Impacts of ozone on ecosystems: indicator to be used in impact assessments

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Take home messages

- Flux-based approach allows for combined ozone and climate change risk assessments
- Baseline concentrations contribute to chronic impacts on vegetation - need for global assessments and mitigation policies
- Outreach activities need to be strengthened to reduce impacts in other regions and baseline ozone in LRTAP countries
- Further evidence needed on the combined impacts of ozone pollution and climate change on crops, ecosystems and biodiversity, including impacts and recovery from extreme events
- Identification of crops, ecosystems and regions/areas globally most vulnerable to ozone pollution and climate change
Ozone injury
- App
- Biomonitoring
- Literature

Field evidence (visible injury, filtered air benefits, epidemiology) provides powerful argument for ozone precursor control at national to global scales.

Experimental and initial modelling studies indicate that biodiversity is potentially at risk in global biomes; more research is needed.

Fuhrer et al. (In press). Ecology and Evolution
Impacts on food security

- Annual wheat yield loss in the EMEP region (2007 – 2011), **13.2%**, **4.6 billion euros**
- Global economic losses due to ozone on wheat yield (**9.4% loss**) are estimated at **$24.3 billion**

- Impacts due to changes in background or peaks are both explained by flux
- Soybean varieties from India and China are more sensitive than from the USA

Newer varieties are more sensitive

- Wheat, cv. Skyfall

Osborne et al., 2016
Global Change Biology

Mills et al., in prep.
O$_3$ impacts in N enriched and changing climate

Mills et al. (2016). Environmental Pollution 208: 898 -908

- Elevated CO$_2$ less likely to ameliorate ozone impacts under field conditions
- Combined impacts of elevated temperature and ozone have rarely been studied
- Ozone-induced reduction of root growth more pronounced at high N supply; this might enhance sensitivity to drought
- Ozone impact on stomatal conductance is species-dependent, with increases, no effect and decreases being observed
- Both responses to gradual changes in pollutants and climate and those under extreme weather events require further study
- Flux-based risk assessment using DO$_3$SE model can take account of modifying effects of climate change. Modifying effects of nitrogen can be included too.

Thank you!