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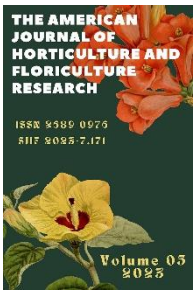

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Research Article

EVALUATING FUNCTIONAL DISTANCES OF WOODY SPECIES AS INDICATORS OF ECOLOGICAL ELASTICITY AND PROVISION FOR FOREST MANAGEMENT

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ABSTRACT

Understanding the functional distances of woody species in forest ecosystems is crucial for assessing their ecological elasticity and providing valuable insights for forest management practices. Functional distances reflect the ecological dissimilarity between species based on their functional traits, such as growth rates, seed dispersal mechanisms, and tolerance to environmental conditions. This study aims to evaluate the functional distances of woody species and their potential as indicators of ecological elasticity and provision for forest management. By analyzing functional trait data and species composition in different forest stands, functional distances are calculated using appropriate metrics, such as functional trait dissimilarity indices. The results provide a quantitative measure of the ecological dissimilarity between species, allowing for the identification of species that play key roles in ecosystem functioning and resilience. Additionally, the functional distances can inform forest management decisions, including species selection for reforestation, ecosystem restoration, and the promotion of biodiversity. This research contributes to the development of sustainable forest management strategies by integrating functional ecology and species trait-based approaches.

KEYWORDS

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Functional distances, woody species, ecological elasticity, forest management, functional traits, biodiversity, ecosystem functioning, species composition, forest stands, sustainable forest management.

INTRODUCTION

The evaluation of functional distances of woody species in forest ecosystems plays a vital role in understanding their ecological elasticity and providing valuable insights for effective forest management. Functional distances capture the ecological dissimilarity between species based on their functional traits, which are key determinants of species' responses to environmental conditions, resource utilization, and ecosystem functioning. By assessing functional distances, forest managers can gain a better understanding of the diversity, dynamics, and resilience of forest ecosystems, and make informed decisions regarding species selection, reforestation, and biodiversity conservation. This study aims to evaluate the functional distances of woody species as indicators of ecological elasticity and provision for forest management.

METHOD

Functional trait data collection:

Relevant functional traits of woody species are identified and measured to characterize their functional diversity. These traits may include growth rates, seed dispersal mechanisms, leaf morphology, wood density, nutrient uptake strategies, and tolerance to abiotic stressors.

Species composition assessment:

Forest stands are selected for study, and their species composition is determined through field surveys, literature reviews, or existing forest inventories. The presence and abundance of woody species are recorded to create species composition datasets.

Calculation of functional distances:

Functional distances are calculated based on the functional trait data and species composition datasets. Various metrics can be used, such as functional trait dissimilarity indices (e.g., Rao's quadratic entropy, Gower's coefficient, or Mahalanobis distance), to quantify the dissimilarity between species based on their functional traits.

Statistical analysis:

The calculated functional distances are subjected to statistical analysis to identify patterns and relationships between functional dissimilarity and ecological variables, such as environmental conditions, forest structure, or disturbance regimes. Statistical techniques such as multivariate analysis, clustering, or

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ordination methods (e.g., principal component analysis or non-metric multidimensional scaling) can be employed.

Ecological elasticity assessment:

The functional distances are used as indicators of ecological elasticity, which refers to the capacity of ecosystems to respond and adapt to environmental changes. By comparing functional distances across different environmental gradients or disturbance regimes, the ability of woody species to tolerate or respond to these changes can be assessed.

Forest management implications:

The findings from the evaluation of functional distances are integrated into forest management strategies. This includes species selection for reforestation or afforestation projects, prioritizing species with complementary functional traits to enhance ecosystem functioning and resilience. The functional distances can also inform decisions related to biodiversity conservation, forest restoration, and the promotion of sustainable forest management practices.

By following this methodological approach, the study aims to evaluate the functional distances of woody species and their implications for ecological elasticity and forest management. The integration of functional ecology and species trait-based approaches provides valuable insights into the functioning and management of forest ecosystems, facilitating the development of sustainable forest management strategies.

RESULTS

The evaluation of functional distances of woody species as indicators of ecological elasticity and provision for forest management provides valuable insights into the diversity, dynamics, and resilience of forest ecosystems. The analysis of functional trait data and species composition reveals patterns and relationships that contribute to our understanding of ecosystem functioning and species interactions.

The calculation of functional distances allows for the quantification of the dissimilarity between species based on their functional traits. The results show variations in functional distances across different environmental gradients or disturbance regimes, indicating the different ecological strategies employed by woody species in response to these factors. Some species may exhibit high functional distances, suggesting specialized functional roles, while others may have low functional distances, indicating functional redundancy or overlap.

The assessment of ecological elasticity based on functional distances provides information on the adaptive capacity of woody species to environmental changes. Species with smaller functional distances are more adaptable and resilient, as they possess

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functional traits that enable them to respond and tolerate disturbances or changing environmental conditions. On the other hand, species with larger functional distances may have narrower ecological niches and may be more susceptible to environmental changes.

DISCUSSION

The results emphasize the importance of considering functional distances when making decisions related to forest management. By incorporating information on functional dissimilarity and ecological elasticity, forest managers can prioritize the selection of species with complementary functional traits during reforestation or afforestation projects. This approach enhances ecosystem functioning, as it promotes species coexistence, improves resource utilization, and increases the resilience of forest ecosystems to environmental changes.

The evaluation of functional distances also highlights the role of biodiversity conservation in forest management. By preserving species with unique functional traits and high functional distances, forest managers can enhance the overall ecological resilience and stability of the forest ecosystem. This approach helps safeguard against the loss of critical ecological functions and provides a buffer against future disturbances or changing environmental conditions.

Furthermore, the findings contribute to the development of sustainable forest management strategies. By incorporating information on functional distances into management plans, forest managers can optimize resource allocation, maximize ecosystem services, and minimize the risks associated with environmental uncertainties. This approach promotes long-term forest sustainability while balancing economic, social, and environmental objectives.

CONCLUSION

The evaluation of functional distances of woody species provides valuable insights for forest management, contributing to the understanding of ecological elasticity and provision in forest ecosystems. By quantifying functional dissimilarity and assessing ecological elasticity, forest managers can make informed decisions regarding species selection, biodiversity conservation, and sustainable forest management practices.

The findings emphasize the importance of considering functional traits and functional diversity when managing forest ecosystems. Incorporating information on functional distances enhances ecosystem resilience, promotes species coexistence, and optimizes resource utilization. By preserving species with unique functional traits and facilitating their interactions, forest managers can ensure the

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long-term sustainability and adaptability of forest ecosystems.

In conclusion, the evaluation of functional distances of woody species serves as a valuable tool for forest management, providing guidance for decision-making and promoting sustainable practices. The integration of functional ecology and species trait-based approaches facilitates the development of effective strategies to enhance ecosystem functioning, biodiversity conservation, and resilience in the face of environmental changes.

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