

Initial Selection of Forest Species for the Rehabilitation of Soils Disturbed by Petroleum Extractions in the Ecuadorian Amazon

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Soils in the Amazon Basin that have been disturbed by petroleum extractions are in dire need of restoration. However, many of the soil restoration projects already undertaken in the area have had limited success, mainly due to the fact that no prior analyses have been conducted to determine the suitability and performance of the forest species selected for these projects. This study explores the performance of plants from 20 tree species transplanted onto three sites disturbed by petroleum extractions [(an oil-platform (PP), mud and drill cutting cells (MDC), and contaminated soil treatment units (CSTU)], and one undisturbed site (W), and analyzes the development of soil characteristics two years after the reforestation took place (Figure 1).

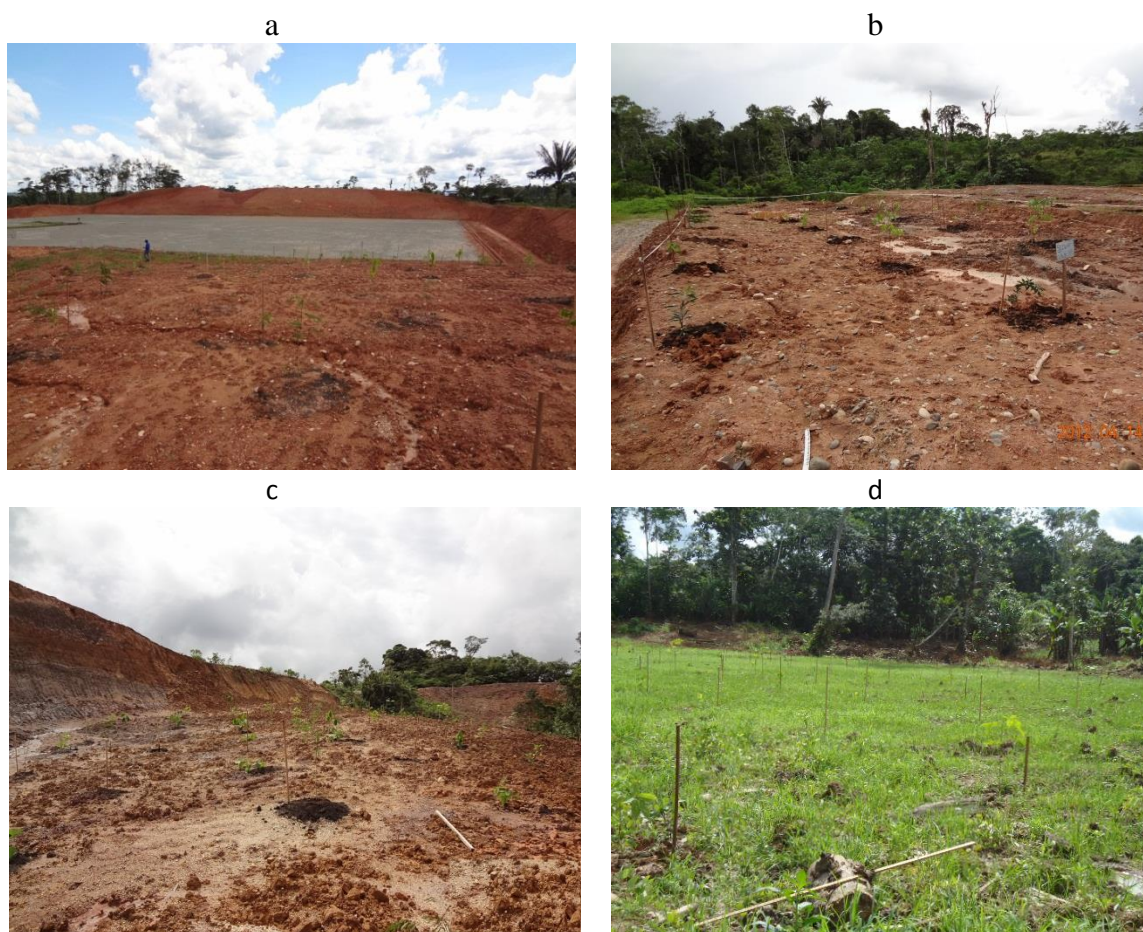


Figure 1. Photos taken at: a) the oil-platform (PP); b) the mud and drill cutting cells (MDC); c) the contaminated soil treatment units (CSTU), and; d) the control, undisturbed site (W).

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Twenty plots were created, after which five specimens of each species were planted in each plot. The analysis calculated survival rate, cause of death for saplings in each site, height and diameter at two years after plantation, and the integrated response index of each species at each site. There was limited sapling mortality, and 17 of the 20 species had survival rates of over 80%. The saplings in the undisturbed site had a higher mortality rate than those in the disturbed sites, with the main cause of death being competition with and/or interference by weeds; these weeds were more abundant in sites undisturbed by petroleum extractions than in the rest of the sites. Despite this low mortality rate, species performance varied by site. At the disturbed sites (PP, MDC and CSTU), the *Flemingia macrophylla*, *Myrcia* aff. *fallax*, *Piptadenia pterocladia*, *Platimiscium pinnatum*, and *Zygia longifolia* species exhibited the best performance and would be the most suitable for use in the rehabilitation there; however, the *Cedrelinga cateniformis*, *Guarea castanea*, *Myroxylon balsamum*, *Nephelium lappaceum* and *Vitex cymosa* species performed poorly and should not be used at the beginning of restoration (Figure 2).

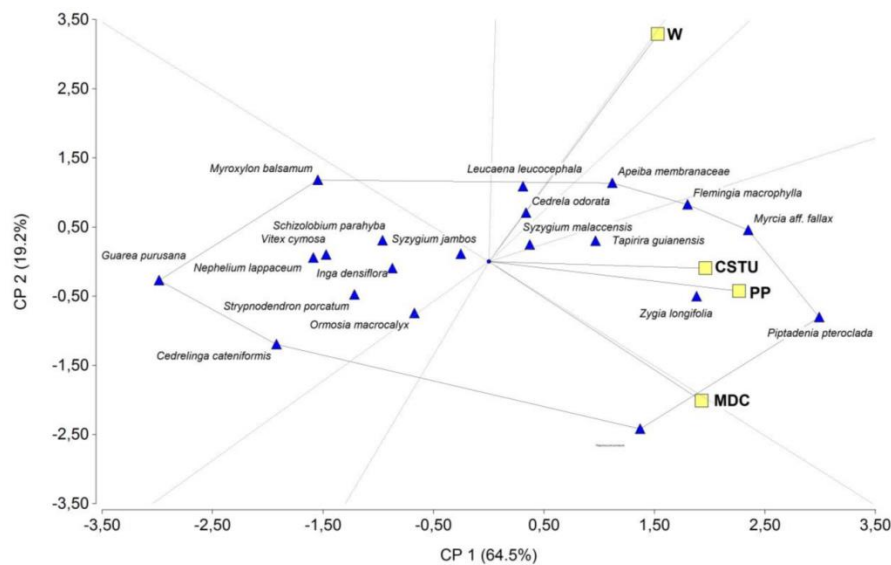


Figure 2. GGE biplot that shows which species performed best at each site (PP: oil platforms; MDC: mud and drill cuttings; CSTU: contaminated soil treatment units; W: undisturbed).

At the beginning of the experiment, the general condition of the soils at the disturbed sites was unfavorable for vegetation growth, due to poor aeration, elevated acidity, low chemical fertility, and an imbalance of bases. At the end of the experiment, only the soils in the oil platforms showed increases in pH levels, organic material, Fe, and Zn. The results of this study shed light on which forest species are most suitable for the rehabilitation of sites disturbed by activities inherently associated with petroleum extraction in the Ecuadorian Amazon.

References

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