Using Machine Learning Species Distribution Modeling as a Novel Approach to Efficiently Predict Forest Development Suitability

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Current reforestation practices are limited, with many failing to meet the necessary rates required for forest expansion. In view that commonly used multicriteria analyses introduce subjective decision-making rules, current approaches do not produce transferable models. This study aimed to develop a novel approach to efficiently generate forest development suitability assessments, determining which regions are most suitable for successful reforestation and afforestation. Using Maximum Entropy (MaxEnt), a machine learning species distribution model, this study developed an efficient method of assessing forest habitat suitability. The MaxEnt model determined which regions had a greater likelihood of containing forests. Forest presence data was then overlaid on the MaxEnt results, demonstrating which areas are not forested, yet have suitable ecological characteristics. The MaxEnt output demonstrated predictive capabilities with an AUC of 0.831. Considering that the model has predictive validity and that all data was acquired from routinely updated, publicly available datasets, this approach is both precise and procedurally feasible. Species distribution modeling and MaxEnt are traditionally used for species conservation, however, the current study employs these methods for novel exploratory development. This approach of determining forest development suitability has implications for large-scale reforestation projects due to their reliance on physical surveying. Additionally, this approach limits anthropogenic impacts, allowing for sustainable forest development. Results of the current study highlight the importance of using machine learning species distribution modeling on a large scale to plan efficient forest development projects for the future of our planet.