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Canopy volume–aboveground biomass relationships of desert perennials and the effects of elevated CO_2

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Abstract. Known allometric relationships between aboveground plant biomass and canopy volume allow standing biomass and net primary productivity (NPP) to be estimated non-destructively. Canopy volume–aboveground biomass relationships are published for many ecosystems, but not for most desert species. It is also unknown if elevated atmospheric carbon dioxide [CO_2] affects canopy volume–aboveground biomass relationships in desert perennials, limiting efforts to model NPP in an elevated CO_2 environment. We measured canopy volume and aboveground biomass for perennial plants in the Mojave Desert, USA, at the Nevada Desert FACE Facility (NDFF): four species before treatment and 22 species after 10 years (1997–2007) of elevated CO_2. Canopy volume to aboveground biomass allometry was estimated for each of the nine most common species individually; the remaining 13 species and unidentified dead shrubs combined to form a single "other" group. The resulting slopes and intercepts, which were estimated using a robust version of major axis regression, were compared across treatments and time points. None of the species had altered allometry in elevated CO_2 compared to ambient CO_2 treatments, nor did the relationships change over time. Data for each species were therefore combined across treatments and time points to provide the best available predictive equations relating canopy volume and aboveground biomass. The data set contains the canopy volume and aboveground biomass for all 3702 individual plants that were measured. We provide the regression coefficients relating canopy volume to aboveground biomass for both treatment and time comparisons and a single equation that predicts aboveground biomass from canopy volume for each species group. Our results suggest that grasses, forbs, and cacti may increase more rapidly in canopy volume than aboveground biomass, resulting in more shallow slopes compared to woody shrubs. The most notable limitation of this data set is that the maximum plant size at this site may be smaller than at other locations with the same species. The canopy volume to aboveground biomass equations could be improved by adding data from additional locations. Our results suggest that aboveground biomass for desert perennial plants in elevated CO_2 conditions may be reasonably estimated from the allometry of plants under ambient CO_2.

Key words: Acamptopappus; *allometry;* Ambrosia; *aridland; climate change;* Ephedra; Krameria; Larrea; Lycium; *net primary productivity (NPP);* Pleuraphis; Psorothamnus.

The complete data sets corresponding to abstracts published in the Data Papers section of the journal are published electronically in *Ecological Archives* at http://esapubs.org/archive (the accession number for each Data Paper is given directly beneath the title).

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