# Italian small ruminant geolocalization to monitor inbreeding and climate threats

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Italy counts over 80 small ruminant breeds adapted to very different environmental and climatic conditions. Most of them are reared in extensive farms and, thus, are strongly affected by climate changes.
Starting from pedigrees and farm addresses provided by Asso.Na.Pa., we geolocalized 42 sheep and 34 goat Italian populations (heads by farm/province) and calculated their effective size ($N_e$). Breeds' distribution was compared with risk maps of hydrogeological and seismic events, and with present and foreseen (2070-2100) Köppen climate classification in Italy. The genomic inbreeding $F_{ROH}$ was calculated following McQuillan formula using medium-density SNP data from BIOVITA (427 sheep, 18 breeds) and IGC2.0 (791 goats, 25 breeds).
14% of sheep and 21% of goat breeds are at short-term risk of extinction ($N_e \leq 50$) and 55% and 50% at long-term risk ($50 < N_e \leq 500$). $F_{ROH}$ is similar in all the risk classes and higher in goats (8±7%) than sheep (6±2%) and equal to 3±4% and 2±1% respectively when using only ROH>16Mb, indicating about one-third of recent inbreeding. 33% of sheep and 24% of goat populations, all at short- or long-term risk, are reared in one or two adjoining provinces. Over 30% of breeds live in areas at high risk of land-

slides, floods, and/or earthquakes. Also, about half of sheep and one-third of goat populations will live in dryer and hotter climates within 70 years. These results support that geographical and genomic information allows us to better identify the climatic threats and ensure genetic variability for the long-term conservation and sustainable production of small ruminant populations.

**Key words:** small ruminants, biodiversity, inbreeding, geolocalization, risk maps.