Even with No Spills, Study Finds Gas Drilling Threatens Watersheds

by Sue Smith-Heavenrich
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Last week the Academy of Natural Sciences released results from a preliminary study that indicates that, even without spills or accidents, Marcellus shale drilling threatens streams and rivers. These are early results based on one summer's study, cautioned Dr. David Velinsky. He and Dr. Jerry Mead, who heads the watershed and systems ecology section for the Academy, stressed the need for further studies.

"At this time there isn't enough information available about the long-term impacts of Marcellus drilling on watersheds," Velinsky said during a phone interview. But the data coming from this summer's study, conducted in collaboration with University of Pennsylvania graduate student Frank Anderson, show that the environmental impact of drilling may be directly related to the amount of drilling in a particular area. Anderson found that populations of sensitive aquatic insects and salamanders were 25 percent lower in areas where there was more intensive drilling activity.

"The question that needs to be addressed," Velinsky said," is whether there is a certain threshold beyond which drilling will impair the ecological health of the watershed, regardless of how carefully the drilling is conducted."

Drilling Density Impacts Water Quality

To understand how the intensity of drilling activity affects watershed ecosystems, the scientists examined nine small watersheds in Pennsylvania. Three of these had no drilling in the area. Three were labeled "low density" drilling areas, with an average of one well per 20 to 40 square kilometers (4240 – 9885 acres). The three "high density" watersheds had anywhere from four to eight wells for that same area – a density close to the 640 acre units proposed for NY Marcellus wells.

The researchers tested a number of water quality parameters for each stream, including dissolved oxygen, pH (acidity) and conductivity. Conductivity, said Mead, is one of the more valuable tests because higher conductivity has been shown to be related to Marcellus drilling.

Higher conductivity is related to an increase of salts in the water, Mead explained. Because salts can also wash off roads or come from farms, Mead wants to measure specific ions dissolved in the water. Some metals, such as strontium, are naturally low in streams; any increase would be related to drilling activities.

Biological Indicators

The presence – or absence – of certain insects, fish and amphibians can tell researchers a lot about the health of a stream. Certain species, explains Mead, are especially vulnerable to changes in their environment. A reduction in the population or loss of these "indicator species" serves as an early warning that something is wrong in the environment.

An EPA document on water monitoring notes that aquatic macroinvertebrates – large insect nymphs, crayfish, snails and worms – are good indicators of stream quality. Not only are they are affected by the physical, chemical, and biological conditions of the stream, they can't escape the pollution. Because some species are more sensitive to

pollution than others, macroinvertebrate populations show the effects of short- and long-term pollution events.

Last summer's stream surveys focused on three insects: caddisflies, stoneflies and mayflies. These species are often used as indicators of stream water quality because their aquatic nymphs are more sensitive to changes in the stream environment than other insects. The scientists also monitored salamander populations. That's because salamanders are abundant in healthy streams, Mead explained. "But their skin is sensitive, and they respond to changes in such things as sediments and chemicals."

When the researchers compared data from the nine study sites they found that the water conductivity levels in the high-density drilling watersheds was almost twice as high as the conductivity in the other sites. They also found a significant decline – 25 percent – in the abundance of macroinvertebrates and salamanders in the high-density drilling areas.

The impact of this level of drilling – one well per 550 to 1200 acres – on the structure of the stream ecosystem needs further study, say Mead and Velinsky. They are not sure how the decline in three or four indicator species in the streams will ultimately play out in how the watershed functions.

"There could still be a lot of shredders that degrade organic matter in the stream," Mead notes. But how drilling impacts the overall ecosystem services of the watershed, from food sources for game fish to degrading nutrients that wash into the water … "That's a good question that needs more study."

Further Studies

To do this well, Velinsky and Mead need to be able to look at the land use of the watershed. They've applied for funding that would allow them to conduct this watershed study on a larger scale. For one thing, Velinsky says, they'd like to conduct more studies in rural areas where it is easier to control for land use. And they need more sites, with a continuous gradient of drilling densities, if they are to determine whether there is a density below which drilling may not harm the watersheds. Right now, Velinsky says, we've just got preliminary data – just enough to warrant that further study is needed.

Researchers from Duquesne University, the University of Pittsburgh and Carnegie Mellon University are also conducting studies on the ecological effects of Marcellus drilling. They are collaborating on an extensive baseline study of aquatic and terrestrial ecosystems funded by the Heinz Foundation.

John Stolz, director of the Center for Environmental Research and Education at Duquesne, says his team is studying the salamanders, fish, and microbes in the Ten Mile Creek watershed. The creek is just south of Pittsburgh and drains into the Monongahela River. For Stolz it's an ideal location because the land is leased, but there's no drilling in the area yet. He hopes to have some preliminary data early next year.