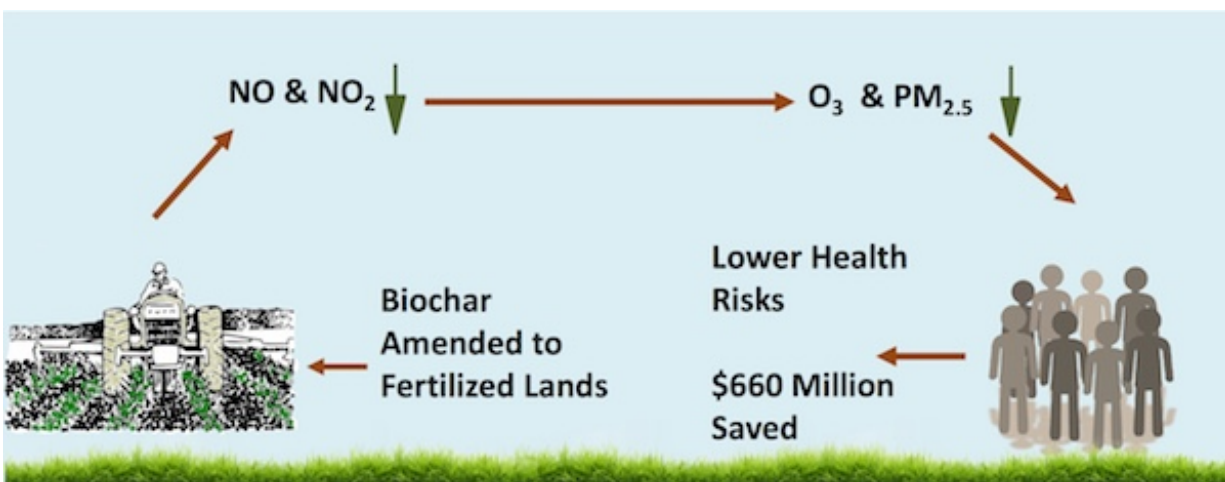


Biochar could clear the air in more ways than one

July 27 2017, by Mike Williams



Using biochar to cut emissions of nitric oxide (NO) and nitrogen dioxide (NO₂) would lower ozone and particulate matter levels in urban areas near farmland and save lives and money, according to Rice University researchers. Credit: Ghasideh Pourhashem

Biochar from recycled waste may both enhance crop growth and save health costs by helping clear the air of pollutants, according to Rice University researchers.

Rice researchers in Earth science, economics and environmental engineering have determined that widespread use of biochar in agriculture could reduce health care costs, especially for those who live

in urban areas close to farmland.

Biochar is ground charcoal produced from waste wood, manure or leaves. Added to soil, the porous carbon has been shown to boost crop yields, lessen the need for fertilizer and reduce pollutants by storing nitrogen that would otherwise be released to the atmosphere.

The study led by Ghasideh Pourhashem, a postdoctoral fellow at Rice's Baker Institute for Public Policy, appears in the American Chemical Society journal *Environmental Science and Technology*.

Pourhashem worked with environmental engineering graduate student Quazi Rasool and postdoc Rui Zhang, Rice Earth scientist Caroline Masiello, energy economist Ken Medlock and environmental scientist Daniel Cohan to show that urban dwellers in the American Midwest and Southwest would gain the greatest benefits in air quality and health from greater use of biochar.

They said the U.S. counties that would stand to save the most in [health care costs](#) from reduced smog are Will, La Salle and Livingston counties in Illinois; San Joaquin, San Diego, Fresno and Riverside counties in California; Weld County in Colorado; Maricopa County in Arizona; and Fort Bend County in Texas.



Biochar could reduce local air pollution from agriculture by reducing emissions of nitric oxide from soil, according to Rice University researchers. Credit: Ghasideh Pourhashem

"Our model projections show health care cost savings could be on the order of millions of dollars per year for some urban counties next to farmland," Pourhashem said. "These results are now ready to be tested by measuring changes in air pollutants from specific agricultural regions."

Pourhashem noted the key measurements needed are the rate of soil emission of nitric oxide (NO), which is a smog precursor, after biochar is applied to fields. Many studies have already shown that biochar reduces the emissions of a related compound, nitrous oxide, but few have measured NO.

"We know that biochar impacts the soil nitrogen cycle, and that's how it reduces [nitrous oxide](#)," said Masiello, a professor of Earth, environmental and planetary science. "It likely reduces NO in the same way. We think the local impact of biochar-driven NO reductions could be very important."

NO contributes to urban smog and acid rain. NO also is produced by cars and power plants, but the Rice study focused on its emission from fertilized soils.

The Rice team used data from three studies of NO emissions from soil in Indonesia and Zambia, Europe and China. The data revealed a wide range of NO emission curtailment—from 0 percent to 67 percent—depending on soil type, meteorological conditions and the chemical properties of [biochar](#) used.

Using the higher figure in their calculations, they determined that a 67 percent reduction in NO emissions in the United States could reduce annual health impacts of agricultural air pollution by up to \$660 million. Savings through the reduction of airborne particulate matter—to which NO contributes—could be 10 times larger than those from ozone reduction, they wrote.

"Agriculture rarely gets considered for [air pollution control](#) strategies," said Cohan, an associate professor of civil and [environmental engineering](#). "Our work shows that modest changes to farming practices can benefit the air and [soil](#) too."

More information: Alfred Obia et al. Effect of Soil pH Increase by Biochar on NO, N₂O and N₂ Production during Denitrification in Acid Soils, *PLOS ONE* (2015). [DOI: 10.1371/journal.pone.0138781](https://doi.org/10.1371/journal.pone.0138781)

Ghasideh Pourhashem et al. Valuing the air quality effects of biochar reductions on soil NO emissions, *Environmental Science & Technology* (2017). [DOI: 10.1021/acs.est.7b00748](https://doi.org/10.1021/acs.est.7b00748)

Provided by Rice University

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