Identification of low productivity sites for European larch (Larix decidua Miller) in Maine, USA

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Application. Three soil based rules are presented to quantify the site quality (based on site index) of potential plantation sites for European larch in Maine:

(1) a multiple regression equation using selected variables from the B soil horizon and solum thickness explained 53% of the variability in site index;
(2) solum thickness, alone, is sufficient to eliminate low quality sites from consideration when silvicultural budgets are small relative to the land area under consideration for plantation establishment; and
(3) a more complex classification rule (using solum thickness, B horizon exchangeable K, and B horizon clay content), which requires more costly soil analyses, provides a refined method of distinguishing good sites which would otherwise would be eliminated from consideration with potentially poor sites.

Abstract. As silvicultural capital becomes limited, allocation of funds to high quality sites becomes critical and sites with low productivity potential should be avoided. Data collected from 31 plots located in 12 plantations established between 1930 and 1982 throughout central Maine were used to develop a soil-based rule to identify sites having a low productivity potential for European larch in Maine, thereby removing them from consideration for plantation establishment. Stepwise regression and discriminant analyses identified several variables that were associated with site index at an index age of 20 years breast height (SI20); solum thickness, B horizon clay content, and B horizon exchangeable K. Using these variables, a classification rule was developed to classify sites into 2 categories (poor, average SI20 = 14.7 m; and good, average SI20 = 17.7 m). Cross-validation demonstrated that the classification functions correctly identified 88% of the poor sites and 81% of the good sites.
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Introduction

Shortages in the spruce-fir fiber supply for the northeastern United States have been projected (Einspahr et al. 1984; Seymour and Lemin 1989) partially as a result of passive forest management practices and the anticipated future demand for paper. This has stimulated interest in “high yield” plantation programs which, if judiciously implemented on an operational scale, would make it possible to reduce the land base currently used for timber production (Seymour and McCormack 1989). The rapid early-growth of European larch (Larix decidua Miller) has exceeded that of native conifers planted on comparable sites in Maine (Carter and Selin 1987) and the desirable wood properties of this species (Einspahr et al. 1984) make it a prime candidate for inclusion in “high yield” plantation programs.

The objective of this study was to develop a soil-based classification rule to identify sites having low productivity potential for European larch in Maine. We used SI_{20}, site index at an index age of 20 years breast height, as a measure of potential larch productivity.

Methods

Study area

The study area was located in the central portion of Maine following a northeasterly band from Rumford to Milo and included all of the European larch plantations known to have been successfully established in Maine prior to 1983. Although this study area spans three climatic regions (Briggs and Lemin 1992), sites located outside the central region were in the lower elevations of the northern region, and the northernmost limits of the southwest interior. Elevations ranged from 35 to 300 meters, slope ranged from 2% to 19%, topographic position ranged from a summit to a toe slope, and soil drainage class ranged from poorly-drained (PD) to well-drained. Eleven of the 12 plantations included in this study were located on lands formerly under cultivation. Soil profiles lacked an organic horizon but usually had a thin (< 3 cm) layer of larch needles. Soils were of glacial or glacial-fluvial origin, acidic, sandy to silt loam in texture, and were characterized by a frigid soil temperature regime (Rourke et al. 1978).