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Development and application of boundary-line release criteria

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Abstract

Identifying releases from suppression represents one of the most fundamental dendroecological procedures for quantifying forest disturbance histories. In this study we evaluate boundary-line release criteria, which incorporates the effects of growth history on release response. In eastern hemlock (*Tsuga canadensis* L.) the maximum possible value of a pulse in percent-growth change is dependent on growth decline immediately prior to the pulse. Maximum values of percent-growth-change decline exponentially as prior growth rate increases. This negative exponential rate is quantified as a boundary line, which is used to scale each percent-growth change pulse by the maximum possible value predicted by prior growth rate. The consistency of the relationship between radial growth prior to a release and the magnitude of the release is evaluated in multiple eastern hemlock data sets. Trees from diverse sites show large releases that approach the maximum value predicted by the prior-growth rates. These sites tend to have a history of disturbance, suggesting that disturbance is the most

sites tend to have a history of disturbance, suggesting that disturbance is the most influential variable determining the magnitude of release response. Possible exceptions are sites on the northern and western borders of eastern hemlock's range, which consistently fall short of the boundary line and may be exhibiting unique relationships between prior growth and percent-growth change. Yet overall the relationship between prior growth and percent-growth change appears to be consistent across much of eastern hemlock's range. Furthermore, we demonstrate that similar boundary lines occur in *Pinus ponderosa* (Laws.), *Pinus echinata* (Mill.), *Quercus alba* (L.), and *Quercus macrocarpa* (Michx.). This suggests that prior growth could form the basis of a more unified set of release criteria better able to standardize release responses within and among species. Standardized release criteria would allow more accurate comparisons of disturbance histories among sites, species, and even across landscapes.

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Keywords

Eastern hemlock; Old growth; Release criteria; Boundary line; Disturbance; Radial-growth averaging; Percent-growth change

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