

## IDENTIFICATION OF SENSITIVE AIR POLLUTION RECEPTORS IN YELLOWSTONE NATIONAL PARK

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### Objectives

This project has three major objectives. The first is to collect and identify lichens from all representative substrates and vegetation types encountered in the study area, the Mammoth Hot Springs vicinity. The second is to establish permanent study plots on suitable substrates for subsequent sampling, using data from 1982-1983 as baseline information. The third objective is to specify lichen species present in this area of the Park that are sensitive to air pollutants.

### Methods

Between 31 August and 9 September, 1982, we (my assistants and I) ascended six peaks in the Mammoth Hot Springs area of Yellowstone National Park: Sepulcher, Everts, Clagett, Electric, Bunsen, and Terrace. These peaks form a semicircle around the Mammoth-Gardiner area, with exposures that face toward the Gardiner/Jardine mining and quarry areas. Lichen samples from all vegetation types and substrates (rock, soil, shrubs, trees) were collected from various altitudes and exposures on these peaks.

An attempt was made to quantitatively record some rock lichen communities on appropriate exposed ridges. However, that particular activity was abandoned during 1982 because of time constraints; we considered it more essential to reach and collect specimens from all peaks before winter snow blocked accessibility.

On four peaks, Sepulcher, Electric, Clagett, and Bunsen, six to ten whitebark pine (*Pinus albicaulis* Engelm.) and subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.) trees were permanently marked with number tags wired inconspicuously around branches. Two lichen species, *Letharia vulpina* (L.) Hue. and *L. columbiana* (Nutt.) Thoms., were collected from these marked trees for baseline and subsequent cellular observations. Baseline algal cell appearances (plasmolysis rates) are being completed, and samples from one site, Bunsen Peak, were also prepared for transmission electron microscopy. The trees from which these *Letharia* collections were taken face toward the Gardiner/Jardine area; indeed, Gardiner and its adjacent quarries are visible from each of these sites.

### Results

Analysis of the collected specimens is in a very preliminary state. Final results expected from identification of the collections are species lists according to substrate and location on the six peaks. Cellular observations of the two Letharia species likewise are not yet complete.

Letharia is a bright yellow-green lichen of the fruticose (bushy) type considered to be extremely sensitive to air pollutants (LeBlanc and Rao, 1975). Letharia vulpina and L. columbiana occur intermixed in great abundance on tree branches at the summit of Bunsen Peak, and to lesser extents on Clagett, Sepulcher, and lower ridges of Electric Peak. Other lichens sensitive to air pollution, i.e., other fruticose genera such as Usnea and Bryoria, and large foliose species, occur only in very small quantities and in rather protected locations that are not suitable for monitoring sites.

Informal observations of the Pinus albicaulis on appropriate exposed sites showed retention of five to eight years of needle growth on the branches, indicating a healthy state. Stress from air pollutants causes loss of older needles with fewer years' accumulation of needles on the branches (Scheffer and Hitchcock, 1955).

### Conclusions

The observations completed to date are very sketchy, but it appears that the most accessible peaks, Sepulcher, Clagett, and Bunsen, are quite good monitoring sites. There is an adequate amount of lichen cover for repeated sampling and exposure to possible pollution sources is appropriate, although wind direction is generally from the sites toward the quarries.

My current estimate is that we collected approximately 60 lichen species from all substrates sampled. The most useful species in terms of biomonitoring of air pollution, particularly acid precipitation, are probably Letharia vulpina and L. columbiana because of their growth form and because of their exposed position on tree branches.

### References Cited

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