

Food crops damaged by pollution crossing continents

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(PhysOrg.com) -- Man-made air pollution from North America causes Europe to lose 1.2 million tonnes of wheat a year, a new study has found.

The research, led by the University of Leeds and co-authored by the University of York, shows for the first time the extent of the Northern Hemisphere's intercontinental crop losses caused by ozone - a chemical partly produced by fossil fuels.

The study also suggests that increasing levels of air [pollution](#) from one continent may partly offset efforts to cut [carbon emissions](#) in another.

The findings have important implications for international strategies to tackle global food shortages, as well as [global climate](#) and human health strategies.

In a paper published in *Biogeosciences*, researchers show how [ozone pollution](#) generated in each of the Northern Hemisphere's major industrialised regions (Europe, North America and South East Asia) damages six important [agricultural crops](#) (wheat, maize, soybean, cotton, potato and rice) not only locally, but also by travelling many thousands of kilometres downwind.

Of the yield losses to Europe caused by ozone, pollution originating from North America is responsible for a 1.2 million ton annual loss of wheat. This is the biggest intercontinental ozone-related impact on any food crop. The scale of the impact of North American pollution on European wheat has previously been unknown.

Dr Steve Arnold, a senior lecturer in [atmospheric composition](#) at the University of Leeds's School of Earth and Environment, who led the study, said: "Our findings demonstrate that air pollution plays a significant role in reducing global [crop productivity](#), and show that the negative impacts of air pollution on crops may have to be addressed at an international level rather than through local air quality policies alone."

Researchers calculated projected levels of surface ozone concentration, a powerful air pollutant that is not only harmful to human health (particularly to the respiratory system) but also damages vegetation by damaging plant cells and inhibiting plant growth .

Enhanced surface ozone concentrations are produced through a chemical combination of hydrocarbon compounds and nitrogen oxides (nitrogen oxides are emitted into the atmosphere during high temperature combustion, for example by combustion of fossil fuels by motor vehicles and in coal fired power plants).

Michael Hollaway, a PhD student at the University of Leeds, used a computer model to predict reductions in global surface ozone if man-

made emissions of nitrogen oxide from the three continents were shut off. Using crop location and yield calculations, he and the research team were able to predict impacts on staple food crops, each with their own unique sensitivity to ozone pollution.

Dr Lisa Emberson a senior lecturer from the University of York's Stockholm Environment Institute and Environment Department, said: "This study highlights the need for [air pollution](#) impacts on crops to be taken more seriously as a threat to food security; currently air quality is often overlooked as a determinant of future crop supply Given the sizeable yield losses of staple crops caused by surface ozone, coupled with the challenges facing our ability to be food secure in the coming decades further coordinated international efforts should be targeted at reducing emissions of ozone forming gases across the globe."

Other findings are:

- In terms of global [crop losses](#), Asian pollution dominates worldwide losses of wheat (50-60%) and rice (more than 90%).
- North American pollution contributes the most to worldwide losses of maize (60-70%) and soybean (75-85%).
- The impact of Europe's pollution on other continents is minor due to fewer low pressure systems and weather fronts, which are responsible for transporting pollution across continents.

Dr Arnold added: "With future emissions of ozone-forming chemicals from Europe and North America expected to reduce, and emissions from Asia to increase, the findings suggest that increasing pollution from Asia may partly offset crop production benefits gained in Europe and North America through local emission reduction strategies."

More information: The paper *Intercontinental trans-boundary contributions to ozone-induced crop yield losses in the Northern*

Hemisphere by Michael Hollaway, Dr Steve Arnold, Prof Andy Challinor and Dr Lisa Emberson was published on 16 January 2012 and is available at: [doi:10.5194/bg-9-271-2012](https://doi.org/10.5194/bg-9-271-2012)

Provided by University of Leeds

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