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An objective approach for classifying precipitation patterns to study climatic effects on tree growth

H.-Y. Yeh[a,*], L.C. Wensel (Professor)[b,1], E.C. Turnblom (Assistant Professor)[c,2]

[a]Department of Environmental Science, Policy, and Management, 145 Mulford Hall, University of California, Berkeley, Berkeley, CA 94720-3114, USA

[b]Department of Environmental Science, Policy, and Management, 145 Mulford Hall, University of California, Berkeley, Berkeley, CA 94720-3114, USA

[c]University of Washington, College of Forest Resources, 232 Bloedel Hall, Box 352100, Seattle, WA 98195-2100, USA

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Abstract

This study applied the simple, quantitative method of statistical cluster analysis to the task of objectively classifying precipitation patterns over northern California into paternally homogeneous regions. The statistical clustering results were then combined with geographical information to generate regional precipitation indices and study the relationship between precipitation levels and tree growth over specific areas. Generating regional indices replaces the often-used practice of associating growth rates with precipitation data from a single, 'remote' weather station, a station located outside the tree growth plot. Use of regional precipitation information generated in this manner can significantly improve the accuracy of growth predictions. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The influence of climate on tree growth has been studied by a number of authors (Holdaway, 1990; Graumlich, 1991; Little et al., 1995; Wensel and Turnblom, 1998; Yeh, 1997). Climatic data are usually supplied by the U.S. National Oceanic Atmospheric Administration or a state's water resource department, based on information recorded at the weather station nearest to each tree growth plot (Holdaway, 1990; Graumlich, 1991; Little et al., 1995). Ideally, of course, climate and tree growth would both be recorded in the same plot, but individual weather stations are rarely located in every growth plot. Some studies (Woollons et al., 1997; Snowdon et al., 1998) used estimated values of climatic variables that were computed from mathematical surfaces for different climate elements of a region. These surfaces were derived by using advanced smoothing splines techniques (Wahba and Wendelberger, 1980) and a network of weather stations for an area of interest. The surfaces are then interrogated to estimate values of climatic variables at any chosen latitude/longitude of that area.

* Corresponding author. Tel.: +1-510-642-7164.
E-mail addresses: huiyi@nature.berkeley.edu (H.-Y. Yeh), wensel@nature.berkeley.edu (L.C. Wensel), ect@u.washington.edu (E.C. Turnblom).
[1] Tel.: +1-510-642-7075.
[2] Tel.: +1-206-543-2762.

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