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Predicting the Spread of Invasive Alien Plant Species by Shared Socio-Economic Pathway Model; A Case Study of Exotic Plant Invaders that Threaten Wet Lowlands of Sri Lanka

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Abstract

Species distribution modelling has received increased attention and popularity at present. There is no doubt that understanding of the spatiotemporal spread of Invasive Alien Plant Species (IAPS) aid in planning of IAPS control and land use management. This study focuses on determining the potential spread of four IAPS [*Tibouchina urvilleana* (DC) Cogn., *Miconia crenata* (Vahl) Michelang. syn. *Clidemia hirta* (L.) D.Don, *Miconia calvescens* DC. and *Dillenia suffruticosa* (Griff. ex Hook.f. & Thomson) Martelli.] that threaten biodiversity of wet lowlands of Sri Lanka using the Shared Socioeconomic Pathways (SSP). Nineteen bioclimatic variables from present day to year 2100 obtained from WorldClim V2.1 database and species occurrence data obtained from the Ministry of Environment were subjected to SSP -585 model of MaxEnt version 3.4.4 to map the future spread. Linear and quadratic feature classes for the Area Under Curve were assessed against a value of 0.8 for higher accuracy. Five thousand iterations were conducted for each species and the importance of bioclimatic variables were measured using jack-knifing. Logistic outputs of the model were checked for 10 replications. Distribution maps of IAPS varied among species exhibiting the highest spread into new areas by vegetatively spreading shrub *T. urvilleana*. Temperature variables were more important for its spread. Precipitation based bioclimatic variables heavily contributed to the potential distribution of woody *D. suffruticosa* which spread by seeds and vegetative means. Both temperature and precipitation variables governed the model of the seed producing shrub *M. crenata* and woody *M. calvescens.* In almost all most cases, the probability of the potential distribution was >50%. The decisive role of present-day species occurrence data in scenario building of SSP and the requirement of consistent sampling of IAPS occurrence data was reflected by the results. Understanding the distribution pattern of plants to climate change is crucial. However, unlike native or endemic species, rapid spread of IAPS is strongly driven by various anthropogenic activities and direct disturbances to the environment. Hence, it is more likely that species distribution models that incorporate both climate data and ecological quality of specific ecosystems provide more realistic spatiotemporal distribution for IAPS. Furthermore, the functional traits of IAPS also act as key determinants of the success in colonization, environment tolerance and establishment of IAPS. Hence biological aspects including biotic interactions should also be given attention in predicting the potential spread of IAPS enabling the results to be used for a variety of applications.

***Keywords*:** Invasive alien plant species, Distribution, Shared Socioeconomic Pathways, MaxEnt.