

## What Goes Up Must Come Down: Persistent Pollutants in High, Remote National Park Ecosystems (including Glacier National Park!)

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People from all over the world come to national parks in the United States to experience natural beauty. Many visitors come to see the majestic views offered by

air pollutants, but it works pretty well for toxic air pollutants, which include a suite of airborne contaminants such as pesticides, industrial by-products such as PCBs, heavy

metals such as mercury, and emerging chemicals such as flame retardants used on fabrics. Emissions of toxic air contaminants from air pollutant sources eventually fall out of the atmosphere and land somewhere on the earth's surface

the food chain. Further, federal legislation requires protection of the natural parks in perpetuity. Based on these issues the NPS conducted the multiagency Western Airborne Contaminants Assessment Project (WACAP) from 2002 to 2007 to determine the risk from airborne toxic compounds to national park ecosystems and food webs.

WACAP provided a window into the contaminant situation at sampling sites in twenty western national parks and forests from the Arctic to the Mexican border. Researchers analyzed air, water, snow, sediment, lichen, conifer needles, and fish from eight "core" national parks, including Glacier National Park's Snyder Lake & Oldman Lake watersheds.

Key findings indicate that airborne contaminants are being transported to protected areas like Glacier NP, and are being deposited at levels that cause concern for wildlife and human health. At Glacier NP, wildlife health thresholds established for fish-eating birds were exceeded by mercury and the historic-use pesticides chlordanes and DDTs. Human health thresholds established for subsistence fishers (i.e., adults who eat an average of 19 meals of fish per month) were also exceeded by concentrations of dieldrin (also a historic-use pesticide) and p,p'-DDE (i.e., a by-product

the unique landscapes found only by peering into the depths of the Grand Canyon, photographing Half Dome from the floor of Yosemite Valley, or standing in awe among the colossal ice and snow fields at Glacier National Park. Visitors also come to enjoy the rich diversity of flora and fauna found within national parks.

The National Park Service (NPS) is responsible for keeping these special places "unimpaired for the enjoyment of future generations." This means preserving intact landscapes and conserving wild life, and also protecting the scenic vistas and ecological communities found within national parks from the harmful effects of air pollution. Air quality is of great concern because many national parks, including Glacier National Park (NP), are downwind of various sources of air pollution, including vehicles, power plants, industry, and agriculture. Some of these sources are nearby, while others are regional or even global.

The old adage "what goes up must come down" doesn't necessarily hold true for all

and are subsequently incorporated into the food chain. These toxic air pollutants are known or suspected to cause cancer or other serious health effects in wildlife and humans, such as reduced reproductive success, impaired growth and development, behavioral abnormalities, reduced immune response, and decreased survival.

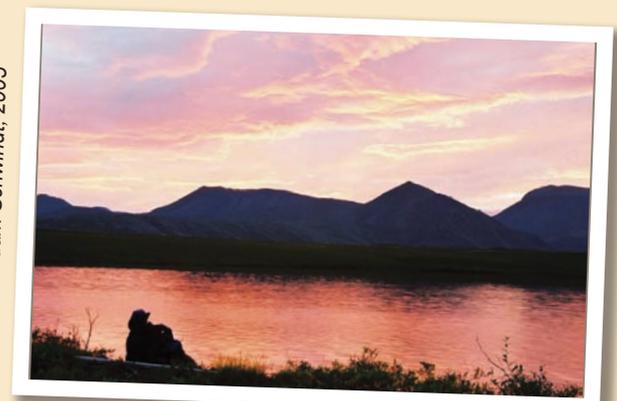
High-elevation and high-latitude areas have previously been identified as areas of particular peril from toxic air contaminants due to the tendency of some types of pollutants to migrate to colder alpine and arctic areas and deposit with the annual snowpack. In addition, many of these compounds bioaccumulate by magnifying concentrations at higher levels of

Source: USGS, 2005



Sampling contaminants for snow at Mount Rainier National Park (Washington), a high elevation WACAP field site

Source: Adam Schwindt, 2005



Burial Lake at Noatak National Preserve (Alaska), a high latitude WACAP field site

of DDT) in fish. Additionally, the dieldrin concentration in one fish from Glacier NP exceeded the contaminant health threshold for recreational fishers (i.e., adults who eat an average of 2.3 meals of fish per month). Elevated concentrations of an estrogen-responsive protein were found in male fish at the Park, and one “intersex” male fish (i.e., male fish testes contained oocytes, a female reproductive structure) was found, suggesting contaminant-induced endocrine disruption. Because the sample size was small, however, the extent of the problem and correlation between fish reproductive effects and contaminant concentrations was not established for parks in the study.

Furthermore, concentrations of PAHs (combustion products formed by industrial and other processes) in vegetation, snow, and sediments at Glacier NP were 1 to 2 orders of magnitude greater than at any other national park site studied. PAH ratios can be used to identify potential sources, and the data strongly suggests that the nearby Columbia Falls aluminum smelter greatly influenced PAH concentrations in Glacier NP’s Snyder Lake watershed.

Project findings suggest that the preserved remoteness of national parks unfortunately

does not indicate that national parks are as pristine as once thought, conveying a cautionary message that increases awareness and illustrates the potential deleterious consequences of toxic air contaminants upon natural resources legally mandated to remain unimpaired. The results not only offer impetus for more in-depth studies but also shed light on the risk to national park resources, cultivating future efforts to coordinate with regulatory entities that may identify strategies to reduce contaminant loads from U.S. and international sources. Some measures the general public can take to decrease the presence of airborne contaminants include conserving energy and reducing one’s chemical footprint via altered application of pesticides or conscientious consumerism.

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In an effort to facilitate communication and to foster research on toxins in the environment, Glacier National Park hosted an interagency, post-WACAP contaminants workshop for the state of Montana in 2008. For more information on that workshop and other post-WACAP workshops, access to Glacier NP’s fish consumption guidance, or to download the WACAP report, fact sheet and database, visit [http://www.nature.nps.gov/air/Studies/air\\_toxics/wacap.cfm](http://www.nature.nps.gov/air/Studies/air_toxics/wacap.cfm).