

Ozone and Soil Fertility

Managing ozone is not only good for climate stability, but also for preserving soil and plant health.

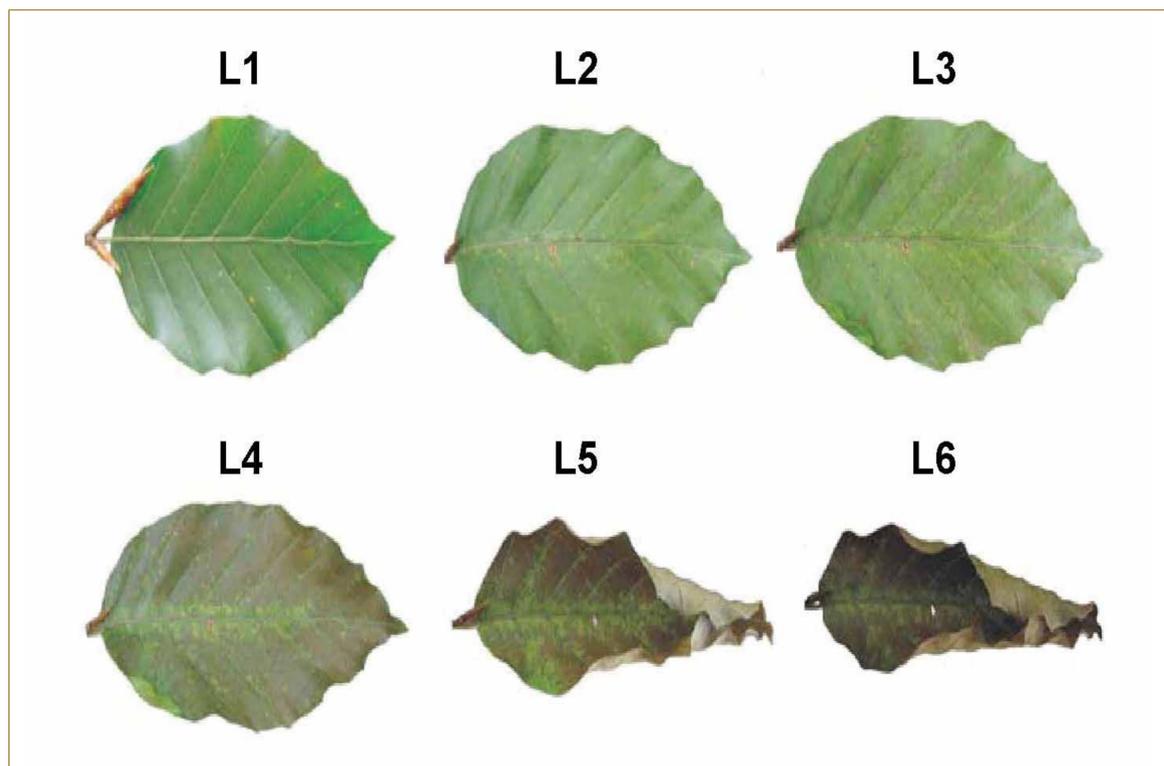
OZONE, THE COLORLESS REACTIVE OXIDANT GAS named O_3 , is a major constituent of atmospheric smog. Elevated concentrations of ozone leads to a reduction in soil health, including a decline of protein content in crops and reduction of microbial activities.

This leads to a reduction of plant growth and increases plant susceptibility to disease, pests and other environmental stresses. It also necessitates increased reliance on nitrogen fertilizers, which are the major source of the greenhouse gas nitrous oxide (N_2O) and interfere with aquatic ecosystems.

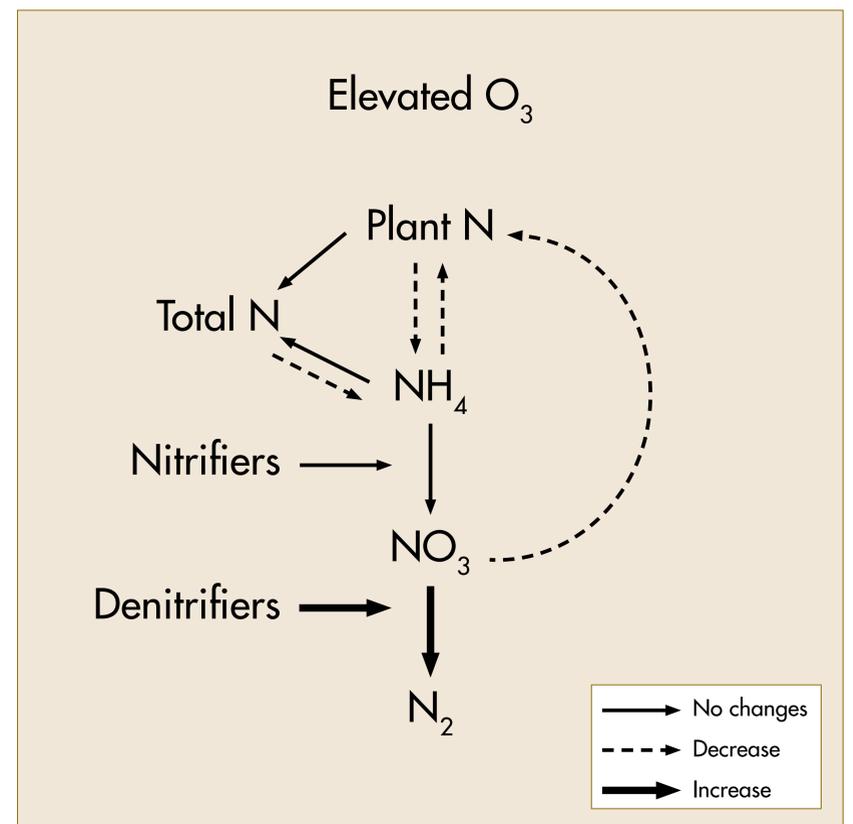
Our study found that ammonium (NH_4) and nitrate (NO_3), represent the forms of nitrogen that plants can uptake from the soil and that ecosystem processes such as microbial decomposition can regulate soil nitrogen.

Environmentally friendly solutions to control for ozone include:

- Use of nitrogen-fixer plants as cover crops preceding non-nitrogen fixers;
- Improved nitrogen fertilization management through improved monitoring of plant nitrogen demand;
- Farming practices to reduce runoff, leaching and erosion.



Ozone-induced leaf lesions in leaves of European beech saplings—Plant health is endangered by increased ozone. The table, above, shows classification of ozone symptoms in leaves from European beech saplings. **L1**—no visible lesions, **L2**—single punctual lesions, **L3**—many small lesions all over the lamina, **L4**—about 50% lesions of the lamina, **L5**—about 70% lesions of the lamina (leaves started to roll up), **L6**—more than 90% lesions of the lamina (leaves were shed). *Image source: Betz et al., 2008*



This diagram shows the flow of nitrogen between plants and soil under elevated ozone. When the mineral N content is low, there is an accumulation of organic matter and subsequently even less availability of mineral N in the soil.

CREDITS:

Engil Isadora Pujol Pereira
Graduate Student in Horticulture and Agronomy

Johan Six
Professor in the Department of Plant Sciences

CONTACT:

Johan Six, Ph.D.
jwsix@ucdavis.edu
(530) 752-1212

www.plantsciences.ucdavis.edu/Agroecology