

genetic data, the predicted past distribution extends northwards up within the extent of the glaciers. This raises questions about the accuracy of ENM for paleoreconstructions and their interpretation, including limitations concerning the available predictor variables (Araújo & Guisan 2006). Indeed, in these models, the species niche is defined in terms of temperature and precipitation data only. Although climate is one of the main factors underlying species distribution, other factors will need to be taken into account in the future (Pearson & Dawson 2003), including dispersal processes (using hybrid approaches), biotic interactions (*e.g.* competitors and pollinators) and stages of succession in forests. One of the main issues of niche modelling is the assumption of niche conservatism. If the species niche shifts over time, the species may not respond to climate change in a predictable way (Jezkova *et al.* 2011). In addition, calibrating the climatic niche of species under current conditions and projecting them to nonanalogous conditions in the past would lead to spurious response curves and therefore to naïve projection (Thuiller *et al.* 2004).

#### From population structure to conservation strategies

Our inferences suggest high rates of historical gene flow between European crabapple populations, but current migration rates may be different, especially due to forest fragmentation. As a wild relative and contributor to the cultivated apple (Cornille *et al.* 2012), the European crabapple is a target for conservation and sustainable management programs for genetic resources. Knowledge of the existence and location of differentiated populations and of admixture zones is essential to guide conservation programs (Pautasso 2009). We report here the South of France, the Balkans and the Carpathian Mountains as hotspots of genetic diversity. In addition the admixture zones correspond to 'melting pots' of genetic diversity (Petit *et al.* 2003; Liepelt *et al.* 2009; Jay *et al.* 2012) that may include recombinant genotypes well suited to new environmental conditions and capable of facing up to global warming. The genetic uniqueness of southern 'rear-edge' populations, such as the populations from the South of France, is thus also of key importance for long-term conservation purposes (Petit & Hampe 2006).

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