Evaluating stem conducting tissue as an estimator of leaf area in four woody angiosperms[1]

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Received July 27, 1976

WARING, R. H., H. L. GHOLZ, C. C. GRIER, and M. L. PLUMMER. 1977. Evaluating stem conducting tissue as an estimator of leaf area in four woody angiosperms. Can. J. Bot. **55**: 1474–1477.

Four woody angiosperm species representing an evergreen tree (*Castanopsis chrysophylla* (Dougl.) A.DC.), a deciduous tree (*Acer macrophyllum* Pursh), an evergreen shrub (*Rhododendron macrophyllum* G.Don), and a deciduous shrub (*Acer circinatum* Pursh) were sampled to assess the relation of cross-sectional area of conducting tissue in the stem to leaf area. For the first three species listed, a linear relation between conducting area and leaf area was obtained with r^2 values ranging from 0.89 to 0.96. For *Acer circinatum* the relation only approached linearity with a log transformation of both axes with $r^2 = 0.80$.

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Quatre espèces d'angiospermes ligneuses représentant respectivement un arbre à feuilles persistantes (*Castanopsis chrysophylla* (Dougl.) A.DC.), un arbre à feuilles caduques (*Acer macrophyllum* Pursh), un arbuste à feuilles persistantes (*Rhododendron macrophyllum* G.Don) et un arbuste à feuilles caduques (*Acer circinatum* Pursh) ont été échantillonnés pour examiner la relation entre la surface des tissus conducteurs de la tige en section transversale et la surface foliaire. Dans le cas des trois premières espèces énumérées, il y a une relation linéaire entre la surface conductrice et la surface foliaire ($r^2 = 0.89$ à 0.96). Cependant chez l'*Acer circinatum* la relation n'approche la linéarité qu'avec une transformation logarithmique des deux axes ($r^2 = 0.80$).

[Traduit par le journal]

Introduction

In assessing the rates at which forest ecosystems recover from a disturbance, an accurate estimate of leaf area is essential (Sollins *et al.* 1974). This is particularly true when angiospermous trees or woody shrubs are present because they can transpire water and assimilate carbon dioxide at high rates (Cline and Campbell 1976; Wareing 1966; Krueger and Ruth 1965). Unfortunately, a suitably accurate means of estimating leaf area of woody angiosperms has not been available. Recent investigations with conifers (Grier and Waring 1974) and earlier studies on *Acer pseudoplatanus* L. (Dixon 1971) demonstrated that accurate estimates could be obtained from a relation between cross-sectional area of conducting tissue and foliar biomass or surface area. Our hypothesis was that a relation between conducting tissue and leaf area exists for both deciduous and evergreen angiosperms.

Study Area and Methods

An evergreen shrub (*Rhododendron macrophyllum* G. Don.), a deciduous shrub (*Acer circinatum* Pursh), and an evergreen tree (*Castanopsis chrysophylla* (Dougl.) A.DC.), and a deciduous tree (*Acer macrophyllum* Pursh) were chosen to test the general hypothesis. Sampling was completed in conjunction with other efforts to estimate component biomass of trees (Grier and Logan 1977) and a comparative study of ecosystem leaf areas (Gholz *et al.* 1976). Field research was conducted in the western Cascade Mountains of Oregon on the H.J. Andrews Experimental Forest, latitude 44° N, longitude 122° W. The forest is dominated by Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco var. *menziesii*), typically with a lower stratum of western hemlock (*Tsuga heterophylla* (Raf.) Sarg.). *Acer circinatum* and *Rhododendron* are common in the understory of most plant communities as well as in open areas created by disturbances (Zobel *et al.* 1976). *Acer macrophyllum* grows along streams and beneath gaps in the canopy, but *Castanopsis* is generally restricted to the open understory of drier habitats (Zobel *et al.* 1976).

Sample plants of *Rhododendron* and *Acer circinatum*

[1]This project was supported by National Science Foundation Grant GB-20963 to the Coniferous Forest Biome, U.S. Analysis of Ecosystem Program. This is also contribution 210 from the Coniferous Forest Biome and paper 1037 of the School of Forestry, Oregon State University.