

Modelling Environmental Resources as constraints for human survival in the Pleistocene

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The availability of trophic resources is one of the principal factors that limits the distribution and survival of any species. Furthermore, the carrying capacity of Pleistocene ecosystems conditioned the survival opportunities and colonization capabilities of the European hominin populations. Several researchers dealt with these important topics by means of non quantitative approaches. Indeed, verbal models have been profusely used in Palaeontology and Archaeology to explain complex phenomena, like the biological dispersions during the Pleistocene or human palaeoecology. Here, we present some examples of new modeling approaches to study the Pleistocene food webs, evaluate the availability of resources, competition, and survival opportunities of hominin populations.

The large herbivore carrying capacity of Pleistocene ecosystems, considered as a key factor in ecosystem trophic dynamics, may be estimated from palaeotemperature and palaeoprecipitation data. The availability of ungulate biomass and the competition with secondary consumers have been repeatedly proposed as key limiting factors to human dispersal across Europe during the Early and Middle Pleistocene. Mathematical models may be used to obtain estimations of the maximum and minimum resources available in a palaeocommunity for the secondary consumers. This provides new insights into the intensity of competition and the available niche space for hominins. Moreover, the structure of the food webs and the composition of a given carnivore guild likely conditioned the access to food resources by the earliest European hominins. It is also shown how network analysis may be used to study the trophic interactions inferred in fossil communities. Certainly, Pleistocene food webs highlight the trophic position of hominins as a central species in the web that channeled energy fluxes. Finally, the use and availability of vegetable resources may also be modeled in this approach. As an example, the quantitative estimations of the energetic return of acorn gathering for a human population show the efficiency of this kind of foraging in the Pleistocene Mediterranean ecosystems.