Choosing species for reforestation in diverse forest communities: social preference versus ecological suitability

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Background

Choosing species for government reforestation programs or community forestry in species-rich tropical rainforest ecosystems is a difficult task. Reforestation objectives are varied, and may include non-timber products, short-rotation crops, and long-term ecological restoration objectives. Reforestation efforts may fail because social preferences for species are not considered by government agencies. On the other hand, species highly regarded by communities may lack the ecological suitability for plantation forestry, and there is usually limited information regarding the establishment, appropriate silvicultural treatments, and productivity for desirable native species.

Objectives

- To survey social preferences and ecological suitability of tree species to arrive at better species choices for reforestation
- To find indicator variables in life history traits and growth performance of trees at different successional stages that can be collected with minimal effort and cost and should be transferable to other regions and tree communities

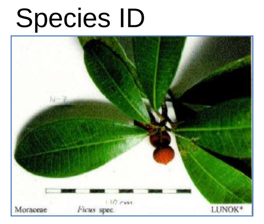
Methods

Surveying native tree plots

Measuring 5x5 m plots

DBH of trees >10cm

Species ID



3 successional Plots (Early, Mid, Late)

9 variables: Frequency, Basal Area, Growth rate

Study area

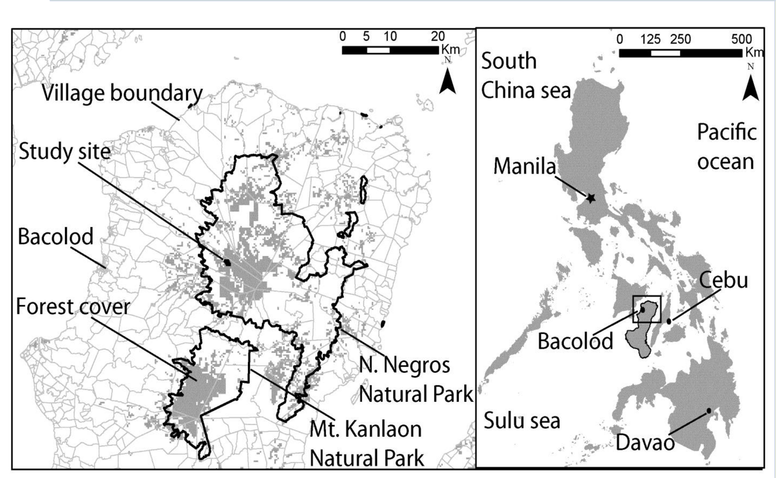


Figure 1. Map of the study area located within the North Negros Natural Park on Negros Island in the Philippines.

Surveying social preference

Table 1. Local uses of native tree species in the Philippines

Species (Code)	Uses	Rank
Agathis philippinensis (A.phi)	Lumber, construction, Varnish, Charcoal	43
Palaquium luzoniensis (P.luz)	Lumber, construction, poles, edible fruits	25
Shorea contorta (S.con)	Lumber, construction, charcoal, medicinal	23
Garcinia brevirostris (G.bre/G.sp2)	Lumber, construction, food for birds	20
Syzygium gracile (S.gra/S.sp2)	Lumber, construction, food for pigs	20
Cinnamomum mercadoi (C.mer)	Construction, charcoal, firewood, food, medicine	19
Platea excelsa (P.exc)	Food, habitat for birds and monkeys, medicine	16
Shorea polysperma (S.pol)	Lumber, construction, poles	15
Dillenia philippinesis (D.phi)	Edible fruits, food for birds	14
Prunus fragrans (P.fra)	Construction, poles, fruits, food for birds	14

47 participants, 35 species identified

Statistical analysis

We applied nonmetric multidimensional scaling (NMDS) of the nine variables. NMDS calculates a multivariate distance matrix based on the measurements, and ordinate the observations based on this matrix. We also performed a correlation analysis between the social preference and ecological rank of native trees.

Results

Successional syndrome of native tree species

Dimension 1 of Fig. 3 appears to be quite strongly associated with an early vs. late successional syndrome. High frequency and basal area on the early successional plot are positively correlated with this axis, although the growth rate is negatively correlated, indicating that the species that fall on the right side of this plot have reached maturity on the early successional plot.

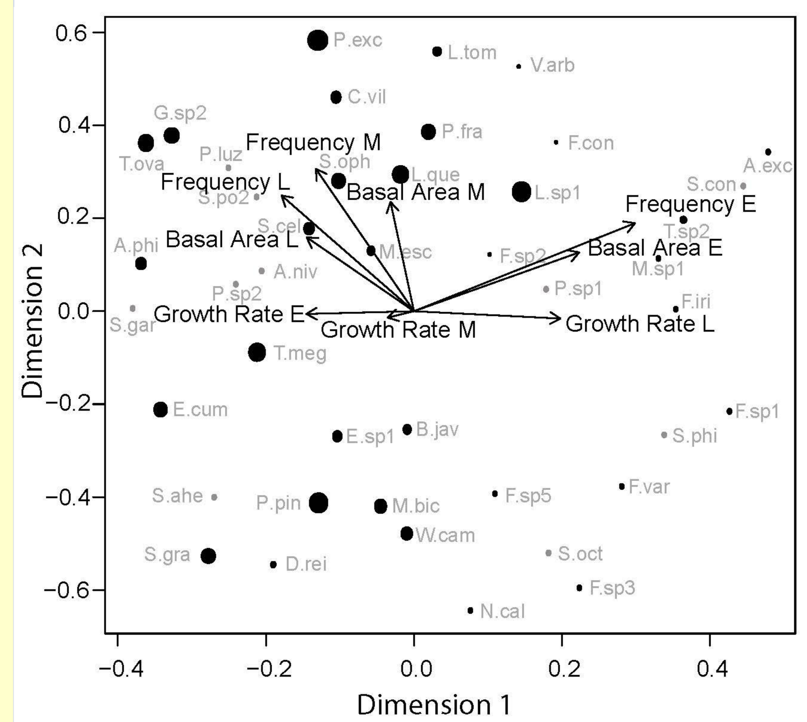


Figure 2. Separating native tree species by ecological attributes (frequency, basal area, and growth rate in early, mid and late successional stands) using NMDS with two dimensions and .

Interestingly these species are also correlated with high growth rates on the late successional plot, where this species group vigorously recruits in gaps after typhoon disturbances shortly after the plot series was established.

The separation was validated by plotting seed sizes (relative size denoted with black dots, Fig. 2).

Late successional *Agathis philippinensis*

Early successional *Ficus sp.*

Species of socioeconomic and ecological suitability

There is a strong negative correlation between successional rank and socioeconomic preference (r=-0.51, p=0.003 without outlier species , A.phi and S.alm) (Fig. 3).

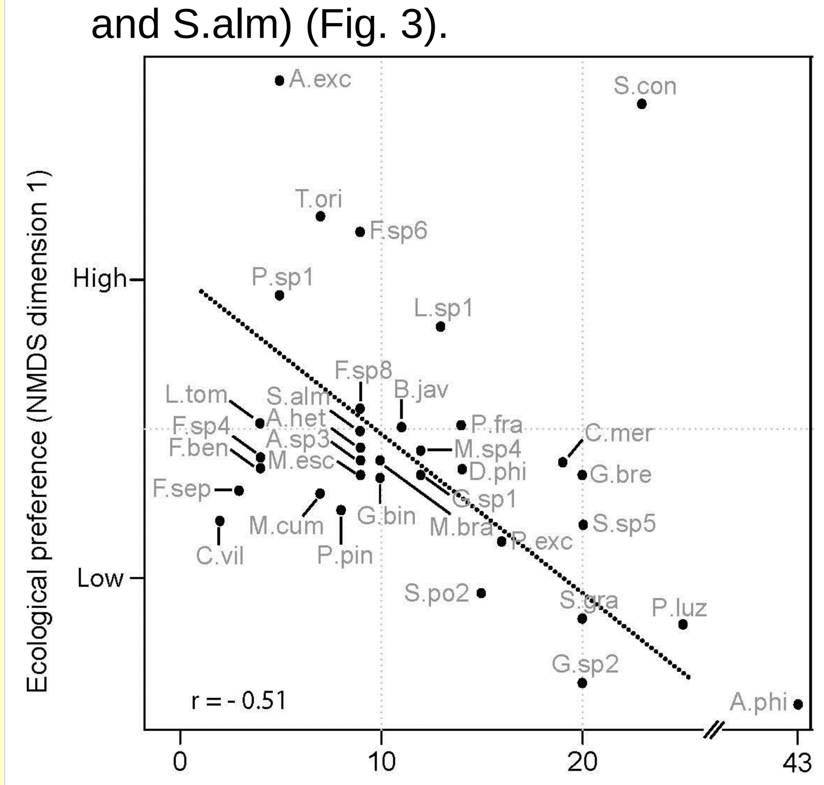


Figure 3. Scatter plot of native species socio-economic preference and successional score.

Many highly desired species like *Agathis philippinensis* (A.phi), *Palaquium luzoniensis* (P.luz), *Syzygium gracile (S.gra), Garcinia sp.* (G.sp2) and *Shorea polysperma* (S.po2) are late-successional, large timber trees. Species that are early-successional and are moderately preferred include *Alphitonia excels* (A.exc), *Palaquium sp.* (P.sp1), *Ficus sp.* (F.sp6), *Lithocarpus sp.* (L.sp1) and *Trema orientalis* (T.ori).

Charcoal making

Collective fruits

Discussion & Conclusion

Surprisingly, we found a strong negative correlation between ecological suitability indicators and social preference ranks, highlighting the difficulty of finding native species for reforestation, and providing a potential explanation why reforestation efforts with native species often fail. Nevertheless, the screening approach that we propose in this study identified several suitable candidate species for the study site, and the general approach could help make better species choices for reclaiming deforested areas that previously harbored species-rich forest ecosystems.

Discussion with community members regarding reforestation needs

Community based reforestation

Many species that clustered into early-successional group are the *Ficus sp*. that are keystone species and can survive in degraded environments adapted to strong light. Many animal and insect species rely on pollen, seeds and fruits of *Ficus sp.,* therefore, they are highly suitable to plant with an intent of bringing back the biodiversity.

Our results suggest a way to screen for succession of many trees using easy to collect field data. Seed size can be used to quickly and accurately distinguish early- and late-successional species. Other indicators are relative basal area and frequency to distinguish succession in a stand of a known age.

References

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