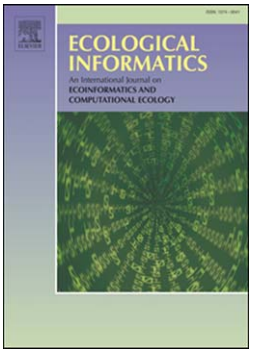

Application of an Artificial Neural Network (ANN) model for predicting mosquito abundances in urban areas

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Abstract. The mosquito species is one of most important insect vectors of several diseases, namely, malaria, filariasis, Japanese encephalitis, dengue, and so on. In particular, in recent years, as the number of people who enjoy outdoor activities in urban areas continues to increase, information about mosquito activity is in demand. Furthermore, mosquito activity prediction is crucial for managing the safety and the health of humans. However, the estimation of mosquito abundances frequently involves uncertainty because of high spatial and temporal variations, which hinders the accuracy of general mechanistic models of mosquito abundances. For this reason, it is necessary to develop a simpler and lighter mosquito abundance prediction model. In this study, we tested the efficacy of the Artificial Neural Network (ANN), which is a popular empirical model, for mosquito abundance prediction. For comparison, we also developed a multiple linear regression (MLR) model. Both the ANN and MLR models were applied to estimate mosquito abundances in two year observations in Yeongdeungpo-gu, Seoul, conducted using the Digital Mosquito Monitoring System (DMS). As input variables, we used meteorological data, including temperature, wind speed, humidity, and precipitation. The results showed that performances of the ANN model and the MLR model are almost same in terms of R and root mean square error (RMSE). The ANN model was able to predict the high variability as compared to MLR. A sensitivity analysis of the ANN model showed that the relationships between input variables and mosquito abundances were well explained. In conclusion, ANNs have the potential to predict fluctuations in mosquito numbers (especially the extreme values), and can do so better than traditional statistical techniques. But, much more work needs to be conducted to assess meaningful time delays in environmental variables and mosquito numbers.

Key words: Mosquito Abundances, Artificial Neural Network (ANN), Multiple Regression Model (MLR)

Introduction