APPENDIX IX

Comparison of sprout and seedling regeneration by coast redwood after logging (After Becking, 1967).

Sprouting Characteristics

Sprouts develop immediately after the cutting or the stump, creating a great imbalance between the shoot and root ratio of the cut tree. This inevitably results in massive root die-back with a general weakening of the root system Or the live stump. A new root system will have to develop itself with numerous new lateral roots replacing old and dying roots.

Sprouts can occupy the site only at the same spacing distances as previously occupied by the old-growth stumps. Since there are comparatively few trees at an average stand age of 1500 to 2000 years, such spacing cannot fully occupy the site for the incoming stand. Further disadvantages are that:

- Sprouts are generally densely grouped around the same stump creating severe competition among themselves,
- Clonal sprout clumps limit the important genetic variability of future trees, and its gene pool,
- Sprouts initially derive their nutrients from the same major root system,
- Sprouts develop very asymmetrical crowns with heavy branches on one side of the tree bole and asymmetrical growth rings,
- Sprouts depend greatly upon each other for wind firmness and support.

Initial height growth of the sprouts is very rapid, often exceeding four to five feet per year during the first few growing seasons. The sprouts will develop long internodes with heavy branch whorls that are prone to wind damage.

As the root-shoot imbalance becomes more acute, the stump root system will begin to die-back partly. Subsequent height growth will be impaired, resulting in reduced internodal length and reduced sprout vigor until, after many years, a new, more balanced and independent root system has regenerated itself. The sprout may then become over-topped by other, more vigorous trees.

Normally, the sprout will decline rapidly in vigor after its five-year impetus, and often start to produce cones within twenty years, long before its normal maturity. Seed quality of such sprout growth is generally inferior to seed from normal seedlings maturing at 100 to 150 years of age.

Timber quality is impaired by the wide growth rings in the center of the bole.

Great differences in age have been observed among sprouts of the same stump, and between sprout age and year of logging. Sprouts often differ more than ten to twenty-five years from the logging date, indicating great mortality and regrowth of new sprouts which delays restocking of the site and consequently wood production.

Seedling Characteristics

Seedlings develop a much better balanced ratio between shoot and root systems. While shoot growth may b retarded initially, root growth expands rapidly in depth and numerous well-branched lateral roots develop. m e roots extend in a more symmetrical manner around the tree bole providing it with better support and wind firmness.

Seedlings normally distribute themselves more evenly and densely over the entire logging site which results in:

- a more favorable equilateral spacing pattern,
- a greater number of seedlings per acre in accordance with no m al stand development,
- a greater selection among trees of different genetic potentials and growth superiority,

- a lesser chance of growth stagnation among seedlings,
- a greater wind firmness with a symmetrical bole and crown development inductive to higher timber quality, and an independent root system.

Initial height growth of the seedling is retarded, particularly if the seedling lacks the benefit of shade and forest shelter. The average five-year old seedling is about one foot in height.

Root development is initially greatly favored, and a better balanced root-shoot ratio is maintained. As the root system penetrates deeper soil layers, it provides a more continuous moisture supply during periods of drought, and its shoot development will accelerate greatly.

Generally, after six to fifteen years of age, the average leader growth exceeds two to three feet F r year, sometimes seven feet per year. Rapid height growth, however, is maintained to about 50 to 80 years of age when the trees may reach heights of over 200 feet depending upon site conditions and sexual maturity .

Timber quality is not so much impaired because of the denser rings in the center of the bole.

Seedling age is generally in closer agreement with the age of logging activities, although age differences of five to ten years between seedling establishment and logging date are not uncommon. Generally, only one dominant age class of seedlings prevails. Restocking with redwood after the failure of its first regeneration wave becomes increasingly difficult the more advanced the age of regeneration.

According to Becking (1967), the best and most successful manner of regenerating redwoods on cutover forest lands is natural regeneration by means of seedlings.