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Marshes can clean pollutant from farm runoff

Study in Central Valley finds that plants, microbes send selenium harmlessly into the air

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Wetlands are a great place to scrub selenium from contaminated farm runoff, two scientists reported this week after a two-year study in the Central Valley -- a finding that challenges the notion that agricultural runoff and wetlands just don't mix. The study, published Wednesday in the online edition of Environmental Science and Technology, found that plants and microbes can send into the atmosphere close to 50 percent of the selenium found in drainage water from the San Joaquin Valley's selenium-rich west side.

"The upshot is that wetlands are a very efficient and affordable solution to ridding polluted water of a toxic chemical," said Norman Terry, a University of California, Berkeley, professor of plant biology and the study's principal investigator.

"You can take enormous quantities of water and clean out the selenium."

Selenium is a rare metal found in soils and used in tiny amounts by organisms -- including humans -- as an anti-oxidant.

In large doses, however, it is toxic, and those toxic effects made headlines in 1983 when scientists linked severe deformities in birds and wildlife at the Kesterson National Wildlife Refuge in the San Joaquin Valley to high levels from polluted farm runoff.

The valley's west side contains soils naturally rich in selenium, which leaches into the region's shallow ground water. Irrigation accelerates this leaching process.

Vast quantities of selenium-polluted drainage water were funneled into the refuge's reservoir in the early 1980s. The discovery of selenium in the reservoir put the brakes on a drainage system that would have carried irrigation runoff from the Central Valley to the San Francisco San Joaquin Delta.

Farmers attributed that disruption to the build-up of salts in their soil, leaving the land fallow.

Terry's research, done with former postdoctoral researcher Zhi-Qing Lin, now an assistant professor at Southern Illinois University at Edwardsville, pinpoints just how well wetlands can work in a drainage system, provided proper controls and monitoring are in place.

"The system can remove significant amounts of the selenium," Lin said on Thursday. "Almost half was volatilized" -- or pumped into the atmosphere by plants and microbes.

And it's cheap. To build a filtering plant or try to chemically strip that much selenium from the water would be "prohibitively" expensive, Terry said.

The study filtered drainage water through a network of small ponds -- each about the size of two basketball courts. Selenium accumulated in the sediment, where it was absorbed by microbes and plants and transformed into a gas -- dimethyl selenide -- found to be 500 times less toxic than the metal.

"People will then say, 'But where does it go?' " Terry said. "Chances are it will go east, ... where the soil is so deficient in selenium that farmers feed their livestock selenium supplements to keep them healthy."

And even if farmers or refuge managers end up digging the remaining selenium out of the soil, it's better than letting the runoff drain into rivers emptying into San Francisco Bay, Terry said.

"Once it's in the Bay, it's gone. You can't get it back."

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