UNITED STATES DEPARTMENT
OF AGRICULTURE

Evaluation of Ozone Damage to Vegetation on the Lye Brook Wilderness in 1989

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ABSTRACT

The Lye Brook Wilderness on the Green Mountain Forest in Vermont is one of the "Class I" areas given special protection under the Clean Air Act. Surveys in both 1988 and 1989 revealed symptoms of ozone injury on several species of plants in the Wilderness. The high concentrations recorded at the ozone meters nearest the Wilderness easily account for the symptoms. Moreover, at a site near the Wilderness, ozone symptoms appeared on potted plants, of the same species as those found in the Wilderness, within unfiltered growth

INTRODUCTION

About 14,600 acres (5910 h) of the 16,000 acre Lye Brook Wilderness on the Green Mountain National Forest has been designated a "Class I" area under the Clean Air Act Amendments of 1977. The intent of the Amendments is to safeguard the air quality of Wildernesses and National Parks by insuring that air pollutant concentrations do not rise above 1977 levels. The legislation gives land managing agencies an active role in the granting of permits by EPA or state pollution control agencies for the construction of new facilities that emit pollutants.

Thus the Forest Service is responsible for the protection of the Lye Brook Wilderness from the adverse effects of air pollution. Accordingly, in 1987 personnel of Region 9 of the National Forest System requested the

Wilderness.

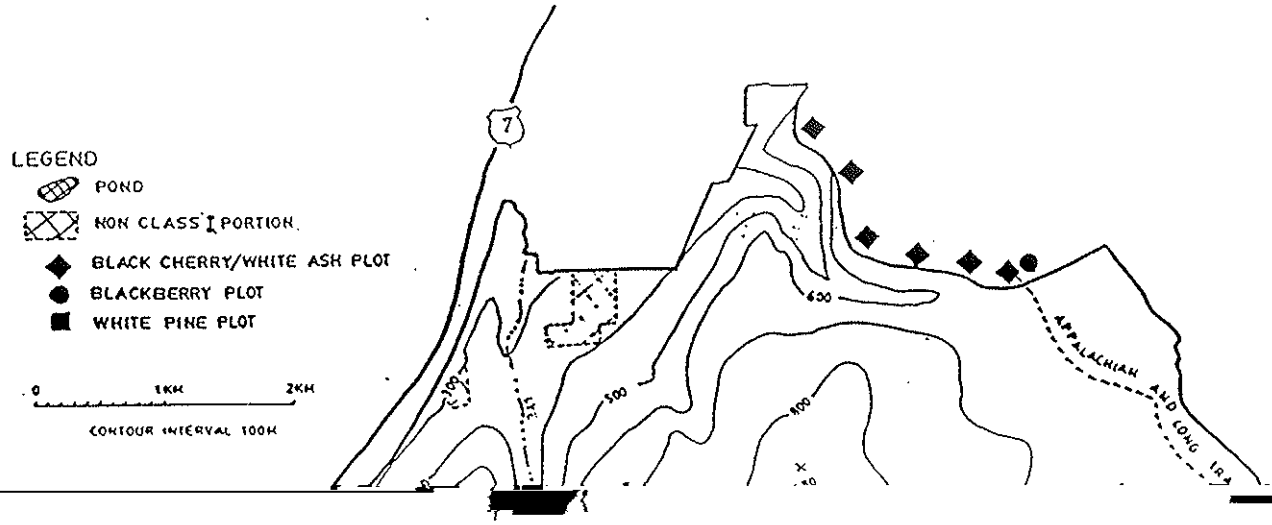
Quality assurance

To assure the quality of the results, the field crew was trained in recognition of the symptoms of ozone injury by experienced personnel at the University of Massachusetts (Drs. Gretchen Smith and William Manning). In addition, I accompanied the crew for several days of each survey. As an aid to the estimation of damage intensity, the crew referred to photographs, such as those from Bennett and Stolte (1985), and to diagrams provided.

Tree group and plot establishment

The species of ozone-sensitive plants that were closely examined were white ash (*Fraximus americana* L.), black cherry (*Prunus serotina* Ehrh.), white pine (*Pinus strobus* L.), and blackberry (mostly *Rubus vermontanus* Blanch.). A few others, such as *Aster* spp. and elderberry (*Sambucus canadensis* L.), were examined in passing.

Data were collected from 13 white ash and 11 black cherry trees (in 5 groups located about 5 km apart) along


LEGEND
POND
NON CLASS I PORTION
BLACK CHERRY/WHITE ASH PLOT
BLACKBERRY PLOT
WHITE PINE PLOT
0
1KM
2KM
CONTOUR INTERVAL 100M
7
100
LEE
500
600
400
APPALACHIAN TRAIL
CONG IRA

White pine was evaluated on both a whole tree and a single branch basis. For the tree, annual height growth

Another difference was found in the symptoms themselves. The 1989 symptoms were often not "classic", as they had been in 1988. On some leaves, the stippling was on both upper and lower surfaces rather than on the upper surface only. As in 1988, injury was classified light.

foliage disease. Only one plot displayed definite and unmixed ozone symptoms. Here, injury to primocanes was rated lower than in 1988 (3.2 vs. 9.2), but injury to floricanes higher (12.0 vs. 7.2).

Table 1. Frequency and intensity ratings of ozone symptoms on black cherry and white ash on the Lye Brook Wilderness in 1988

Ozone concentrations in 1988 and 1989

occurred during the 1989 growing season - May 18-19 and July 2-4. The July episode, as well as some other incidences of high concentrations that were of shorter duration, was recorded by both the Bennington and Mt. Equinox monitors, and ozone symptoms were soon found on black cherry in the unfiltered chambers and ambient air plots at the Mt. Equinox site. No symptoms appeared in the filtered chambers. Thus, there is little doubt that at least some of the injuries found within the Wilderness were ozone-caused.

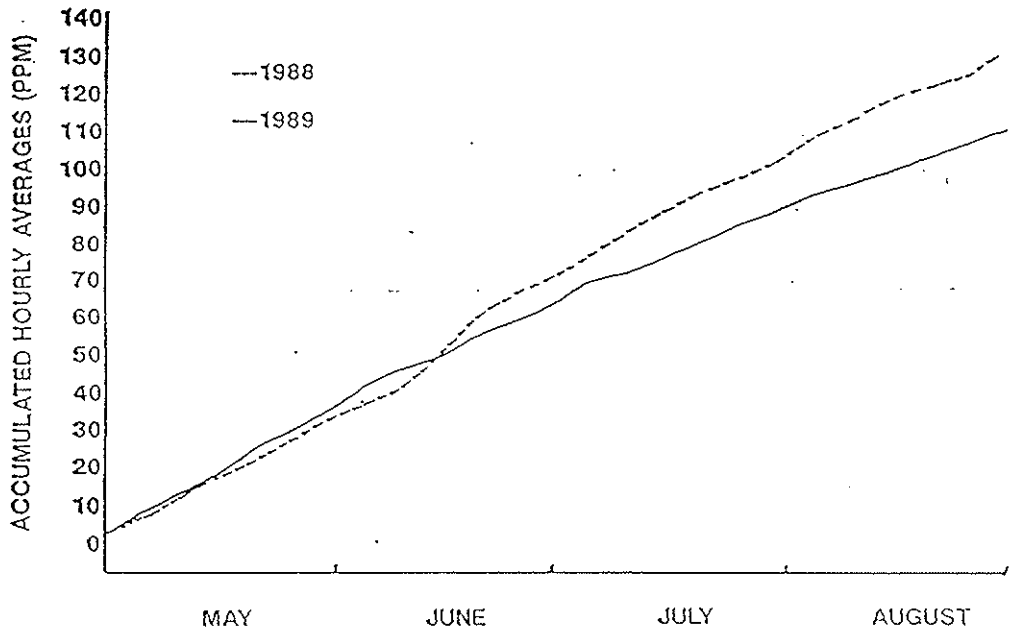


Figure 2. Cumulative hourly ozone concentrations in southern Vermont as recorded by the Bennington monitor in 1988 and 1989.

With regard to ozone concentrations, elevation is important. Wolff and his coworkers (1987) discovered that peak concentrations may be similar at high and low elevations, but the duration of high levels is longer at high elevations. At night, ozone accumulated during the daylight hours is rapidly depleted below the nocturnal inversion layer but not above it. Hence, the vegetation at the higher elevations is exposed to high concentrations for longer periods.

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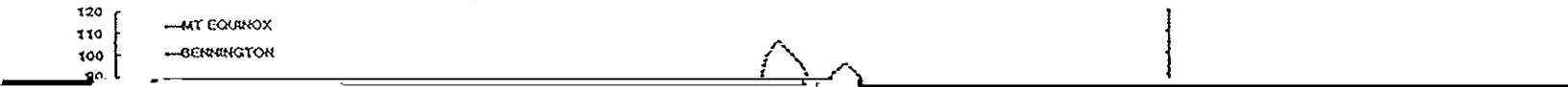
days in 1989 during which both monitors were operated at least 22 hours per day. The pattern follows that


120
110
100
90
—MT EQUINOX
—BENNINGTON