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Droppings from thousands of roosting ravens cause power outages near Roundup

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During the winter of 2016/2017, NorthWestern Energy began experiencing frequent and perplexing simultaneous power outages along its largest capacity transmission lines, running from Colstrip, Montana to Washington State.

After each outage, crews patrolled the lines but could not find a root cause. Large transmission lines can periodically fault through flashovers precipitated by lightning, fire, ice, and line galloping during high wind events, but none of these common causes of power outages could be linked to the Montana transmission line failures.

It was a perplexing and costly dilemma, and it took a stroke of luck to solve the mystery of what was causing the outages on NorthWestern's transmission lines. Late one winter afternoon, NorthWestern Energy employee James Lueck was out with a crew who were working on the 500kV lines. Just as the sun was starting to set, huge flocks of ravens began landing on the 500kV towers to roost for the night."It was like something out of a Hitchcock movie," Lueck said.

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Ravens are a challenge for energy companies because their numbers — flocks can number in the thousands. They roost on power lines and leave droppings on insulators. When the dried droppings combine with fog or light rain, the mixture conducts electricity and creates a bridge along the insulator "skirts," which causes a fault on the line. It creates the perfect opportunity for outages. Little more than 40 years ago, ravens were nearly non-existent in south-central Montana. The first documented sighting of a common raven on the Billings Audubon Christmas Bird Count occurred in 1979. Today populations of the bird have increased exponentially in the Treasure State and across the country. "Ravens are generalist feeders, and human-altered landscapes provided food subsidies," states an article published in the scientific journal *Human-Wildlife Intreractions,* coauthored by Lueck and Marco Restani, a wildlife biologist for NorthWestern Energy.

Plentiful access to cereal grains, landfills and vehicle-killed animals along roads has increased the bird's food supply resulting in massive increase in the species populations. After that first chance encounter with the roosting ravens, Lueck started going out in the evenings to investigate.

He enlisted the help of NorthWestern Energy biologist Marco Restani, who studied ravens for three decades. The numbers of ravens flocking to the transmission towers was shocking. One roost alone contained more than 1,500 birds during a single night.“That’s an astonishing number of ravens,” Restani said.

"The number of ravens roosting on 500kV towers showed a predictable seasonal pattern with counts highest in mid-winter," Restani and Lueck's journal article states. "Thereafter, size of roosts declined, presumably as breeding pairs dispersed to establish territories in March and April. "The roosts along the 500kV lines in central Montana could have attracted ravens that foraged during the day at the Billings landfill, along highways supplying vehicle-killed carrion, and at agricultural operations. Very few ravens were observed in the vicinity of roosts during the day, which made initial identification of their role in faults difficult to detect."

"We considered but ultimately decided against hazing, shooting, and effigies or carcasses to reduce the size of raven roosts because these methods can illicit strong negative reactions from the public," their article states. "More importantly, these methods have the additional potential drawback of dispersing ravens to other towers, thereby spreading the risk of contamination and increasing the possibility for faults over a wider area." Ultimately, NorthWestern Energy crews settled upon a three-part strategy to deter the ravens and address the recurring power outages; replace common glass insulators with silicone coated ones, cleaning the towers of bird waste, and installing spiked deterrents to keeping the birds from perching there in the first place.

Power lines are attached to each transmission tower by strings of glass insulators to keep the electricity from flowing from the line into the metal support towers. Silicon-coated insulators have are frequently used in marine environments where they mitigate faults derived from salt accumulation and coastal fog.

Energy news: Biden to pause oil and gas sales on public lands, Daines to introduce counter-legislation

These silicon-coated insulators were installed on the seven towers with the largest raven roosts early on because the properties of the silicon percolate through the bird droppings, forming discrete droplets that aren’t as conductive, even when wet.

Then over a three-year period, NorthWestern Energy crews went through the laborious task of cleaning the bird poop off dozens of 150-foot tall transmission towers.

"Between 2017 and 2019, tower crews washed contaminated insulators within roosts," Lueck and Restani's article notes. "Contaminated insulators were also discovered through transmission line maintenance flights and from ground inspections following faults. Crews accessed towers by either direct climb from the ground or by bucket truck. Contaminated insulators were cleaned by hand or power washer."

"Only one tower per day could be washed if done by hand while climbing," the article goes on to explain. "The number of towers that could be cleaned increased with the use of a bucket truck and sprayer (two to three towers per day) and was greatest in late winter 2020 when a helicopter-mounted sprayer was entered into service (eight towers per day)."

Finally, NorthWestern crews installed perch deterrents, stainless steel spikes, on the upper portions of the towers, with the goal of preventing or reducing the amount of bird droppings collecting on certain insulators. It was a measured strategy that did not apply to every tower equally.

"Covering the entire tower in spikes might push the birds to roost on a different structure and would eventually require spikes on a great deal more of the towers," NorthWestern Energy explains. "By putting deterrents on part of the known impacted towers, spikes only had to be installed on 92 of the 2,040 towers on the 500 kV transmission lines."

“We actually want to keep the ravens on the towers that they like and manage them there,” Restani said.

NorthWestern Energy shares its bizarre finding

Restani and Lueck's scientific analysis of the impact of perching ravens on electric transmission lines and NorthWestern Energy's strategy to address the situation was published in the winter 2020 edition of *Human–Wildlife Interactions*, a Utah State University Berryman Institution scientific journal.

Publishing the paper was a chance for NorthWestern Energy to share its findings on a common problem that hasn’t been widely studied.

“NorthWestern is out there ahead of things,” said NorthWestern Energy Director of Environment, Lands, Permits and Compliance Mary Gail Sullivan. “This is pretty cutting edge.”

“We’ve learned so much about this in a very short period of time,” Lueck said. “We have picked up a tremendous amount of information and knowledge in the last three years. This was a chance

to help other utilities who may also be struggling to identify why they’re having similar type outages."

The insulators along NorthWestern's Colstrip to Washington transmission line will still get covered by droppings and need to be cleaned. In the years ahead NorthWestern Energy will use a helicopter-mounted sprayer, allowing crews to clean eight towers a day compared with one a day by hand. The helicopter can also reach remotes sites on the 500kV transmission line.

"Perhaps the best long-term means to manage ravens is to reduce the habitats and food resources that sustain populations and support growth," Restani and Lueck's article suggests. "Managers recommend reducing food availability at landfills, changing feedlot and dairy operations, burying dead livestock, removing vehicle-killed animals, and covering commercial dumpsters. These efforts would take years—perhaps decades—to have a noticeable effect on raven populations in central Montana.