# Investigation of Potential In-Canopy Vegetative Uptake of Ozone and other Gases at Maine's Howland Research Forest

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Abstract:
From September 2011 to April 2013, the Clean Air Status and Trends Network (CASTNET) conducted a collaborative effort with Ameriflux to investigate atmospheric to vegetative exchanges of ozone and sulfur and nitrogen species at the Howland Research Forest Ameriflux site in Maine. The forest is comprised of mature, lowland evergreen trees aged 40 to 160 years with a local canopy height of 20 m. Measurements taken at the site consisted of hourly ambient ozone concentrations sampled at eight levels throughout and above the evergreen canopy and weekly integrated ambient concentrations of gases and particles from CASTNET filter packs located above and below the canopy. Design for the ozone system centered on the use of a single ozone analyzer and site transfer standard in conjunction with a solenoid system to allow for all eight levels to be measured with a residence time > 20 s using the same analyzer. Daily quality assurance and analyzer performance showed no evidence of line loss.

Hourly ozone data shows evidence of episodic, nighttime negative concentration gradients with decreasing sampling heights that may indicate potential deposition and scavenging mechanisms occurring within the canopy. These losses were statistically compared with atmospheric stability and moisture parameters to identify potential drivers of vegetative uptake and discern from existing gradients due to poor mixing within the canopy. Loss events, defined when measured ozone concentration at the canopy floor is < 50% of the above canopy concentration, appear stability dependent and rarely occur at low wind speeds and small temperature differences at the above and below canopy levels. Loss events also occur at relative humidity levels higher than 60%. Weekly-integrated ambient concentrations measured with the filterpack support these observations, having below canopy concentrations of approximately 60% and 64% of above-canopy concentrations for sulfur dioxide and total nitrate (including gaseous nitric acid), respectively. Above and below-canopy concentrations for concentrations of particulate matter components (i.e. total ammonium and sulfate) show much less difference, which may be indicative of slower deposition rates than those of the gaseous species.

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