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News Release

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Roadsides, contaminated fields could be unlikely solutions to fuel shortages, water pollution

ARGONNE, Ill. (August 11, 2009) — The lonely, weed-choked roadsides along America's highways may turn out to be an unexpected solution to two of the biggest issues facing the U.S. today—potential fuel shortages and water pollution.

In a new study, environmental scientists Cristina Negri and Gayathri Gopalakrishnan of the U.S. Department of Energy's (DOE) Argonne National Laboratory considered a new idea: using contaminated and unused land to grow crops for biofuel.

Negri and Gopalakrishnan knew that hardy, inedible plants like switchgrass or poplar trees grow quickly and need far less attention than conventional biofuel crops like corn—and it turns out they may also purify water and soil as they grow.

“Really the crux of this study is, can we take environmental problems and think of them as resources?” Gopalakrishnan said.

From the twin liabilities of contaminated water and land springs a solution to a third issue: energy. Negri and Gopalakrishnan call it ‘closing the loop.’

“People focus on one system—only crops, only fuel, only environmental problems—in a world where they’re actually tightly intertwined," Negri said. "If you put all three together, you can often make one a resource for the other. That’s how we started thinking of plants as agents of environmental cleanup and restoration. And the same plants could be the next generation of biofuels,”

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Gopalakrishnan pored over maps of Nebraska to locate unused land: contaminated industrial sites, abandoned agricultural land and buffer strips along highways, roadsides and rivers. She and Negri estimated that approximately 8 million acres could be planted with biofuel crops, and the harvest could supply 22 percent of Nebraska's annual energy demand—even more if the state irrigated the land.

By seeking out inarable roadsides, soggy ditches and contaminated former industrial sites, the Argonne study also responds to objections from critics of traditional biofuel production, who say that arable land is better used to grow food than fuel.

Because these biofuel crops are not being grown for human consumption, they are also an elegant remedy for the water pollution caused by agricultural runoff. Farming residues often wash into streams and eventually into the Gulf of Mexico and are blamed for the massive algae-choked "dead zones" that have bloomed there.

In Negri and Gopalakrishnan's proposal, however, irrigation for biofuel plants could come from agricultural runoff and municipal wastewater—polluted with everything from antibiotics to pesticides, hormones and fertilizers. Though these pollutants would pose a health risk in our food or drinking water, the biofuel crops soak them up happily.

The two scientists have been studying different plants for their potential to take up chemical pollutants from soil and water. "Woody plants have roots that go deep enough to catch most industrial pollutants," Negri said, "and they readily take up agricultural chemicals, like nitrates, as fertilizer."

"Rain on the roadway, for example, easily turns into polluted runoff," Gopalakrishnan said. A buffer strip of thirsty biofuel crops could absorb that water before it becomes a problem for neighboring food crops.

Biofuel crops most often studied include native prairie grasses, like switchgrass, and woody crops, such as poplars and willows. The latter are not as finicky as food crops like corn, which keeps farmers to a very tight schedule of planting and harvesting.

"If the farmer doesn't have time to harvest that year, or if he wants to wait to see higher prices, woody crops will sit there and grow until he needs them," Negri said. "They're very flexible."

Biofuel crops could improve land fertility, too. "Plants modify the microbial community in the soil," Negri said. "There's an interactive system between roots and microbes. We know that soil with roots is more fertile than soil without."

Although the model promises to help alleviate environmental and economic stressors, the Argonne scientists caution that implementation could run into challenges at the ground level. For example, steep slopes on roadway buffers could be more difficult to harvest than the flat Midwestern plains. Further, the researchers cannot predict exactly how much carbon would be sequestered or how many pollutants taken up.

In addition, to maximize energy output, biofuel processing plants need to be strategically located near cropland. The team used spatial analysis to demonstrate how to find ideal locations for processing plants and how biofuel plots could be planted to maximize the contaminated water they receive.

"For implementation, the next step is to begin looking at the farm scale," Negri said.

In addition to a flexible harvest time, the crops offer a backup source of revenue without draining valuable resources. "In many ways, the model makes good economic sense," Gopalakrishnan said.

"There are huge potential benefits to this method," she added. "You get clean water, minimize cost, increase biodiversity and improve the economy of rural communities."

Other members of the research team included Seth Snyder (ES), Michael Wang (ES), May Wu (ES), Lorraine LaFreniere (EVS) and Paul Benda (ES).

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Roadsides—add three

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— By Louise Lerner

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