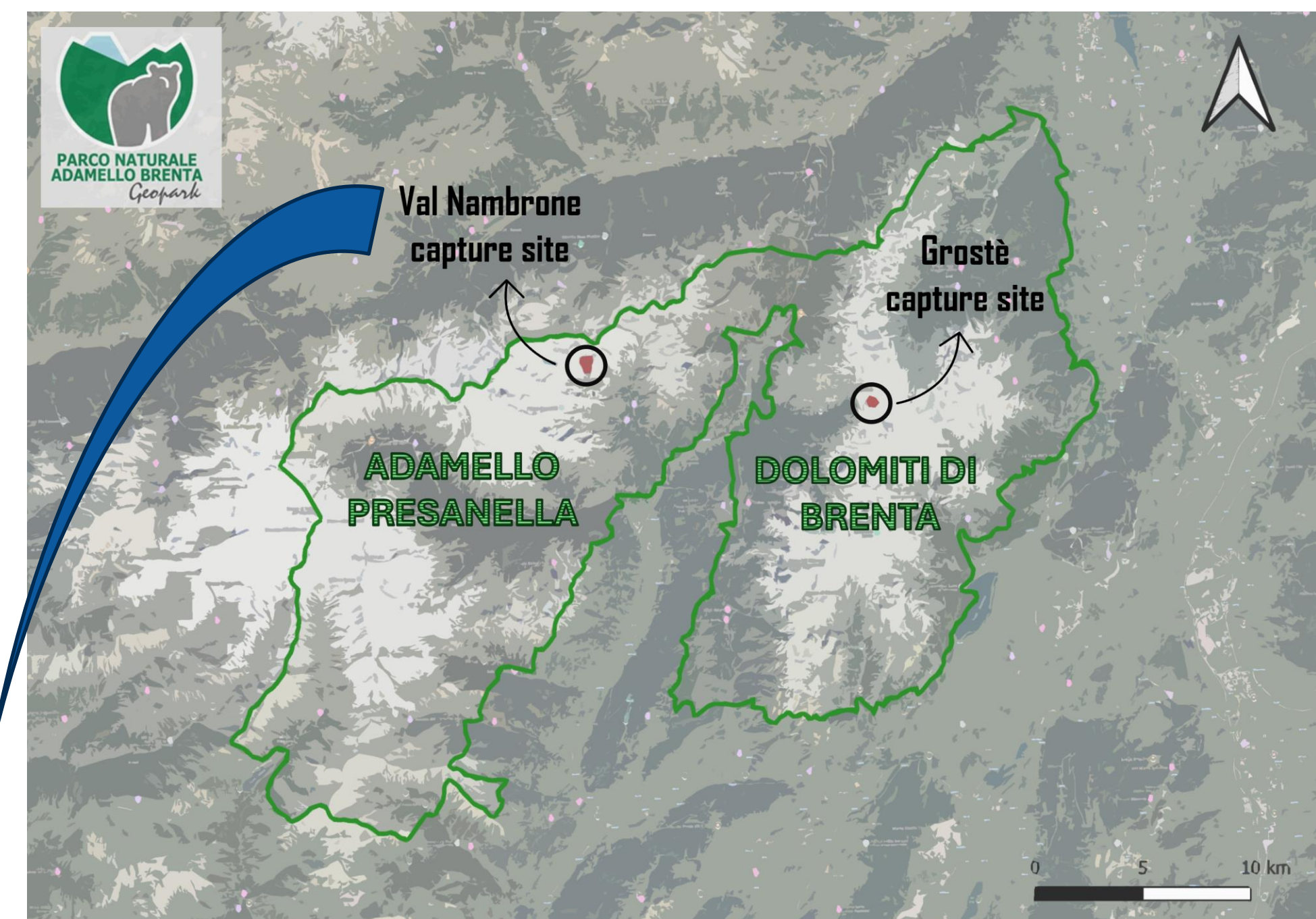
Premise

Small mammals are valuable indicators of environmental health and biodiversity. In response to ongoing climate change, many low-elevation species have expanded their ranges upward, while high-elevation species have seen their ranges contract. These shifts are altering community composition at mid and high elevations, potentially increasing interspecific competition and species replacement. Abiotic factors - particularly temperature - act as environmental filters that shape community structure. Unfavored (usually stenotherm) species experience a range restriction and fragmentation, with possible consequent isolation, reduced gene flow and loss of genomic diversity.

Live captures

In summers 2024 and 2025, voles were live trapped in the granitic Presanella massif and in the calcareous Brenta Dolomites (Fig. 1). Steps of the activity:

- Trapping using Sherman LFA live traps [A]
- Species identification
- Recording of sex, age, reproductive status, and body measurements [B]
- Marking by hair shaving [C]
- Ear sampling for genomic analysis [D]



Capture sites: Val Nambrone and Grostè (top); Detail of the Val Nambrone capture site (bottom)

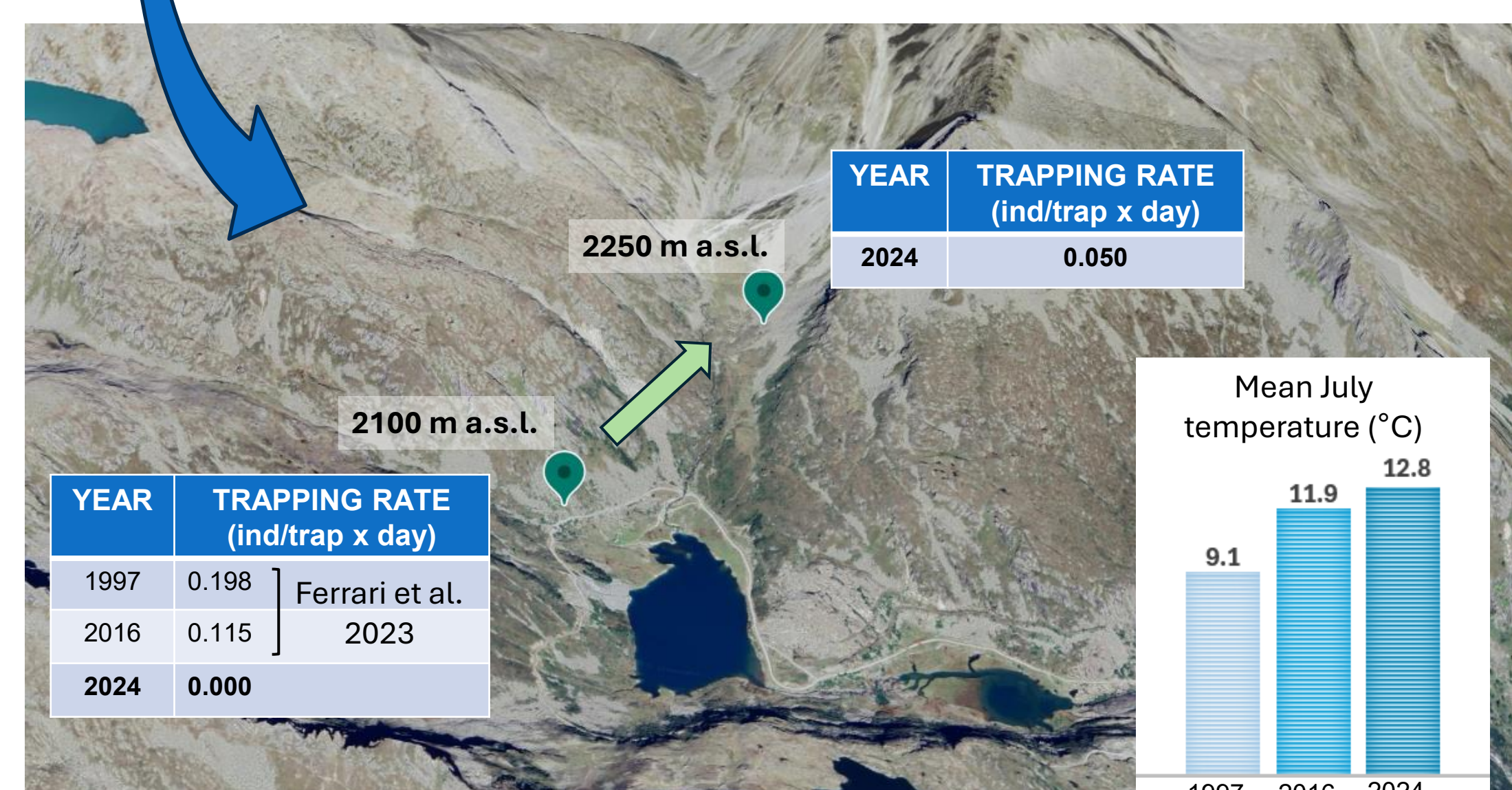
Adamello-Brenta Natural Park

Results

A total of **51** voles were trapped and sampled (ear biopsy) in the Adamello Brenta Natural Park in summers 2024 and 2025. They were represented by 38 snow voles (*Chionomys nivalis*), 11 bank voles (*Clethrionomys glareolus*), and 2 common voles (*Microtus arvalis*). 20 snow voles were trapped in the granitic Presanella massif (Val Nambrone), while 18 individuals in the calcareous Brenta Dolomites (Grostè). Data for Val Nambrone could be compared with two previous trapping sessions carried out respectively in 1997 and 2016 (Ferrari et al. 2023 *Animals* 13,1407).

Genomic analyses

DNA was isolated from 42 snow voles (38 trapped and 4 found dead) using a commercial kit (Genelute Mammalian Genomic DNA) and subject to Whole Genome Sequencing (WGS). WGS data are reduced to a genome-wide SNPs panel to accurately estimate the amount of gene flow between the two populations, their respective amount of genomic diversity and N_e , and to test for the degree of possible maladaptation to new environmental conditions (i.e. *genomic offset*).



Snow voles trapping success in Val Nambrone have strongly declined over 27 years, in parallel with an increase of + 3.7°C in mean summer temperature. They are only found in rocky scree at higher elevations (above 2200 m a.s.l.), whilst bank vole and common vole are found at lower-elevation sites where snow voles were once present.