

AGRO-FORESTRY: GROWING TREES, FORAGE, AND LIVESTOCK TOGETHER

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For a lot of landowners the major obstacle to starting a new forest is the long wait for mature trees. "I can't afford to plant trees and wait 30 to 40 years for an income," is a complaint many landowners voice. It's a realistic complaint, too! No matter how great the final return on a tree-planting investment, income during the intervening years is virtually non-existent.

"Show me a way to maintain an annual income from my property while I wait for those trees to mature, and I'll plant them," is the challenge coming from ranchers and other woodland owners. Agroforestry could be an answer.

Agroforestry involves planting widely spaced trees into pasture to attain the best combination of pasture growth and timber quality. It provides an annual income from livestock production, while the trees are maturing. This combined production could result in a greater profit than does either forest or pasture production alone.

This concept - combining forage and tree production on the same land to obtain greater profit - may sound too good to be true. But preliminary results from research in New Zealand, Australia, and Oregon indicate that it is possible.

These are not the only locations where forest grazing is being tested. Forest grazing with cattle has been a common practice in the southeastern United States for several years.



Note, however, that there are two different agroforestry production systems - a producer can plant trees into existing pasture or attempt to establish forage plants under an existing timber stand.

This publication describes the system in which a producer

plants timber seedlings into an established pasture to maximize the land resource with multiple crops. While experience has shown that forage can be established under existing timber stands, this system is less desirable and more limiting. Do not confuse it with our description here.

AGRO-FORESTRY IN NEW ZEALAND AND AUSTRALIA

Agro-forestry has been investigated most thoroughly in New Zealand and Australia. Both countries have extensive acreages consisting of research installations and private holdings.

One of the largest research studies began in 1973 on a 230-acre installation near Rotorua, New Zealand. Here, Monterey pine was planted on pasture at various stocking densities to research the best combination of livestock and trees for maximum financial return from the land. Here are some results of this research.

Grazing. Approximately 20 percent of the grazing potential can be obtained in the first year after planting; 40 percent, in the second year; and 80 percent, in the third year.

No grazing is recommended until trees are approximately 3 feet tall. For the first 2 years, while trees are within browsing range, hay may be cut between the rows on suitable terrain, or lambs can be grazed. (Areas with poor tree growth may still require restricted grazing after 3 years.)

Protection. Experiments using mechanical guards to protect young trees from damage have been successful, but costly. An alternative is to plant taller seedlings to reduce the period of tree vulnerability to livestock.

Thinning. A typical planting consists of 300 to 500 trees, thinned to 82 trees per acre when the trees are 10 feet tall. Thinning is done to leave only the fastest-growing crop tree specimens and to minimize shading of the pasture.

Pruning. As the trees mature, pruning the lower branches (in five stages) to a height of 26 to 36 feet prevents knots in wood and produces more veneer, clear boards, and good quality framing material. This also reduces shade and improves pasture production.

Livestock performance. Weight gain and wool quality are affected little by densities up to 41 trees per acre. However, performance declines when the density is more than 82 trees per acre (in comparison to performance on a pasture with no trees).

Although researchers in New Zealand have not completed an entire rotation of tree growth, their preliminary findings indicate there are no insurmountable barriers to grazing under Monterey pine forests, provided the final crop objective is no more than 82 trees per acre.

AGRO-FORESTRY IN OREGON

In 1979, an agro-forestry demonstration was started near Roseburg in southwestern Oregon. As shown in figures 1, 2 and 3, Douglas-fir and Knobcone-Monterey pine (KMX) seedlings were planted. (Similar research also began in the fall of 1982 at Oregon State University in Corvallis, using Douglas-fir.)

Figure 1 — An agro-forestry demonstration area near Roseburg, Oregon. Three year old Knobcone-Monterey pine (KMX) in subclover-ryegrass pasture.



KMX is a hybrid (an offspring of two different plant species) that incorporates the cold hardiness of knobcone with the fast growth of Monterey pine. Monterey pine is found naturally only in a small belt between San Francisco and Santa Barbara, California, but it is an important forest tree elsewhere in the world. Knobcone pine occurs in a broader area - from southern Oregon to Los Angeles at elevations up to 5,000 feet.

The two species were planted at 12 by 12 foot spacings in alternate rows on an improved subclover and ryegrass pasture in excellent condition. Grazing trials with sheep were conducted during the first 3 years of plantation growth with the following results:

Grazing. Sheep will feed on seedlings, even when planted in improved pasture. (Grazing trials were conducted in the spring before tree bud break.) It appears that grazing should be avoided until trees are 3 feet tall and out of browsing range.

Browsing. Douglas-fir usually sustain more damage than KMX and seem to be the preferred browse. You can avoid browsing damage with mechanical devices (Vexar tubes supported with wood stakes); however, this method is expensive. Less costly, and less effective, is BGR (Big Game Repellent) - you apply it to the trees just before grazing.

Subsequent experience with portable electric fencing and different tree planting designs has proven to be an excellent solution to browsing during the early establishment period. Trees can be planted in rows with grazing lanes between them. This planting design makes installation of portable electric fencing very easy. Single strand is often all that is required.

Herbicides. These should be used in the first 2 years after spring grazing to eliminate competing vegetation around each tree and conserve moisture during the summer growing season. Their purpose is to insure maximum tree survival and growth.

Pruning. Theoretically, the KMX should be ready to harvest within 20 to 25 years, leaving the Douglas-fir to mature at approximately 40 years of age. During that time, it is necessary to maintain productive pasture for as many years as possible by tree thinning, and pruning of lower branches.

While pruning has not been a common forestry practice, it appears that in the context of agro-forestry, it will be important.

Spacing. The initial 12 by 12 foot spacing (300 trees per acre) will have to be increased as the trees mature. Optimum spacing for Douglas-fir and KMX in pasture is not known at the present time. Subsequent trials have planted as few as 150 trees per acre with promising initial results.

Judging from the results of the research cited, the benefits of agro-forestry are promising; however, you should consider carefully both its advantages and disadvantages before trying it on your property.

ADVANTAGES OF AGRO-FORESTRY

Multiple use. There is more production from an acre of land and potentially more net profit. Product diversity could help stabilize your income - being able to sell logs when livestock prices are low and to retain standing trees when livestock prices are high, strengthens your cash flow and provides more marketing options.

Ecological benefits. These are significant. Legume plants in the forage crop (subterranean clover) capture nitrogen from the air that exists in the soil and convert it to a form of nitrogen that facilitates greater plant growth. This could improve tree growth.

Livestock. Sheep or cattle can harvest the forage growing under the trees and provide salable material (meat and wool) from it. They also contribute to faster tree growth by converting plant material into dung and urine. The nitrogen in these byproducts is then available as plant food for both trees and pasture.

Fertilizer. This costs less because nitrogen fertilizer is not necessary. Nitrogen comes from the forage crop (clover) through nitrogen fixation.

You must apply phosphorus and sulfur as necessary, but they tend to be low-cost fertilizers and have low-energy requirements for production. You won't need to apply them as often once soil nutrients have been built up - the ecological system requires lower energy inputs to maintain soil fertility.

Soil fertility. Agro-forestry minimizes depletion of soil nutrients. The products you intend to sell - livestock or trees, or both - don't require that you add much fertilizer to the soil.

When you harvest the trees, you may leave some or all of the foliage on the site. High in nutrient content, this waste material helps replenish the soil. This nutrient cycling system minimizes soil depletion, making for low fertilizer costs.

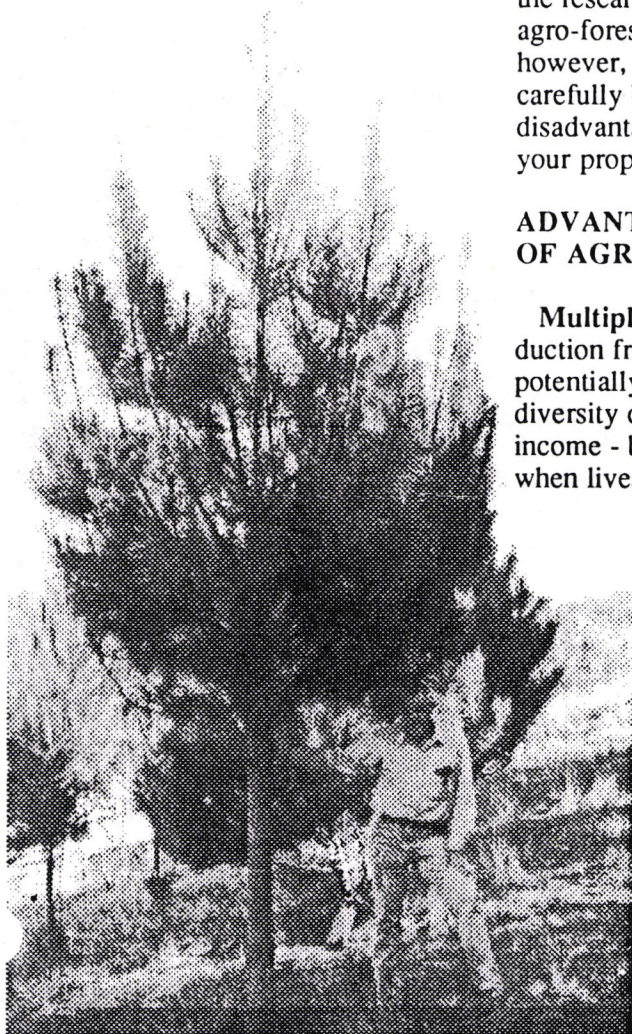


Figure 2 — 5 year old Knobcone-Monterey pine (KMX) after first pruning. This practice maintains adequate light for pasture forage and produces clear, high-volume veneer from the tree.

Grazing. Sheep can control much of the competing vegetation (brush, grass, etc.), and can reduce moisture stress on established trees. This provides easier access through the trees when culturing. It also improves tree growth and reduces the concern of wildfire.

The grazing loss from the maturing trees is offset by the returns from the timber crop.

Environment. Agro-forestry creates an area with visual appeal (trees growing in a pasture are esthetically pleasing). It also encourages birds, but few rodents. In addition, the trees moderate climatic extremes at ground level, which may increase livestock performance with greater weight gains and better wool quality.

DISADVANTAGES OF AGRO-FORESTRY

Investment. There is an obvious reduction in grazing potential as the trees mature - increasing canopy reduces the available light and limits pasture growth. Investments in tree thinning and pruning will be necessary to slow this process and maintain forage for as long as possible. Also, you may need to invest in fencing to control grazing livestock.

Restricted grazing. There are limitations in pasture use during the first 21 to 3 years while the tree seedlings are more susceptible to browsing damage. This delay in grazing can be eliminated however, with the use of portable electric fencing and tree planting designs that include broad grazing lanes between tree rows.

Management. Agriculture and forestry management require some modification under the concept of agro-forestry. Therefore, management will probably be more complicated, and you may need to acquire new skills.

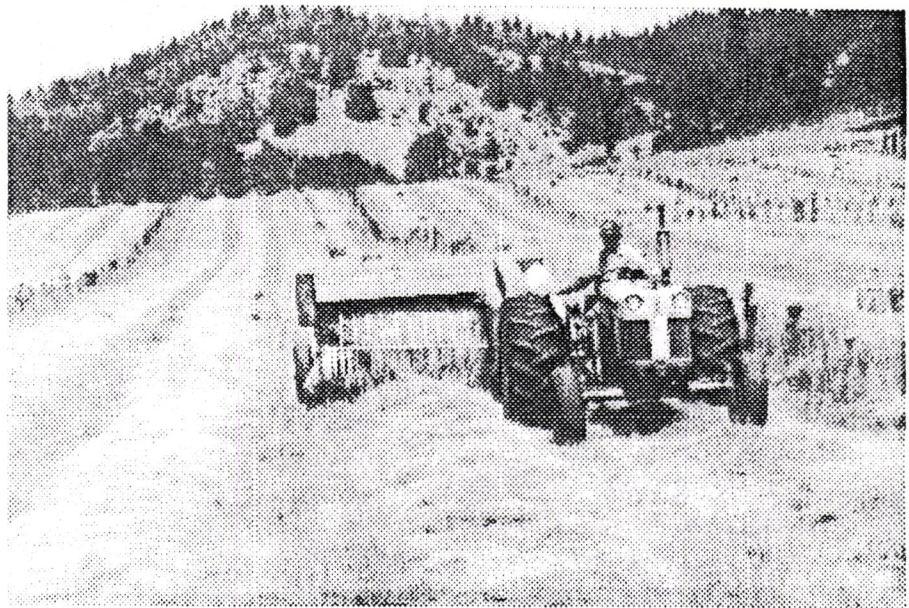


Figure 3 — Hay crop grown between rows of trees in experimental areas near Roseburg, Oregon. During early years trees can be protected with portable electric fencing with livestock confined to grazing lanes.

ALTERNATIVE CROPS

Don't limit the agro-forestry concept to trees and livestock. Where terrain is suitable, alternative cropping between rows of trees is possible.

A wheat crop has been grown successfully between rows of first-year KMX seedlings in Douglas County, Oregon. The only problem encountered was the right tree spacing at the edges of the field - harvesting equipment needed more space to maneuver than was allowed.

SOME FINAL QUESTIONS

There are still many questions concerning agro-forestry that need to be answered. Test areas need to be established. Refinement of optimum spacing and yield of the various tree species, forage types, and livestock all need to be determined.

The most crucial question must still be answered: at what level of tree stocking can we expect the best combination of animal and timber production to derive the highest net profit?

SUMMARY

Although the concept of agro-forestry is still in its infancy, New Zealand research shows it to be technically feasible. On suitable sites, it promises higher financial returns than from pasture grazing alone.

The ultimate goal of agro-forestry is increased production - of both wood fiber and red meat. Demand for wood in the United States is predicted to double by the year 2000. The compatibility of tree crops with livestock could provide a key to meeting this demand.