

The Forest-Atmosphere Interaction

Edited by
B. A. Hutchison
and
B. B. Hicks



D. Reidel
Publishing Company
Dordrecht / Boston / Lancaster

The Forest-Atmosphere Interaction

Proceedings of the Forest Environmental Measurements
Conference held at Oak Ridge, Tennessee,
October 23-28, 1983

Edited by

B. A. Hutchison

and

B. B. Hicks

with editorial assistance from

L. W. Gay

K. L. Perttu

J. B. Stewart

D. Reidel Publishing Company

A MEMBER OF THE KLUWER ACADEMIC PUBLISHERS GROUP



Dordrecht / Boston / Lancaster

CONTENTS

Acknowledgements	ix
Preface	xi
Main Symbols	xv
Part I. The Characterization of Forest Environments	
Characterization of Boundary Conditions Affecting Forest Environmental Phenomena	
L. J. Fritschen	3
Meteorological Data Stations at Long-Term Ecological Research Sites	
L. W. Swift, Jr. and H. L. Ragsdale	25
Leaf and Bark Area Distribution in a Pine Forest	
S. Halldin	39
Canopy Architecture of a Red Maple Edge Stand Measured by a Point Drop Method	
D. R. Miller and J. D. Lin	59
Estimates of Surface Roughness and Displacement Heights Above a Growing Pine Forest from Wind Profile Measurements over a Period of Ten Years	
L. Jaeger	71
Preliminary Study of Dependence of Surface Conductance of Thetford Forest on Environmental Conditions	
J. B. Stewart and H. A. R. de Bruin	91
Data Acquisition for Forest Environmental Measurements in Sweden	
K. L. Perttu	105
An Approach to Microcomputer Based Data Acquisition and Control for Forest Environmental Measurements	
J. R. Simpson, M. O. Smith, R. D. Stevenson, and L. J. Fritschen	117
Sulfur Dioxide, Carbon Dioxide, and Water Vapor Flux Measurements Utilizing a Microprocessor-Controlled Data Acquisition System in a Pine Plantation	
R. Lorenz and C. E. Murphy, Jr.	133
Data Acquisition System for Wind Induced Tree Vibration	
R. Amtmann	149
A Forest Evapotranspiration Model Using Synoptic Weather Data	
B. Bringfelt	161

Simulating Interception Loss Using Standard Meteorological Data J. P. M. Mulder	177
Adapting an Agricultural Soil-Plant-Air-Water Model for Use in Forests J. R. Simpson, L. J. Fritschen and K. E. Saxton	197
Determination Of The Energy Exchanges of a Forest Type Culture: <u>Hevea Brasiliensis</u> B. A. Monteny, J. M. Barbier, and C. M. Bernos	211
Determination of The Year-To-Year Variation in Growing Season Water Use of a Douglas Fir Stand D. L. Spittlehouse	235
An Areally Intensive Approach to Hydrologic Nutrient Transport in Forested Watersheds J. J. Rhodes, C. M. Skau, and J. C. Brown	255
A Lysimeter Characterization of Evaporation by Eucalypt Forest and its Representativeness for the Local Environment F. X. Dunin, I. C. McIlroy, and E. M. O'Loughlin	271
Lysimetric Evaluation of Pine Forest Evapotranspiration H. Riekerk	293
Variability of Rainfall Chemistry Within a 40 Ha Field in North Central West Virginia P. J. Edwards and J. D. Helvey	309
Measurements of Solar Radiation on Vertical Surfaces in the Shade of Individual Trees G. M. Heisler	319
Urban Forest Cover and Aggregation from High-Altitude Aerial Photographs H. G. Halverson	337
A Device for Rapid Quantification of Seedling Morphology K. R. Chisholm and W. C. Carlson	349
Application of Atmospheric Tracer Techniques for Determining Biogenic Hydrocarbon Fluxes from an Oak Forest G. Allwine, B. Lamb, and H. Westberg	361
Analysis of Forest Environmental Measurements to Estimate Parameters of Microclimate And Air Pollution Deposition Velocity Models C. E. Murphy, Jr. and R. Lorenz	383
Internal Consistency of the Bowen Ratio Approach to Flux Estimation over Forested Wetland D. S. Munro	395

Part II. Wind Turbulence, and Turbulence Exchange above and within Forest Canopies	
On Diffusive and Dispersive Fluxes in Forest Canopies R. H. Shaw	407
Flux-Gradient Relationships in a Forest Canopy O. T. Denmead and E. F. Bradley	421
Turbulent Transport in Flexible Plant Canopies J. J. Finnigan	443
Modeling Turbulent Exchange in Forest Canopies W. S. Lewellen	481
Modeling Windfields and Surface Layer Wind Profiles over Complex Terrain and Within Vegetative Canopies R. M. Cionco	501
Modelling Canopy Exchanges of Water Vapor and Carbon Dioxide in Coniferous Forest Plantations P. G. Jarvis, H. S. Miranda, and R. I. Muetzelfeldt	521
Correlated Vertical Wind Speeds in a Spruce Canopy J. M. Crowther and N. J. Hutchings	543
Spatial and Temporal Variation of Eddy Flux Measures of Heat and Momentum in the Roughness Sublayer Above a 30-m Douglas Fir Forest M. O. Smith, J. R. Simpson, and L. J. Fritschen	563
Eddy Diffusivity And Instrument Resolution in Relation to Plant Height L. J. Fritschen, L. W. Gay, and J. R. Simpson	583
Variability of Short Term Eddy-Correlation Estimates of Mass Exchange M. L. Wesely and R. L. Hart	591
Some Estimates of Dissipation from Turbulent Velocity Component Gradients over a Forest Canopy J. D. Bergen	613
Application of Forest Canopy-Atmosphere Turbulent Exchange Information B. B. Hicks	631
Measurements of Turbulent Heat and CO ₂ Exchange over Forest from Aircraft R. L. Desjardins, J. L. McPherson, P. Alvo, and P. H. Schuepp	645
Panel Discussion on Research Needs and Directions Led By: Roger Shaw, Tom Denmead, Steve Lewellen, and Bruce Hicks	659
Appendix A Forest Environmental Measurements Conference Attendees	665
Appendix B Forest Environmental Measurements Conference Manuscript Referees	673
Index	679