

Hard questions about weather modification

Complex social and legal issues accompany man's increasing ability to modify the weather

by Kendrick Frazier

The ability to squeeze significantly more snow and rain out of mountain winter storm clouds is now an accepted fact (SN: 4/11, p. 365). Work on seeding cumulus clouds is progressing well. Hail-reduction efforts seem to be showing some signs of success. And there is the first tantalizing evidence that the intensity of hurricanes might some day be reducible (SN: 12/13, p. 551).

Meteorologists and others who will benefit from these new approaches are delighted with the progress. But those who are concerned with the complex and sometimes undesirable side effects of new technologies are looking ahead to try to assess the implications. They realize that, like other technologies, weather modification comes with no automatic money-back guarantee that it will do only good for society.

At this point weather modification is so much in its infancy that the future social and legal issues are just beginning to emerge. Few people have been affected so far. But many responsible persons feel that the time to examine the issues is now, before the capability to cause widespread effects is developed.

The most fundamental question regarding weather modification is: Should it be done? In one area, modifying the weather and climate of large, continent-sized areas, the judgment of a National Academy of Sciences panel in 1966 still has to prevail: "We cannot now predict with certainty all the important consequences of such acts. As long as our understanding is thus limited, to embark on any vast experiment in the atmosphere would amount to gross irresponsibility."

But none of the efforts now on the

horizon involves anywhere near such scope. The scale being examined now is of individual clouds and small cloud systems. But much of the argument still applies.

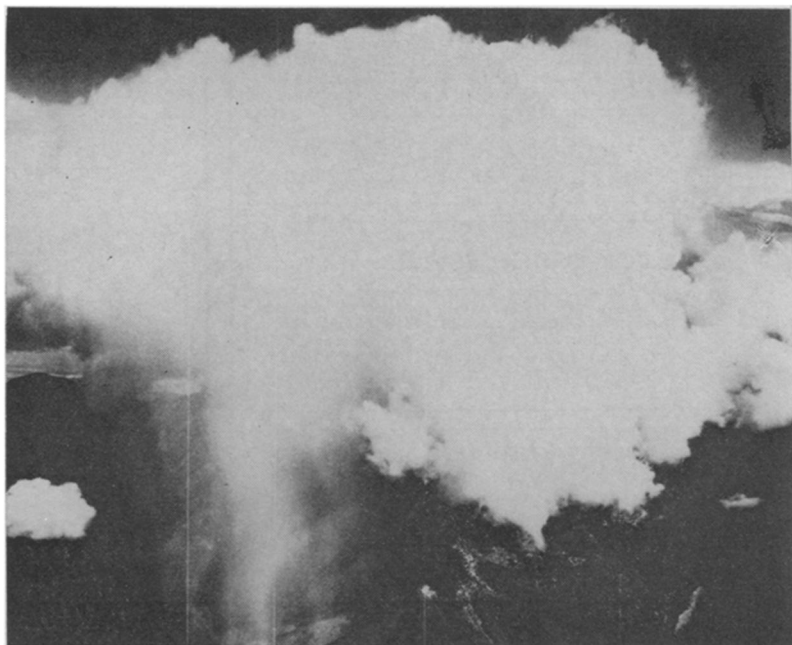
"The problems we face here are new in nature and entirely unprecedented in scope," says Dr. Myron Tribus, Assistant Secretary of Commerce for Science and Technology. "Effects of weather modification are, at least, regional, often national, and, in many cases, international. We must be able . . . to assess consequences and to assign responsibility.

"Perhaps even more important . . . are the human and social considerations. A scientist can bombard a nucleus with neutrons without asking the permission of the nucleus. He cannot engineer the environment without consulting the people who will be affected."

No way is known to confine the effect of cloud seeding to those who desire the modification. A basic moral question then concerns the rights of an individual not to have manmade precipitation fall on his property without his having a role in the decision.

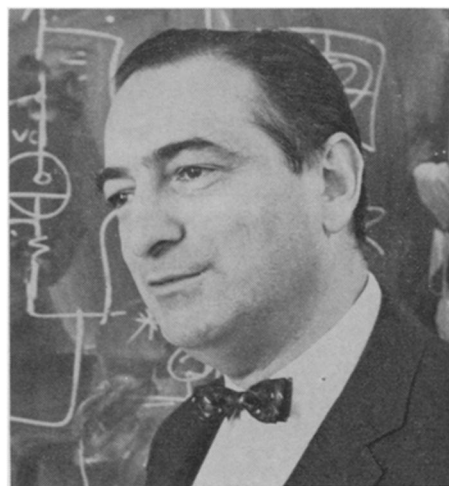
A rain that benefits one farmer may ruin the crops of another. Increased rainfall that profits a hydroelectric company might depress an area's tourist industry. Heavy mountain snow that looks good to reclamation officials and thirsty down-basin residents might not have quite the same appeal to the mountain rancher with a cabin below an avalanche-prone ridge.

On the other hand, it may just as often happen that a person or area not paying any of the costs of a modification attempt may reap the same benefits as those who are.



U.S. Navy

Technology can produce rain from half of a cloud.



Dept. of Commerce

Tribus: A basic moral question.

Some of these issues have already arisen in southwestern Colorado, where the Bureau of Reclamation is completing plans to begin seeding this fall in its Upper Colorado River Pilot Project. The goal is to increase summer runoff by adding to the snowpack accumulation over a 3,300-square-mile area of the San Juan Basin.

Many residents of that mountainous region, which already receives up to 30 inches of precipitation each winter in snow that can accumulate to 15 or 20 feet, have been less than enthusiastic about having more snow dropped on them.

"If you dump as much as one snowflake of snow I didn't ask for," a resident of the small mountain town of Ouray told the project's manager, Dr. Archie M. Kahan, "you are abridging my rights as a citizen."

Such people problems, as Dr.

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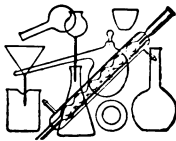
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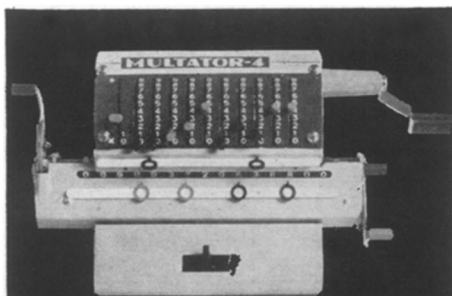
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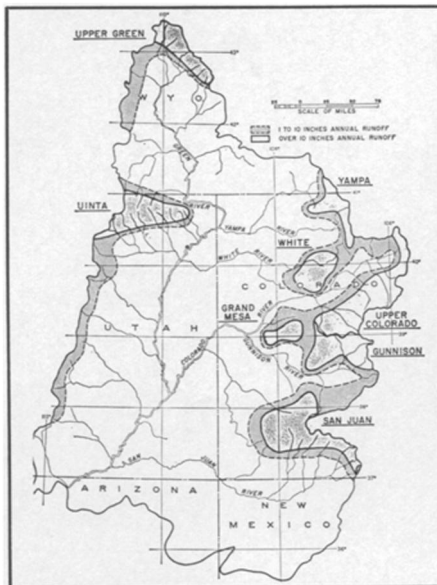
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Bureau of Reclamation

Possible areas for future seeding.

Kahan terms them, may prove to be a possible limiting factor on the success of the project. A 15 percent increase in snowpack seems well within the limits of physical possibility, he says, "but it may be optimistic for what is socially acceptable."

Because the high mountain highway between Silverton and Ouray is highly vulnerable to dangerous avalanches, no seeding in that area of the basin will be conducted. Surprisingly there has been little opposition from highway department officials, charged with keeping U.S. 160 over 10,850-foot Wolf Creek Pass open in the winter. They explain that their heavy equipment can easily handle a small additional amount of snow each storm.

Dr. Kahan believes the social concerns about the Colorado pilot project can be resolved by mutual discussion. "Some of the people were emotional at first, but now they are rational. You can sit down and discuss it with them."

Whether this is a reliable mechanism for the future is open to debate.

If the pilot project is as successful as its proponents hope, the economic pressures for additional winter cloud seeding are sure to mount. Southern California water officials are watching the effort closely in the hope that it will provide a solution to expected water shortages in the lower Colorado River basin in coming decades. Already Dr. Kahan's office has prepared a list, in tentative order of seeding priority, of seven other runoff-producing areas in Colorado, Wyoming and Utah that look favorable for similar weather-modification efforts in future years.

There is now no legal precedent for how any additional runoff from cloud

seeding should be allocated between upper- and lower-basin states. This is another example of issues expected to arise from future modification efforts.

What troubles persons not directly involved with weather modification is certain evidence of insensitivity to larger human issues on the part of enthusiasts. At the recent weather-modification conference in Santa Barbara, a paper by Albert Rango of Pennsylvania State University on possible adverse ecological consequences of increasing rainfall in the arid West provoked considerable disagreement.

He pointed out that conceivably rapid increases of streamflow could heavily damage stockpond dams, roads and bridges and that the increased sediments could reduce stockpond capacity and clog irrigation structures. He asked that environmental consequences be studied before weather modification is accepted as a cure for the West's water problems. Arid lands will be highly vulnerable to change, he pointed out, because of the relative instability of the soil and the sparseness of the vegetation. "It is evident," he said, "that increased runoff derived from precipitation modification could rapidly dissect much arid land, producing perhaps even greater problems than that of an inadequate water supply."

For his effort, he was accused of unduly stressing adverse secondary effects over predominantly beneficial favorable ones.

Political decision-making processes about weather modification are at a primitive stage. Dr. W. Henry Lambright, a Syracuse University political scientist completing a book-length study of the subject, characterizes them as a case of "muddling through."

"The danger is that technology may outrun policy," he says. "Broader questions of national policy must be considered. Practically all the major issues—regulations, public-private relations, Federal-state responsibilities, international questions, Federal organization—have yet to be resolved."

Legal systems are in no better shape. There are no Federal laws regarding weather modification. Although more than half the states have some sort of law relating to the subject, almost all are regarded as inadequate. Only three states have statutes dealing at all with compensation for losses attributable to cloud seeding.

"The cases in the weather-modification field that to date have been reported by the courts are too few, too scattered and too divided to provide a sound basis for ascertaining what is the law of weather modification," says Jay Ray

Davis of the University of Arizona College of Law.

Issuance of a permit for seeding projects amounts to allocation of a natural resource, Davis points out. Powers of licensing and supervision are needed. As for compensation, the courts have been the traditional legal means for restitution to claimants for losses to their personal property. But most claimants seeking injunctions to stop weather-modification efforts have lost because they have been unable to establish a causal relationship between the cloud seeding and their damages.

For the past year a task group on the legal aspects of weather modification under the chairmanship of Howard J. Taubenfeld of Southern Methodist University has been studying the subject for the National Science Foundation. Their final report, to be published later this year will recommend the creation of a new independent Federal regulatory agency to oversee weather-modification activities.

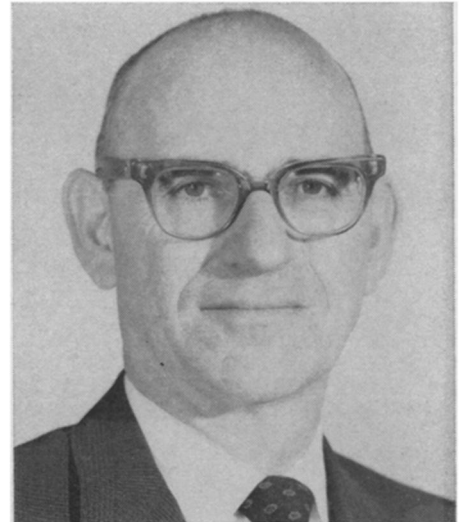
Such a body at the Federal level, the panel of lawyers decided, is necessary to clarify what they regarded as a chaotic legal situation in weather modification: the absence of law.

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Davis: Protecting the public interest.



Bureau of Reclamation

Kahan: "Sit down and discuss it."

and objectivity, the lawyers decided that the new agency should not be a part of any of the existing agencies concerned with weather modification, such as the Environmental Science Services Administration or the Bureau of Reclamation. They do not want another Atomic Energy Commission, both regulating and promoting a technology.

They will also recommend lightening

the burden of the plaintiff in weather modification cases by introduction of new legislation stating that the plaintiff seeking compensation for damages does not have to prove negligence.

"Our idea," says Davis, a member of the task group, "is to encourage the emergence of a new technology while at the same time trying to protect the public interest." □

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