Gravestone decay and the determination of deciduous bulk canopy resistance to acid deposition

Howard D. Mooers,⁎ William J. Massman

Department of Earth and Environmental Sciences, 230 Heller Hall, 1114 Kirby Dr., University of Minnesota Duluth, Duluth, MN 55812, USA
United States Forest Service, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526, USA

HIGHLIGHTS
- Gravestone decay provides a measure of the flux density (F) of acid.
- Bulk canopy resistance is derived as the difference between deposition velocities.
- Quantitative estimate of tree canopy resistance to gaseous deposition of acid.
- Up to 55% annual reduction in acid deposition under seasonal tree canopy.

GRAPHICAL ABSTRACT

Resistance to gaseous deposition of acid

SO₂
Aerodynamic effects
Diffusive boundary
Canopy uptake
Acid flux to surface

ABSTRACT

Gravestone decay and atmospheric concentrations of SO₂ are used to determine deposition velocities in two adjacent cemeteries in the Birmingham, UK, Jewellery Quarter. Warstone Lane cemetery is essentially open to the environment with only a limited number of trees. Key Hill Cemetery, located within 100 m, has a continuous canopy of 100+ year-old London plane; gravestone decay at Key Hill is 50% less than at Lane for the period after 1960. This difference is used to calculate canopy resistance as a residual term assuming that aerodynamic and quasilaminar resistances are generally similar at both sites. Calculated resistances range from approximately 300 to 900 sm⁻¹ and are consistent with estimated and calculated values from a wide variety of studies.

1. Introduction

Dramatic contrast in decay of lead-lettered marble gravestones between two adjacent cemeteries in Birmingham, UK, allows estimation of the canopy resistance to gaseous deposition of SO₂. Warstone Lane...