The change in the distribution of arable weeds in Europe as a consequence of climate change

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Climate change will mediate shifts in the distribution of plant species, which may cause the invasion of species having potential to become harmful arable weeds to new regions. Predicting the probability of successful establishment and invasion of weed species at global scale, by matching climatic data, is a priority for the risk assessment. This study aimed at exploring the future distribution of 25 weed species, representing different distribution patterns and taxa, at European scale. Using generalized additive models, and data on current climate and species distributions and two different climate scenarios (HadCM3A2 and HadCM3B2) for the period 2051–2080, we developed predictions of the currently suitable area and potential range size changes of 25 European weed species. The level of discrimination in our single weed models varied in from fair to excellent (AUC values 0.78–0.94). The distribution data of weed species were obtained from Atlas Florae Europaeae. We calculated losses of climatically suitable areas assuming no migration, and gains and turnover assuming universal migration. The estimations of species loss, species gain and species turnover were compared between the outcomes of different climate scenarios in order to determine whether these estimates are critically sensitive to the differences between the types of scenarios. Based on the HadCM3A2-scenario species loss was in average 21.3%, whereas the gain was 29.4% and turnover 45.8. Scenario models predict high percentage of species loss in Mediterranean and temperate Europe, whereas high gain in mountainous areas and boreal Europe. Our modelling showed a relatively close fit between climate variables and the distributions of different weed species in Europe, although the species data were only binary and rather coarse-grained. This suggests that weed species in Europe are correlated clearly with climate, and consequently that bioclimate envelope models can provide useful tools to understand the changing geography of potential weed damage in warming climate.