

Drawing on material held by the Weyerhaeuser Company and oral history transcripts available in the Forest History Society library, Ted Nelson has assembled a history of how Weyerhaeuser established its High Yield Forestry program in the 1960s. Pushed in a new management direction after a major blow-down in the Pacific Northwest in 1962, company leaders turned a pressing situation into an opportunity to apply the results of two decades of forestry research.

WEYERHAEUSER COMPANY

AND SUSTAINED-YIELD FORESTRY

In October 1966, Harry E. Morgan, Jr., Weyerhaeuser Company's vice president of timberlands, made a presentation to the company's board of directors at the direction of President George H. Weyerhaeuser. Morgan sought approval for a bold new approach to the management of the company's Douglas-fir timber-

lands. They included 1.7 million acres in western Washington and 478,000 acres in western Oregon. Morgan titled his presentation "The Fir Target Forest."

The company first acquired a portion of these lands in 1900, when Frederick Weyerhaeuser, George Weyerhaeuser's great-grandfather, bought 900,000 acres in western Washington from the Northern Pacific Railroad. For most of the years following this acquisition, the old-growth timber harvested from the increasing land base had been used to supply the company's growing number of sawmills, plywood plants, and pulp mills.

Weyerhaeuser Company executives had long seen the importance of forest management, beginning with fire protection. After a disastrous 1902 fire on the company's Washington timberlands, General Manager George S. Long led the formation of the Washington Forest Fire Association to protect forests from fire. In 1933, J. P. Weyerhaeuser, Jr., told shareholders that "We are... committed to the business of growing trees as part of a sustained-yield program."

As a first step toward sustained-yield forestry, the company

began leaving small blocks of trees within clearcut areas to provide seed for a new forest. Plantation forestry began in a minor way in 1938 with seedlings from the company's first nursery, at Snoqualmie, Washington. In 1941, the company dedicated the nation's first tree farm—the Clemons Tree Farm in western Washington. Today, the American Tree Farm System includes 90,000 owners. In 1942, the company established a forest research department at Centralia, Washington, to begin developing a scientific basis for managing the company's forests.

On Columbus Day 1962, hurricane-force winds blew down old-growth timber on 83,000 acres of company timberland in Oregon and Washington. The affected volume far exceeded the capacity of the company's mills to convert the timber to finished products. To achieve prompt salvage, Weyerhaeuser foresters opened noncompany, domestic markets for downed timber and a new market for logs in Japan.

As salvage of the downed timber progressed, company leaders began studying ways to sustainably manage the company's timber resource while increasing production to capture the profit

BY TED NELSON

COURTESY OF THE WEYERHAEUSER ARCHIVES, PHOTO T50-0112-5



Timber blown down in the Northwest's 1962 Columbus Day Storm influenced Weyerhaeuser's plans for the future.



COURTESY OF THE WEYERHAEUSER ARCHIVES, PHOTO W05-0239



COURTESY OF THE WEYERHAEUSER ARCHIVES, PHOTO HEM JR B10 B20474

In 1966, Weyerhaeuser Company's President George H. Weyerhaeuser (top) and Harry E. Morgan, Jr., vice president of timberlands, (bottom) presented a new plan for managing the company's Douglas-fir region forests.

opportunities from the export market in Japan. These studies led to Morgan's target forest presentation.

THE TARGET FOREST CONCEPT

The concept behind the target forest could be found in forestry school textbooks under the term "the fully regulated forest." The concept, adopted by early forest educators in this country, came from nineteenth-century European foresters. In 1925, retired professor Filibert Roth said the idea behind the fully regulated forest is "to build up, put in order, and keep in order a forestry business." In his 1954 text *American Forest Management*, Dr. Kenneth Davis of the University of Michigan wrote, "The essential requirement

of a fully regulated forest is that age and size classes be represented in such proportion and be consistently growing at such rates that an approximately equal annual or periodic yield of products of desired size and quality may be obtained."

The starting point for achieving the eventual target forest came from the existing forest inventory at each of six tree farms. Clearcutting was the norm on these predominately Douglas-fir lands. Some areas had yet to be reforested after logging. Other areas held a matrix of timber stands of different ages, some with trees more than 400 years old.

To measure tree volume, Weyerhaeuser abandoned the Scribner board foot measure. This measure, historically used by the industry, understated the amount of lumber that could be



Weyerhaeuser Company forest scientists studied tree growth in young, naturally regenerated stands. Their study results were incorporated into the 1966 Fir Target Forest presentation (right) to illustrate the expected benefits of intensive forest management in comparison to an unmanaged stand as shown in the lower curve.

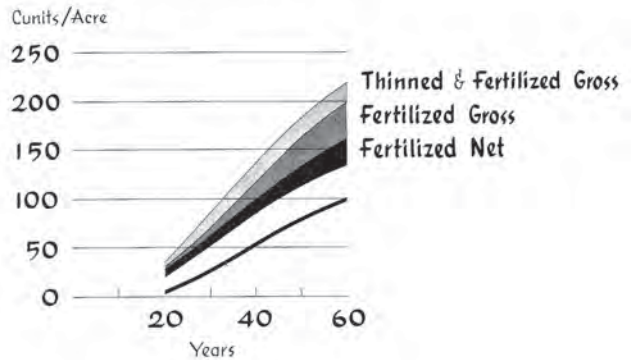
produced from trees of different sizes and did not account for the volume of other useful wood products, such as chips and sawdust. In its place, the company adopted a cubic foot measure, expressed in units of 100 cubic feet called cunits. This measure accurately gave the total volume of wood fiber in trees, based on diameter and merchantable height.

The science to support the target forest concept came from the years of field and laboratory studies conducted by the company's forest scientists. Dr. Eugene Steinbrenner studied the soils of the company's Douglas-fir region. His maps delineated the basic tree-growing capabilities of the company's holdings, based on soil properties, geology, and elevation. Using these maps, Dr. Jim King established 210 sample plots throughout the company's Douglas-fir tree farms. Over a period of twenty years, King's staff measured the annual growth rates of more than 12,000 trees. Morgan told the board of directors that analysis of the data "produced yield tables that will predict volumes for any acre, of any age."

King's studies showed that growth rates in young stands significantly increased when the stand's life began with an optimum number of trees. Other studies indicated that periodic applications of nitrogen fertilizer further increased growth, and additional growth and merchantable timber yields could be expected by thinning young stands. Morgan displayed graphs to illustrate these increments by age on a typical acre.

TOTAL MANAGED FOREST

SITE 2



After describing the science to support his target forest proposal, Morgan turned to the financial implications. Here he used the results of analyses developed by a staff of forest economists under the direction of Gilbert Baker. Morgan introduced this complex topic with a series of graphs depicting a theoretical forest inventory as invested capital and harvest volumes at different ages as the interest earned on the capital.

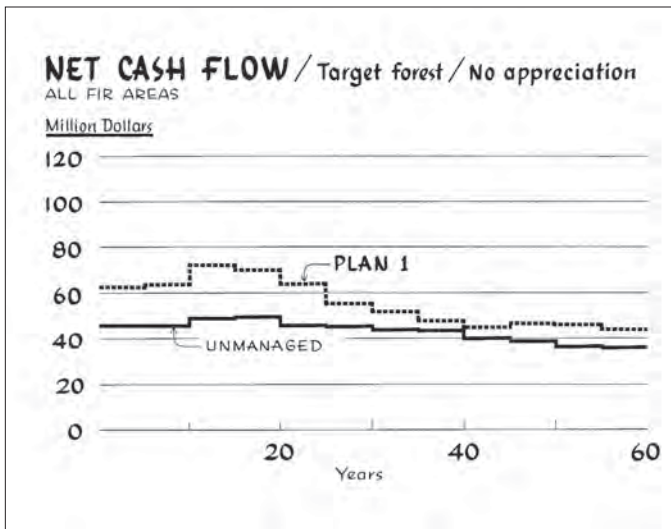
Using this analogy, Morgan described the incremental returns on investment that accrued from tree growth in young, intensively managed forests carried to different ages of final harvest. Depending on soil productivity, the data showed that target forest harvest ages became optimal between the ages of forty-three and fifty-five years. Previous expectations were for a young forest harvest age of sixty years.

The information that followed came from more than seven hundred computer simulations with depictions for each of the Douglas-fir region tree farms. Foresters, devising programs as they went, shepherded punch card data through the company's first computer, which took up much of the basement in the Tacoma, Washington, headquarters building. Despite its size, the GE 225 lacked capacity and worked at one-hundredth the speed of a modern laptop. For many simulations, the foresters traveled to Hanford, in eastern Washington, to use the Atomic Energy Commission's UNIVAC computer, which was available only at night.

Incorporating hundreds of variables for each tree farm, the simulations predicted harvest levels 120 years into the future. They included growth and yield by age and soil productivity, management intensities, and ages of final harvest in young stands. They also included the assumption that seedlings would be established on each acre within a year following harvest, an objective not previously met.

The simulated harvest levels under different scenarios were tested for their economic implications. The parameters included net cash flows by year for sixty years into the future along with their discounted net present values. These projections required assumptions about future costs and values. Costs, without inflation, were ascribed to each step in the forest cycle from stand establishment to final harvest, including precommercial thinning, commercial thinning, and fertilization.

Morgan pointed out that to gain confidence in future values,



This graph showed the net cash flow from one of the plans considered in the 1966 Fir Target Forest presentation.

the company had employed the Stanford Research Institute to study the future demand for wood products. Their findings indicated a seventy-two percent increase in worldwide demand by 1985. Simulations tested the economic effects of nominal rates of real appreciation in product values.

The time required to harvest the remaining old-growth timber became a critical variable. In 1964, George Weyerhaeuser informed the board that this period would last thirty to forty

years, given the assumption of an average, young forest harvest age of sixty years. However, he cited the corporate policy manual, which stated, "The Company shall: constantly seek optimum profitability by adopting timber harvest schedules in accordance with broad sustained-yield principles." Thus, target forest simulations tested significantly shorter periods for old-growth removal with the associated economic benefits, and the implications for achieving future target forest harvest levels under various management intensities.

Morgan concluded his presentation with a series of graphs and tables that combined selected simulations from the six tree farms. In each case, he depicted the results of not initiating intensive forest management as envisioned by the target forest proposal.

FROM CONCEPT TO PRACTICE

That data supported Morgan's recommendation for implementing the Fir Target Forest. Depending on the tree farm, the remaining old-growth timber would be harvested over the next thirteen to twenty-five years while retaining the ability to achieve an optimal balance of age classes in the target forest. Morgan told the board, "We are confident of being able to grow wood fast enough to justify increasing our cut thirty-seven percent above the level recommended in 1964. This appears to make excellent economic sense."

Morgan placed caveats on his recommendation. He told the board that "only by making rapid and imaginative progress toward improved forest management can we increase our cut



Weyerhaeuser foresters in the southern pine region had already initiated elements of intensive forest management as shown in this photo of an early loblolly pine plantation in North Carolina.

COURTESY OF WEYERHAEUSER, LONGVIEW, PHOTO FLC814



After salvaging 800 million board feet of timber from lands devastated by the 1980 eruption of Mount St. Helens, (above) Weyerhaeuser foresters used High Yield Forestry techniques to establish a new forest with 18 million seedlings planted on 45,000 acres (below).

COURTESY OF WEYERHAEUSER, LONGVIEW, PHOTO FLC819



while still maintaining our land stewardship integrity. This intensification will require the investment of large sums in fertilizing, thinning, nurseries, seed orchards, research and other necessities for growing wood more efficiently. These funds can come from the additional revenues generated by increased timber harvests.”

Weyerhaeuser’s board of directors adopted the 1966 proposal for the Fir Target Forest. A year later, the target forest concept was adopted for implementation on 600,000 acres of the predominately ponderosa pine forest in south-central Oregon and 917,000 acres of southern pine forests in North Carolina, Mississippi, and Alabama.

Acquisition of the southern pine forests had begun in 1956. On these lands, company foresters had already initiated many of the intensive management practices incorporated into the target forest concept. With the acquisition of Dierks Forests in 1969, the company extended the concept to lands in Arkansas and Oklahoma. The company adopted the term “High Yield Forestry” to describe its commitment to intensive and sustainable forest management on its 5.6 million acres of timberlands in the United States.

In its 1975 annual report, the company stated that its intensively managed forests in the Douglas-fir region were averaging more than twice as much growth than in an unmanaged forest. In the South, the yields averaged up to four times more than in an unmanaged forest. The report also noted that although the company owned only nine percent of the nation’s industrial forestlands, it accounted for thirty percent of the acres reforested by the industry.

By 1986, Weyerhaeuser’s western and southern nurseries were producing 200 million seedlings per year. A celebration that same year marked the planting of the two billionth High Yield Forestry seedling on lands being reforested after the 1980 eruption of Mount St. Helens. Lumber came from state-of-the-art small-log mills in the West and South, and the market for export logs extended from Japan to China and Korea.

ORAL HISTORIES AND HIGH YIELD FORESTRY

In 1986, the company began conducting a series of oral interviews with the executives and staff who developed and implemented High Yield Forestry. Weyerhaeuser’s George Staebler, director of forest research, and Dr. Bill Lawrence, director of environmental science, conducted most of the interviews, and they too were interviewed. The interviews provide candid insights into a major undertaking by a large forestry enterprise as it transitioned into a future of intensive forest management.

In his interview, Harry E. Morgan, Jr., who became vice president of the newly formed timberlands division in 1964, was asked when he first became aware that “managing [forest] growth could be a potentially profitable enterprise.” Morgan said, “I think it came first in the meetings I had with George Weyerhaeuser after I was appointed to the timberland’s responsibility. He was probing at this very question in trying to find some way of viewing timber investment, [and] what kinds of returns could be expected. Originally, it was George Weyerhaeuser’s own personal priority.” Morgan noted that “There was no great vision that I had...that was close to what was finally done. It really was evolutionary.”

Morgan credited Gil Baker’s “financial acumen” and “tena-

aciousness” as pivotal in the development of High Yield Forestry. Baker, who had an accounting background, came to Weyerhaeuser from Crown Zellerbach in 1965, when Morgan hired him on the recommendation of George Weyerhaeuser. At Crown, Baker worked with Crown’s forester Clarence Richen to develop many of the ideas that Baker incorporated into the target forest concept.

In his interview, Baker said, “We had to set up the timberlands division. We had to figure out what to do.” Forest economists Wes Rickard and Phil Woolwine were with the company when Baker arrived. “We talked about how to get into a target forest kind of situation given yield tables and imbalanced age classes [and] how we could go about the long-term harvest plan and financial evaluation. Here’s where [Jack] Bandel had tremendous value,” said Baker. “He had a crew of people that were real good with computers. When they found a problem, they would just work all night and they would get the answers.”

In reference to questions about implementing High Yield Forestry, Morgan said, “There were a lot of skeptics.” Many in other companies “looked at it as a PR gimmick.” Many within Weyerhaeuser thought “it was just a rationale to cut all the timber and that nothing was ever going to be done.” Even some of our directors “were not in favor of increasing the cut on almost philosophical grounds. I don’t know how we would have done it if we had a proposal which did not balance in the forestry approach.”

Morgan expressed disappointment in the time it took “to get the urgency and capability in place. The first two years we could not spend our budgets.” Staebler interjected, saying, “I would wager that someday, some historian is going to discover that it went remarkably fast. I would also suggest that you [Morgan] are going to get a lot of credit for that.”

Responded Morgan, “The success was finally related to a whole host of things... I give a whole host of people credit.” As an example, he cited the “people in the research group...who felt a sense of accomplishment and also a sense of involvement from start to finish, so it is hard to distinguish between the research and the implementation.”

Morgan cited Bob Hansen, High Yield Forestry operations manager, for his contributions in the West and the South. Hansen echoed Morgan’s comments about the speed of implementation. He recalled that “we had a difficult time in trying to convince people at the operations that they could really accomplish all these tasks that were huge.”

At the outset of High Yield Forestry, about half of the regeneration effort in the Douglas-fir region was accomplished by seeding from helicopters. Royce Cornelius managed the purchase of seed from contract seed collectors and seedlings from outside nurseries. In his interview, Cornelius said that as High Yield Forestry evolved, “it pointed up the need to move toward more and more planting to improve spacing and [to employ] the genetic improvements taking place.”

Cornelius recalled that early in 1967, we “surveyed the whole damn west side of the state of Washington” to find a site for a new nursery. Once it was established, the nurserymen knew “they were responsible for providing the best seedlings that would survive.” The field foresters “were not a damn bit bashful about letting them know when they were not getting top quality.”

In 1968, Morgan became a senior vice president with addi-



Weyerhaeuser established new nurseries, such as this one near Little rock, Washington, to meet High Yield Forestry's demand for seedlings.

tional corporate responsibilities. Charles W. Bingham succeeded him as timberlands division vice president. In his interview, Bingham recalled that by then, “we had a good blue print. It was exciting to see the physical growth that was taking place, and the nurseries coming into production, and the seed orchards [producing genetically improved seed] being established.”

In his interview, Bill Lawrence recalled that not everyone shared Bingham's excitement. “The academic world didn't believe us, unfortunately.” As a result, sometime in the late 1960s, we developed “a travelling program” to visit the forestry schools around the country. “The skepticism at the schools was very high. There were lots of questions about our regeneration, lots of questions about ‘Aren't you just ripping off the forests to make the cash flow quicker?’ We tried to show through Bob Hansen and me and others that we were really doing these things.”

Besides noting the “attention on campuses of forestry around the country,” Bingham said, “we got international attention. We were making an impact on public forestry.” Without elaborating, he noted, “At the same time we were struggling with the environmental dimensions of forestry.” (In 1974, John G. Mitchell published a long article in *Audubon Magazine* about Weyerhaeuser and High Yield Forestry called, “The Best of the S.O.B.s.” Mitchell lamented many of the company's practices but grudgingly admitted its environmental leadership.)

In 1971, Bingham became a senior vice president as Weyerhaeuser enlarged its international sphere with the acquisition of a major Indonesian timber concession. Jack Wolff, reporting to Bingham, became timberlands vice president. He noted in his interview that about this time, “There began to be some real concerns expressed, not in the overall commitment to High Yield Forestry or to research, but do we understand what's going to

happen on each acre in relation to the final values we are going to receive.” As an example, he said, “It was starting to bother people” within the company that seven hundred trees were being planted on each acre without regard to the soil's productivity.

As a new group of financial analysts began to study these issues, Wolff noted that researchers and field foresters were starting to ask, “Are you guys backing out? What's the deal?” Wolff said his response was, “Hey, we now are at another stage of this program. In 1966 and '67 we were building the bicycle and trying to ride it all at the same time. We told you that there would be further changes, and now we want to start to look more carefully at the financial aspects of what we are doing.”

In his interview, Hansen spoke to this new analytical approach. Referencing forest research, he said each item had to have a financial justification rather than a biological one. “We went from problem-driven research to where we had to have some type of computer analysis done by a group of MBAs.”

During this period, Weyerhaeuser benefitted from growth in the Asian log market and a strong demand for domestic wood products. Product values far exceeded those foreseen in the target forest simulations. Western domestic mill owners, environmental groups, and some labor unions lobbied Congress for restrictions on the export of logs. Wolff pointed out that the company's analysts “developed the data” that helped oppose bills that would have banned the export of logs from private land.

HIGH YIELD FORESTRY'S EFFECT

In addition to questions about High Yield Forestry from an internal perspective, Staebler and Lawrence asked about the program's effect on other companies. In his interview, Baker noted a 1969



COURTESY OF THE WEYERHAEUSER ARCHIVES, PHOTO C03-0080

Genetically improved seed from company seed orchards substantially increased growth in High Yield Forestry plantations.

forest economics seminar at the Yale School of Forestry. Baker recalled that Yale Professor Zeb White told the attendees that “when you talk about intensive forest management, you’ve got to recognize that the only place it exists is Weyerhaeuser.”

In his interview, Hansen described a study he conducted in 1983 to look “at the industrial lands in the southeast as to what was going on.” He found that “they’re doing a darn good job of harvesting, and site preparation, and regeneration on their lands. They are right up there with us.” Hansen added that “they didn’t

spend in the learning process probably back there what we did. A lot of these people picked up on what we were doing over time. I think [High Yield Forestry] got the industry started earlier.”

William Hagenstein, executive vice president of the Industrial Forestry Association, provided a view from a western perspective. He said that as association foresters made their regular inspections of the Douglas-fir region’s tree farms, they told the owners “to go see” what Weyerhaeuser was doing. “It wasn’t long after you fellows [Weyerhaeuser] got into the High Yield Forestry bit that every major land owner in this industry adopted the policy to plant every damn acre within twelve months of the time it was harvested.”

Staebler and Lawrence, along with two others, eventually conducted nineteen interviews. The typed transcripts totaled more than one thousand pages. Though mostly focusing on High Yield Forestry in the Douglas-fir region, some of the discussions included open and often critical assessments of management styles, corporate politics, and company procedures.

Only a few of the interviews included discussions of the elements that had not achieved the target forest goals or exceeded their expectations. Morgan said, “We made assumptions on appreciation of value and it exceeded that many, many times over...even though our costs were higher, the value of the timber [in the 1970s] was far beyond that.” Morgan also noted the use of genetically improved seedlings showed gains not included in the original Douglas-fir region projections.

Mainly referencing the coastal hemlock forests within the Douglas-fir region, Baker said, “I see no sign that the [commercial] thinning is being done that is supposed to be done.” Hansen noted that the original projections did not correctly reflect the operational difficulties and costs associated with large-scale thinning.

In his 1987 interview, George Staebler addressed the topic of thinning in the Douglas-fir region. By then, experience had shown that the primary benefit of commercial thinning was to produce trees of larger size, and therefore greater value, at final harvest. Staebler said, “We always anticipated that the

wood to be harvested in thinnings would be high cost, but our accounting system is not set up to reflect the increased value in the asset because of thinning.”

Stabler elaborated on Morgan’s comments regarding genetic tree improvement. “I think the brightest light is that we did not account for any gain in yield from genetics in the Fir Target Forest. However, we did make projections: with the first generation of improved seed we’d get a twelve percent increase in yield. Now, twenty years later, studies indicate that the first generation projections were right on the button—a tremendous gratification.”

HIGH YIELD FORESTRY TODAY

Weyerhaeuser foresters continue to apply the fundamentals of intensive forest management as described in the target forest presentations of more than forty years ago. A new cycle begins as each High Yield Forestry plantation reaches harvest age. Planting remains targeted to occur within a year following final harvest. The seedlings come from company seed orchards, which are now producing the second and third generations of genetically improved seed. Based on expanded growth-and-yield studies and changing markets, some prescriptions have changed. For example, in the Douglas-fir region, plantations are established with fewer trees per acre. Commercial thinning is concentrated in stands growing on the most productive soils, and it begins later and occurs less frequently than originally envisioned.

Foresters today face new challenges that involve goals beyond reforestation and sustained yield, including federal and state environmental laws, state forest practice regulations, and consumer-driven forest certification requirements. They are unlike the

challenges faced in the early years of High Yield Forestry, described by Jack Wolff as “building a bicycle and trying to ride it all at the same time.”

In his 1986 interview, Bob Hansen captured the essence of that time in Weyerhaeuser’s history. “I think I was very fortunate to have lived through those years, been a part of it. I never saw so many people so high on their jobs. The new foresters coming in are never going to have that opportunity.” □

Ted Nelson began his long career with Weyerhaeuser in 1964. He wishes to thank retired Weyerhaeuser forest economist Dick Pierson, forest scientist Tom Terry, and Weyerhaeuser’s archivist Megan Moholt for their help in compiling this article.

REFERENCES

- Davis, Kenneth P. *American Forest Management*. New York: McGraw-Hill Book Company, Inc., 1954.
- Morgan, Harry E., Jr. “The Fir Target Forest,” Weyerhaeuser Company, unpublished, 1966.
- . “The Target Forest in the Pine Regions,” Weyerhaeuser Company, unpublished, 1967.
- Sensel, Joni. *Traditions through the Trees: Weyerhaeuser’s First 100 Years*. Seattle: Documentary Book Publishers, 1999.
- Snyder, Marion. “Still Growing after 100 Years: Weyerhaeuser Celebrates its Centennial,” *Forest History Today*, Fall 1999: 2–8.
- Weyerhaeuser, George H. “Northwest Timber Supply Review,” Weyerhaeuser Company, unpublished, 1964.
- Winters, Robert K. *Fifty Years of Forestry in the U.S.A.*, Washington, DC: Society of American Foresters, 1950.

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