Penalties for dropping out of ecosystem services incentive programs should equal lost environmental benefits

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Payment for Ecosystem Services programs (PES) are important tools that governments around the world use to improve water quality, protect

forests and wildlife habitat, and sequester carbon. Under these programs, landowners—usually farmers—are paid to use their land in ways that protect or restore the environment, such as replacing row crops with trees or grassy zones adjacent to waterways. Many PES program contracts last 5 to 20 years, but participant drop out rates have consistently risen over the years.

A recent study by University of Maryland economists showed that PES programs are currently structured in ways that could limit their participation or create incentives to leave the programs early, before the full environmental benefits are realized. The new study identifies a key flaw in the way penalties are assessed for participants who withdraw early and suggests that addressing this flaw would increase program completion rates and result in both higher payments to farm owners and more ecosystem benefits.

The study was published on May 15 in the *Journal of Environmental Economics and Management.*

"The current programs are backward looking, so if a participant withdraws early from the contract, they must pay back all the money they received through the program," said David Newburn, an associate professor of agricultural and resource economics at UMD and a co-author of the study.

"But in economics, we know that if payments are directly tied to penalties, that's restrictive, and it can't be optimal. So, we said, let's uncouple them and see what solution would happen."

Newburn and his colleagues found that calculating penalties based on the environmental benefits lost by early withdrawal provided the optimal economics for both the participants and the government offering the program.

PES programs make payouts to land owners each year they participate. Which means every year, participants have to decide if the overall benefits of staying in the program exceed what they would expect to earn if the land were converted back to crops. With the current programs, the penalties for quitting early escalate each year along with the total amount of money they have received.

If at any time a farm owner believes they might not stay in the program through the end of the contract—because the price of crops rises and they risk losing out on a lot of profit, for example—it makes more fiscal sense to get out early rather than waiting another year or two, when the penalty will only increase.

"There are many studies looking at payment structures, and government agencies have increased payments to landowners to increase participation," Newburn said. "But no other researchers have looked at the effect of penalties in these programs, and they turn out to be significant."

To understand the impacts of uncoupling penalties from payments, the team modeled costs and benefits to the landowners of different program designs as well as the benefits from the ecosystem services gained. They found that the optimal program design charged an early withdrawal penalty tied to the value of ecosystem services and payments remaining in the program.

So, if a farmer withdrew from a 10-year conservation contract in year 2, they would have to pay 8 years' worth of lost future ecosystem services. If they withdrew in year 8, they would pay only 2 years' worth of lost ecosystem services.

In this way, the penalty for leaving is greatest early in the program and decreases over time, unlike the current programs in which penalties

increase over time as payments accumulate. This design would not only incentivize landowners to stay in the program, but it also returned the highest benefits in ecosystem services, which translates to the highest value to the government agency paying for the program.

Newburn and his colleagues modeled a PES program that pays farmers to convert cropland adjacent to streams into grass buffer zones. These grassy streamside areas absorb nutrients and sediment runoff that would otherwise pollute the local waterways and the Chesapeake Bay. In the Chesapeake Bay watershed, such programs are an essential tool that helps Bay states achieve the EPA-designated limits for sediment and nutrients flowing into the watershed.

The team used USDA data on the value of cropland within 100 feet of a stream throughout Maryland to determine the payment structure for their model programs. Then they used commonly accepted formulas from the EPA's Chesapeake Bay Watershed Model and the Chesapeake Bay Program to estimate the dollar value of the ecosystem services of grass buffers in those same areas. (Broadly, those formulas calculate the amount of nitrogen phosphorus and sediment each acre of grassland would prevent from entering the adjacent stream or waterway, and then put a per-pound price tag on each of those pollutants.)

The result was a dollar figure for the ecosystem services each farm could provide if it was enrolled in a grassland buffer PES program. Newburn said their study could be applied to any PES program, in any country, as they all currently use the same flawed penalty structure.

"In every PES program we found in Costa Rica, the UK, South Korea, Mexico, Australia, the European Union and others, they all have this same flawed structure of tying penalties to payments," he said.

"It's easier to track than ecosystem services, which is very complicated

to calculate, and may be hard to implement in practice. But the important point is that rather than getting the benefits precisely estimated, the optimal program structure will be forward looking versus backward looking as they are now."

In addition to Newburn, Professor Erik Lichtenberg and Ph.D. candidate Youngho Kim are co-authors on the paper.

More information: Youngho Kim et al, Payments and penalties in ecosystem services programs, *Journal of Environmental Economics and Management* (2024). DOI: 10.1016/j.jeem.2024.102988

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