HOW TO PROTECT EUROPEAN FORESTS FROM OZONE POLLUTION

Ozone in the air we breathe is a global pollutant that damages our forests at different scales, from cells to ecosystems. Forests are critical for economy, nature conservation, environmental protection, and removal of the greenhouse gas CO2 from the air. To protect forests against ozone, appropriate legislative standards are needed. Currently, the European Union uses the Accumulated Ozone over a Threshold of 40 ppb (AOT40) as standard. AOT40 is a metric of the amount of ozone in the air. However, the scientific community is moving towards a new index, the Phytotoxic Ozone Dose with a hourly threshold Y (PODY), that summarizes how much ozone enters into the plant. Injury, in fact, occurs only when ozone is uptaken into the leaf through its specialized micropores, called stomata. This study compares these two indices (AOT40 and PODY) for ozone risk assessment and analyses advantages and inconsistencies associated to the indices calculation (i.e. length of the growing season) over Europe for the time period 2000-2005.

In the figure above we compare AOT40 and POD with a hourly threshold of 0 nmol m$^{-2}$ s$^{-1}$ (POD0) in the anomalous year 2003, when a serious heat wave occurred in Europe. If we use AOT40, the areas at higher risk of forest injury by ozone (in red) are in the Southern part of Europe. If we use POD0 the risk is higher over the Atlantic region. What is the metric that gives a more realistic picture of risk? What adjustments are necessary for a correct calculation of these indices?

Our study published in Global Change Biology answers these questions and suggests that a new definition of European legislative standard is needed in the near future.