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Quantification of ecological nests of some plant species along Niatek river rangelands using habitat suitability models

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Abstract

Accurate prediction of spatial distribution of plant species and knowledge of environmental factors affecting their establishment can be useful in the proper management of vegetation in any area. Accordingly, the present study aimed to identify the environmental needs of C. spinosa, P. farcta and C. colocynthis species and prepare a potential spatial distribution map of these species using tree-based and regression methods in the Niatek river rangelands in the region. Sistan was done in an area of ۱۱۱۲۳ hectares. For this purpose, after identifying the habitats of this species in the study area, information about the presence of the species was collected using a systematic random method and information about environmental variables was collected using field sampling and digital elevation map. ۱۶ environmental variables including land characteristics, vegetation index and salinity index were used as estimators to prepare environmental maps. In order to implement the model, the available data were divided into ۸۰٪ for model training and ۲۰٪ for validation. Species distribution modeling was performed using Random forest (RF), classification and regression tree (CART) and generalized cumulative method (GAM) methods in R software and the potential habitat distribution map was prepared. The accuracy of the models used was assessed using the sub-curve surface criterion. A domain-based model was used to prepare pseudo-absence points. After confirming the output of the Domain model (AUC = ۰,۹۴), the binary map of these models was used to prepare pseudo-absence points. The appropriate threshold for attendance in predictive models was determined by TSS method and its efficiency was evaluated using kappa index. Performance evaluation of the models used based on AUC criteria showed that the random forest model has the highest accuracy (AUC = ۰,۹۸۵). After this method, generalized collective models and classification and regression trees were used (AUC values were ۰,۹۴۳ and ۰,۸۸۵, respectively). The highest and lowest values of kappa index were assigned to the generalized random and collective forest model (۰,۷۵ and ۰,۴۳, respectively). Accordingly, the stochastic forest model is the most accurate model in estimating the potential habitat distribution of the species. The results of the study of the importance of variables also showed that in the studied scale, factors related to soil and distance from the river have a greater impact on species distribution than other factors, so that in all models used, variables of acidity and electrical conductivity are important variables. More were identified. In general, considering that the central and marginal parts of the Niatek River are most desirable for species distribution, it is suggested that species distribution development plans be planned in these areas.

Keywords: Tree base methods, Distribution modeling, Random forest, Soil characteristics, Sistan region