LONG ROTATION FORESTRY
Making the Most of Our Commercial Forests

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> *"Very short rotations (40 to 50 years) produce moderate to large reductions in mean annual [timber] volume production.... Rotations could be extended beyond those now in common use to minimize conflicts between timber production and environmental, aesthetic, and wildlife values, without necessarily reducing long term production. Timber value production might even increase."* (Curtis, 1994)

Overview

The Northwest's most productive timberlands -- those held by the wood products industry -- are managed as short-rotation tree farms. In other words, trees are logged at a very early age, long before they have reached their economic potential, much less their biological maturity. Short rotation forestry perpetuates a legacy of forest liquidation, and misses important opportunities for sustainability and economic gain.

Compared with the industry's poor forestry practices, longer rotations and other more sustainable forest practices can increase timber yields, forest income, wildlife values, sequestration and storage of atmospheric carbon dioxide, and other forest ecosystem services, while reducing timber management costs, cumulative impacts to watersheds, water quality, and salmon habitats.[1] In the Oregon Coast Range, moving to 140 year rotations from 45 year rotations could increase timber inventories by over 500%, reduce acres clearcut annually down to 32%, increase the volume of timber logged by 138%, and increase profits by 218%. These types of results have been confirmed repeatedly by leading Northwest forestry researchers.

Today, 40 - 45 years is a typical rotation length on industry owned timberlands in western Washington, Oregon, and California. This means that the average age of millions of acres of forestland is actually only 22.5 years. Some landowners are experimenting with even shorter rotations, including rotations of only 25 years, which would yield average timber stand ages of 12.5 years.[2] New research indicates that 57% of Oregon's Coast Range forests, for example, were over 150 years old prior to widespread logging.[3] Is it any wonder that fish, wildlife, and plant species that evolved with older forest habitats and less frequent disturbances are now threatened with extinction?[4]

The message is clear -- protecting Northwest values and reconciling environmental and economic concerns requires a new forestry, one that generates older, more productive forests. Our challenge is to find public policies and other solutions that encourage and support this transition.

Benefits of Long Rotations vs. Short Rotations

- Yields more timber, including higher quality and higher value timber
- Reduces some timber management costs
- Yields more revenue over the long term
- Supports more value-added wood processing jobs
- Sequesters and stores more atmospheric carbon dioxide, mitigating global climate change
- Provides a range of wildlife habitats, and better habitat for species impacted by forestry
- Reduces acres clearcut and cumulative impacts to watersheds, water quality, and fish habitat

Corporate Forestry -- Perpetuating Forest Liquidation

Our natural resources are like a trust account -- but instead of living off the interest, investor-driven timber companies have gone on a spending spree with the capital. For years, logging rates on industry-owned lands in the Pacific Northwest and California have outstripped timber growth rates. Timber companies have essentially "mined" the forest, with logging levels exceeding growth levels by 144% to 355% between 1952 and 1991.[5]

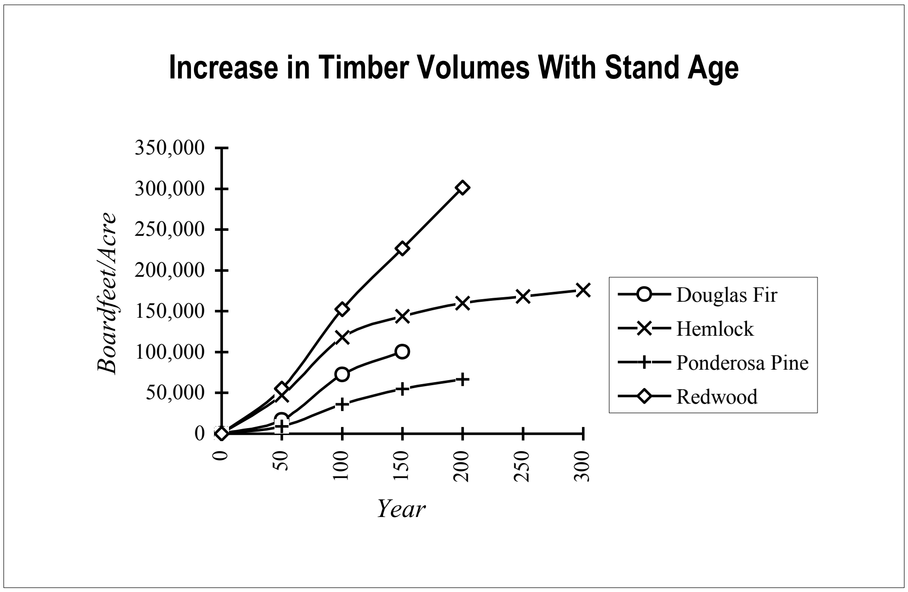
The results can be found in depleted timber inventories and corresponding habitat losses and watershed impacts. Timber inventories on industry lands in Washington, Oregon, and California declined by 21% to 59% between 1952 to 1992.[6] These figures do not include the substantial losses that occurred in many areas before the 1950s.

Liquidation of Timber Inventories and Productivity on Industry Lands[7]

	million boardfeet 1952	*million boardfeet 1992*	*Inventory Loss, 1952 to 1992*
Oregon	128,081	52,884	59%
Washington	108,184	61,107	44%
California	63,406	50,191	21%

Long Rotations -- Increasing Timber Production and Profits

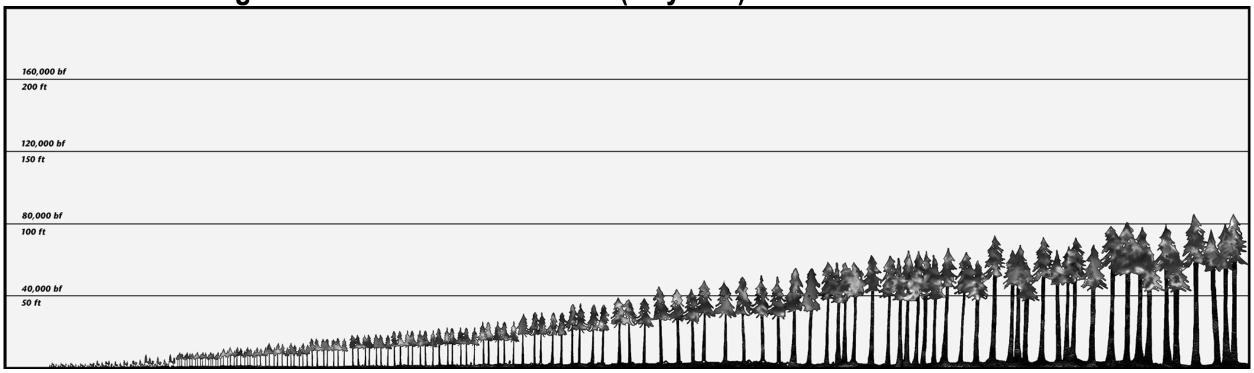
Standard timber yield tables for western commercial conifer species show that timber stands will continue to increase substantially in volume through at least year 200 and often continue growing significantly thereafter.[8] In the words of one silviculturalist, "extended rotations... offer... larger trees, higher quality wood, and higher values per unit of volume... and perhaps improved long-term site productivity...."[9]



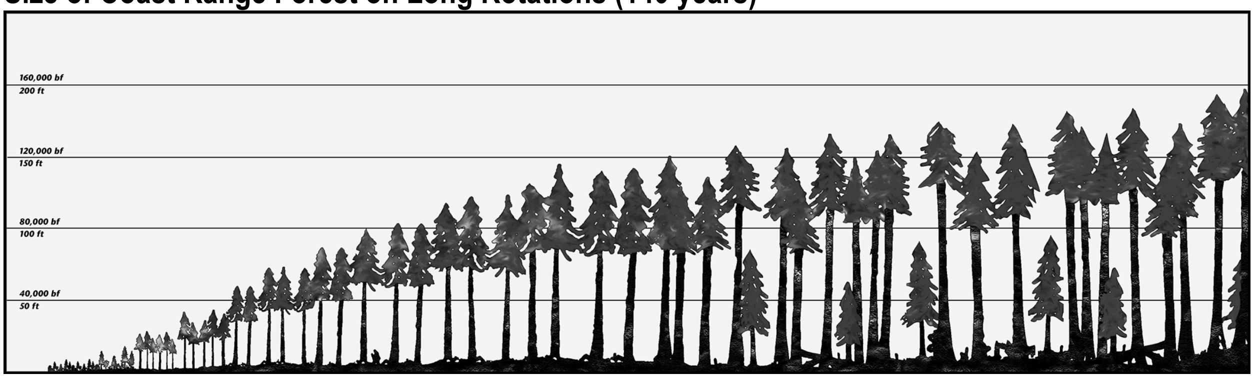
Not surprisingly, Curtis (1994) found that short rotations, particularly on sites that have been heavily logged, yield only 26% to 89% of the average annual timber production possible with longer rotations.[10] In other words, shifting to longer rotations can increase timber production by 112% to 385%.

The Coast Range Association's study of a hypothetical 100,000 acre tract of Douglas fir in the Oregon Coast Range also found that that the forests produced by standard 45 year rotations are a mere shadow of those produced on 140 year rotations.

Size of Coast Range Forest on Short Rotations (45 years)[11]



Size of Coast Range Forest on Long Rotations (140 years)[12]



These differences are reflected in the financial and ecological bottom line. The Coast Range Association's study found that moving to 140 year rotations from 45 year rotations would increase timber inventories by over 500%, decrease the acres clearcut annually to 32%, increase the volume of timber logged by 138%, and increase profits by 218%.[13] The Association's study is based on 1999 log prices, meaning that longer rotations pay better even when the price premium for large logs temporarily dips, as it has over the last few years.

Performance of Short Versus Long Rotations in Oregon Coast Range[14]

	45 Year Rotation	*140 Year Rotation*	*% Change, Short to Long Rotations*
Standing Timber Inventory (bdft)	**1,019,669,786**	**5,284,483,914**	**518%**
Acres Clearcut Annually	**1,955**	**628**	**32%**
Acres Thinned Annually	1,955	2,514	129%
Total Acres Logged	3,910	3,142	80%
Volume Logged Annually (bdft)	**90,601,474**	**125,095,670**	**138%**
Timber Revenue	$57,182,977	$104,171,773	182%
Expenses	$21,154,675	$25,538,457	121%
Annual Profit	**$36,028,302**	**$78,633,316**	**218%**

While making the transition to long rotations may involve some short term reductions in logging, several factors can minimize these costs. In addition to the greater medium and long term revenue yielded by long rotations, thinnings, sales of non-timber forest products, and "sales" of forest ecosystem services can all provide significant income during transition periods.

Long Rotations -- Restoring Forest Ecosystems

While some people suggest that widespread clearcutting mimics natural stand-replacement fires, large stand-replacement fires in Western Oregon, for example, occurred infrequently, on average every 200 to 450 years.[15] Typical short rotation clearcut forestry also fails to leave behind the large amounts of standing snags, down logs, and patches of green trees found with natural fires.

In addition to better approximating natural disturbance regimes, increasing rotation lengths will also help reduce -- though not eliminate -- various ecological impacts associated with commercial logging. By providing older forests, longer rotations can help maintain and restore habitat for some imperiled species, while also producing more naturally occurring snags, down woody material, and understory vegetation for a variety of wildlife and plants. Using long rotations allows fewer acres to be clearcut (or selectively logged) per year, reducing soil compaction and other cumulative impacts, while helping to maintain habitat connectivity across the landscape.[16]

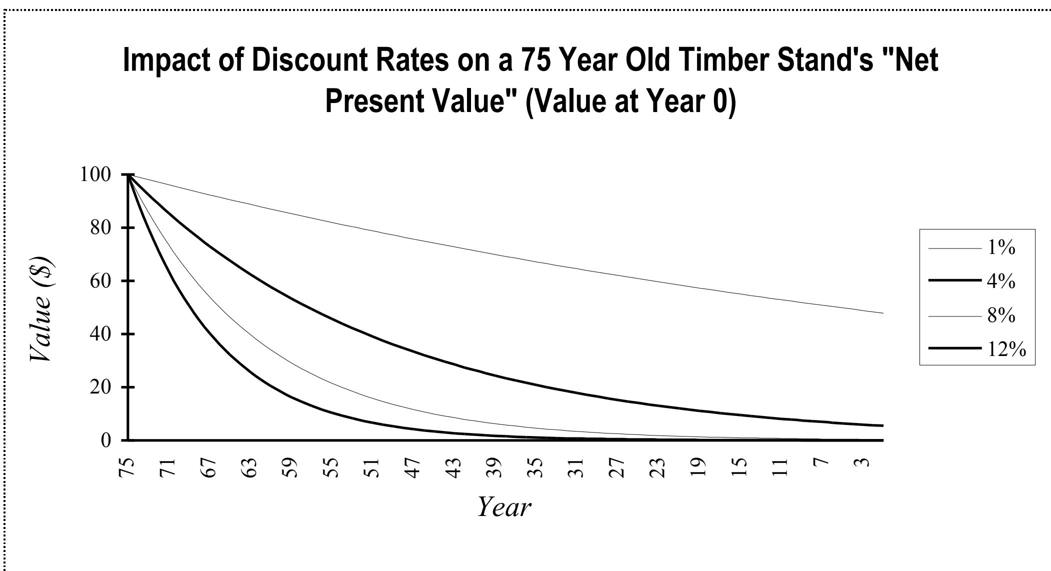
Long rotations can also facilitate reduced dependence on chemical herbicides, pesticides, and fertilizers, reducing environmental impacts and forest management costs. Forests managed to better approximate natural conditions may also be less susceptible to catastrophic diseases like Swiss needle cast.[17] Switching to longer rotations may also facilitate reductions in road density and associated impacts. Arguably, long rotations might also offset some of the need for inviolate riparian buffers by reducing the frequency of disturbance and impacts to watersheds, water quality, and fish habitats.

With their large trees and immense biomass, older, mature forests also store substantial amounts of atmospheric carbon above and below ground, helping to offset future climate disruptions from industrial greenhouse gases. One 500 year old conifer site in Southwestern Washington, for example, is still sequestering more carbon than it is releasing.[18] Conversely, short rotations keep net carbon dioxide (CO_2) uptake and storage at very low levels.[19] Logging, roading and other soil disturbances, slash burning, fertilizer applications, and other industrial practices all release substantial amounts of CO_2. At best, tree growth in such plantation forests just replaces the carbon lost during previous logging -- while failing to sequester and store the level of carbon found in mature forests.

So Why Doesn't the Timber Industry Use Long Rotations?

On average, forests (and thus forest investments) grow more slowly than investments in many other sectors. Moreover, while an older forest's growth in timber volumes and values can be substantial, and while young forests produce relatively little timber year to year, the rate at which young forests grow (i.e., the difference in one year's growth compared to the previous year's) is often higher, and may appear more competitive with other investments. Note that this framework tends to assume that landowners start with cutover and young timber stands -- not well-stocked forests.

Thus conventional timber economics holds that as soon as timber stands' growth rates begin to decline -- including below investors' desired internal rates of return -- investor-oriented timber companies will liquidate their timber stands, allowing reinvestment in another "crop" of young trees or in non-forest sectors. Even though longer rotations yield more timber and higher annual profits, the even greater increase in standing timber inventories is seen as wasted capital that could have been invested elsewhere.[20] Conventional timber economics also expects timberland owners to "discount" the value of future timber revenues, under the assumption that a dollar in the hand today is worth more than a dollar in the hand tomorrow. Applying even a 4% or 8% discount rate can virtually eliminate the perceived "net present value" of future timber stands.[21]



Are these indeed the reasons that the wood products industry chooses to use short rotations? This is a question worth examining more closely. Other disturbing factors may play an equal or greater role. Industry timberlands are frequently acquired through heavy debt financing -- encouraging early timber harvest to pay off the debt.[22] Corporate foresters trained in conventional timber economics may be unaware of new research showing that older forest stands are more productive than once thought, and may simply assume that short rotations are the best approach. Several major Northwest timber companies also have active land development and sales programs -- and liquidating timber inventories is simply a precursor to converting productive resource lands to residential sprawl.[23] Timber companies also tend to see reduced labor and employment levels per unit of production as something to be desired -- not as an impact on communities.

Conventional timber economics may also ignore changing market conditions and exceptions to the rule. Some case studies show that longer rotations can, under some conditions, produce more income even after discount rates are applied to the future revenues, due to the vastly greater timber production.[24] Changing consumer expectations, expanding markets for certified wood products, rapidly emerging markets for recreation, non-timber forest products, clean water, carbon sequestration, and forest ecosystem services, and the need to restore wildlife habitat may also make long rotations and other more sustainable practices even more practicable in the near future. Indeed, some studies find that more sustainable practices can already be competitive.[25]

In any case, clearly it makes no sense to base public policy -- or the future of our forests and forest communities -- on conventional industry accounting and investment practices.

What Are the Solutions?

The wood products industry is generally failing to use longer rotations -- indeed, some industry landowners are shifting to drastically shorter rotations. In other words, conventional timber economics ignores substantial opportunities for forest productivity and timber production, impacts to the environment, and impacts to employment levels, and treats natural resources and ecosystem services as “free” inputs which can be liquidated at will. Clearly, we have a profound case of market failure -- and a dire need for reform. By focusing solely on capital return ratios, current market, investment, and commercial forest management practices are cheating our forest economies and ecosystems, and are failing to take advantage of immense potentials for forest productivity.

One set of responses involve restructuring markets and accounting practices. For example, the practice of carrying forest inventories as costs on balance sheets could be changed; forest inventories should be viewed as assets, not liabilities. Tying state timber harvest (or “yield”) taxes and federal capital gains taxes to rotation lengths has also been identified by a number of authors as a particularly sound approach.[26] To provide a level playing field for more sustainable forest practices, and specifically to support longer rotations, taxes could be increased on trees logged under short rotations, while taxes could be reduced on trees logged under long rotations.

Similarly, timber companies could be held more accountable for the externalities of short rotations. Forest practice rules could be developed to establish a foundation for sustainability. Currently, some state forest practice acts require sustainable forest management, but fail to establish minimum stocking requirements or other standards. Restrictions could also be placed on exemptions from the Endangered Species Act known as "Habitat Conservation Plans" (HCPs) and Clean Water Act TMDL deferrals which are now being handed-out to timber companies. At the very least, long rotations should be required as part of HCPs' mitigation measures. More effective state and local land use policies could also be developed to guard against conversion to non-forest land uses, reducing this incentive for inventory liquidation.

Encouraging Longer Rotations by Restructuring Markets -- Examples

- ♦ Reduce timber yield and capital gains taxes for trees logged under long rotations, and increase taxes on trees logged under short rotations.
- ♦ Change accounting practices, so that timber inventories are viewed as assets, not liabilities.
- ♦ Hold companies liable for the externalities of short rotations and liquidation patterns, including through more effective forest practices, land use, and wildlife policies, and by restricting exemptions from the Endangered Species Act and other resource policies.

Encouraging Longer Rotations by Insulating Forests From Capital Markets -- Examples

- ♦ Facilitate acquisition of forestland and interests in land by ownerships not driven primarily by traditional, investor-oriented timber economics, i.e., new state agencies, new community forestry enterprises, land trusts, and non-publicly held family companies.
- ♦ Develop carbon sequestration markets as a source of funding for acquisition by new state agencies, land trusts, or other appropriate entities that will restore and protect key forest sites, and manage other sites under long rotations.

Another key set of responses involve simply insulating forestland from harmful capital markets. Forestlands held by non-publicly held family companies, land trusts, new community forestry enterprises, and some state agencies are less subject to the perverse incentives for short rotations created by high levels of debt financing, high investor rate of return expectations, and other market forces.[27] Forestlands acquired by such entities could be managed for varying levels of timber production, non-timber forest products, carbon sequestration, and other resource values, including through the use of long rotations. In cases where family landowners and others wish to retain their basic ownership, the use of longer rotations and other more sustainable practices can also be insured through the sale or donation of interests in land, i.e., conservation easements.

A number of timber companies routinely buy and sell their lands when advantageous, so funding is likely to limit forest acquisition programs more than willing sellers. Markets that are likely to be developed for climate change "credits" may provide one important source of new funding. Managing for older forests sequesters and stores substantial amounts of carbon dioxide, one of the gases driving global climate change. Along with acquiring, restoring, and fully protecting forestlands in key salmon watersheds, regions lacking public lands, and other priority conservation areas, acquiring forestlands and interests in land in other areas, and managing these forests under long rotations, is the most effective way to cleanse the air of excess carbon dioxide, provide increased timber yields and habitat values, and avoid greenhouse gas emissions associated with standard commercial timber practices.

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Notes

[1] Other more sustainable practices include selection logging, increased retention, multiple species management, and eliminating chemical inputs. Long rotations can be used together or separately from these other approaches.
[2] Bernton (1999).
[3] See Wimberly et al (in press), for example.
[4] Willer (1999).
[5] Haynes et al (1994) in Hall (1999).
[6] Powell et al (1993) in Hall (1999).
[7] Powell et al (1993) in Hall (1999). Includes softwoods, using Int'l 1/4" rule.
[8] McArdle et al (1949), Barnes (1962), Meyer (1938), Burkhardt (1994) (CA Dept. Forestry data), in Hall (1999). Data not available for some years from these sources. Douglas fir, site 150, hemlock, site 160, ponderosa, site 100, redwood, site 160.
[9] Curtis (1994).
[10] Curtis' results varied by site conditions, initial stocking levels, and the timber growth model used.
[11] Willer (1999). For high site class site.
[12] Willer (1999). For high site class site.
[13] Willer (1999). 88,000 acres of the hypothetical forest are in forest production.
[14] Willer (1999)
[15] McComb et al (1993), in Hall (1999).
[16] Curtis (1994) and Benda et al (1998), Carey et al (1996), Franklin et al (1997), Franklin (1997), Marcot (1997), Schowalter et al (1997), Curtis (1997), and Robinson (1988), in Hall (1999).
[17] Gossen (1999) and Hall (1999).
[18] Franklin (1999). In the context of commercially managed forests, long rotations offer the best approach to carbon sequestration. However, additional sequestration and ecological gains can be acheived by protecting older forest stands once they are established.
[19] Harmon et al (1990).
[20] Industry accounting practices also show forest assets as costs on balance sheets. (Best et al, 1999.)
[21] Hall (1999).
[22] Best et al (1999).
[23] Examples include Weyerhaeuser, Pope & Talbot, and Plum Creek.
[24] Hall (1999).
[25] Best et al (1999) and Hall (1999).
[26] Hall (1999b).
[27] Best et al (1999), Willer (1999).