Growth and Survival Performance of Data-Deficient Native Tree Seedlings for Forest Restoration in Northern Thailand

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Abstract

Forest restoration in degraded landscapes requires careful selection of tree species that are well adapted to local environmental conditions. However, many native species lack field-based data on their establishment and growth performance. This study aimed to evaluate and rank the performance of 14 data-deficient native tree species planted in a restoration plot at the Nong Hoi Royal Project Development Center, Chiang Mai Province. Seedling growth and survival were monitored two weeks after planting and again at the end of the first rainy season (July–November 2025). Performance indicators included Relative Growth Rate (RGR) of root collar diameter (RCD), height, and crown width, as well as percentage survival. Data were analyzed using two-way ANOVA, and species performance was ranked using Z-scores and Performance Index. The overall survival across all species was high (96%), indicating favorable site conditions for early seedling establishment. Michelia floribunda and Dalbergia ovata showed the highest growth rates and performance scores, suggesting strong potential for use in highland forest restoration. These findings provide evidence-based guidance for species selection in sustainable forest restoration in northern Thailand.

Introduction

Forest restoration is essential for recovering biodiversity and ecosystem functions in degraded tropical landscapes. [1] In northern Thailand, many areas have experienced ecological degradation due to land-use change, agricultural expansion, and repeated disturbance.

The Framework Species Method (FSM) is widely applied to accelerate forest recovery by planting selected native tree species that establish quickly and facilitate natural regeneration. [2] However, species selection often relies on a small group of well-studied species, while many native trees remain **data-deficient**, with limited field information on their survival and growth performance.

This study evaluates and rank the performance of **14 data-deficient native tree species** planted in a degraded restoration site in Chiang Mai, Thailand. We assessed seedling survival and relative growth rate (RGR) to determine their potential suitability for forest restoration. [3]



Materials and Methods



The study site is near the Nong Hoi Royal Project Development Center, Chiang Mai. (covered 4.7 rai)

Monitoring after planting for 2 weeks and at the end of the first rainy season.

Rapid site assessment (RSA)
↓
Species selection
(**14 native** species)
↓
Planting experiment
3 plots (Red / Blue / Yellow)
↓
Data collection
Survival + Growth (RCD, Height, Crown width)
↓
Data analysis
Two-way ANOVA + Z-score + Performance index

Relative growth rate (RGR) was calculated to compare growth among species. Differences among species and plots were analyzed using two-way ANOVA followed by Fisher's LSD test. Performance was evaluated using Z-score and FORRU index.

Results and discussion

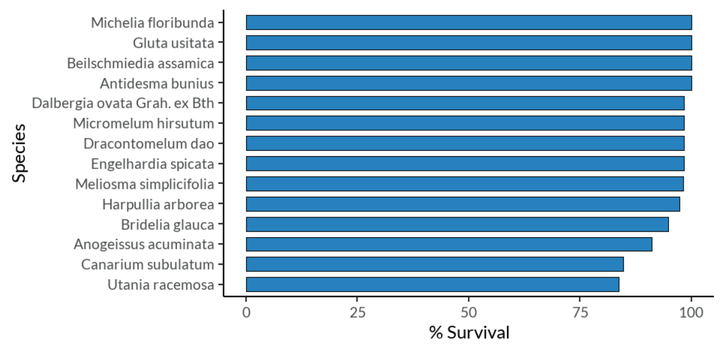


Figure 1. Percentage of survival for 14 native tree species.

The survival rate of the 14 native tree species was generally high, with an overall mean survival of 95.93% during the first rainy season. Four species—*Michelia floribunda*, *Gluta usitata*, *Beilschmiedia assamica*, and *Antidesma bunius* —showed **100%** survival, indicating strong early establishment in the restoration site.

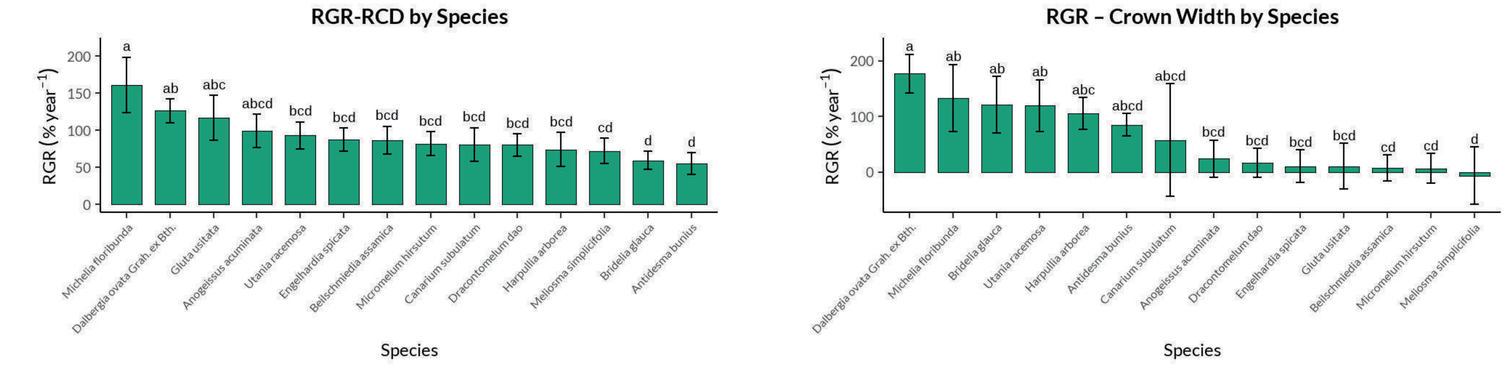


Figure 2. Growth performance varied among species. Two-way ANOVA indicated that species significantly affected relative growth rate (RGR) for root collar diameter (RGR-RCD) and crown width ($p < 0.05$), whereas plot location showed no significant effect.

Among the studied species, *Michelia floribunda* exhibited the highest **RGR-RCD**, while *Dalbergia ovata* showed the greatest **crown** expansion. These traits are important for restoration because rapid stem growth and crown expansion help seedlings compete with weeds and accelerate canopy closure.

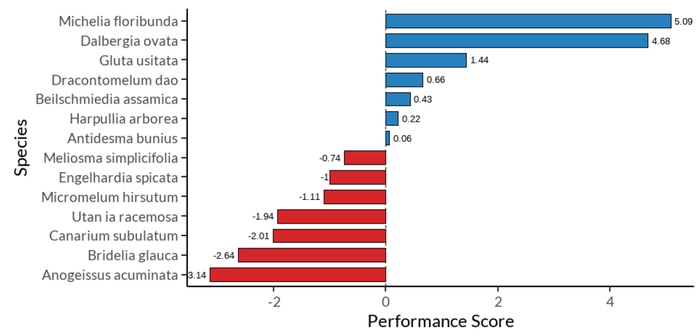


Figure 3. Performance ranking based on standardized scores (Z-score)

These results identified *Michelia floribunda*, *Dalbergia ovata*, and *Gluta usitata* as the **top-performing species**. These species combined high survival with relatively strong growth performance, suggesting their potential suitability as candidate framework species for forest restoration.

The high survival rate observed in this study is consistent with previous restoration studies using the Framework Species Method, which report high establishment success when suitable native species are planted and early management such as weed control is applied.

Conclusion

- Overall seedling survival was high (95.93%), indicating that most native species established well in the restoration site.
- Growth performance differed among species, suggesting that species traits strongly influence early establishment.
- *Michelia floribunda*, *Dalbergia ovata*, and *Gluta usitata* showed the highest performance based on survival and growth indicators.
- These species have strong potential as candidate framework species for future forest restoration.
- The study highlights the importance of evaluating data-deficient native species to improve species diversity in restoration programs.

References

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