To climate-change worries, add 1 more: Extended mercury threat

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Mercury pollution has already spurred public health officials to advise eating less fish, but it could become a more pressing concern in a warmer world.

So suggests a paper that appears in a recent issue of the journal *Oecologia*.

Sue Natali, a postdoctoral associate in botany at the University of Florida and the paper's lead author, compared mercury levels in soils under trees growing in air enriched with carbon dioxide to soil beneath trees in ambient air. Carbon dioxide, the main greenhouse gas, has increased nearly 40 percent since the industrial revolution and is expected to continue climbing unless power plant and other emissions are restricted or curtailed.

Natali's main finding: Soil samples from the carbon dioxide-enriched soil contained almost 30 percent more mercury — apparently because the soil had greater capacity than soil in today's atmosphere to trap and hold on to mercury.

On the one hand, Natali said, that increased capacity could slow the mercury's release into water — its main conduit to aquatic wildlife and the fish that pose a hazard to people. On the other, it means that even if policy makers manage to ban or severely restrict mercury emissions, the metal will remain a source of pollution for a long time.

"From the time you cut off mercury emission to the time it positively affects fish, you might have this lag, because the soils hold on to the mercury better," Natali said.

Global mercury emissions today range from 4,400 to 7,500 tons per year, according to the Environmental Protection Agency. Natural sources such as volcanoes account for about half, with coal-fired power plants, smelters and incinerators contributing the remainder.

When mercury is belched into the air, it returns to Earth via rain, with bacteria and other natural processes converting it to methylmercury in lakes, rivers and oceans. Methylmercury builds up through the food chain, with the flesh of the biggest, most sought-after predator fish — tuna, swordfish, king mackerel and so on — containing the highest concentrations. That's why the federal government has advised pregnant women, children and other groups considered vulnerable to limit their consumption.

Natali said scientists have long recognized mercury levels in soil spike under trees, averaging four times the concentration in open areas.

That's because trees effectively scavenge the poison from the atmosphere. Leaves and stems collect rainwater, and with it mercury; trees drop mercury-laden leaves on the ground, and trees take in the metal through their stomata, or breathing pores on leaves.

Scientists also have shown repeatedly that increased atmospheric carbon dioxide leads to increased plant and tree growth. Natali said she launched her research to find out whether that process would in turn have any effect on pollution from mercury and other metals.

Fortunately, two experimental sites were already in place: the free-air carbon dioxide enrichment experiments at forests in North Carolina and

Tennessee, operated by Duke University and Oak Ridge National Laboratory, respectively. These sites consist of plots in naturally growing forests surrounded by vertical pipes that constantly pump out carbon dioxide — and have done so since 1996, for the North Carolina site, and 1998, for the Tennessee site. The systems surround deciduous and coniferous trees in the plots with 200 parts per million more carbon dioxide than ambient air, or between 549 and 582 parts per million. That is the anticipated concentration in the air in 2050 without new emissions restrictions, Natali said.

Natali assessed mercury levels in rain that struck the canopy and then flowed down stems and trunks; in rain that fell directly from the canopy to the forest floor, and in leaves that fell below the trees, or "leaf litter."

To her surprise, none contained particularly elevated levels of the poison. In fact, although the trees in the enriched plots produced more leaf litter, mercury concentrations in the leaves actually decreased. The uptick in mercury in the soil apparently happened instead because of "changes in soil properties" that occur in the enriched environments, according to the paper. These changes increase the soils' mercury storage capacity.

Johan Varekamp, a professor of earth science at Wesleyan University who also studies mercury and the environment, agreed that Natali's results can be seen as both negative and positive. Mercury will stick around longer in a carbon-dioxide-enriched world, he said, but it also will remain bound to the soil for a longer period.

"I agree with her conclusion that with further cutbacks in mercury emissions, there will be a delay in delay in direct response," he said. That said, "the mercury fluxes to the coastal zone related to past emissions may then be less damaging to the ecosystems."

Source: University of Florida

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