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Biogeographical detection of Holocene climate refugia in Italian Ecoregions: an applied proposal

By

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Abstract

Facing the accelerating pace of climate change that the Italian peninsula is experiencing, any attempt to define long-term strategies for habitat integrity conservation seems doomed to excessively high levels of uncertainty. These forcings are expected to keep on increasing in the next decades, eventually attaining unknown thresholds beyond which the entirety the Earth's surface can be considered virtually affected by human presence. Global warming defines one of the main ecological threats both for human societies and the biosphere. The increase in average temperatures, the alteration of precipitation regimes and the intensification of extreme events are already affecting terrestrial ecosystems. The current phase of global warming is predicted to produce disruptive effects in the biosphere, among which the modification in vegetation distribution. For every species there are physiological thresholds beyond which the range of climate variability is no longer sustainable, and at that point distribution range migration and/or evolutionary adaptation are necessary for surviving. Within this context, the so-called climate change refugia, i.e., those geographical areas exhibiting a delayed response to the global trends of climate change, may become a key factor to curb the effects of climate change pressure on ecosystems, yielding a locally smoothed transition to higher temperature scenarios. The state-of-the art methods in biogeography suggest Ecological Niche Modelling (ENM) as a promising technique for studying species distribution ranges predictions, as well as their projections into scenarios of non-analogue climate conditions. For this task, the climate data simulation outputs from different General Circulation Models (GCM) can be imported to transfer the models into future environmental variable regimes. With this research, a workflow to identify these potential strategic areas across Italian ecoregions is tested, tailoring the investigation on some representative species of the Northwestern Alps Subsection. Cartographic deliverables are produced, and their reliability is assessed. Their final scope is to serve as reference points for furthering the exploration and the assessment of climate change impact on keystone Alpine plant species, and for subsequent regional planning initiatives through which current climate change forcing could be incorporated in biosphere conservation at the local level.