

Drones used to locate dangerous, unplugged oil wells

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Natalia Romanzo, a master's student in sustainable communities at Binghamton University, wears a Geometrics G-858 cesium vapor magnetometer and battery pack on August 8, 2019. The sensing equipment, which weighs about 40 pounds, is still being used, but drones are increasingly providing a more practical alternative for remote sensing. Timothy de Smet, Environmental Visualization, Research Assistant Professor with the First-Year Research Immersion Program, helps Natalia with the pack. Credit: Binghamton University, State University of New York

There are millions of unplugged oil wells in the United States, which pose a serious threat to the environment. Using drones, researchers from Binghamton University, State University of New York have developed a new method to locate these hard-to-locate and dangerous wells.

New York State has an estimated 35,000 abandoned oil or gas wells, while Pennsylvania has more than 600,000 dating back to the early days of drilling. Overall, the United States has an estimated 2 million orphaned wells. These wells pose multiple risks. They release methane into the atmosphere, a far more potent greenhouse gas than [carbon dioxide](#), along with chemicals such as benzene, carbon tetrachloride and chloroform. Through sunlight-driven [chemical reactions](#), methane also increases tropospheric ozone, which is considered a pollutant connected with respiratory distress.

"If all the orphaned and abandoned oil and gas wells in New York State were plugged, the equivalent of nearly 750,000 metric tons of carbon dioxide could be removed from the atmosphere, which is the equivalent of removing the cars of Buffalo for one year," said Timothy de Smet, Geophysics and Remote Sensing Laboratory Director at Binghamton University.

There are economic reasons to plug [gas wells](#), too; left uncapped, these wells make it difficult to re-stimulate older oil fields with newer technologies such as hydraulic fracturing, according to the article.

Plugging the wells is the right thing to do—but first you need to find them.

In 1879, New York State became the second state in the country to require plugging wells after their useful life has ended. But that plugging

requirement was poorly enforced until modern regulations came to the state in 1963, and what constituted "plugging" in those early days was crude by modern standards.

The greatest concentration of unplugged wells lies in the western part of the state, especially near the border with Pennsylvania and in southwestern counties such as Cattaraugus. Currently, state Department of Conservation staff must go out on foot to identify and plug these wells, an incredibly slow and inefficient process for even a small area.

Long before the invention of satellites and global positioning systems (GPS), locations were recorded on crude hand-drawn maps, which are often inaccurate, de Smet said. Sometimes these maps under-report well sites, or record wells that ended up never being drilled. That is, where the maps exist at all.

"Some areas are completely undocumented," de Smet said.

To find abandoned wells, researchers outfitted a drone with a magnetometer that can detect magnetic anomalies in the wells' metal casings, pinpointing their location.

But before the technology could be deployed in the larger field, they first needed to do multiple smaller test trials to ensure that the process works as intended. For example, every drone has a unique magnetic and electromagnetic interference signal that needs to be compensated for, de Smet explained.

Assistant Professor of Geological Sciences and Environmental Studies Alex Nikulin and de Smet have been testing the technology as a way to detect unexploded ordnance in Ukraine, and used advanced signal processing methods to determine the optimal parameters necessary to increase the signal-to-noise ratio. In previous experiments, they also

tested flight elevations over the tree canopy.

They finally tried out the well-detecting drone at a Cattaraugus County site where 11 wells had previously been mapped on foot. It worked: In just over three hours, they located 72 wells.

"We could actually have flown the drone faster and for longer missions, but this was actually the first time we'd tested this, so we were pretty conservative with mission planning," de Smet said.

Long-term, the DEC plans to adopt this strategy to locate abandoned wells, which the agency will then plug.

"Our method is pretty much the most reliable method to find them," de Smet said.

Also contributing to this research were then-graduate student Natalia Romanzo, as well as Nathan Graber and Charles Dietrich from the New York State Department of Environmental Conservation (DEC) and Andrii Puliaiev of the drone company UMT.

More information: Timothy S. de Smet et al, Successful application of drone-based aeromagnetic surveys to locate legacy oil and gas wells in Cattaraugus county, New York, *Journal of Applied Geophysics* (2020). [DOI: 10.1016/j.jappgeo.2020.104250](https://doi.org/10.1016/j.jappgeo.2020.104250)

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