Predictive Species Distribution Models of Three Range-Expanding Mammal Species in Japan

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Predictive Species Distribution Models of Three Range-Expanding Mammal Species in Japan

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Abstract: Three mammal species, namely sika deer (*Cervus nippon*), wild boar (*Sus scrofa*), and Japanese monkey (*Macaca fuscata*), have been rapidly expanding their distribution ranges in the last 50 years, and are heavily impacting agriculture and forestry in Japan. This paper aims to demonstrate how random forests can be applied as a tool for predictive modelling of the spatial distributions of the three species recorded in 1978 and 2004. Twenty one habitat variables regarding landuse, topographic and climatic factors were considered when modelling the species distributions. In order to understand controlling factors of their distributions and changes after 26 years, habitat information such as variable importance and response curves were extracted from the species distribution models (SDMs). As a result, the SDMs could fit the spatial distributions of the three mammal species perfectly. It was found from variable importance that climatic factors such as air temperature, maximum snow depth, precipitation and solar radiation as well as topographic factors such as elevation are the most influential factors governing the distribution of the three mammal species. Changes in the shapes of response curves over years illustrated the niche shifts of sika deer and wild boar partly because of range expansions, whereas the niche of Japanese monkey remained almost the same after range expansion. This result is in line with the previous studies on the ecology of the species, supporting the applicability of random forests for species distribution modelling and knowledge extractions in ecology.

Keywords: mammal; habitat information; response curves; spatial distributions; variable importance