AN EVIDENCE-BASED ASSESSMENT OF THE IMPACTS OF CURRENT AMBIENT OZONE ON VEGETATION IN EUROPE

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In 2007 there will be a review of the Gothenburg Protocol, the 1999 Protocol of the Convention of Long-range Transboundary Air Pollution, aiming to abate acidification, eutrophication and ground-level ozone (WGE, 2004). To coincide with this review, the ICP Vegetation is collating evidence of damage to vegetation in Europe caused by ambient ozone pollution over the time-scale 1990 – 2006 with the aim of quantifying the link between field observations and critical level exceedance. Three main types of data exist in published papers and reports: records of ozone injury recorded during field surveys, effects detected during biomonitoring exercises such as the ICP Vegetation clover network and effects detected experimentally by comparing responses of plants grown in ambient air with those exposed to air with reduced ozone content.

To date, over 250 records of incidences of ozone injury on vegetation are included in the ICP Vegetation database, although collection of data is still ongoing. Each record includes the country, grid reference, year of observation, species and species type. The database indicates that ozone-injury has been detected in 17 countries across the width and length of Europe and provides a clear indication that ozone injury is indeed very prevalent in countries experiencing high ozone fluxes. These results are backed up by ICP Vegetation biomonitoring studies in which an ozone-sensitive biotype of white clover has been exposed to ambient ozone at sites in ca. 15 countries each year. Ozone injury has been detected at almost every site in every year, with the extent of injury reflecting the fluctuating ozone climate. The injury scores at the monthly cut-backs were averaged across five geographical regions to investigate trends. Injury scores were always highest for the Western Mediterranean (WM), with the exception of the unusually cool wet August of 2002, were lowest in Northern Europe (NE) and Atlantic Central Europe (ACE) and were generally intermediate for Central Continental Europe (CCE). High injury scores were observed across Europe in 2003, a high ozone year. From all the studies conducted so far, it has been shown that trends in impact reflect the spatial and temporal variation in ozone concentration, with no marked decline or increase evident.

A comparison of plant responses in ambient air compared to filtered air experimental exposures is also being made as part of this study. Data collection is ongoing and the dataset currently comprises information for approximately 25 species in five countries. Responses noted include the development of visible ozone injury such as small yellow or bronze spots on the leaf surface, reductions in growth, seed production and/or ability to over-winter (for perennial species). Literature reviews and monitoring programmes conducted by the ICP Vegetation have therefore shown that over 100 species of crops and (semi-)natural vegetation are responding to ozone pollution at the concentrations currently experienced within the ECE region.

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