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Who Makes It Rain?

Analysis by Dr. Joseph Mercola | June 27, 2024

STORY AT-A-GLANCE

- Cloud seeding, in which dry ice pellets or silver iodide are applied to certain clouds to modify their output, is used to increase precipitation, decrease hail and clear fog
- North Dakota reports that cloud seeding produces an estimated 5% to 10% additional rainfall annually while reducing crop hail losses by 45%
- A group of North Dakota farmers has asked the County Commission to halt cloud-seeding programs for the remainder of the season, with some opponents suggesting the practice may be making dry conditions worse

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The artificial manipulation of the weather, known as weather modification, seems like something out of a science fiction novel, but more than 50 countries worldwide already participate in one type of weather modification known as cloud seeding.[1] The U.S. Government Accountability Office predicts that in just the next decade, 40 U.S. states will experience some type of water shortage, which stems, in part, from droughts.[2]

The prospect of using cloud seeding to increase rainfall — its most popular usage — is an enticing one, but it comes along with a fair share of controversy as well. In the U.S., about $15 million is spent on cloud-seeding projects annually, which pales in comparison to the $100 million a year spent in China. Still, in the U.S., cloud seeding has grown by one-third in the last 10 years.[3]

It's used in North Dakota, for instance, not only to promote rain but also to inhibit hail (and thereby reduce hail damage to crops). Cloud seeding is also sometimes used to clear fog.

In California, meanwhile, a mountain-top "cloud seeder" has been used to enhance rain and snow in efforts to fight drought. As its popularity grows, however, some are asking whether the practice is cost effective and whether it could end up having some negative effects on the weather, the latter of which is why some farmers in North Dakota are asking for the area's cloud-seeding programs to end.

How Does Cloud Seeding Work?

There are a number of different ways that cloud seeding can work, but typically dry ice (frozen carbon dioxide) pellets or silver iodide are applied to certain clouds to modify their output. Seeding agents may be applied to clouds from the ground but, most often, aircraft are used to apply the materials to the clouds.

This occurs either by releasing the seeding agent below the cloud into its updrafts or by dropping the seeds directly into the upper regions of the clouds. According to NDCMP — the North Dakota Cloud Modification Project:[4]

> *"In North Dakota, all seeding is done by aircraft. Base-seeding aircraft release seeding agent into updrafts from below the developing storm using a combination of wing-mounted ice nucleus generators and burn-in-place flares. Cloud-top seeding aircraft use ejectable flares and dry ice released directly into the supercooled cloud."*

There are several considerations as to which method is used. Direct injection works quicker, with results occurring almost immediately. However, NDCMP notes that this is costlier because it requires higher-performance aircraft capable of flying at higher altitudes and directly in-cloud. Updraft treatment, which is done at the cloud base, is an easier and less expensive method, but the results may take up to 30 minutes.

As for who's in charge of deciding when to seed clouds, in North Dakota the program falls under the direction of the radar meteorologist. "In addition to weather conditions, a number of factors play a part in the decision-making process including safety criteria, radar information, pilot observations and aircraft instrument data," according to NDCMP.[5]

North Dakota Reports Up to 10% Increase in Rainfall Due to Cloud Seeding

Determining whether cloud seeding is effective poses a challenge, in part because many areas using the technology want all of the seedable clouds treated in order to reap the most potential benefits. In Wyoming, however, the Wyoming Weather Modification Pilot Program (WWMPP) conducted a randomized cloud-seeding program, which found the seeding increased snowfall by 5% to 15% under ideal seeding conditions.[6]

In North Dakota, meanwhile, NDCMP reports that cloud seeding produces an estimated 5% to 10% additional rainfall annually in the project area while reducing crop hail losses by 45%. As for costs, they say it only costs 16 cents per acre to enhance rain and suppress hail.[7]

The environmental effects are also reported as minimal, with NDCMP stating, "Cloud seeding agents, including **silver iodide** and dry ice, meet all National Environmental Policy Act (NEPA) regulations and are safe for the environment." They further note that no environmentally harmful effects have been detected from cloud seeding with silver iodide, explaining:[8]

> *"The silver concentration in rainwater from a seeded storm is well below the acceptable environmental concentration of 50 micrograms per liter as set by the U.S. Public Health Service. Also, the concentration of iodine in iodized salt used for human consumption is far above the concentration found in rainwater from seeded clouds. Because silver iodide is such an effective ice nucleus, it is used in very small quantities.*

> *Based on the average rate of silver iodide use in North Dakota each summer, it would take nearly 500 years for 1 gram of silver iodide (1/28th of an ounce) to be evenly spread out over an area equal to a full-sized basketball court!"*

North Dakota Farmers Ask for End to Weather Modification

Not everyone believes cloud seeding is a win-win proposition. In Ward County, North Dakota, farmers have asked the county commission to halt cloud-seeding programs for the remainder of 2017 amidst a drought, with some opponents suggesting the practice may be making dry conditions worse. The commission voted 4-0 to ask the Atmospheric Resource Board to suspend operations.

Spokesperson Roger Neshem told the commission, "We are not asking for a radical thing here. We are asking to join the other 47 counties in the state who do not try to modify their weather." In The Dickinson Press, he noted:[9]

> *"I was asking, 'What are we getting for spending this money?' The only fact in this whole situation is hail insurance rates in Ward County are higher than area counties … I think there are some people … who think they may be doing some accomplishing of the negative sort for the weather patterns here."*

Did Cloud Seeding Cause the Rapid City Flood of 1972?

June 9, 1972, is a date etched in the memories of many Rapid City, South Dakota, residents. During a period of just six hours, 10 inches of rain fell on the city, adding up to 14 inches overnight. Area streams overflowed and a dam at Canyon Lake failed, leading to massive flooding in the city that killed 238 people and injured 3,000 more.[10]

Before the flood, the South Dakota School of Mines and Technology was conducting a cloud-seeding research study in the area, leading some to suggest that cloud seeding could have been responsible for the catastrophic flooding. An investigation prompted by the governor reportedly came to the conclusion that the seeding project was not

responsible, however. Darin Langerud, director of the North Dakota Atmospheric Resource Board, told The Green Sheet Farm Forum:[11]

> *"There were some people that wanted to blame cloud seeding on that event … There was a study that was done at the governor's request after that event to look into all the details, and the conclusion was that the seeding was not the cause of the flood that occurred in Rapid City in 1972, but it did have some negative impact on interest in cloud seeding."*

California Resorts to Cloud Seeding to Fight Against Drought

California is among the U.S. states that have turned to cloud seeding to try to enhance rainfall in the drought-stricken area. In 2002, and again in 2016, Los Angeles and other municipalities used "flare trees" installed on the hilltops to send silver iodide into the clouds. The problem, as is the case in other areas utilizing the technology, is that its effectiveness is dependent on getting the conditions just right.

"Part of the trick," Scientific American reported, "is finding the right geographical and meteorological situation as well as getting the silver iodide into the right spot in a cloud — while not seeding monster storms or inducing rainfall over places susceptible to dangerous flooding, landslides or other ill effects."[12]

The news outlet even quoted William Cotton, an atmospheric scientist and Professor Emeritus at Colorado State University, who noted that cloud seeding may be more of a political move than anything. "In terms of water agencies," he said, "a lot of it is just getting out there and doing something."

Another less-than-stellar vote of confidence came from Don Griffith, president of North American Weather Consultants, who has been seeding clouds for more than 50 years. When asked if California's cloud-seeding efforts worked, he told Scientific American, "That's a very difficult question to answer … We think so, we hope so, but there's no way you can demonstrate that."[13]

In fact, there is some misconception that cloud seeding can end droughts. In reality, this isn't possible because droughts are characterized by a lack of clouds that produce precipitation, and such clouds are necessary for cloud seeding opportunities.

During droughts, there are therefore few opportunities for successful cloud seeding. As Roelof Bruintjes, an atmospheric scientist at the U.S. National Center for Atmospheric Research, said to Scientific American, "Nobody can create a cloud."[14]

That being said, there is an attitude that doing something is better than doing nothing, but whether that is the case or not remains to be seen. There is also a chance that cloud seeding can be used to help increase rainfall before and after a drought to "temper the reduction of rainfall during the drought period," according to NDCMP.[15]

It is not a quick fix that can suddenly make rain fall from the sky in the middle of a long drought, however. "Cloud seeding is more a long-term water resource management tool," Bruintjes said.[16]

What Are the Risks and Ethical Issues of Cloud Seeding?

Modifying the weather should not come lightly and neither should cloud seeding. Though such techniques have been in use for more than 70 years, including during the Vietnam War, there are still many questions about whether the practice is beneficial or results in unintended consequences. The latter, the American Meteorological Society (AMS) noted, cannot be ruled out:[17]

> *"Unintended consequences of cloud seeding, such as changes in precipitation or other environmental impacts downwind of a target area have not been clearly demonstrated, but neither can they be ruled out. In addition, cloud seeding materials may not be always successfully targeted and may cause their intended effects in an area different than the desired target area.*
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> *This brings us to the ethical concern that activities conducted for the benefit of some may have an undesirable impact on others. At times unintended effects may cross political boundaries. Weather modification programs should be*

designed to minimize negative impacts. International cooperation may be needed in some regions."

In addition, weather modification doesn't end with cloud seeding. Programs have been attempted to reduce the intensity and/or direction of tornadoes and tropical storms, for instance, while other methods have been used aside from cloud seeding to enhance rainfall. "Much less is known about the effects of these other techniques, and their scientific basis is even further from being demonstrated, either statistically or physically, than it is for cloud seeding," AMS reported.

In order to minimize risks and ethical issues from what is an inherently unpredictable science, they recommended well-designed and well-supported research programs that "improve the predictability of the undisturbed weather and the magnitude of weather modification effects." In short, in the spirt of the precautionary principle, perhaps we should learn more about the immediate and long-term effects of weather modification techniques before unleashing them onto the planet.

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