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NEEDLE BIOMASS EQUATIONS FOR SINGLELEAF PINYON ON THE VIRGINIA RANGE, NEVADA

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ABSTRACT.—Foliar biomass of singleleaf pinyon (*Pinus monophylla* Torr. & Frem.) was estimated on the Virginia Mountains, Nevada, based on the easily measured dimensions of crown volume and sapwood area. Leaf biomass estimation techniques used in other studies of pinyon where total leaf biomass was collected were supported. Both sapwood area (cm^2) and crown volume, calculated as one-half of an ellipsoid (m^3), were found to be significantly related to total dry weight needle mass (g). Best predictive equations for crown volume were obtained with nonlinear regression analysis. A previously reported two-part relationship based on tree size for predicting needle biomass with sapwood area was supported. Foliar biomass of singleleaf pinyon can be accurately estimated with a minimum of 10 sapwood cores.

Key words: singleleaf pinyon, foliage biomass, sapwood area, biomass prediction.

In recent years land managers trying to fulfill the goal of multiple use have needed to ascertain the potential value and use of pinyon-juniper woodlands extending over 17 million ha across the Rocky Mountain and Great Basin regions (Chojnacky 1986). Singleleaf pinyon and Utah juniper (*Juniperus osteosperma* Little) woodlands cover more than 6 million ha in the Great Basin alone (Tausch and Tueller 1990). This forest type has historically supplied fuelwood, charcoal, nuts, fence posts, and poles (Fogg 1966), especially during heightened mining activity in the late 1800s (Budy and Young 1979). Pinyon-juniper forests also provide essential areas for wildlife habitat (McCulloch 1969, Short and McCulloch 1977, Balda and Masters 1980). Balancing out these benefits is the nearly complete loss of forage and potential increased soil erosion resulting from the establishment of this species (Doughty 1987).

Estimates of biomass are essential to most studies of plant community competition, succession, and resource allocation including studies of pinyon-juniper woodlands. Total foliar biomass, or phytomass, can be vital to assessment of plant water-use efficiency (Long et al. 1981, Waring 1983), nutrient cycling (Waring and Running 1978), soil moisture conditions (Grier and Running 1977), the hydrologic environment (Nemani and Running 1989), and competitive interactions (Tausch and Tueller 1990). The amount of foliage biomass on a tree is strongly related to the area of conducting tissue transporting water and nutrients to these tissues. This relationship has been found for many conifers (Grier and Waring 1974, Kaufmann and Troendle 1981, Marchand 1984, Miller et al. 1987), including pinyon (Tausch and Tueller 1989). Survival of trees in arid environments demands efficiency, and production of excess xylem and associated supporting tissue would waste precious resources. Alternately, insufficient development of conducting tissue would dehydrate and starve a tree. Also, as a tree grows, its mass and the spatial volume it inhabits expand in a nonlinear fashion (Tausch and Tueller 1988).

Many studies have shown close relationships between whole-tree phytomass and easily measured plant dimensions (Budy et al. 1979, Miller et al. 1981, Cochran 1982, Hatchell et al. 1985, Tausch and Tueller 1989, 1990). Measuring needle mass of entire singleleaf pinyon (*Pinus monophylla* Torr. & Frem.) trees through harvest can be inefficient and expensive (Meeuwig and Budy 1979), especially on large trees in remote areas. The ability to accurately estimate phytomass based on simple allometric measurements can greatly ease the process. Cross-sectional sapwood areas for pinyon pine can be estimated with a high degree of accuracy using increment cores and trunk diameter measurements (Whitehead 1978, Tausch 1980). Equations generated by these procedures can apparently vary for this

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