April 2012

Hawai'i's koa tree (Acacia koa) is a much beloved and venerated native tree which grows only in Hawai`i. For centuries Hawaiians have traditionally used the koa tree and its wood extensively to make objects ranging from canoes to personal ornaments. Its exquisite grain and endlessly varying colors make it one of the world's most prized and expensive woods. Unfortunately, much of its native range has been converted to other uses, primarily grazing. The value of high quality koa lumber has created a strong demand for and pressure on the remaining koa forests. Planting koa trees to date has not kept pace with the use of the tree's wood. This webpage is designed to encourage and inform potential planters and investors in koa plantations. Growing koa has numerous risks and pitfalls, however this gorgeous tree with its spectacular wood could be worth the risk if the planter or investor is fully informed.

There is currently strong interest in growing koa both for conservation and utilization. There has been substantial research conducted, which is ongoing, however there has been limited operational experience. The Hawai'i Forest Industry (HFIA) believes that growing koa is both environmentally and culturally the right thing to do and it can make financial sense, if the investor is well-informed on growing practices and very cautious with planting costs.

60-year old merchantable second growth Acacia koa tree. Ka`u, Hawai`i Island.

Example of prime mature koa tree, naturally seeded. Note sprawling nature of branches.

Forestry Investment 101

Millions of acres of timberland have been planted by or purchased internationally by Timber Investment Management Organizations (TIMOs) starting around 1980. The investors are primarily pension funds such as Hawai`i State Employee Retirement System and education trusts such as the Harvard Trust. As timber and timberland has become a well-known and accepted investment, and with billions of dollars in play, common methods of valuing these assets have become accepted. The most common metric is to calculate IRR (internal rate of return), which is similar to the interest rate on a bank account or bond. Elements of this calculation are:

- Purchase price of the asset or planting cost of a new plantation;
- Costs to hold or manage;
- Income, normally from tree harvest. Income is the price of standing trees (stumpage) multiplied by volume of logs to be removed. Serious investors rely on current prices and do not speculate on future price changes; and
- The selling price of the asset, if any, at the end of the investment period.

Return on investment is calculated like any other enterprise considering initial cost, cost to maintain, time elapsed, and return at the end.

The University of Hawai'i College of Tropical Agriculture & Human Resources (CTAHR) has developed an excellent worksheet to input your own estimated variables for a situation or property of interest.[8] In today's world, investors look for an interest rate around 6%. In strong financial markets rates can climb to 8%. If your calculated rates on a proposed investment vary from this range by much, it is a good idea to check the assumptions.

Note: Be careful, be informed. Globally there are bogus forestry investment schemes.[7]

Planting Koa

It is difficult to forecast koa economic planting outcomes because koa has never successfully been grown in a plantation through to successful harvest. However, it appears that with current koa pricing and careful attention to establishment costs, koa plantations can be economically viable.

Spacing

Typically trees are planted about ten feet apart, which will result in 440 trees per acre. Most of these planted trees will not survive to maturity. If a tree is planted 10 feet from the next tree, its branches can only grow out five feet until it is touching the next tree's branches. Koa branches naturally grow much longer than this, giving koa its typical sprawling shape. Most of the planted trees will either die naturally or be crowded out by their neighbors. If this does not happen, they must be pre-commercially thinned by the grower. Otherwise growth will slow dramatically and few of the trees will reach usable size by the target harvest age. Typical growing prescriptions today call for stocking to be reduced to around 70 trees per acre (25 feet between trees) over time, so the remaining trees can grow large enough to be useable.[2, 4, 5, 6]

One-year-old koa seedling that received fertilization and both pre- and post-planting weed control.

Tree Planting
Koa can be planted in areas cleared of competing brush and grass and free of any grazing animals. If grazing animals are present the trees will almost certainly suffer extensive damage or be killed. Koa appreciates a little fertilizer and is environment specific. Best results are from seed collected in the area to be planted. When seed cannot be obtained from the intended planting site, the seed source should be from a location with as many of the same characteristics of the intended site as possible. (eg. elevation, soil type, rainfall)

Where to Plant
Koa does best at elevation above 2,500 feet. While all koa are subject to rusts, wilts, and insects, those planted at low elevation are especially vulnerable and complete plantation losses can occur. Koa likes moist soils and climates but can grow (at slower rates) in very rocky soils. Koa trees are intolerant of frost but may survive. [2, 4, 5]

Planting and Growing Costs
Friday, Idol, et al.[10] reports costs of $1,965 per acre ($4.91 per tree). Forest Solutions, a privately owned forest management group, sets establishment plus maintenance at $2,300 per acre ($5.22 per tree) based on their experience. These costs are for planting 400 – 450 trees per acre plus two or three years of maintenance. This cost of establishment does not include fencing, which can substantially increase the cost.

Maintenance Requirements
Planted trees will require one or two weed control treatments plus one or two pre commercial thinnings before maturity.

Pests
The major diseases and pests that affect koa are "Koa wilt," Fusarium SPP, Xylosandrus twig borers and the koa moth. Koa does not recover well from physical injury such as broken branches or insect injury to top buds. Losses may include complete plantation mortality and disfiguring trees, resulting in no commercial value for the investment.[2, 4, 5]

Acacia koa wilt disease. Koa mortality shown most likely caused by vascular wilt fungus *Fusarium oxysporum.*

Acacia koa wilt stain. Typical stain caused by the vascular wilt fungus Fusarium oxysporum.

Growth Rates and Time to Maturity

Measured growth rates of young natural stands and plantations are showing rates in maturing trees in the range of 150 to 250 board feet per acre per year. Forest land management should increase these “wild”

yields, however but no data is available on such stands. Consensus between academics, forestry agency specialists and commercial foresters is that it is possible that there might be commercial use for koa trees as young as 35 years. The uncertainty stems from the fact that no plantation-grown koa trees have been grown to commercial maturity at this time. To test this hypothesis, the US Forest Service Forest Products Lab, University of Hawai`i, and Hawai`i Forest Industry Association, with considerable contributions of time and equipment by saw miller Jay Warner, did a thorough technical analysis of lumber yields from logs harvested from four stands ranging in age between 31 and 36 in February of 2012. Results are not yet published, but three wood quality observations were made during the test:

- There is a high portion of unusable or very low value "sapwood" on the outside of the logs. This wood is white, turning to dull yellow with brown flecks with aging. It is not recognizable as koa wood without a technical examination. There is no market currently for this wood.
- The logs yield some classic "koa look" lumber.
- Much of the lumber was an un-figured, un-distinctive brown color and included stain and other defects. There is no consensus yet on the market value of this type of wood.

Results should be published soon and will be posted on this page.

There is wide agreement among forestry professionals that a harvest age of between 45 -50 years should be achievable.[1, 2, 3, 4, 5]

Naturally seeded stands of koa can also do very well. The seed lives in the soil for long periods of time. Natural stands need soil disturbance so the trees can grow past grass and other competitors. Protection from grazing animals is also necessary. Natural stands often emerge very thick and can benefit from thinning and fertilization.

A natural stand of thirty-year old Acacia koa. Kona, Hawai`i.

Acacia koa tree in a fifteen-year old natural stand. Kapapala, Ka`u, Hawai`i.

Genetic Variability

Koa has highly variable genetics. Genetics can have great impact on wood quality, but is not yet well understood. Over time, genetics will be better understood and will present an opportunity for wood quality improvement.

Two fifteen-year old trees with very different colors of heart-wood.

Marketing the Crop

Value of Harvested Trees – Example

If typical plantation harvest ages settle out around age 45, this might yield gross volume of 9,000 board feet per acre (200 board feet per acre per year) before deductions for defect or sapwood. There is no reliable data for such deductions.

Thirty-year old Acacia koa wood from Kona, Hawai`i Island. Note unusable white sapwood and heart stain.

Current stumpage rates for mature koa are in the $4 per board foot range. No one knows whether the market will accept second growth lumber at the current price for the mature koa. Using an optimistic assumption that second growth trees will garner today's prices for the older koa, then net stumpage in this example would be $36,000 per acre--$82 for each of our originally planted 440 trees per acre or around $514 for each of the remaining crop trees. Poor form (eg. branchiness and multiple stems) limits the amount of volume that can be economically harvested from koa stands.[11]

An alternative strategy would be to make modest harvests periodically and allow some trees to grow larger and older. A harvest of 1,000 board feet per acre once every five years starting at about age 35 would be sustainable, yielding perhaps $4,000 per acre once every five years.[1, 5]

Utilize the CTAHR calculator to use any assumption you care to make and find the economic yield.[8] An example of current economics using one possible set of assumptions is located here:

EXAMPLE KOA ECONOMICS

Subsidies

There are several attractive subsidy programs.[1] The National Academy of Science in a report authored by representatives of Stanford, University of Hawai`i and Harvard indicates that a koa plantation without subsidies would be worth a net present value of $453 per acre, while with subsidies it could be worth $1,661 per acre. Incentive Programs for forest landowners in Hawaii can also be found here.

Ongoing Research

There are several organizations currently researching Acacia koa, including the University Of Hawai'i College Of Tropical Agriculture and Human Resources, the US Forest Service and the Tropical Hardwood Tree Improvement and Regeneration Center. Anyone interested in Hawai'i forestry as an investment should follow the efforts of these and other scientific organizations.

Mahalo for your research and insights!

University of Hawai'i, College of Tropical Agriculture and Human Resources (CTAHR)

U.S. Department of Agriculture

U.S. Forest Service

Purdue College of Agriculture

Hawai`i State Department of Land & Natural Resources

Hawai'i State Division of Forestry and Wildlife (DOFAW)

Institute of Pacific Island Forestry

Stanford University

Harvard University

Forest Solutions, Inc.

Tropical Hardwood Tree Improvement and Regeneration Center

FOOTNOTES

1 - Koa Forestry as a Case Study

Joshua H. Goldstein, Stanford University; Gretchen C. Daily, Stanford University; James B. Friday, University of Hawai`i, CTAHR; Pamela A. Matson, Stanford University; Rosamond L. Naylor, Stanford University; Peter Vitousek, Stanford University; William C. Clark, Harvard University

http://www.pnas.org/content/103/26/10140.full?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=Hawai'i+forestry&searchid=1&FIRSTINDEX=0&resourcetype=HWCIT

2 - Species Profiles for Pacific Island Agroforestry – Acacia Koa

Craig R. Elevitch, Kim W. Wilkinson, James B. Friday, University of Hawai`i, CTAHR

3 - Hawai'i Growth Plot Data

Michael Constantinides, Hawai`i Department of Land & Natural Resources

4 - Farm and Forestry Production and Marketing Profile – Koa

James B. Friday, University of Hawai`i, CTAHR

5 - Koa (Acacia koa) Ecology and Silviculture (PSW GTR 211)

Patrick J. Baker, US Department of Agriculture; Paul G. Scowcroft, Institute of Pacific Island Forestry; John J. Ewel, Institute of Pacific Island Forestry

6 - Potential for Koa improvement in Hawai`i

Nick Koch, Forest Solutions; Purdue College of Agriculture

7 - Problematic Forestry Schemes

http://www.panamaforestry.com/GTI_Teak_information/Teak_Plantation_investment_controversies.htm

http://www.guaduabamboo.com/bamboo-investment-scams.html

8 - Financial Analysis for Tree Farmers in Hawai`i

J. B. Friday, University of Hawai`i, CTAHR; Carol Cabal, University of Hawai`i, CTAHR; John Yanagida, University of Hawai`i, CTAHR

http://www2.ctahr.Hawai'i.edu/oc/freepubs/spreads/RM-9_forest_econ_calc.xls

9 - Acacia koa Photo Gallery

J.B. Friday, University of Hawai`i, CTAHR

10 - The Value of Managing Acacia Koa Forests

Idol, T., P. G. Scowcroft, N. Dudley, P. Simmons, K. Dancil, and J. B. Friday. 2007. Hawai‘i Forest Journal, Hawai‘i Forest Institute, Hilo, HI.

11 - Poor Stem Form as a Potential Limitation to Private Investment in Koa Plantation Forestry in Hawaii

Scowcroft, PG, JB Friday, J Haraguchi, TW Idol, NS Dudley. 2010. doi: 10.1007/s11842-009-9107-1

References for further reading on Koa from CTAHR