

COMMERCIAL FORESTRY

HARVESTING OF PLANTED KOA: A CASE STUDY FROM HALEAKALA RANCH

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Paniolo Tonewoods is a joint venture between Taylor Guitars and Pacific Rim Tonewoods, and was formed in 2015 specifically to supply koa guitar components to Taylor and other instrument companies. It is our desire to promote, encourage and invest in koa forestry, and it is our intention to build a small, efficient milling operation in Hawai'i in the coming years. Haleakala Ranch, ("HR"), on Maui, has two stands of Koa that were planted in 1985, in conjunction with "A Million Trees of Aloha", a program started by Jean Ariyoshi, then Governor Ariyoshi's wife. The two stands, A and B, are of about 20 acres and 8 acres, (8 and 3 hectares), and are at 5000 feet and 6000 feet of elevation respectively (1500 and 1800 m) (figure 1 and 2).

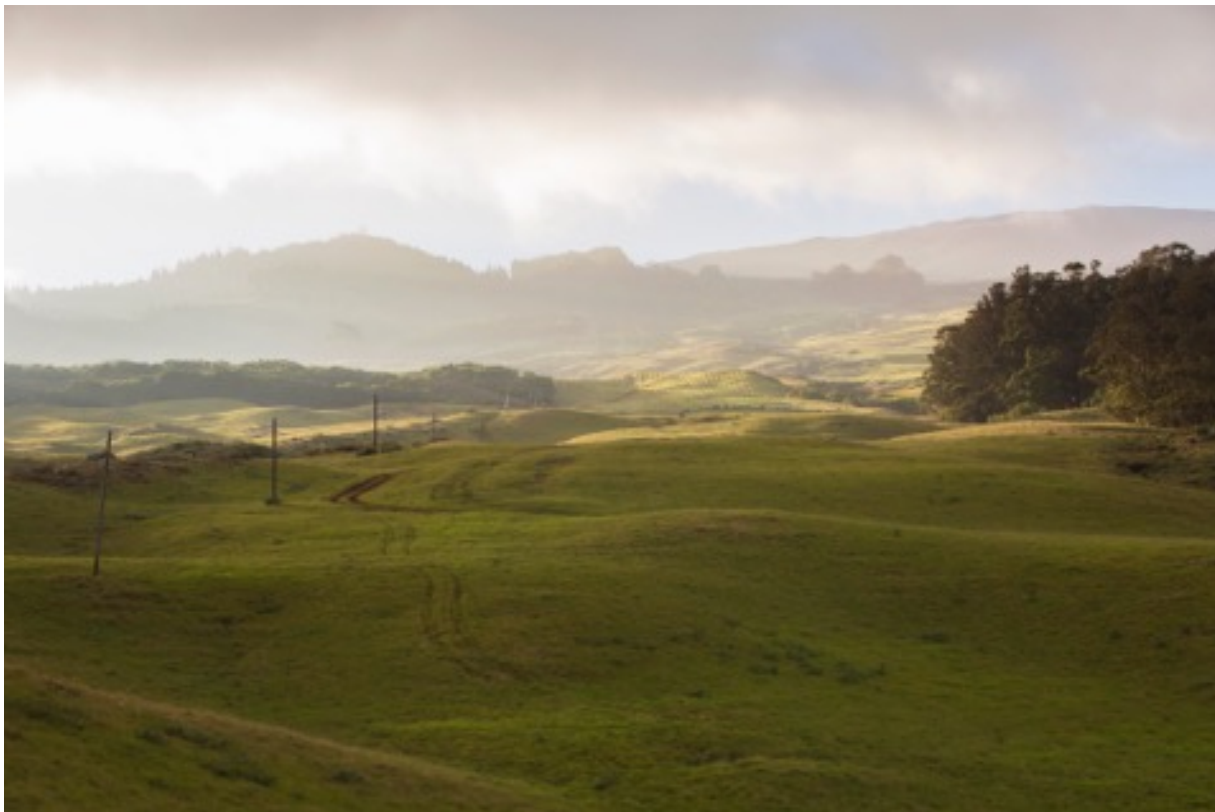


Figure 1: Stand A from below.



Figure 2: Plaque commemorating the planting of the Haleakala Ranch stands.

Both stands are said to have been planted from seedlings grown from Hawai'i Island seed stock. In both stands, the canopies were closed, and both had a floor that was covered chiefly with leaf litter, although A had some gorse intrusion. B is long and narrow; the trees are more widely spaced. Since B has more edge exposure, it also has more grass intrusion.

Both stands had initially been fenced, but at some point early on, cows got in and ate the top out of every tree, so that the stands resemble an un-tended apple orchard. The trees have short boles with candelabra tops. In only a couple of cases was there a useful bole greater than 7 feet (2.1 m) in length, and most were 4 - 6 feet (1.2 - 1.8 m). Overall, tree height was 35 to 55 feet in A (11 - 17 m), a bit less in the higher elevation stand B. Dbh's of the trees were from around 10 inches to 40 inches (250 - 1000 mm), with many of the better trees being around 20 inches (500 mm). The biggest trees were usually near an edge, where there was diminished competition. Rot was starting to occur in the crotches of some trees, particularly the larger ones, as a result of ponding water (figure 3).

In June, 2015, we did a trial cut of 40 logs, and ascertained that we could, with considerable effort, yield material that was useful for guitars. So we struck a deal with the ranch, and in two operations in the following months, cut a total of 500 stems from stand A. The material we deemed useful had a dbh of 13" (330 mm) or better. This was around 32,000 board feet, Scribner Decimal C log scale (160 m³). Paniolo Tonewoods purchased this wood from HR as stumpage, and we did the cutting ourselves. We worked closely with HR, who engaged contractors and assisted us at every stage in handling and transporting the logs to the ranch headquarters, where the ranch did the loading into containers.



Figure 3: Steve McMinn and Scott Meidell with a better HR tree, *Stand A*.

Prior to felling the trees, in most cases, we cut out the multiple tops, so that the boles could be cut off flush at ground level, leaving no hinge (from a control cut), and no stump. The location of each tree was noted by GPS, and each log and each stump was numbered and recorded, in the event that the tree was highly figured and that sprouts might be used in future propagation of elite koa.

Once felled, we positioned the “logs” with a small excavator and stacked them in a central location so that they could be moved to a loading point at the edge of the stand with a skid steer machine.

Then they were loaded on a farm truck for transport down the mountain. Average weight was about 800 lbs (360 kilos) (figure 4).



Figure 4: Justin El-Smeirat pushing over flush-cut tree.

From our 40 log trial, we knew that, in order to use the sapwood, we had to avoid bruising the logs in handling, and that we had to move quickly so that ambrosia beetles wouldn't have time to bore in (figure 5).



Figure 5: Jordan Jokiel with HR logs.

We shipped the logs in containers to Seattle, and transported them to the PRT mill in Concrete WA. There, we sawed them into 6/4 boards (38 mm), numbering each board in sequence, color coding, and noting the tree number (figure 6).



Figure 6: Boards marked out from 20-year-old koa from Maunawili, O'ahu

Once sawn, we promptly marked out numbered, matched guitar parts (backs, tops, sides, ukelele tops, binding parts, etc.), trimmed the 6/4 boards to blanks, end sealed them to eliminate checking, and stickered them on non-staining stickers. We placed the stickered piles in front of fans, and air dried - whenever possible - prior to drying to 7 - 8% moisture content in our dehumidification kiln (figure 7).



Figure 7: Meghan Parker marking out wet koa boards.

When dry (~ 4 weeks), we surfaced the blanks and re-sawn them into 6 pieces - 3 sets- using either our Wintersteiger frame saw or one of our band re-saws. In either case, the kerf was between .040" and .050" (1 - 1.25 mm.) (figure 8). Once re-sawn, we sorted the book matched guitar sets, graded them and marked them for trimming.



Figure 8: Frame saw making 18 pieces from 3.

Challenges in using this wood for guitars: Size, Sap, and Stability.

Building a guitar from lumber produced from a 13 – 20-inch diameter tree, (300 -500mm) is a challenge, but it is not impossible. Taylor Guitars changed their manufacturing specifications in order to best use the available koa. With Haleakala Ranch koa, more of the backs in full sized guitars were made from 3, rather than 2 pieces. Much of the wood was used as tops in a line of smaller guitars, and Taylor adapted these to use a 4-piece top, which was glued up from narrow pieces. Taylor was also able to develop special models to use more un-figured wood (figure 9).



Figure 9: Taylor GS Mini Guitar tops glued up from 4 pieces.

Because the sapwood width in these trees is substantial, varying from about 1 to 4 inches of the trees' radius (25 - 100 mm), a builder has to be willing to utilize it. In these HR guitars, this often required allowing a white band in the center of a book match. At times, this was treated as a feature of interest, but at other times it was disguised with a stain, or wash.

Occasionally, sapwood was placed at the outside edge of the guitar, where it would be covered by a sunburst finish (figure 10).

Typically, once a guitar builder receives the dried, matched, and trimmed guitar components, they are put on back on stickers, over-dried, and then allowed to “fluff up” again to an equilibrium with the 45% relative humidity in the guitar factory. In the case of this younger koa, the sets were still, after this treatment, unstable and prone to movement, so they couldn't readily be glued up into



Figure 10: Bob Taylor with guitar made of toon (*Toona ciliata*) from Kamehameha Schools lands and koa guitar from 20 year old HARC tree, grown at Maunawili. O'ahu.

guitar sized panels. Taylor developed a protocol of sending these guitar sets through their in-house drying regimen three times, at which point they became sufficiently compliant.

This extra drying regimen is the same method that Taylor uses to get Big Leaf Maple to settle down—the third time is a charm. We are hopeful that, through a combination of vacuum and dehumidification drying, we may be able to both dry the sap whiter and to more quickly increase the stability of the wood, rendering this extra drying unnecessary.

In summary, using young koa is a challenge, and vertical integration of our enterprise is the only thing that has made it economically feasible for Paniolo Tonewoods; Taylor Guitars is the main customer for this wood. However, this vertical integration is a model that used to be common with furniture endeavors, when the builder or furniture factory owned the trees that became a product.

If the useful length of these trees hadn't been so severely shortened by cows, if they had been thinned and pruned, and if some of the better tall, pruned, trees had then been allowed to grow for 40 - 60 years, this stand would have been even more valuable. In spite of these caveats, stand A will soon have provided substantial koa components for about 10,000 Taylor guitars, with a retail value in the millions dollars. These are actual sales, not market research.

Thousands of people have purchased these guitars; when buyers are made aware of the fact that these guitars are from deliberately planted trees that are adjacent to the land that HR is actively reforesting, they are pleased. Using younger wood, such as koa, that is locally and ethically sourced, is a sales argument in the minds of many people. The story of HR's commitment to and investment in koa forestry as a possible alternative to their lands being over-run by invasive species, particularly gorse, is equally compelling.

Wood Notes and Future Projects

We did not use a colorimeter to quantify the color of these 500 stems, although the range seemed typical of—if a bit lighter—than the Hawai'i island koa that we have sawn over the last 30 years.

The range of density, when tested, seemed comparable to that of most Big Island koa, with the first couple of inches of growth from the heart out being less dense.

Stump figure and reaction figure was not uncommon, but about 17% of the stems showed continuous figure of the sort that was potentially suitable for a line of "figured" guitars. We took full length photos of the central boards from these "elite" logs, and saved samples of the wood from

these. When we had sorted the dried, re-sawn boards, we further refined our selections, reducing our elites to about 10% of the stems from Grove A. Figure in the elites was often visible in what would have been the first 2-3 years of these trees' growth; in some, it was quite prominent at this age (figure 11).

We are interested in testing the extent to which figure in koa may be genetic. Our first harvest, of about 40 stems, was in June of 2015. When we returned in October of that year, we noted that many of the stumps from these trees had sprouted vigorously. When we first realized this, we subsequently marked each log and its stump, so that its location could be tracked later. For the two subsequent harvests, after we had documented the wood quality of our elite

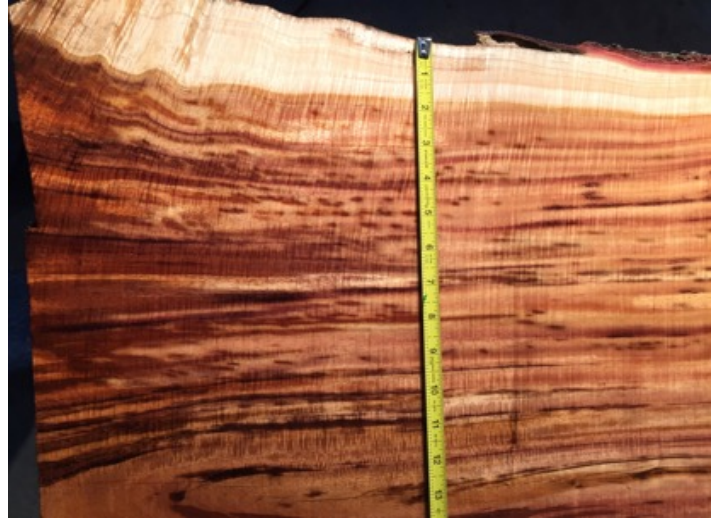


Figure 11: Elite Board

logs, we returned to the ranch, GPS-ed and flagged their stumps. It is our intention to try to propagate these; this is a project that we are undertaking jointly with Haleakala Ranch and Maui Native Nursery. If we are successful, we plan to plant these selected lines in trials (and likely a seed orchard) on the ranch (Figure 12). Reforesting in koa has many ecological benefits; it also, with careful silvicultural management and harvesting, presents great economic opportunities.



Figure 12: Stump sprout