Foreword

Comments About Long-term Observation of Stand Dynamics

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Silvicultural practice is hopefully based on knowledge of the dynamic responses of stands to disturbance, treatment or just letting nature take its course over long periods. Few forms of technology have such long time horizons. Owing to the dearth of real long-term observations we have relied too heavily on two models of European origin about how stands develop.

The model that dominates is embodied in yield tables for pure even-aged stands planted in the open in which any tree that falls behind in a race for the sky is doomed to die or be removed in thinning. This started from observation of stands established by planting on deforested open heaths and moors where the little new trees had to be fenced from the browsing of the deer of the nobility and the cattle of the peasantry. This approach is simple, straight-forward, and easily monitored for stands that are pure and even-aged but it does not work for stands that are mixed or started from natural regeneration.

For such stands the alternative model chosen long ago emerged from observation of old mixed stands, often high-graded, in remote areas. The larger trees were assumed to be old and the small over-topped trees of shade-tolerant species presumed to be of younger age-classes. It was observed that such stands often had reverse-J-shaped curves of diameter distribution. This distribution was taken to be the ruling criterion of a theoretical uneven-aged selection forest. The smaller trees, assumed to be younger, were counted upon to grow faster than the larger presumably older and more mature ones (most of which were periodically harvested). Unfortunately this really works only if each age-class is a tiny even-aged stand open to the sky. This may well operate in pure, truly uneven-aged stands such as those of ponderosa pine and other pines on dry sites. European experience with mixed growth on better sites has sometimes shown that over a century or more these stands are usually slowly whittled away until they must be replaced.

Mixed natural stands in North America are often found to have arisen from advanced growth released all at once by heavy release cutting or major disturbance. The resulting stands usually have a layered structure with intolerant species on top and strata of successively increasing tolerance arranged beneath. Such stands often have the reverse J-shaped curve of DBH distribution that is supposedly the criterion of an all-aged condition. The dynamics of development of such essentially even-aged or single- cohort stands are complex. Often the species that dominate early prove to be “sprinters” that lapse into lower strata while “stayers” emerge from beneath and become the dominants. However, the behavior of a given species may depend on the site or on interaction with a different competitor.

For example, in some northern hardwood forests of the Northeast, stands start after heavy removal cutting with tiny new yellow birch seedlings on the bottom, advanced-growth sugar maple saplings above, and beech on top. After 20-30 years a few birches get to the top and the maple gets ahead of the beech. This remarkable reversal of positions was observed (Hill, 1987) on soils that were slightly too wet but not on moist but well-drained sites where the birch did not do so well although the maple still got ahead of the beech.

Tracing historical patterns of stand dynamics has often depended on the study of patterns of annual rings. This approach has the drawback of showing which trees endured but not about the more numerous ones that were lost along the way. Long-term observations on specific plots would be far better. Advantage has been and can continue to be taken of studies done for other purposes. Permanent mapped plots laid out for Continuous Forest Inventory (CFI) can be selected and adapted for use. During the 1940s and 1950s many "compartment studies" were established for economic research on US Forest Service experimental forests throughout the country. Sometimes these have been continued to investigate the dynamics of stands with differing silvicultural treatments.

The time scale of the necessary repeated observations is longer than the active career of one observer. This means that such investigations generally require the commitment of continuing entities such as research agencies, corporations, or professional groups with interests in learning about responses to silvicultural treatments or natural disturbances. One critical ingredient is retention of old plot records that sometimes fall victim to over-zealous housecleaning!

Reference

Hill, D. B. 1987. Stand dynamics and early growth of yellow birch and associates in the White Mountains. USFS Gen. Tech. Rept. SE-46. Pp. 20-26.