SILVICULTURE

AN INTEGRATED PROGRAM FOR KOA PLANTATION ESTABLISHMENT (MECHANICAL, CHEMICAL, FERTILIZATION, PRUNING, THINNING)

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Paper Title: Koa Silviculture

Method of Regeneration

Two methods of koa regeneration, soil scarification and seedling planting, are contrasted in terms of the differing silvicultural inputs. Where scarification relies on natural seed as the primary driver of stocking, planting takes a direct approach. Scarification works well on sites that already have some koa canopy cover to provide seed, where stocking gaps are acceptable and where planting is difficult, such as in rocky terrain.

Planting offers certainty in stocking, control over cohort genetics and works best where existing seed bank is unreliable for regeneration or soil quality justifies additional investment, as in ex-pasture loam soils. Planting features higher and earlier costs relative to scarification yet results in more even tree distribution and, as a result, higher growth and yield.

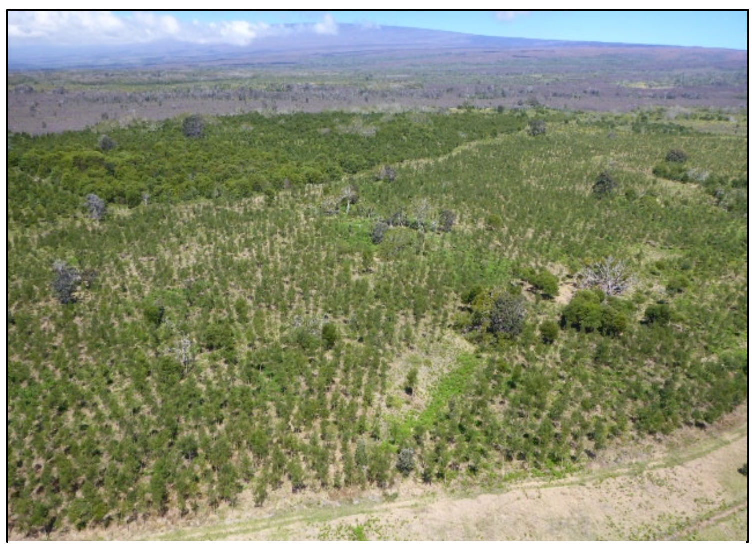

Figure 1: Koa planting makes business and ecological sense, providing a ROI of 6% or higher over a 60-year rotation. Image is of 3 year (foreground) and 4 year (background) planted koa on Mauna Loa.

Financial Analysis

Regardless of regeneration method, koa silviculture is analyzed in the context of inputs and outputs, using a single-acre discounted cash flow as a method of analysis. The economics of koa silviculture include establishment, the basic growth and yield of koa trees over time and the changing value of the wood produced during a proposed koa growing rotation of 60 years on a minimum 50 acre project scale. For modeling purposes, growth rates (mean annual increments) were assumed to peak at 600 bdft/ac/yr (approximately 7.5 m^3/ha/yr) at 15 years and then gradually decrease to about 200 bdft/ac/yr (approximately 2.5 m^3/ha/yr) by age 60. These growth rates are conservative relative to several permanent sample plots (PSPs) recorded annually over the first 10 years post establishment resulting in log MAI between 1,600-2,400 bdft/ac/yr (20-30 m^3/ha/yr).

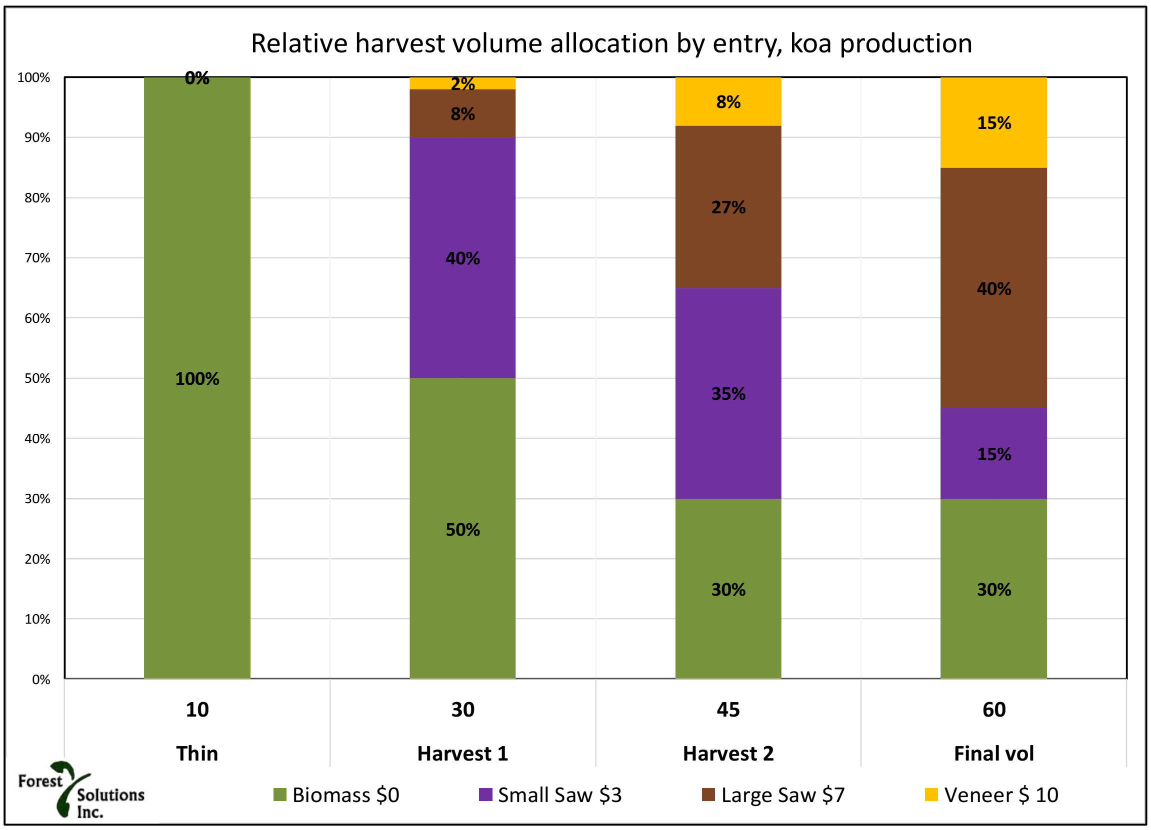

Figure 2: Different log quality allocations were used in each harvest entry, assuming thinning from below. Each harvest entry thus results in a higher quality product mix. Relative percentages are based on author experience.

An establishment cost of US$ 2,450 per acre (US$ 6,050 / ha) was used, together with three different stumpage values for small saw-timber ($ 3, <20"), medium saw-timber ($7, 20"+) and veneer ($10). The relative production of the three stumpage classes varies by harvest entry with higher value material appearing later in the rotation. The result of the rotation calculations including three harvest entries is that koa forest planting turns a predicted 6% ROI or LEV of US$1,700/ac (US$ 4,200 /ha) using an annual discount of 5% on upland (3,000 foot+/900 m+) sites used as a base scenario for evaluation. It is very likely that real world returns will be substantially higher than those resulting from this model due to higher observed growth rates (PSPs) and lower plantation establishment costs. Koa cultivation and silviculture on upland sites in Hawai'i thus make both business and ecological sense.

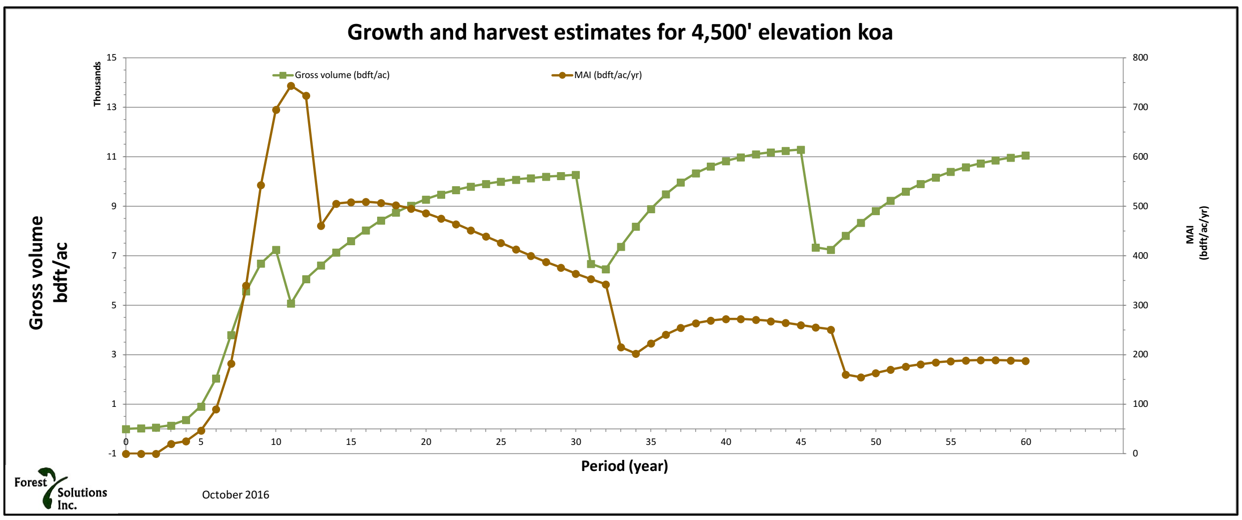

Figure 3. Predicted growth rates for planted koa slowly decline over the projected rotation due to ageing trees and reductions in stocking resulting from 3 harvest entries. Data beyond the first 12 years of growth is extrapolated from the first curve and compared to other stands of known age in