

## Response of Italian Late Neogene and Quaternary mammals to climatic and vegetational changes

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Progressive changes in the composition of Italian mammal communities and vegetation from the Late Neogene to the Quaternary can be interpreted as a response to climate changes, which in turn reflect glacial/interglacial cycles. Modifications of Italian plant and animal communities (fluctuations in biodiversity and biomass, alternations between forests or woodlands and more open habitats, exchanges of browsing and grazing ungulates, etc.) paralleled significant changes in temperature and moisture. Habitat oscillations, however, were never cyclical returns to previous conditions. Temperature and moisture declined steadily, and sometimes dropped dramatically, whilst seasonality increased. The result was a cumulative decline in primary productivity, the replacement of smaller browsing taxa by larger, gregarious grazing animals and the replacement of ambush or solitary carnivores by social predators.

A gradual global cooling, interrupted by several warm oscillations, followed the Middle Miocene climatic optimum. Over the course of the Late Miocene, Italian land mammal biodiversity steadily increased, owing to the arrival of new carnivores and a variety of browsing and, especially, grazing perissodactyls and artiodactyls. Grazers became increasingly preponderant. These faunal changes indicate that forests or woodlands gradually gave way to more open habitats.

During the Early Pliocene, tapirs, rhinos, suids, as well as several small-sized cervids prospered in dispersed woodlands, whilst the appearance of large-sized Ruscinian grazing ungulates attests to the slow, persistent spread of grasslands. During the Middle Pliocene, the onset of minor climatic fluctuations, which gave rise to fresh and moist conditions, saw the appearance of gomphotheres, zygolophodont

proboscideans, new browsing ungulates, more mobile, gregarious, large-sized grazing bovids, together with a variety of carnivores attracted by considerable concentrations of prey. These faunal changes indicate an expansion of open grasslands. The onset of a significant glaciation in the Northern Hemisphere, and the ensuing increase in aridity and more intense seasonality, caused the disappearance of forest-dwellers and their replacement by new large browsers. Already occurring grazers flourished and additional ones arrived (such as *Equus*), while zygolophodont proboscideans gave way to elephants (the "Elephant-*Equus*-event").

A drop in temperature marked the transition to the Early Pleistocene. The extinction of gomphotheres proboscideans and the majority of smaller browsing and grazing ruminants caused a drastic decline in faunal biodiversity. In contrast, large ungulates prospered, attracting cooperative foraging carnivores (the "wolf event"). Early Pleistocene communities are characterised by only minor phyletic adjustments, as otherwise they remained virtually stable. Intensified glacial phenomena, seasonality and aridity between 0.9 and 0.6 Ma B.P. had dramatic consequences on resident Villafranchian faunas but, on the other hand, favoured the arrival of new, better-suited taxa from central Asia and Africa. Faunal biodiversity grew considerably over the course of the Middle Pleistocene. Late in the Pleistocene, Alpine and Apennine orogenic uplift added its effects to the glacial/interglacial fluctuations. This divided Italy into three bioprovinces, corresponding to the north, west and east of the peninsula. A dramatic fall in Italian faunal biodiversity during the Holocene indicates a temporary interruption in the trend of increasing expansion of xeric conditions and a new widespread expansion of woodlands.

Fig. 1  
Italian Neogene to Quaternary local faunas, faunal units and bioevents.

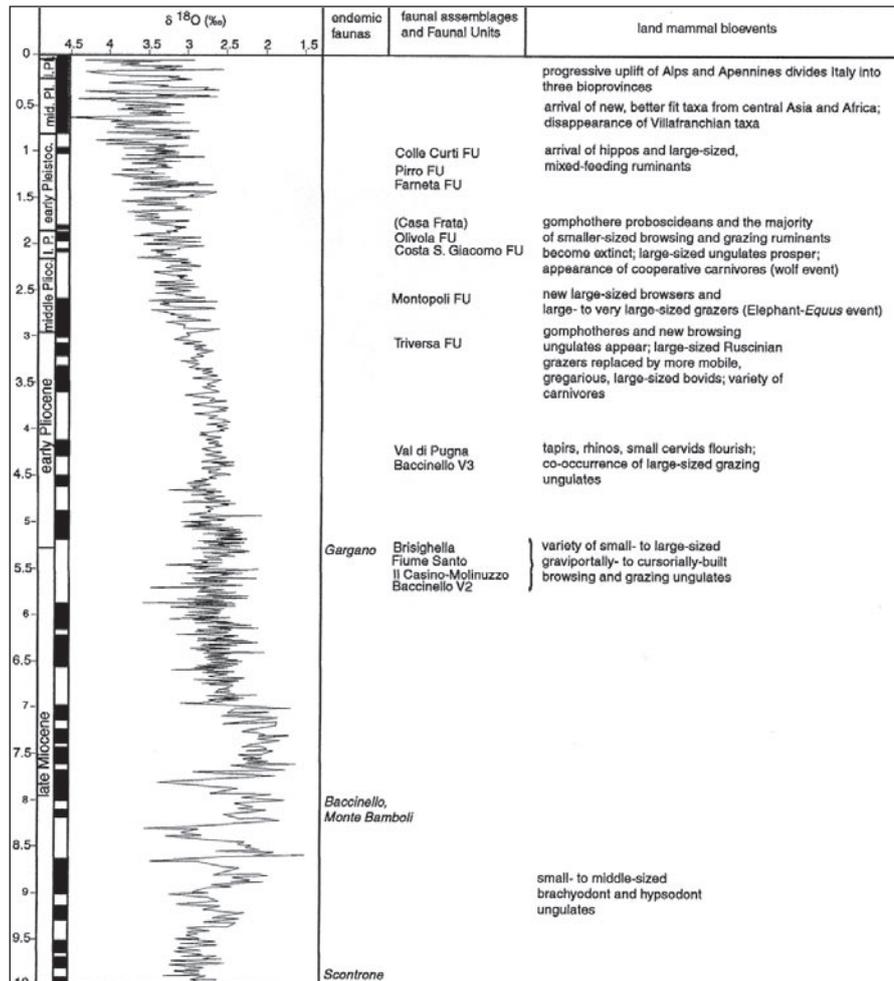


Fig. 2  
Major changes in Italian habitats and climate.

