Observations About the Effectiveness of Utilizing Single Tree Selection Silviculture in Redwood Forestlands

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Abstract

Harvesting in predominantly redwood forests has been ongoing in the Santa Cruz Mountain region for over 150 years. Under California Forest Practice rules specific to the Southern Subdistrict of the Coast District, clearcutting has been outlawed since 1970. Since that time, single tree selection has been the only silvicultural practice allowed in the Southern Subdistrict. Big Creek Lumber Company has been practicing some form of selective harvesting throughout coastal redwood forestlands in the Santa Cruz Mountains since 1946. Sixty-five years of experience makes it is possible to form general observations about the effectiveness of this silvicultural practice within a redwood forest environment. Increasing population and urban sprawl have created pressures on redwood forestlands in California, and particularly on the Central Coast. Tensions resulting from population increases and ongoing urban encroachment into forestlands in the Santa Cruz Mountains have increased over time. This has created significant logistical and socio-political challenges for the local forest products industry. Not surprisingly, these challenges are now beginning to be seen elsewhere in the redwood region. Selection harvesting can provide positive benefits, particularly adjacent to densely populated areas. These benefits include providing local, sustainable products for local consumers, supporting working forestlands that provide a buffer against the pressures of land conversion and urban sprawl, as well as being a mechanism for maintaining complex redwood forest ecosystems.

Introduction

This paper is not intended to be a scientific analysis. Rather it is a case study and compilation of experiences gleaned from forest resource professionals over the past sixty years. Particular thanks go to Frank (Lud) McCrary, Homer T. (Bud) McCrary and Dale Holderman, Registered Professional Forester No. 69, for their perseverance in seeing the concept of single-tree selection forestry through to a successful outcome in the Santa Cruz Mountains.

Harvest history

The extraction of forest products in the Santa Cruz Mountains by European settlers undoubtedly commenced on their arrival. However, the first recorded commercial lumber ventures were those of Thomas Larkin and Jose' Amesti during the year 1832, in what is now Santa Cruz County. These operations were very crude. Logs were placed straddling a pit and a worker above and below the log would run a whipsaw down the length of the log to create boards. Mechanical sawmilling began

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around 1841. The first mechanical mills used water power to drive the saws. During this time, draft animals (oxen and horses) were primarily used to transport logs to the mills from the forest and lumber to the end user.

By the 1850s, steam began to replace water flow as the power source in many sawmills. Steam driven log yarders (steam donkeys) were used in woods operations starting in the latter 1880s. With the development of new technologies, the rate of harvest increased. Two seminal events contributed to increased forest resource extraction in the Santa Cruz Mountains. The first was the 1849 California gold rush. While few local forest products were actually delivered to the Sierra gold country, there was a tremendous demand in San Francisco, which had become the primary hub for materials and manpower destined for the gold fields. The second event that spurred forest resource production in the Santa Cruz Mountains was the 1906 San Francisco earthquake and fire, which destroyed many of the existing wood-frame structures. By 1897, there were 32 fully operational sawmills in Santa Cruz County alone. The procurement, production and transporting of forest products was the primary industry in Santa Cruz County from 1850 to 1925.

Not all felled timber was turned into dimensional lumber. In fact, it is likely that more old-growth redwood was cut in the Santa Cruz Mountains to make “split stuff” (shakes, fence posts, railroad ties and grape stakes) than lumber. Hardwoods, logging debris and mill ends were used for fuel in heating, cooking and the generation of steam power. Tanoaks were felled and the bark transported to local tanneries. Clearcutting of the redwood/Douglas-fir conifer forests of the Santa Cruz Mountains continued more or less unabated until the mid-1920s. By 1930, most of the contiguous stands of old-growth timber had been cut or transferred to park land.

Big Creek Lumber Company

Big Creek Timber Company was established in 1946. The Company’s first sawmill was located approximately 5 miles up Waddell Canyon on land that is now part of Big Basin State Park. This forestland had been previously harvested by William Waddell from the mid-1860s until 1872. In 1946 this forestland was comprised of some residual old-growth and robust stands of small second-growth redwood and Douglas-fir ranging from 70 to 80 years old.

State regulations at that time required that four “seed trees” per acre, 18 inches in diameter or larger, be retained. All other trees could legally be cut. However, Big Creek Lumber decided to not cut that heavily and instead selectively harvested some of the residual old-growth trees and some of the larger second-growth. Trees that were too small to be economically profitable and trees that were too large for the sawmill were left uncut. The company continued sawmill operations in Waddell Canyon until 1955 when Waddell Creek experienced a significant flood. The company moved its sawmilling operation to the west side of California Highway 1, near its present location. The company became incorporated in 1960 and the name was changed to Big Creek Lumber Company. After 1955, Big Creek Lumber began to concentrate on harvesting second growth timber.

Development of single tree selection silviculture in the Santa Cruz Mountains

The development of selection harvesting in the Santa Cruz Mountains was more a gradual transitional awareness than it was a singularly planned outcome. Big Creek Lumber Company concluded that the kind of forest management practiced on the North Coast of California at that time would not be acceptable to the local public. Urban development had slowly encroached into Santa Cruz Mountains forestlands and by 1946 there were few potentially harvestable forested parcels that did not have some degree of residential influence. From an aesthetic perspective, an acre with only four seed trees was not significantly different than a total clearcut. It made sense to consider a harvesting strategy that reflected local attitudes and concerns.

From Big Creek Lumber Company's perspective there was also a practical business consideration in its approach to forest management. The composition of redwood forestland in the Santa Cruz Mountains was considerably different in 1946 than prior to 1925. While there was no legal prohibition against harvesting old-growth, most of the larger contiguous stands of old-growth had been cut by 1946. Most harvesting at this time involved cutting scattered residual old-growth and was conducted on a smaller scale than the turn of the century operations. At that time there were far more acres of young second-growth. It became clear that the second-growth constituted a larger and rapidly growing resource base. However, given the improvements in logging equipment, it was also evident that harvesting these second-growth lands under the existing regulatory standard of retaining four trees per acre would have resulted in the depletion of the resource within several decades. Harvesting at more conservative levels not only addressed neighborhood concerns, it also insured a sustainable resource.

Absent any regulatory mandate, local timber operators voluntarily formed the Central Coast Timber Operators Association in July 1956. The purpose of this organization was to create a mutually agreeable set of logging standards beyond what state and local regulations required. The impetus for these self-imposed voluntary standards was the increasing public concern over logging operations and their potential affect on streams, roads and particularly drinking water. At that time there were a few careless logging operators whose lack of consideration for these legitimate public concerns resulted in increasing conflict between neighbors and timber harvesting. On August 14, 1956, the Central Coast Timber Operators Association adopted self-imposed rules which included an assessment of surface water on every proposed timber harvest site to determine whether the water was being used for domestic purposes, rigorous confirmation of property lines and rights-of-way, strict attention to logging slash treatment and a prohibition of log hauling on weekends and legal holidays. The Central Coast Timber Operators Association also began discussions regarding developing practices for improving stream crossings, road and landing construction as well as establishing buffer zones adjacent to creeks.

In 1967, representatives of Big Creek Lumber Company participated in Board of Forestry sub-committee discussions of county-specific forest practice rules. It was during these discussions that the basic principles of selection silviculture began to take shape. These principles would eventually be formally established as government regulation in the Santa Cruz Mountains.

Three operational standards were adopted at this time which formed the basis for single-tree selection silviculture in San Mateo, Santa Cruz and Santa Clara Counties. The first was the 60-40 Rule. This rule stated that no more than 60 percent of trees 18 inches in diameter or larger could be cut during any harvest entry and no more than 40 percent of the trees 8 inches to 18 could be cut per entry.

The second operational standard established at this time was the minimum reentry time period. It was set at 10 years, based on harvest entry intervals being practiced by several local foresters at that time.

The last standard was lopping. This operational concept was first tested for economic effectiveness by Big Creek Lumber Company on a harvest site in San Mateo County in the 1960s. The eventual outcome of this standard was that all logging slash now had to be cut to within 30 inches of the ground. Interestingly it was this requirement that had the most immediate impact on timber operations in the Santa Cruz Mountains. Once operators became responsible for the cleanup of logging slash, the quality of timber operations improved significantly. Timber fallers and equipment operators could no longer knock down or damage smaller conifers and hardwoods, at least not without incurring prohibitive cleanup costs.

In 1973, the legislature passed the Z'berg-Nejedly California Forest Practice Act, enabling legislation that charged the California Board of Forestry and Fire Protection with establishing the California Forest Practice Rules. The Act permitted individual counties to create their own separate logging regulations as long as those regulations were more protective than state regulations. On January 1, 1983 Senate Bill 856 was passed. This legislation removed county authority to regulate the conduct of timber operations. The impetus for SB 856 was that Santa Clara County Board of Supervisors had decided in 1980 to completely disallow timber harvesting within the county.

SB 856 also recognized the fact that counties might have specific needs. The legislation empowered individual counties to petition the Board of Forestry for Special County Rules. In the early 1980s, not long after the passage of SB 856, several counties, including San Mateo, Santa Clara and Santa Cruz, petitioned the Board of Forestry for such rules. Primarily using the threshold of necessity, the Board of Forestry passed some of the requested Special County Rules and rejected others. Interestingly, the rules that filtered out of this process were remarkably similar to the operational standards adopted by the Central Coast Timber Operators Association during the 1950s.

Observations from an industry perspective

From Big Creek Lumber Company's perspective, the development of an uneven-age silvicultural paradigm served several purposes. First, it was an effective strategy to address several public concerns regarding aesthetics and resource protection. Second, it had the potential to provide a dependable and renewable resource over time. There was also a sense of what forestlands managed under selection harvesting might look like over time, but it would be years before there was an understanding of the results of multiple harvest entries.

By the 1950s, foresters and timber operators were well aware of the ability of individual coastal redwood trees to exhibit significant, and at times phenomenal, release growth when competing trees were removed. Cross sections of residual trees frequently showed a small core section of very slow growth and a fast growing outer section. These were small, suppressed trees that released when the adjacent old-growth overstory was felled. The increased sunlight, coupled with an existing established root system created an opportunity for rapid growth. Foresters at that time theorized that selection thinning could result in increased growth on individual uncut trees. Over 60 years of periodic selective harvesting in the Santa Cruz Mountains has demonstrated that this is generally true.

Big Creek Lumber Company's timber marking and harvesting philosophy has remained fundamentally unchanged both before and after the passage of the Z'berg-Nejedly California Forest Practice Act. Defective trees with little growth potential are harvested, allowing overall stand growth to be distributed on better formed trees. More recently, larger trees with recognizably pronounced cavities or other potential wildlife habitat attributes are generally retained. The remainder of the redwoods are thinned using the principal objective of increasing spacing between adjacent dominant and co-dominant trees. This would not be considered "thinning from below". It is our experience that limiting harvesting to understory trees results in little growth release in the dominant and co-dominant trees and does not sufficiently open the canopy to allow for successful sprout regeneration.

Careful consideration is also given to the logistics of each proposed timber harvest. It is not sufficient to solely consider silviculture when marking trees for harvest. Logging is a mechanical process and selection harvesting has a value set that does not exist in even-age management: protection of the unmarked trees, also referred to as the "leave stand". Foresters are trained to consider how a tree will be felled and yarded when they mark timber. It is counter-productive to mark timber that cannot be felled or yarded without breaking the marked tree or damaging the leave stand. Our newly hired foresters spend significant time working directly with logging crews in order to understand the mechanical principals of logging operations. Big Creek Lumber has always placed the responsibility for road and log landing layout with its foresters. At the same time, logging crew personnel are trained to minimize damage to the leave stand when conducting yarding operations.

Three timber yarding methods are utilized in local selective harvesting; ground-based tractor/skidder yarding, cable yarding and helicopter yarding. Terrain and infrastructure usually dictate which yarding method is used.

Ground based yarding

This method is utilized when the terrain permits and there is either an existing skid road system or the ability to construct skid roads without creating potential environmental problems. Cable and helicopter yarding methods are used when the terrain is excessively steep, the forestland is inaccessible or new road construction is not feasible. Ground-based yarding is the least expensive. Particular care is taken to minimize soil disturbance when conducting ground-based operations and all skid roads are seeded, straw mulched or covered with logging slash to prevent erosion following harvest operations. A direct advantage of this yarding method is that tractors can be used to distribute logging slash on skid roads and then crush the slash to create an effective barrier against erosion.

Cable yarding

This method is primarily used when the terrain is too steep for ground-based yarding. Cable yarding is operationally more challenging in a selection harvest because of the need to protect the leave stand. Cable corridors are designated and trees are felled on an angle towards the corridor in order to minimize damage to standing timber. Local operators are able to maintain cable corridors no wider than 15 feet. Within several years the canopy closes in over these corridors and they are no longer visible.

Helicopter yarding

This is the most expensive method, roughly twice the cost of ground-based yarding. It is primarily used when there is neither existing road infrastructure nor the ability to create new roads. It is the least intrusive relative to ground disturbance. Because of steep terrain and limited road access, lopping of logging slash on cable and helicopter operations is restricted to hand crews and is considerably more expensive and less effective than lopping operations on tractor-logged ground.

The 60-40 cutting rule has been in effect since the 1960s, first as a self-imposed operational standard, and then as California Forest Practice Rules specific to the Southern Subdistrict of the Coast District. While this rule technically allows sixty percent of the trees over 18 inches in diameter to be harvested every ten years [2], the reality is that few properties have been cut that heavily during an initial entry and almost no forested parcels have been harvested at that rate repetitively. In reality, logging in the Santa Cruz Mountains has evolved into a self-regulating system that has resulted in harvest levels that have consistently fallen short of the regulatory limits. There are several reasons for this.

Under certain circumstances in a densely stocked second-growth forest, a heavy initial harvest level can be justified from a silvicultural perspective. It can stimulate accelerated growth in the leave stand and promotes successful regeneration. An argument can be made for a slightly less aggressive harvest during a second entry, but heavy cutting on short intervals over time does not make sense economically and could theoretically result in smaller average tree size. Simply put, the growth may not be sufficient to make future harvest operations economically desirable. The loggers, sawmill and landowners do not necessarily want small trees and the landowner has an expectation of a reasonable return from harvest operations and their commitment to responsible land stewardship. To be certain, there are a number of variables that affect decisions about harvest levels and entry periods. For example, the growth potential of the forestland is an important factor. Nevertheless, the result over time is that the harvest levels in the Santa Cruz Mountains have not approached the regulatory limits and the average size of trees harvested has consistently increased.

Looking forward

Responsible forest management in the Santa Cruz Mountains faces considerable challenges. These challenges are not dissimilar from those occurring elsewhere in California or the nation, but they began earlier here than in other areas and are

[2] In Santa Cruz County, if the harvest level is between 50 and 60 percent, the minimum reentry period is 14 years.

frequently more intense. The Santa Cruz Mountains have been subjected to urban sprawl, including development encroachment into forestlands for more than a century.

More recently, the transition of the Santa Clara Valley into a regional economic powerhouse has predictably placed extreme land use pressures on adjacent rural lands and particularly on local forestlands. Properties that historically were owned and maintained with periodic selective harvesting as an objective have now became desirable as an upscale bedroom community for Silicon Valley. This dynamic not only creates competing economic pressure on local forestlands, it has also resulted in a population of new residents who have little knowledge of local logging practices of the area's longtime history sustainable forest management. Communicating this information to a constantly changing general public, their elected representatives and various government regulatory agencies is an ongoing necessity for the local forestry community.

One of the current challenges to maintaining sustainable forestry and a forest products industry in the Santa Cruz Mountains is the loss of viable timberlands to preservation policy. In the last 30 years, tens of thousands of acres of potentially harvestable forestland have been taken out of production by park and open-space acquisition. While many of these lands technically could be harvested, that has generally not been the policy objective of those administering these lands.[3] Encouragingly, several open space organizations are now considering the potential of responsible forest management as a mechanism to achieve their conservation goals. Time will tell what decisions are made.

In conclusion, selection harvesting has evolved into an effective and sustainable forest management methodology within the Santa Cruz Mountains. It was not created by government regulation alone, but is better explained as the result of multiple inputs which include: industry initiative, social and political pressure, as well as environmental considerations. While this kind of forest management works well in the predominantly redwood forestlands of the Santa Cruz Mountains, it remains to be seen whether it would be appropriate in other forest ecosystems.

[3] A significant exception to this dynamic is the Byrne/Milliron forest owned and managed by the Land Trust of Santa Cruz County. This sustainably managed and harvested parcel has generated over $1.1 million, funds which in turn have been used by the Land Trust to support their conservation work.