REVERSE THINKING THE NEGATIVE EFFECTS OF TOPOGRAPHIC SHELTERS ON TAIWAN RED CYPRESS DISTRIBUTION BY GEOSPATIAL INFORMATION TECHNOLOGY

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Abstract: Recently, ecological niche modeling (ENM) coupled with geospatial information (3S) technology has become increasingly important to provide useful information for forest management on a large spatial scale. *Chamaecyparis formosensis* (Taiwan red cypress, TRC) is a representative species in Taiwan. TRCs often form pure forests and grow in the fog-forest belt with rich humidity brought by northeastern season wind. Humidity thus is an important environmental factor to TRCs' distribution. Our study area, encompassing the Huisun Experimental Forest Station, is located in central Taiwan and falls within the fog-forest belt. TRCs grow on Pahsien Mountain and Paiku Mountain in the study area, but almost do not grow in most Huisun area, except Shou-Cheng Mountain in Huisun. As pointed out in previous studies, topographic shelters formed by mountains protect *Abies kawakamii* (Taiwan fir, TF) from a high wind so that TFs can grow in gullies or depressions rather than near ridges or peaks. Ultimately, we will attempt to find out northeastern season wind blocked by topographic shelters is a key to the absence of TRC forests in most Huisun area by reverse casting from the case study of Taiwan firs in Hohuan Mountains. Hence, we developed ENMs by generalized linear model (GLM), back propagation neural network (BPNN), and maximum likelihood (ML) based on elevation, slope, aspect, and five spectral variables derived from satellite images for predicting the suitable habitat of TRCs and evaluated them by an independent test dataset. The *kappa* values of the models generally increased with the rise of sample size until reaching a certain number. And the mean *kappa* value of the models (0.96) developed by TRC samples taken only from Shou-Cheng Mountain was significantly greater than that of models (0.54) developed by TRC samples taken from the entire study area, especially Pahsien Mountain

and Paiku Mountain. Topographic variables currently used except elevation in ENMs were shown to be almost useless for explaining the absence of TRCs in most Huisun area, and even worse than that, models merely containing elevation developed by TRC samples taken from three aforementioned mountains erroneously predicted non-TRC pixels in Huisun but far from Shou-Cheng Mountain to be TRC. This result indicated that our ENMs could have left out certain critical predictor variables. Through reverse casting from the case study of TFs, we thus herein proposed the hypothesis that the absence of TRC forests in most Huisun area is attributable to the negative effects of topographic sheltering brought by mountain range in the northeast of Huisun, and we will attempt to confirm the hypothesis in any subsequent study. Meanwhile, we will incorporate climatic factors or their **surrogates** derived from remotely sensed images into ENMs so that they can be applied on a larger spatial scale and their predictive accuracy can be improved.

Keyword: Ecological niche modeling (ENM), Topographic sheltering effect, Generalized linear model (GLM), Back propagation neural network (BPNN), Maximum likelihood (ML)