

Terrestrial Effects of Air Pollution

Results from the first four years of the Air Quality Division's **Biological Effects Program** are summarized in *Park Science* (Summer 1985, p. 8-9). The main points: 1) The worst effects of air pollution on national park vegetation come from elevated levels of ozone. 2) Heavy metals, such as lead, have the next most serious effects. 3) The worst effects are found in parks, such as Indiana Dunes and Santa Monica Mountains, that are designated class II under the Clean Air Act. 4) Fumigation exposure studies indicate that selection is favoring genotypes tolerant of air pollution and sensitive ones are being removed from the existing populations. The Biological Effects Program excludes study of terrestrial and aquatic effects from acidic deposition, which fall under a program of the NPS Office of Natural Resources. Some major additional results of the Biological Effects Program up to March 1986 are summarized below.

Ozone Injury on Pine Plots, 1985

	% Trees injured	% Injury tree
Great Smoky Mountains NP	90	5
Acadia NP	89	4
Indiana Dunes NL	100	5
Cuyahoga Valley NRA	97	3
Sequoia NP	87	9
Yosemite NP	58	5
Saguaro NM	52	3
Rocky Mountain NP	0	0
Everglades NP	(03-like symptoms awaiting final diagnosis)	

(Eastern parks = *Pinus strobus* (white pine) and *Pinus elliotii* (slash pine); western parks = *Pinus ponderosa* (ponderosa pine) and *Pinus jeffreyi* (Jeffrey pine))

Mammoth Cave National Park

The results of an air pollution injury survey in the fall of 1985 have been analyzed and summarized. Ozone injury was found on most of 14 species examined, and was common on six: *Cercis canadensis* (redbud), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (red ash), *Platanus occidentalis* (sycamore), *Liriodendron tulipifera* (tuliptree), and *Asclepias syriaca* (common milkweed). Percent of injured individuals ranged from 3 for *Acer negundo* (boxelder) and *Acer saccharinum* (silver

maple) to 100 for common milkweed. Injury per plant was greatest on the common milkweed, followed by wild grape (*Vitis* sp.), the ashes, and redbud. Significant differences between sites demonstrated that trees on ridges and higher elevations were most likely to be injured. Injury was found throughout the park, indicating uniform ozone concentrations (probably greater than 0.06 ppm).

Isle Royale National Park

Elemental analyses of bryophytes collected as far back as 1900 show concentrations of sulfur as high as 6120 ppm, nearly three times higher than normal values found in pristine areas in northern Canada. These values are consistent with elevated sulfur levels found in lichens in the park. Possible sources include the pulp mills and a power plant in Thunder Bay, Ontario and long-distance transport.

James P. Bennett
Air Quality Division
Denver, Colorado