Management of Young Growth Redwood Forests

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This is an honor to be invited and have the opportunity to come to Humboldt County to talk with a group like this. I recognize many in the group from many other contacts, some as students, others as cohorts, some as memorable teachers of the practical arts of forestry. With respect to the latter, the instructor and researcher working with a professional field in an academic institution depends heavily on professional workers in the field for adding an aspect of practicality and reality to his work. There are many in this group that have contributed importantly in this way to my topic tonight.

What I would like to do this evening is to talk about some economic aspects of growing young growth redwood and to point out some differences between economic and biological criteria for managing such stands. I plan to do this by developing an example of financially guided thinning, recognizing that thinning is not economically possible on a broad scale yet. Thinning does, however, stand as an outstanding possibility for maintaining acceptable and competitive rates of financial return from wood production on lands which have an increasingly broad spectrum of use alternatives. These competing uses for lands certainly force the commercial forest land owner to review every possibility of increasing his return from the land. Thinning will be one means of doing this.

A discussion of thinning may be somewhat of an anomaly in this region these days because thinning implies a highly intensive kind of forestry with the production of wood as the primary objective. The Redwood Park issue appears to occupy many forestry forums both here and across the nation and the discussion it raises documents an important resurgence of interest by man in the quality of some parts of his natural environment. There is, however, also a new surge of interest and strengthening economic necessity of intensifying our wood production-practices on high-site, commercial quality, timber lands. The basic reason for this is that timber production must now compete with so many alternate uses for the land. Without most intensive production efforts, more and more lands will go to other uses.

The use of wood, we know, is growing but not at the rate that other land uses are growing currently, and we don't expect any tremendous changes in this. It is well recognized by the Forest Service in their new timber trends report that we are a nation of wood surplus. That is, we're growing wood now faster than we are using it. This has some important implications for wood production.

I think another important trend is that the environmental aspects of forests are becoming so important. People are much more aware of the forest environment, and this exerts a particular kind of pressure on our forests. More highways from which to see the forests, more motels, more small ownership's for the weekender and his cabin, more escapes from the urban environment will all take land from wood production. They will also affect taxes and other land holding costs. These become competing opportunities and in order to hold lands in wood production against a relatively static wood market and a burgeoning alternate land use market, wood must be produced as efficiently and intensively as possible, at least on those lands so suited.

All uses for forest lands should be looked at as investment opportunities. There are so many more alternative uses for capital than we have had in the past that a careful look must be taken at the forest stands to analyze whether

the investment in the forest stand - the capital standing there - is earning at the same rate that same capital could be earning elsewhere in the forest business or elsewhere in the region. Another pressure which is going to affect the kind of wood growing that goes on is the higher holding costs of land now. Certainly we are aware of what's happened to taxes, here in the county particularly, but it's happening all over. Costs of holding are higher than they have been before. Interest rate, the alternative rate of return, is continually higher than it has been in the past. Thus the demands on the return you get from your land are a greater force than they have been in the past. I think these forces will move use of our forests lands in many directions. Certainly much of our privately owned lands will be moved in the direction of intensifying for the use which will provide the greatest economic return and in some cases, perhaps the greatest social usefulness -- whatever this is.

Now this region is particularly well adapted to intensification of wood growing. Perhaps not all of it. But certainly from the viewpoint of site the redwood country is in excellent position. Nearly one-fourth of the state's highest site forest land occurs within the redwood region. Two-thirds of the land which is now in commercial timber ownership in the redwood region is of good to high site, thus containing an excellent economic opportunity to grow wood. Many of the alternate land uses which I have mentioned, do not require high site --- for success. Thus intensification for wood production should be centered on high site for here wood production can compete most successfully for the use of the land. Thinning stands is a highly promising means of intensifying wood production.

Thinning, however, is only one of many ways of intensification for wood production. Certainly pruning is a technique that may have possibilities as time goes on. Planting and precision seeding are means of getting better stocking and better control of the kind and quality of wood that is being produced. I recognize these other possibilities, but would like to concentrate on thinning primarily as just one example of intensive economic management of high site lands which probably can best be devoted to wood production.

The purpose of thinning is to gain control over the growing stock at an early age and manipulate it periodically throughout its life, to achieve certain objectives of management. Basic to this is a recognition that forest land has a fundamental productive capacity which is a reflection of climate, soil, available moisture, etc., and that this basic capacity can be fully utilized by a rather wide range of stocking. For example, an acre of land can be as fully occupied by a 50 year old stand with 150 trees, as one of the same age with 300 trees. Individual trees in the 150 tree stand will in all likelihood be of larger diameter, and, if carefully selected in previous thinnings, be of higher quality than those in the 300 tree stand. No growing capacity is wasted in either stand, but a substantial difference exists in the earning rates and the characteristics of the two stands. A meaningful analogy exists between growing carrots and growing trees. Three carrots per square foot will utilize that square foot as well as will twenty carrots on that same square foot. The difference is the size of the carrot that is ultimately produced. The forester has a similar choice with trees. As long as he is within a certain range of stocking, he fully occupies his area. No wood production capacity is lost, in fact, some may be saved through lower mortality in the stand with fewer trees.

Now another basic point is that land and trees must be considered as a capital investment Capital is tied up in the land and certainly also tied up in the growing stock on that land. You may not have invested it in terms of planting, but it is invested capital in terms of taxes on the land and in terms of protection. And certainly this capital probably is liquid from age 40 on. It could be sold and turned back into capital again, invested elsewhere. So it's capital in the sense that you should be earning on it and it could be pulled out of this forest investment at any time and probably any time beyond the age of 30 or 40 years, and turned

over to other uses. So it is capital in the normal capital sense.

In the outputs from this capital investment in land and in growing stock, and in the costs of holding and growing, such as the tax and labor inputs, the outputs then, may be considered in terms of wood. And when we measure rates of return on this capital invested, it must be measured in terms of the wood that comes off the area. One other step in the basic economics evolves - what are the values of the wood produced?

There is a difference in value on a per thousand basis between a log that is 14 inches in diameter and one that is 22 inches in diameter and this relationship is generally one of increasing value with increasing diameter. This is a choice we have then. In utilizing this basic productive potential of the site, we have the choice of growing a relatively small number of large trees per acre, or a larger number of small trees . In either case we produce about the same amount of wood and we have the opportunity for regulating and choosing the type of stand desired.

Looking at the yield tables "for redwood", a normal stand contains at age 30 about 628 trees per acre, and it had lost in the previous ten years about 350 trees. This loss is due to mortality of various kinds because of crowding, shading, etc., and those 350 stems probably make up about a fourth of the total volume that has, been produced on the area up until that time. If we continue this relationship from age 20 to nearly 100, the annual losses due to mortality from crowding make up about a third of the total volume of wood that has been produced on the area. These are losses which cannot be utilized because the trees were too small or we find them too late. However, it's wood that is lost and also capital that is lost at the same time.

Let's take one further step in looking at stands and growing them in an economic sense. This involves the sort of return we expect from these stands. If stands are producing too slowly, we should either get rid of them, thin them, or do something to increase the earning rate up to an acceptable level. Those of you who invest in mill facilities, I'm sure, talk about "write off" period of 5 to 10 years, or a 10% to 20% return. On longer term investments such as in growing stock a 4% to 6% return is expected from your invested capital. Thus investment in capital in-growing stock or land should be returning up to this minimum rate of return of somewhere between 4% and 6%. Any stand that is not growing at this rate is a poor investment, and you should do something to increase the rate of return, either by cutting or by thinning or other measures . But at least we have a cut off point that I am going to use here as a 6% rate. If stands are not growing at the rate of 6% return on the capital that is in the m, then something should be done to make them grow at this rate again.

Now let's calculate earning rates on growing stock capital . If we look back for a moment to the normal yield tables, at 30 years on a high site you could have something over 35, 000 board feet of redwood . The forest will grow about 15,000 board feet during the next decade on an annual basis, which is a net growth of a thousand and a half board feet per acre per year. If we multiply this times $10, which is a very rough stumpage value for the moment, this stand is earning only at a rate of 4%. This is not enough for most private investors to hold their money in this sort of land. In the next 10 year period, between ages 40 and 50, stands will contain 53,000 board feet and grow at the rate of 1.4 thousand board feet per year during that decade. If we strike a percentage on this on the basis of value growth, we are now earning at the rate of 2.8%, which is certainly too little for good investment practice and there would be a question whether you could get someone to invest in these lands which are earning at that particular rate. From a long term timber production viewpoint, both with young and old growth stands, the rate of return now is considerably less than 6%, but the opportunity for achieving a rate of near 6% is quite good. Particularly on the high site lands of the redwood region .

To find out what can be done to earn at a rate acceptable for an investor or a rate that should be acceptable to land owners, I should like to use an example. This is a site 180 land which has a capability of producing somewhere around 10 square feet of basal area per year, if we control its value growth rate to an acceptable level, we find that its production changes considerably. We can consider a stand at age 30 where there are something over 300 stems of dominant or codominant size. These stems are growing at the best rate and have the best possibility for future development. We can then remove all of those stems that are growing at a rate of less than 6 rings per inch. At 30 years the average diameter of the trees is about 13 inches diameter, as the normal yield tables would show. Enough stems can be removed to accelerate the growth of the remainder to a growth rate of about 5 or 6 rings per inch, which would give an earning capacity at this time of about 7%. This is based on value growth based on a stumpage price of $10 per thousand board feet.

Economically it appears as a stand thinned at this rate (to maintain 5 rings per inch over a long period of time) does not fall below a 6% rate of return short of 100 years, which - is an interesting phenomenon considering unthinned stands culminate economically at much less than 100 years. The earning rate is still going upward even though on thinned stands at age 100.

Let's take an extreme example of heavy thinning and carry a stand through two thinnings to show the potential. We thin our stand at age 30 to 159 trees, which is about enough on this site 180 for the average tree to grow at 5 rings per inch over the next 10 year period. The rate of return at this diameter growth rate is about 7.5% on the individual tree and total stand performance is about the same. At age 40 this same stand can be thinned from 159 trees to 105 trees, this allows enough basal area potential growth so that remaining trees can continue to grow at 5 rings per inch. They now earn on this much larger diameter that they have and the greater volume that they have, thus earning rates are down to slightly below 7%.

Now two things are happening. The total volume of the stand is going up even though we have taken off some wood in thinning, but enough stems remain so that volume continues to go up. But the total volume does not go up at the rate of the unthinned stand. You have a smaller base on which to calculate the percentage and you will also have a smaller investment in a sense. A smaller amount of capital remains in that stand and the earning rate will be high on a percentage basis. It is the percent of return that becomes important to you as the criterion of whether this stand should be kept or whether it should be thinned as long as sufficient volume remains to fully utilize the site. So the base upon which you're calculating this rate of return is decreasing, the amount of wood production is remaining about the same, but its value per unit now goes up. It goes up very rapidly.

In studies made by some of the companies in the region here on a young growth timber, it's interesting to extrapolate the value per thousand of logs delivered in the pond based on lumber grade recovery. Here you get a large difference in value with change of diameter. This is a normal relationship, but it is a rather remarkable one in redwood.

In those stands that have been thinned and are growing at this particular rate which we have set as a cut off point, we are achieving very large diameters in a relatively short period of time, growing them at about the rate of 5 rings per inch by allowing enough growing space so that they could grow this fast. At 40 years the average stumpage price calculated, based on lumber grade recovery from two organizations in the state, would indicate a stumpage value of about $9.40 for both the thinned and the unthinned stands whose diameters would be about the same. At age 50, the average diameter of the two stands, has changed tremendously. And now the stumpage price per thousand on the thinned stand is worth $11.90, while that of the unthinned stand remains at

about $9.94. to age 60 this change becomes rather dramatic.

The thinned stand is growing rapidly in diameter and now the value per thousand in the thinned stand is worth about $20, while that on the unthinned -stand is only worth about $11.50. The price more than doubles on the basis of a much larger diameter, practically double the diameter on the thinned stand which is growing at the rate of 5 rings per inch and you would expect more than double size in that. In the meantime you also have had (assuming thinning once every ten years on these particular stands) the income from thinnings at interest, since we're also charging interest in these calculations on all input costs, including income taxes on a capital gains basis and current property taxes as they exist now.

The present net value of the stand at age 80, including the intermediate incomes on these thinnings at $10 per thousand, is almost triple that of one that is not to be thinned. This is the difference in economic opportunity of thinning alone. And all during this time the individual trees have been earning at a rate of 6% and the total stand has been earning at about the same rate. The cut off point then, occurs where the total earning on the capital represented by growing stock falls below the 6% mark on the unthinned stand; this occurs at about age 34. In other words, this is the economic rotation age of this stand. It is also termed the soil rent rotation, or the Faustman rotation. This occurs at ages from 35 to 40 years in unthinned stands, while in thinned stands rotation may not come before age 100.

These hypothetical examples need some qualification, because they are all based on suppositions that there would be a market for thinned material. Currently, I know of no such market that would take small material below 12 inches in diameter. A sporadic market is developing to the south for material in the 14 to 20 inch diameter class, and it's a rather lively market in limited locations. This would indicate that small saw logs in various areas could be removed by thinning and sold. Also, where no thinning before age 30 was suggested, it was assumed that there are still a few stems of salable size before age 30 that you probably could not afford to thin. But I think that as these approaches are developed further we could very easily justify a thinning at age 20. Not on the basis of current return, but on the basis of its effect on growth rates in this stand at some future time.

In releasing the stand before 30 years the economic opportunity increases, even though thinning cannot be paid for at the time it is done. These comments are based on a current study, in progress at the Forestry School in Berkeley, on information on industrial lumber grade recovery from recent harvests - including analysis of diameter distributions within stands. These results are preliminary in nature and subject to numerous changes . We will probably get some changes in size and distribution relationships as we get into this further. But it certainly looks as if the basic relationships of earning capacity are going to remain the same from the results to date. It appears that thinning is probably one of the best timber investment opportunities that this region will have as time goes on.

With thinning and other management inputs of various other kinds, these lands are highly suitable for timber production and the earning rates are good enough to hold this land against anything but subdivision. For a reasonable place to invest capital for a long term investment, these timber stands on good sites will remain as very good investment opportunities.

I would now like to turn the discussion over to our county extension forester, Bob Krohn, who has done some work on preliminary demonstration and' study of this particular method we've talked about here - that is thinning by basal area and attempting to maintain a particular-diameter growth rate on thinned stands for a period of time.