



## **Responses of terrestrial ecosystem productivity to global fire air pollution**

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Fire is an important disturbance to the terrestrial carbon budget. Every year, global fires directly emit 2-3 Pg carbon into the atmosphere. In addition to the carbon emissions, fire plumes also generate short-lived climate pollutants, including ozone ( $O_3$ ) and aerosols, which may worsen air quality in the local and downwind regions. Increases in  $O_3$  and aerosols have strongly contrasting impacts on plant productivity.  $O_3$  is phytotoxic and reduces plant photosynthesis, while aerosol pollution may promote photosynthesis by enhancing diffuse radiation. Here, we perform the first global estimate of the net effects of fire  $O_3$  and aerosols on land ecosystem productivity, in combination of various models and multiple measurements. Without fire emissions, surface  $O_3$  decreases global gross primary productivity (GPP) by  $3.8 \pm 0.1$  Pg C/yr while aerosols increase GPP by  $1.2 \pm 0.2$  Pg C/yr, resulting in a net reduction of  $2.6 \pm 0.2$  Pg C/yr in GPP. Inclusion of fire pollution results in a further GPP reduction by  $0.7 \pm 0.1$  Pg C/yr, because  $O_3$  damaging is usually much higher than the aerosol diffuse fertilization. Such dampening effect on GPP suggests that fires weaken land carbon sink indirectly through the emissions of air pollution.