Ozone trends in Great Smoky Mountains National Park over the past two decades: Implications for Plants and Ecosystems.

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Hourly ozone data from five sampling locations in Great Smoky Mountains National Park and one low elevation location adjacent to the Park in NC were analyzed over the period 1989 to 2012 for diurnal and season trends. Sampling locations spanned an elevational range from 564 m at Cades Cove to 2030 m at Clingmans Dome in TN. Diurnal ozone concentrations [O_3] reach a minimum around 6 am at the two lowest elevation sites, followed by a peak between 1 and 4 pm, with a diurnal range of approximately 46 ppb in 1999, but only 37 ppb in 2012. High elevation sites exhibit flatter profiles with diurnal ranges of only 8 to 20 ppb, with minimum [O_3] occurring between 8 and 11 and maximum [O_3] at night. Sites in NC at comparable elevations have lower [O_3] which most likely reflects scavenging as winds move primarily west to east and also dilution due to mixing with air in the free troposphere as it moves up and over the high elevations in the Park. Seasonal exposures increased dramatically from 1989 to 1999 and then dropped considerably after 2003. The number of hours with [O_3] $\geq$ 60 ppb has decreased substantially since 2003, especially at high elevation sites. The decrease in the frequency of high ozone concentrations has been attributed to implementation of the NO_x SIP call, as required by the Clean Air Act, a slow-down in the economy in recent years resulting in less industrial activity, and lastly, by turnover in the car and truck fleet to newer, less polluting vehicles.

Seedlings of several tree species native to Great Smoky Mountains National Park were exposed to ozone in open-top chambers from 1988 to 1992 for one or two growing seasons. Synthesized diurnal exposure profiles were used in 1988, and modified ambient profiles from 1989-1992, with 2.0x ambient the highest exposure used. Exposure-response curves for biomass were developed using the Weibull function and SUM06 index. Species responses ranged from totally insensitive (no biomass or foliar effects) in Table Mountain pine, hemlock and chestnut oak, to no biomass responses but evident foliar stipple in above ambient treatments for Virginia pine, sycamore, and black locust, to both biomass reductions and elevated stipple in above ambient treatments for the remaining species (Black cherry,

Tulip Poplar, Winged Sumac). People, plants and natural ecosystems in the Park today are at lower risk from tropospheric O_3 than a decade ago.