STATE REGULATION OF WEATHER MODIFICATION*

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During a dry midsummer week roughly the same volume of vaporized water will move across the Arizona skies as annually flows in the Colorado River.[1] Nature is inefficient in tapping the rivers of the skies, so man has sought means for triggering precipitation and modifying the weather.[2] During the past quarter century meteorologists have been "seeding" clouds by introducing into them substances such as silver iodide, salt, dry ice, water, and urea. Through laboratory tests, field studies, and operations they have learned much about cloud physics and have developed techniques, equipment, and materials for weather modification.[3]

A National Academy of Sciences study panel on weather modification reported in 1966 "increasing but still somewhat ambiguous statistical evi-

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1 Statement of former Secretary of the Interior Stewart L. Udall in *Hearings on Progress in Weather Modification Before Subcomm. on Water and Power Resources of the Senate Comm. on Interior and Insular Affairs*, 90th Cong., 1st Sess., at 20 (1967).

2 "Weather modification" has been variously defined. Proposed federal legislation speaks of altering the "composition, behavior and dynamics" of the atmosphere. H.R. 9212 and S. 373, 90th Cong., 1st Sess. § 102(a) (1967). The regulations of the National Science Foundation requesting reports concerning modification of weather refer to (1) intentional efforts, (2) designed to modify the atmosphere, (3) through use of artificial means. The NSF rules contain a list of various substances as illustrations of materials that are dispersed to accomplish this purpose. 45 C.F.R. § 635.2 (1968), *as amended*, 33 Fed. Reg. 12654 (1968).

3 Development of practical techniques, equipment, and materials for seeding has been the subject of several conferences of Bureau of Reclamation weather modification contractors. OFFICE OF ATMOSPHERIC WATER RESOURCES, PROCEEDINGS: SKYWATER CONFERENCES I-IV (1967-69). Improvement in the skills of weather changers can be traced through examination of the series of reports of the National Science Foundation on weather modification. NATIONAL SCIENCE FOUNDATION, WEATHER MODIFICATION (First-Ninth Ann. Rep.) (1960-69).

For textual treatments of the scientific aspects of weather modification that are written for laymen, see Battan, *A Brief Survey of the Scientific Aspects of Weather Modification*, in CONTROLLING THE WEATHER: A STUDY OF LAW AND THE REGULATORY PROCESSES 46 (1970); L. BATTAN, HARVESTING THE CLOUDS: ADVANCES IN WEATHER MODIFICATION (1969); L. BATTAN, CLOUD PHYSICS AND CLOUD SEEDING (1962); D. HALACY, THE WEATHER CHANGERS (1968); B. MASON, CLOUDS, RAIN AND RAINMAKING (1962); Roberts, *The State of the Art in Weather Modification*, in WEATHER MODIFICATION AND THE LAW 1 (H. Taubenfeld ed. 1968).

dence that precipitation from some types of cloud and storm systems can be modestly increased or redistributed by seeding techniques. . . . The Panel's evaluations of 14 operational silver iodide seeding projects in the eastern United States . . . indicate variable rainfall increases averaging about 10 to 20 percent in the nominal target areas."[4] While statisticians might regard such increases as modest, to a drought-plagued farmer they could bring great economic benefits.[5]

During the past winter the Bureau of Reclamation awarded a contract for a pilot project of cloud seeding in the San Juan Mountains of southwestern Colorado.[6] The Bureau's Office of Atmospheric Water Resources hopes to start within the next few years an operation designed to increase the snowfall along the slopes of the Rocky Mountains, deepen the snowpack, and enhance the runoff in the upper Colorado River basin by an estimated average of approximately two million acre-feet of water annually.[7] Power companies and water management organizations have been sponsoring snowmaking operations for two decades.[8]

Engineering techniques have been designed for clearing "cold fogs" —those with temperatures below 32° F—at airports to permit more efficient handling of aircraft landings and takeoffs. At Orly Airport near Paris, France, an automated system has been installed for dispensing propane into cold ground fogs to improve visibility.[9] In this country United Airlines has pioneered efforts to cope with such fogs. It employs contractors at airports in the Northwest to seed supercooled fogs with crushed dry ice from small planes.[10]

Warm fogs—those at temperatures above freezing—represent most of the dense fogs in the United States and are responsible for many air flight

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[4] 1 PANEL ON WEATHER AND CLIMATE MODIFICATION, NATIONAL ACADEMY OF SCIENCES, WEATHER AND CLIMATE MODIFICATION: PROBLEMS AND PROSPECTS 4-5 (1966) (emphasis omitted).

[5] Castle & Stoevener, *The Economic Evaluation of Weather Modification With Particular Reference to Agriculture*, in HUMAN DIMENSIONS OF WEATHER MODIFICATION 141 (W. Sewell ed. 1966).

For examination of national problems of water supply and management, see WATER RESOURCES COUNCIL, THE NATION'S WATER RESOURCES (1968); F. MOSS, THE WATER CRISIS (1967).

[6] 2 CCH CLEAN AIR & WATER NEWS, No. 9, at 6-7 (1970); *cf.* OFFICE OF ATMOSPHERIC WATER RESOURCES, PROCEEDINGS: SKYWATER CONFERENCE V (1969).

[7] Lecture by P. Hurley, Augmenting Upper Colorado River Basin Water Supply, presented at American Society of Civil Engineers Meetings at New York, N.Y., Oct. 18, 1967. *See also* speech by A. Kahan, Weather Modification Potential for Water Supply In the Colorado River Basin, presented at Second National Conference on Weather Modification, Santa Barbara, Calif., April 8, 1970; H. Nakamichi & H. Morel-Seytoux, Suitability of the Upper Colorado River Basin for Precipitation Management, Colo. State Univ. Hydrology Paper No. 36, Oct. 1969.

[8] Discussion by Mooney & Lunn, The Area of Maximum Effect Resulting from the Lake Almanor Randomized Cloud Seeding Experiment, presented at Western Snow Conf., April 1968; California Dep't of Water Resources, Weather Modificaton Operations in California, Bull. No. 16-66, at 12, Aug. 1967.

[9] Beckwith, *Impacts of Weather on the Airline Industry: The Value of Fog Dispersal Programs*, in HUMAN DIMENSIONS OF WEATHER MODIFICATION 195, 197 (W. Sewell ed. 1966).

[10] *Id.* at 198-207.

cancellations, diversions, and delays.[11] Using heat to clear such fogs, as was done for some military operations during World War II, is too costly for peacetime use.[12] Recently there has been a revival of interest in seeding with sized salt particles—a technique used at Los Angeles International Airport during the winter of 1969.[13] The Air Transport Association has tested use of polyelectrolytes as seeding agents;[14] and the Naval Weapons Center is working with substances like urea.[15] Although none of these approaches is wholly satisfactory, further work on warm fog may produce a breakthrough.

The Russians have invested the major share of their weather modification funds in efforts to reduce crop damage by hailstorms. They deliver seeding materials directly into storms by artillery or rockets and have claimed spectacular success.[16] In the United States there is no massive governmentally funded hail suppression program.[17] Some groups operating in the hailbelt feel, however, that their efforts have tended to reduce the destructiveness of hailstorms.

"Weather modification might have a benefitical effect in many ways on the problem of the ignition and control of forest fires . . . ."[18] For example, rainmaking could dampen forest lands, and cloud seeding might reduce lightning. Project Skyfire, the lightning suppression program of the United States Forest Service, involves seeding thunderstorms in order to alter their electrical properties. There are indications that seeding might reduce lightning, but results are not yet conclusive.

Hurricane Debbie was seeded with silver iodide five times during an eight-hour period on August 18, 1969, and again on the 20th. The seeding was a part of a federal undertaking known as Project Stormfury in which the Navy and the Environmental Science Services Administration are the main participants. Winds decreased by 31 percent between the first seeding and five hours after the fifth seeding on the 18th. The storm,

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11 Beckwith, *An Analysis of Airport Fog Dispersal Operations*, in PROCEEDINGS OF FIRST NAT'L CONF. ON WEATHER MODIFICATION 361-71 (1968).

12 Beckwith, *supra* note 9, at 196; Battan, *supra* note 3, at 60-61.

13 L.A. Times, Dec. 13, 1968, at 1, col. 8. For the theoretical basis of the seeding used in Los Angeles, see Jiusto, Pilie & Kocmond, *Fog Modification With Giant Hygroscopic Nuclei*, 7 J. APP. METEOR. 860 (1968).

14 AIR TRANSPORT ASS'N OF AMERICA, AIRLINE WARM FOG DISPERSAL TEST PROGRAM AT SACRAMENTO, CAL. (1968).

15 Interviews at Naval Weapons Center, China Lake, Cal., April 4, 1970.

16 L. BATTAN, HARVESTING THE CLOUDS: ADVANCES IN WEATHER MODIFICATION 95-97 (1969).

17 The major American hail suppression program is Project Hailswath. It is discussed in 1 R. SCHLEUSENER, PROJECT HAILSWATH: FINAL REPORT (1966); Goyer, Howell, Schaefer, Schleusener & Squires, *Project Hailswath*, 47 BULL. AM. METEOR. SOC'Y 805 (1966). *See also* Ross, *They Make Cloud Seeding Work*, THE FARMER, Aug. 3, 1968, at 28; Phillips, *Hail Suppression Concepts*, in FIFTH CONFERENCE ON SEVERE LOCAL STORMS 10 (Oct. 1967); Schleusener, *Lessons from Project Hailswath*, in *id.* at 24; REPORT OF THE FIRST NAT'L SYMPOSIUM ON HAIL SUPPRESSION, Dillon, Colo. (Oct. 1965).

18 Fuquay, *Weather Modification and Forest Fires*, 1967 AM. ASS'N ADV. SCI. 309.

however, reintensified the following day. After the seedings on August 20, wind speed again dropped, this time by 15 percent. Evidence suggests that the decreases could have been caused by the seedings. Obviously, though, much remains to be learned about manmade alteration of violent storms.[19]

Although reshaping our atmospheric environment will benefit us, there also will be undesirable consequences. We do not all desire the same kind of weather. Precipitation changes could bring unwanted rain to some persons,[20] cause droughts harming others,[21] reduce streamflow,[22] or bring on floods.[23] Even moderate shifts in weather can trigger ecological[24] and biological[25] consequences, some of which may be important. Altering the weather will have social, economic, and psychological results as well.[26] Not all of these changes will be beneficial.

Operation of a weather modification project is justifiable only if society drives a net gain from it. Should the economic, social, biological, and ecological losses outweigh the benefits, the project should be altered so losses outweigh the benefits, the project should be altered so losses will be minimized or benefits increased. If a beneficial balance cannot be struck, the project should be curtailed. If a beneficial weather changing project gives rise to losses that can be measured in monetary terms, persons whose interests have been injured have a strong argument for obtaining financial compensation. Both control over projects and award of compensation call for governmental intervention.[27] Some states have assumed this regulatory role and have adopted legal controls over weather modification.

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19 Gentry, *Modification Experiments on Hurricane Debbie, August 1969*, in PROCEEDINGS OF SECOND NAT'L CONF. ON WEATHER MODIFICATION 205 (1970). *See also* N.Y. Times, Aug. 18, 1969, at 22, col. 4; Aug. 19, 1969, at 24, col. 6; Aug. 20, 1969, § C, at 27, col. 3; Aug. 21, 1969, at 26, col. 3.

On hurricane seeding, see generally DEP'T OF THE NAVY & ESSA, PROJECT STORMFURY, ANNUAL REPORTS (1965-68).

20 For allegations to this effect, see Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950).

21 The downwind effect of weather modification is subject to controversy. Battan, *supra* note 3, at 51-52, 61. Fear of drought from rainshadow is nonetheless quite real among some persons.

22 The Northern Cascades project in Washington seeks to increase streamflow on the eastern slopes of the mountains while decreasing it on the western side. S. SHUMWAY, CASCADES ATMOSHHERIC WATER RESOURCES PROGRAM (1966).

23 Litigation growing out of the 1955 Yuba City, Cal., flood involved as defendants North American Weather Consultants and their client, Pacific Gas and Electric Co., as well as the State of California. Adams v. California, No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964).

24 Ecological Soc'y of America, Ad Hoc Weather Working Group, *Biological Aspects of Weather Modification*, 47 BULL. ECOL. SOC'Y AM. 39 (1966).

25 C. COOPER & W. JOLLY, ECOLOGICAL EFFECTS OF WEATHER MODIFICATION: A PROBLEM ANALYSIS (Rep. to Bureau of Reclamation, May 1969). *See also* Rango, *Possible Environmental Response to Weather Modification*, in PROCEEDINGS OF SECOND NAT'L CONF. ON WEATHER MODIFICATION 411 (1970).

26 *See* HUMAN DIMENSIONS OF THE ATMOSPHERE (W. Sewell ed. 1968); HUMAN DIMENSIONS OF WEATHER MODIFICATION (W. Sewell ed. 1966).

27 Wollan, *Controlling the Potential Hazards of Government-Sponsored Technol-*

AGENCIES FOR STATE REGULATION OF WEATHER MODIFICATION

States' strategies for regulation of weather modification might involve use of one or more of the branches of state government. The judiciary might develop the legal norms for governing weather modification activities.[28] This also could be accomplished through the legislative or administrative processes, with judicial or administrative enforcement of those norms.[29] These control methods might be employed alone or used in conjunction with each other.[30]

JUDICIAL CONTROL

The common law has been built through judicial adherence to prior precedents, a process known as stare decisis. There are three main strengths inherent in this method of resolving conflicts:

(1) impartiality,
(2) stability, and
(3) efficiency.[31]

In any civilized system of government, the law should attempt to achieve impartiality. Law that is applied to one set of circumstances usually should also be applied to similar situations. When courts do not adhere to prior rulings, the new norms applied by them may change what otherwise would have been the outcome of a lawsuit. In that event the losing litigant has not been afforded the same treatment as litigants who in similar prior cases prevailed because the older legal norm was applied. The shift from prior precedent denies an impartial result.

Following the past may, however, lead to an undesirable sort of uniformity. "From the standpoint of justice little can be said in favor of equality in error."[32] Even though like cases are not treated in like fashion, it is necessary to discard mistakes from the past and to keep the law in tune with the times.[33] Sacrificing impartiality to the extent necessary to keep

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ogy, 36 GEO. WASH. L. REV. 1105, 1115 (1968). *See also* E. MURPHY, GOVERNING NATURE 257-93 (1967).

28 Howe, *The Judicial System and Assessment of Technological Developments in Weather Modification*, in PROCEEDINGS OF SECOND NAT'L CONF. ON WEATHER MODIFICATION 308 (1970).

29 Davis, *The Legislative Process and Assessment of Technological Developments in Weather Modification*, in PROCEEDINGS OF SECOND NAT'L CONF. ON WEATHER MODIFICATION 303 (1970).

30 Governmental assessment of technology is explored in PANEL ON TECHNOLOGY ASSESSMENT, NAT'L ACADEMY OF SCIENCES, TECHNOLOGY: PROCESSES OF ASSESSMENT AND CHOICE (1969).

31 Davis, *New Wine in Old Bottles: Weather Modification Legal Analogies*, 1967 WESTERN RESOURCES CONF. 93; *cf.* Davis, *The Doctrine of Precedent as Applied to Administrative Decisions*, 59 W. VA. L. REV. 111, 116 (1957).

32 Goodhart, *Precedent in English and Continental Law*, 50 L.Q. REV. 40, 56 (1934).

33 According to Justice Holmes, having no better reason for a rule than that it was laid down in the past by remote ancestors is "revolting," especially when the

the law of weather manipulation free from the complexities and misunderstandings of the past is a small price to pay if it leads to results which are justifiable on their own merits.

Moreover, complete impartiality is unsatisfactory, unless it can be safely assumed that the claims among which selection will be made are equal. Casting dice or using a lottery to reach a decision is normally an inadequate means of making a choice even though it is an impartial one.[34] Chance takes no account of the relative merits of the possible decisions. Mechanical application of prior precedents may also neglect weighing the claims involved.

Stability in the law is a worthy aim, for it promotes in society the necessary security of acquisitions and security of transactions. Frequently it is more important that the law be settled than that it be settled "right."[35] When the law is settled, the lawyer has a basis for giving his client professional advice concerning the legal consequences of a given course of conduct, and the layman has a basis for reasoned reliance. Uncertainty about the legal ramifications of weather modification can hinder both development and operation of weather modification techniques.[36]

Stare decisis tends to break down with wide and rapid change in society. The law must have more than mere stability; it must have flexibility as well. Security should not be obtained at the expense of rigidity. The law must change. Old norms that have outlived their utility should be cast off and other rules should be adapted to prevailing conditions.[37]

However, effective administration of justice requires at least an examination of applicable precedents when presented with new problems. Constant redetermination of rules would be a waste of time and energy. Drawing from the learning of the past complements the judge's own experience. It guides him as to the social standards of justice and the moral concepts of the community.[38]

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reason for the rule has vanished. Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 469 (1897).

[34] The Rabelaisian character Judge Bridlegoose gave litigants appearing in his court absolute judicial impartiality by throwing dice to decide cases. F. RABELAIS, GARGANTUA ET PANTAGRUEL, *cited in* Horack, *In the Name of Legislative Intention*, 38 W. VA. L.Q. 119 (1932); and *commented upon in* Gest, *The Trial of Judge Bridlegoose*, 71 U.S.L. REV. 503 (1937).

[35] Burnet v. Coronado Oil and Gas Co., 285 U.S. 393, 405 (1932) (Brandeis, J., dissenting); Salmond, *The Theory of Judicial Precedents*, 16 L.Q. REV. 376, 382 (1900).

[36] Remarks by W. Howell, Practical Limits of Current Weather Modification Practice: Meteorological Viewpoints, presented at ASCE meetings at Phoenix, Ariz., Nov. 14, 1968.

[37] Justice Cardozo expressed the need for flexibility in the following fashion:

> 'Law must be stable, and yet it cannot stand still.' Here is the great antinomy controlling us at every turn. Rest and motion, unrelieved and unchecked, are equally destructive. The law, like human kind, if life is to continue, must find some path of compromise. Two distinct tendencies, pulling in different directions, must be harnessed together and made to work in unison. R. CARDOZO, THE GROWTH OF THE LAW 2 (1924).

[38] The judiciary can find through examination of prior precedents a "rapid if

Even with the inefficiency inherent in making new rules, their creation may in the long run serve the needs of society more effectively than repetition of past solutions to new problems. The painful process of reanalysis of legal issues raised by application of new technology, such as that employed in changing the weather, is certainly slower than relying on earlier case law. But the result may be superior. This is particularly true when the potentially applicable precedents do not really fit the present problems.

The judiciary has had extensive experience in protecting the investments of entrepreneurs and compensating persons whose interests have been harmed. This general expertise might be applied by the courts when judges are called upon to decide similar issues arising from intentional manipulation of the weather.

Protection of Investment

The major groups seeking to obtain the benefits from weather modification activities will be modifiers (and their clients) and landowners. In storm modification the benefits generated from modifier activities will more or less automatically accrue to their clients and to other landowners. Thus, the owner of a neighboring tract of forested land will benefit from suppression of lightning strikes over the area subject to weather modification. Diminution of the forest fire threat next door benefits the neighbor. The person paying for the weather modification activity does not lose because of the fact that it collaterally helps his neighbor. The same is true where there is direct application of incremental precipitation to the ground. But where there is an increase in upstream precipitation for purposes of downstream use, the modifier and his client may have a problem protecting their investment. If other persons were permitted to use the additional waters, the modifer would be benefiting them and at the same time losing such benefits for himself. This then is an area where the interests of the modifier and of the other landowners may collide.[39]

a. Modifier Rights

Weather modifiers might claim the benefits of their upstream modification by using arguments akin to those employed by other resource developers. "We were there first; we expended our capital and developed this additional water source. Through us the community benefits. We are entitled to protection, for without it there is inadequate in-

incomplete review of social contexts comparable to the present, and of a rule thought suitable for those contexts by other minds after careful inquiry." J. STONE, THE PROVINCE AND FUNCTION OF LAW 192 (1950).

[39] For analysis of water rights problems arising in connection with streamflow alteration, see Davis, *Special Problems of Liability and Water Resources Law*, in WEATHER MODIFICATION AND THE LAW 103 (H. Taubenfeld ed. 1968).

centive to develop the resource." Similar logic has been persuasive in states following the doctrines of prior appropriation of ground and surface waters.[40] These arguments underlie the law concerning developed and salvaged waters,[41] and have an influence upon oil and gas law and mining law.[42]

If the courts rely upon precedents which recognize the interests of developers of ground and surface waters and of oil, gas, and mineral deposits, they should take into account the physical differences between these resources and atmospheric water resources. Winds shift more readily than do stream courses; the atmosphere is a more immediate part of the environment of the community than are subsurface minerals or subterranean waters; and measurement of the extent of any rights recognized in the clouds involves more difficult technical problems than determinng the quantity of other resources which may legally be extracted.

In addition, the case law which protects ownership rights in water and minerals is a product of an earlier time. Development of natural resources held a high priority until well into this century and the law placed the developers' rights in a favored position in order to give effect to that priority. Today, however, sound management and conservation of natural resources is a more important national goal than their exploitation. Use of arguments which protected the rights of 19th century resource developers in order to protect today's weather modifiers may not further our need to manage atmospheric water resources in the public interest.

As yet there have been no reported cases concerning weather modifiers' claims to water allegedly reaped by them but used by another. Instead litigation has involved liability for cloud seeding.[43] When modifiers

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[40] See Hutchins, *Background and Modern Developments,* in 1 WATERS AND WATER RIGHTS § 18 (R. Clark ed. 1967).

[41] One authority has stated that:

> If one by his own efforts adds to the supply of water in a stream, he is entitled to the water which he has developed, even though an appropriator with a more senior priority might be without water. The reason for this rule is the obvious one that a priority relates only to the natural supply of the stream as of the time of appropriation. J. SAX, WATER LAW: CASES AND COMMENTARY 225 (1965).

See also Clark, *Background and Trends in Water Salvage Law,* in 15 ROCKY MT. MINERAL L. INST. 421 (1969).

[42] *See* Westmoreland & Cambria Natural Gas Co. v. DeWitt, 130 Pa. 235, 18 A 724 (1889).

[43] Plaintiffs sought damages or injunctive relief in Samples v. Irving P. Krick, Inc., Civil Nos. 6212, 6223, and 6224 (W.D. Okla. 1954); Adams v. California, No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964); Summerville v. North Platte Valley Weather Control Dist., 170 Neb. 46, 101 N.W.2d 748 (1960); Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950); Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749 (1968); Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W. 2d 417 (1959); Auvil Orchard Co. v. Weather Modification, Inc., No. 19268 (Super. Ct. Chelan County, Wash., 1956).

Criminal liability was charged in Pennsylvania *ex rel.* Township of Ayr v. Fulk,

and landowners do become involved in lawsuits about atmospheric water rights there will be formidable problems of proof by the claimant to establish that his efforts caused the waters in controversy to be available.[44] Laying claim to specific amounts of water harvested by past cloud seeding will, however, be easier than protecting the cloud seeder in court from future interference with new waters that he will produce. There is no guarantee that atmospheric conditions will repeat themselves so that future cloud seeding will bring about results similar to past weather manipulation efforts.

No state statute thus far enacted provides guidelines which judges may follow in allocating atmospheric waters. It would seem, though, that inherent in all of the legislation concerning weather changing is the implied assumption that the modifier will receive the benefits of what he has brought about. This unstated policy might well be relied upon by the judiciary in recognizing in modifiers a legal right to waters developed by them. If so, the courts would still have to determine when a modifier would become entitled to a water right, the duration of the interest, and the quantity of water included within the right.

b. Landowner Rights

The principal theory of water law employed in the common law would today is that of riparian rights—rights to waters on and under the surface of the owner's land.[45] The logic of riparian rights could be invoked by landowners to claim the benefits of weather modification activities performed by or paid for by other persons. The landowner might assert that the clouds over his land and their water content are his property, and that other persons seeking to harvest the atmospheric water are meddlers who should not derive any property right from their activities.

In three instances of weather modification litigation judges have spoken on the matter of landowner rights in the atmosphere. In Jeff Davis County, Texas, ranchmen sought to enjoin cloud seeding by weather modifiers who were employed by a large number of farmers to conduct a hail suppression program. The ranchers claimed and the trial judge found that the seeding retarded rainfall upon the plaintiffs' properties. Temporary injunctive relief was granted and upheld by the Court of Civil Appeals in *Southwest Weather Research, Inc. v. Rounsaville and Southwest*

No. 53 (C.P. Fulton County, Pa., Feb. 28, 1968).

The other cases relating to weather modification have been of a procedural nature. Summerville v. North Platte Valley Weather Control Dist., 171 Neb. 695, 107 N.W.2d 425 (1961); Avery v. O'Dwyer, 305 N.Y. 658, 112 N.E.2d 428 (1953); Reeve v. O'Dwyer, 199 Misc. 123, 98 N.Y.S.2d 452 (Sup. Ct. 1950).

[44] Causation has been established only in the Texas litigation. Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

[45] 4 RESTATEMENT OF TORTS, Scope Note 339-50 (1939).

Weather Research, Inc. v. Duncan in which the identical opinions said the landowner has a right to "such precipitation as Nature deigns to bestow . . . [and] to such rainfall as may come from clouds over his own property that Nature, in her caprice, may provide."[46]

In tune with the *Southwest Weather Research* cases is the view expressed by a Pennsylvania judge in *Pennsylvania Natural Weather Association v. Blue Ridge Weather Modification Association*[47] where he noted that "every landowner has a property right in the clouds and the water in them." The judge further indicated that although this right was subject to "weather modification activities undertaken under . . . governmental authority," the private modifier has no right "to determine for himself what his needs are and produce those needs by artificial means to the prejudice and detriment of his neighbors."[48]

During the infancy of scientific weather modification New York City employed a meteorologist to seed clouds in order to increment rainfall over watersheds where city water works reservoirs were located. The owners of a Catskill resort brought an action to secure an order barring the seeding. The trial judge in *Slutsky v. City of New York*[49] stated flatly that property owners "clearly have no vested property rights in the clouds or the moisture therein"—at least, as against the water needs of New York City.

The precedent value of the pronouncements from these opinions is diminished not only by the fact of their contradiction with each other, but also because the cases in which they were uttered involved only the issue of the right of landowners to obtain an injunction against seeding. Both the Pennsylvania and New York judges denied injunctive relief because the plaintiffs did not produce evidence that they had in fact been harmed.[50] In the Texas case evidence of injury and causation was found to be sufficient, but the trial court had relied heavily upon lay testimony of the ranchers.[51]

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[46] 320 S.W.2d 211, 216 *and* 319 S.W.2d 941, 945 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959). This litigation was commented upon in *Legal Problems of Weather Control*, 12 BAYLOR L. REV. 113 (1960); and *Legal Remedies for "Cloud-Seeding" Activities: Nuisance or Trespass?*, 1960 DUKE L.J. 305. Additionally, it has been noted in 73 HARV. L. REV. 790 (1960); 36 N.D.L. REV. 72 (1960); 4 S. TEX. L.J. 400 (1959); 14 SW. L.J. 425 (1960); 37 TEXAS L. REV. 799 (1959); 4 VILL. L. REV. 603 (1959); and 15 WYO. L.J. 92 (1960).

[47] 44 Pa. D. & C.2d 749, 759-60 (C.P. Fulton County 1968).

[48] *Id.* at 760.

[49] 197 Misc. 730, 731, 97 N.Y.S.2d 238, 239 (Sup. Ct. 1950). This case was commented upon in *Rain Making and the Law*, 29 CHI.-KENT L. REV. 150 (1951); *Rain and the Law*, 39 GEO. L.J. 466 (1951); *Rights of Private Land Owners as Against Artificial Rain Makers*, 34 MARQ. L. REV. 262 (1951); *The Weathermaker and the Law*, 1 S.D.L. REV. 105 (1956); and *Legal Problems Raised by Artificial Rainmaking*, 4 VAND. L. REV. 332 (1951).

[50] Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950); Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749 (1968).

[51] Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest

Further lawsuits on landowner rights could well consider the distinction between surface waters in watercourses and underground waters in aquifers and the variant paths taken by atmospheric waters in "flowing" through the skies. The riparian doctrine does not well fit the different physicial setting. Judges should also develop reasons why landowners should (or should not) be entitled to unmodified weather or to water produced by the efforts of other persons.

Apart from their arguments to ownership of atmospheric water resources, landowners located where rain or snow falls or where water flows have a strong practical position with regard to such waters. If the landowner uses the water, the burden is then on the modifier to prove that the use was improper because the waters were derived from weather modification activity.[52] The modifier may have a great deal of difficulty in proving his case.

Redistribution of Losses

State courts have been dealing with the law of liability since the founding of the country. Their expertise is born of this long experience. Payment for losses through the mechanism of the state court system is a strategy for state regulation of weather manipulation that has a great deal to commend itself. Judges are experienced in the matter of redistributing losses resulting from the interaction of persons and groups in our society.[53]

Development of the law of liability has, however, been very slowly accomplished. In the hundreds of years prior to the Industrial Revolution, only glimmerings of the law of negligence had evolved; but in the 19th century the pace did pick up with the advent of modern technological advances.[54] In spite of that, judicial building of the law of liability takes time. The time lag may inhibit efforts by persons who do not know what legal norms may be applied to their cloud seeding activities.

The use of the jury for fact-finding provided a means of obtaining a community evaluation of what had taken place. So long as the problems involved were within the normal experience of the average juror, employment of 12 men good and true provided a sound method for giving the community a voice in redistribution of losses. However, when jurors are called upon to cope with problems of a scientific and technological nature, they are dealing with matters beyond the range of experience of most

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Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

[52] Pierce, *Legal Aspects of Weather Modification Snowpack Augmentation in Wyoming*, 2 LAND & WATER L. REV. 273, 289-92 (1967).

[53] *See* Katz, *The Function of Tort Liability in Technology Assessment*, 38 U. CIN. L. REV. 587 (1969).

[54] For a short history of the law of negligence, see W. PROSSER, THE LAW OF TORTS § 28 (3d ed. 1964).

members of society. It is therefore not surprising that in *Adams v. California*,[55] a case involving claims by flood victims against a public utility and its weather modifier asserting that the defendants had added to the magnitude of the flood, counsel for both plaintiffs and defendants agreed to waive a jury.

Even when the matter is being determined by a judge, as has been the case in most weather modification lawsuits,[56] the problem of lack of continuity of experience remains. Judges can educate themselves to understand the issues involved in storm and precipitation modification liability problems, but it is unlikely that an individual judge will be called upon to handle more than one lawsuit of this nature during his career. Instead, they will be passed around among judges at large and there will be no continuity in experience in dealing with the problems at hand. The thin number of lawsuits to date manifests something of this problem. No judge has yet been called upon to cope with more than one round of weather modification litigation.

Thus far there have been very few lawsuits involving weather alteration activities. The sporadic nature of legal activities here almost inevitably leads to overemphasis upon the few cases decided. Consequently, the mistakes in these cases can carry unusual weight in shaping future development of the law. In many other areas of liability litigation, the volume of cases is great enough to provide a balancing of erroneous decisions by those determinations which seem to be more legally defensible. Such is not necessarily the case in the area of weather modification.

Before going further to examine judicial application of liability theories and defenses, it should be determined whether there will in fact be any losses. In the area of storm modification it is clear that some types of activitiy will involve economic losses to certain persons. Changing the track of a hurricane could lead to devastation of an area.[57] Hail suppression improperly performed may lead to loss of precipitation. In the *Southwest Weather Research*[58] cases this was alleged, and there was lay

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[55] No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964).

[56] The jury was waived in the *Adams* case. In other instances judges were also called upon to make the factual determinations. See Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950); Pennsylvania *ex rel.* Township of Ayr v. Fulk, No. 53 (C.P. Fulton County, Pa., Feb. 28, 1968); Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749 (C.P. Fulton County 1968); and Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

[57] *See* Morris, *The Law and Weather Modification*, 46 BULL. AM. METEOR. SOC'Y 618 (1965), for a discussion of the legal ramifications of changing the track of a hurricane.

[58] Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

testimony to this effect, although scientific evidence seems to support the proposition that hail modification properly performed does not diminish precipitation.[59] Lightning suppression conceivably could cause redistribution of precipitation,[60] and this could result in economic losses to persons who would have had more or less precipitation over specific areas. Even with fog dissipation there could be losers,[61] although normally the effects are very localized.

In the field of precipitation modification there is also loss potential. There can be shifts in the amount, timing, and intensity of precipitation;[62] and this can have not only direct effects, but can also affect runoff patterns[63] and access to areas.[64]

Assuming that there will be losses, the next problem is proof in court of such losses. So far, no claimant seeking damages has satisfactorily explained in court that deliberate weather changes proximately caused losses for which he has sought compensation. In the *Southwest Weather Research* cases a temporary injunction was granted, but there was no proof made of losses for which compensation could be awarded.[65] In the *Pennsylvania Natural Weather Association* case, injunctive relief was denied. There was no proof that loss had been caused.[66] *Slutsky v. City of New York* was another case in which relief was denied because

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[59] NATIONAL SCIENCE FOUNDATION, WEATHER MODIFICATION 31 (Ninth Ann. Rep. 1968).

[60] Lightning suppression efforts of the Forest Service are described in Barrows, *Weather Modification and the Prevention of Lightning-Caused Fires*, in HUMAN DIMENSIONS OF WEATHER MODIFICATION 169, 177 (W. Sewell ed. 1966).

[61] In discussing a warm fog suppression operation, one meteorologist noted that "[a]t the present time, salt is being used for this purpose, but it is believed that the corrosion problems associated with sodium chloride are not acceptable and substitute materials will have to be used in the near future." Report by L. Davis to Weather Modification Ass'n Meeting, Santa Barbara, Cal., Feb. 17, 1969.

[62] Chamberlain & Grant, *Weather Modification and Its Relationship to Environment*, 1967 WESTERN RESOURCES CONF. 69, 74-75.

The Bureau of Reclamation planning document for atmospheric water resources development contemplates achievement of operational precipitation control on a regional basis. It projected the target date of 1980 for "a general capability for . . . enhancing, under favorable conditions, precipitation for direct use on lands and crops in most regions." OFFICE OF ATMOSPHERIC WATER RESOURCES, PLAN TO DEVELOP TECHNOLOGY FOR INCREASING WATER YIELD FROM ATMOSPHERIC SOURCES 50 (1966).

[63] The only reported case concerning flooding alleged to have been induced by cloud seeding is Adams v. California, No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964). The case is discussed in Morris, *Preparation and Trial of Weather Modification Litigation*, in WEATHER MODIFICATION AND THE LAW 163 (H. Taubenfeld ed. 1968).

[64] Plaintiffs have experienced difficulty in proving causation in cases outside the weather modification field where they have claimed disruption of access. *See* Annot., 120 A.L.R. 896 (1939). The problems of proof certainly would not be easier in an action against a weather modifier.

[65] Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

[66] Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749 (C.P. Fulton County 1968).

the plaintiff had not proven his case,[67] and in *Adams v. California* the plaintiffs did not establish any causal relationship between cloud seeding in the Sierras and the flood damages suffered by the downstream claimants.[68] It is this difficulty of proving loss, as well as the likelihood that there have been very few individual losses of an economic nature caused by weather modification, that has limited the number of cases brought to court.

It is ironical that as weather modifiers improve their techniques, they will be opening themselves to the potential of a greater number of lawsuits and more success on the part of claimants. Plaintiffs will be able to utilize records from the modifiers to prove causation.[69] So, as the science improves and its instrumentation is perfected, losses will become easier to prove and the number of lawsuits is likely to increase.

Assuming that there are losses and that these can be established by evidence acceptable in court, the next issue is the extent to which the losses should be compensated. Suggestions have been made that at least some of the losses from weather changing are the inevitable price of technological development.[70] We may not care for the raucous sounds of modern life, the uglification of the world in which we live, or the spoilation of our environment, but the law seldom compensates us for these undeniable losses. Perhaps some of the inconvenience and even economic loss resulting from weather modification should also be considered damnum absque injuria. This is not to say that all persons suffering loss from weather alteration should be satisfied with an explanation that they are paying part of the cost of living in a technological society. Those persons who have been flooded, who have suffered drought, or who have undergone the rigors of a storm that has artificially been made more damaging should be permitted to recover.

If we decide that those persons with provable losses (or at least some of them) should be compensated, we are left to determine the means by which compensation may be forthcoming. The law of liability furnishes us with a number of different theories which could be employed. These are subject to various defenses, and such losses can be shifted by insurance and indemnification.

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[67] 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950).

[68] No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964).

[69] Rule 34 of the *Federal Rules of Civil Procedure permits* inspection and copying of an opposing party's nonprivileged records upon motion and a showing of good cause. Records required to be kept by statute are not usually privileged. 1 K. DAVIS, ADMINISTRATIVE LAW TEXT § 3.09 (1959). A number of states already require record keeping. See discussion at note 123 *infra*. Seeking to obtain material which provides an evidentiary basis to establish the litigant's case constitutes good cause. See cases cited in 2A W. BARRON & A. HOLTZOFF, FEDERAL PRACTICE AND PROCEDURE § 796, n.62 (C. Wright Rev. Supp. 1967). Most states have adopted rules of discovery parallel to Rule 34.

[70] *See, e.g.*, remarks of P. King, Comments as to Legal Aspect of Weather Modification, presented at ASCE meetings at Phoenix, Ariz., Nov. 14, 1968.

a. Liability Law

The difficulty with employing present liability theories as a means for judicial control over weather modification is that anyone's theory is about as good or as bad as the next person's. In the legal periodical literature in this area, there is no agreement as to what theory or theories the courts should impose here.[71] Litigation generally has followed a shotgun approach. Counsel for claimants have asserted every possible theory they could think of.[72] The problem is that there are too many theories in the lawyer's bag of tricks.

From the point of view of the claimant, perhaps the most popular approach would be to employ some "no-fault" theory—absolute liability, liability without fault, ultrahazardous activity, or abnormally dangerous activity.[73] This approach minimizes problems of proof. The claimant does not need to establish that the modifier intended to do any harm or that he fell below any standard of care. However, liability is not automatic under a no-fault theory. It is necessary to establish that the modifier acted, that the claimant was injured, and that there was a causal relationship between the activity and the injury. Moreover, it must be proven that the weather modification activity involved was the sort that gives rise to liability without fault.

Pennsylvania and West Virginia have legislated that cloud seeding which causes storms or droughts is the kind of activity which gives rise to no-fault liability.[74] On the other hand, Texas has enacted the rule that no type of weather modification activity, if it is properly licensed, would give rise to absolute liability.[75] Perhaps the courts will treat different types of modification differently. They might rule that severe storm modification involves such high potential risk as to give rise to absolute liability. They might decide that rainfall augmentation is not so dangerous an activity as to be deemed ultrahazardous. No one can tell at this time what course the courts will chart. However, they ought not to prejudge the issues and lump all types of weather modification and all kinds of activities into one category or the other.

Theories of fault as a basis for weather modifier liability would all require proof of the activity, proof of loss, demonstration of a causal relationship, and proof of fault.[76] A negligence approach would require

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[71] For a bibliography of publications concerning the legal implications of weather modification, see Davis, *Weather Modification*, in 4 WATERS AND WATER RIGHTS § 364 (R. Clark ed. 1970).

[72] *E.g.*, Adams v. California, No. 10112 (Super. Ct. Sutter County, Cal., April 6, 1964), in which there were counts charging negligence and seeking recovery for an alleged ultra-hazardous activity. Mann, *The Yuba City Flood: A Case Study of Weather Modification Litigation*, 49 BULL. AM. METEOR. SOC'Y 690, 695 (1968).

[73] *See* RESTATEMENT (SECOND) OF TORTS §§ 519, 520 (Tent. Draft No. 10, 1954).

[74] PA. STAT. ANN. tit. 3, § 1114 (Supp. 1969); W. VA. CODE § 29-2B-13 (Supp. 1969).

[75] TEX. REV. CIV. STAT. ANN. art. 8280-12 § 18 (Supp. 1969).

[76] RESTATEMENT (SECOND) OF TORTS §§ 158, 281 (1965).

the plaintiff to establish that the defendant did not live up to the standard of care required of him. The standard expected of cloud seeders is a matter with which the courts have not yet dealt, but following general tort principles, it would seem that a modifier would be free from any responsibility if he acted as carefully as would a reasonable, prudent modifier. In other words, the standard would be that of the industry.[77] Proof that this professional standard was violated could be a very difficult undertaking for claimants. This in turn could lead to adoption of a no-fault system.[78]

In most cases trespass would not be a sound approach. Neither the intrusion of the delivery vehicle, into the airspace, nor the intrusion of the speeding material, or of the resultant precipitation into the airspace or ground below should normally justify a lawsuit; there usually would be no substantial interference with the use and enjoyment of the land below.[79] Of course, if a modifier intrudes upon the land of another in setting up equipment, he could be held responsible for such a trespass.

Nuisance is a catchall in the law of torts which may provide an avenue for determining weather modifer liabilities. It attractiveness results from the fact that the courts in nuisance cases are called upon to balance the various interests involved as part of the determination of whether liability should follow.[80] This type of balancing act led the New York court in the *Slutsky* case to rule in favor of the city and its cloud seeder.[81] It led the Pennsylvania court in the *Natural Weather Association* case to rule in favor of the claimant. That court, however, noted that should a governmental entity undertake the activity there, it might rule differently because of the public interest involved.[82]

b. Defenses

Under present liability law, a defendant will prevail if the plaintiff fails to prove his case; additionally, he may win even where the plaintiff does prove his case, if the defense can be proven. Where a governmental entity is the seeder, the defense of governmental immunity might be employed. There has been considerable erosion in this defense, and it is

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77 *Id.* § 299A.

78 This is proposed in *Report of the Task Group*, in CONTROLLING THE WEATHER: A STUDY OF LAW AND THE REGULATORY PROCESSES 32-35 (1970).

79 The "substantial interference" doctrine is now adopted by the *Restatement of Torts* with relation to air commerce. RESTATEMENT (SECOND) OF TORTS § 159 (1965).

Silver iodide, the main seeding substance, is used in such diluted concentrations and small amounts as to pose no pollution problem. Kahan, *Weather Modification Effects on Man's Environment*, 1967 WESTERN RESOURCES CONF. 81, 84-86. *See also* W. DOUGLAS, THE SILVER IODIDE GENERATOR AND PUBLIC HEALTH (1968); W. DOUGLAS, TOXIC PROPERTIES OF MATERIALS USED IN WEATHER MODIFICATION (1967).

80 RESTATEMENT OF TORTS §§ 822, 826-28 (1939).

81 Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950).

82 Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749, 760 (C.P. Fulton County 1968).

not necessarily available to modifiers acting under contract with governmental entities.[83] Moreover, governments are limited by constitutional requirements so that there must be compensation for their activities which are deemed to constitute a "taking" of private property.[84]

Consent by the claimant is likely to be an important defense.[85] Although it would be impossible for a modifier to obtain consent from all persons who might in some way be affected by his undertaking, advance consent may be obtained from those persons most likely to be directly affected. Thus, an airport authority involved in fog modification could secure advance consent to its fog seeding from neighboring property owners if the authority feels they will be sufficiently affected to give the agency legal troubles. Private or governmental property owners in high mountain country where additional snows would be deposited from cap cloud seeding could be asked in advance to give their consent. Frequently consent would involve financial compensation. But this may be cheaper than waiting until after the losses to make adjustment for them.

Conceivably in an emergency situation the defense of privilege of necessity might be employed.[86] Where fire danger is great, suppression of lightning through weather modification, even though it may result in some losses to neighbors, may be privileged. The same approach could be applied to hail suppression or emergency increases in precipitation to meet problems like that faced by the City of New York when it undertook the cloud seeding program that led to the *Slutsky* case.[87]

c. Insurance and Indemnification

A recent questionnaire sponsored by the Weather Modification Association indicates that thus far weather modifiers have experienced a minimal amount of difficulty with liability suits.[88] Based on these findings, private insurance should be available at comparatively low rates. Some persons and organizations, however, have experienced difficulty in obtaining the kind of insurance coverage they want and feel they need; and many modifiers feel that rates are higher than they ought to be. This has led to agitation from some quarters for a governmentally created insurance program.[89]

Should the present system of private insurance be continued, it would

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83 For discussion of governmental immunity, see 1 F. HARPER & F. JAMES, THE LAW OF TORTS §§ 29.1-.6, 29.8-.15 (1956).

84 For an analysis of the concept of "inverse condemnation" that is involved in such "takings," see Sax, *Takings and the Police Power*, 74 YALE L.J. 36 (1964).

85 *See* C. MORRIS, TORTS § 2 (1953).

86 RESTATEMENT (SECOND) OF TORTS § 196 (1965).

87 Slutsky v. City of New York, 197 Misc. 730, 97 N.Y.S.2d 238 (Sup. Ct. 1950).

88 Study of R. Davis, Weather Modifiers' Liability Insurance Experience, presented to Weather Modification Ass'n Meeting, Santa Barbara, Cal., Feb. 17, 1969.

89 *E.g.*, SPECIAL COMM'N ON WEATHER MODIFICATION, WEATHER AND CLIMATE MODIFICATION 111 (1965).

likely be administered by the state court systems. They would, as they do generally in the field of liability insurance, interpret the clauses in the insurance contracts and oversee their enforcement. Liability insurance contracts used in weather manipulation cases read substantially like the regular automobile liability policy; consequently, the courts have amassed a good deal of experience with the provisions of these contracts.

Any change from the present state of the law would have an impact upon present insurance practices. Should the law be clarified and should it become clearer to insurance companies that their losses will not be great, rates ought to decrease. On the other hand, should causation become easier to establish with resultant recoveries by plaintiffs, insurance rates will reflect the situation.[90]

Weather modifiers have sometimes agreed to assume liability by means of indemnification agreements with their sponsors. Both governmental and private sponsors frequently require cloud seeders to indemnify them for any losses suffered.[91] These indemnification contracts are subject to judicial scrutiny both as to their validity and interpretation.

JUDICIAL ENFORCEMENT OF LEGISLATIVE ENACTMENTS

There is a need for legislation to clarify the law of weather modification. Legislation of one sort or another has been enacted in 29 states,[92]

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90 McLaren, *Weather Modification and the Law*, 34 SASK. L. REV. 1, 11 (1969).

91 Bureau of Reclamation weather modification contracts, for instance, provide that:

> [T]he Contractor agrees to indemnify and to hold harmless the Bureau against and from any and all liability . . . for claims on account of property damage, personal injuries, or death resulting from the acts or negligence of any and all employees and other personnel working under the direction of the Contractor or any of its subscontractors in connection with the performance of its obligations under this contract.

92 ARIZ. REV. STAT. ANN. §§ 45-2401 to -2407 (1956); CAL. WATER CODE §§ 400-415 (West 1956), *as amended*, (Supp. 1969); CAL. WATER CODE—APP. § 48-49(13) (West 1968); CAL. GOV'T CODE § 53063 (West 1966); COLO. REV. STAT. ANN. §§ 151-1-1 to -12 (1963); CONN. GEN. STAT. ANN. § 25-5 to -8 (1960), *as amended*, (Supp. 1969); FLA. STAT. ANN. §§ 373.261-.391 (1960), *as amended*, (Supp. 1969); HAWAII REV. LAWS § 174-5(8) (1969); IDAHO CODE ANN. §§ 22-3201 to -3202 (1968); KAN. STAT. ANN. § 82a-927(4) (Supp. 1968); LA. REV. STAT. ANN. §§ 37:2201-2208 (1964); MD. ANN. CODE art. 66C, § 110A (Supp. 1969); MASS. ANN. LAWS ch. 6, §§ 17, 72 (1966), *as amended*, (Supp. 1969); Minn. Laws 1969, ch. 771; MONT. REV. CODES ANN. §§ 89-310 to -331 (Supp. 1969); NEB. REV. STAT. §§ 2-2401 to -2449 (1962), *as amended*, (Supp. 1967); NEV. REV. STAT. §§ 244.190, 544.010-.240 (1967); N.H. REV. STAT. ANN. § 432.1 (1968); N.M. STAT. ANN. §§ 75-37-1 to -15 (1968); N.Y. GEN. MUNC. LAW § 119-p (McKinney Supp. 1969); N.D. CENT. CODE §§ 2-07-01 to -13 (Supp. 1969); N.D. CENT. CODE § 58-03-07(19) (1960), *as added*, (Supp. 1969); OKLA. STAT. ANN. tit. 82, § 1078, n. §§ 2(I), 2(V) (Supp. 1969); ORE. REV. STAT. §§ 558.010-.990 (1967); PA. STAT. ANN. tit. 3, §§ 1101-18 (Supp. 1969); S.D. COMPILED LAWS ANN. §§ 38-9-1 to -24 (1967); S.D. COMPILED LAWS ANN. § 10-12-18 (Supp. 1969); TEX. REV. CIV. STAT. ANN. art. 8280-12, §§ 1-19 (Supp. 1969); UTAH CODE ANN. §§ 73-15-1 to -2 (1968); WASH. REV. CODE ANN. §§ 43.37.010-.200 (1965), *as amended*, §§ 43.37A.080(6), -.180(1) (Supp. 1969); W. VA. CODE ANN. §§ 29-2B-1 to -15 (Supp. 1969); WIS. STAT. ANN. § 195.40 (1957), *as amended*, (Supp. 1969); WYO. STAT. ANN. §§ 9-267 to -276 (1957), *as amended*, (Supp. 1969).

including those states where the primary weather modification experimentation and operations have taken place. But these laws for the most part have very little to say about the major issues arising from weather manipulation. In some states they amount to nothing more than an official pronouncement that weather modification is a subject concerning which there is legislative interest.[93] Some jurisdictions have provided for weather modification regulation through licensing, requirements concerning operational permits, and reporting;[94] yet no state has enacted laws stating anything concerning ownership rights and only three have had specific legislation regarding liability.[95] Should the current interest in weather alteration continue, it is quite possible that further legislation on the state level might be forthcoming. Future statutes should be more all-encompassing than are the present enactments. Such legislation could set forth the basic principles of weather modification law and leave to the courts the power to interpret these rules and enforce them.

Two major areas in which legislative guidelines would assist the courts are redistribution of losses and allocation of benefits. Statutory provisions concerning liability could range from immunization of cloud seeders from suit for losses caused by them to imposition of liability upon them without regard to any fault on their part. The first course has been followed in the Australian state of Victoria. The law there provides that no "person carrying out rainmaking operations authorized by the Minister under this Act shall in any way be liable in respect of any loss or damage caused by or arising out of the precipitation . . . in consequences of the rainmaking operations so carried out."[96] This immunity for licensed rainmaking activities would tend to encourage such cloud seeding. No threat of liability, ruinous or slight, would hang over the head of the modifier. There should, however, be some sort of remedy available to persons suffering from rainshadow, unwanted precipitation, and floods where such phenomena have been caused by weather changes. If not, citizens deprived of compensation for losses likely would seek anticloud seeding laws.

Rather than exempting certain types of modification activities from liability, state laws could stipulate that persons adversely affected by cloud seeding could recover only if they establish that their injuries were caused

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[93] *E.g.*, CONN. GEN. STAT. ANN. §§ 24-5 to -8 (1960), *as amended*, (Supp. 1969); HAWAII REV. LAWS § 174-5(8) (1968); KAN. STAT. ANN. § 82a-927(4) (Supp. 1968); N.H. REV. STAT. ANN. § 432.1 (1968); OKLA. STAT. ANN. tit. 82, § 1078, n. §§ 2(I), 2(V) (Supp. 1969).

[94] For charts depicting state licensing, permit issuance and reporting requirements, see R. DAVIS, LEGAL GUIDELINES FOR ATMOSPHERIC WATER RESOURCES MANAGEMENT 16-19, 20-25, 58-61 (1968) [hereinafter cited as LEGAL GUIDELINES]. On state regulation generally, see R. DAVIS, THE LEGAL IMPLICATIONS OF ATMOSHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT § 11 (1968).

[95] PA. STAT. ANN. tit. 3, § 1114 (Supp. 1969); TEX. REV. CIV. STAT. ANN. art. 8280-12 § 18 (Supp. 1969); W. VA. CODE ANN. §§ 29-2B-1 to -15 (Supp. 1969).

[96] Rainmaking Control Act of 1967 § 12(1), Act No. 7637, 1968 VICTORIA GOV'T GAZ. 709.

intentionally or through negligent conduct of the modifier. The Texas provision concerning exemption of all licensed activities from the category of ultrahazardous activities[97] is a possibility here. Legislation of this sort is neither self-interpreting nor self-enforcing. The judiciary would be called upon to perform these functions.

The Pennsylvania and West Virginia weather modification statutes state that "any licensee who causes a drought . . . shall compensate farmers for damages."[98] On its face this provision would appear to require only that the claimant establish that the modifier conducted activities, that there was a drought which injured him, and that there was a causal connection. The law's apparent meaning would seem to rule out any need on the part of the claimant to establish that the modifier fell below the standard of care of a reasonable, prudent man or that he intended any harm to the plaintiff. Although these particular statutes delegate the judicial power to an administrative agency, the same power of interpretation could be given to a court. The judge might not read the statute as granting absolute liability. Other legislative enactments could leave similar problems of interpretation.

When courts administer statutory enactments, they have the advantage of having before them a set of authoritative guidelines. Assume that the legislature has determined the rules for ownership of runoff from snowmaking. It is merely up to the courts to interpret the legislation, find the facts involved, and apply those facts to the interpreted legal norms. Courts have long experience in legislative interpretation, and state judges could doubtless do this in a satisfactory fashion. Also, state courts are competent in applying facts to the law at hand. The basic difficulty is fact-finding. Whether this chore is accomplished by judges or by juries, they are dealing in an area requiring scientific understanding—a kind of understanding which they may not in fact possess. Even legislative guidelines would probably not have saved the Texas court from reaching an erroneous conclusion of fact in the *Southwest Weather Research* cases[99] or have prevented the Pennsylvania court from being carried away with notions of the potential danger of weather modification in the *Pennsylvania Natural Weather Association* case.[100]

Governmental intervention prior to the time a cloud seeding project is launched will often be a more effective way of protecting the interests of all parties concerned than post-activity regulation. Yet judicial en-

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97 TEX. REV. CIV. STAT. ANN. art. 8280-12 § 18 (Supp. 1969).

98 PA. STAT. ANN. tit. 3, 1114 (Supp. 1969); W. VA. CODE ANN. § 29-2B-13 (Supp. 1969).

99 Southwest Weather Res., Inc. v. Rounsaville, 320 S.W.2d 211, *and* Southwest Weather Res., Inc. v. Duncan, 319 S.W.2d 940 (Tex. Civ. App. 1958), *both aff'd sub nom.* Southwest Weather Res., Inc. v. Jones, 160 Tex. 104, 327 S.W.2d 417 (1959).

100 Pennsylvania Natural Weather Ass'n v. Blue Ridge Weather Modification Ass'n, 44 Pa. D. & C.2d 749, 760-62 (C.P. Fulton County 1968).

forcement of legislative enactments usually will be available only after something has been done by the modifier. Private parties must demonstrate that they have "standing to sue" in order to institute legal proceedings. Standing requirements are normally met by showing the project has had some impact upon an interest of the complainant.[101] Usually for that to occur the weather manipulation effort must already be under way. Even when governmental officials are authorized to seek injunctive relief, they must satisfy requirements concerning "case or controversy."[102] Sharpening of issues between the parties is a condition for meeting the "case or controversy" requirements. Ordinarily this would happen only when the modifier has done something.

ADMINISTRATIVE CONTROL

Because of the difficulties with judicial control of weather modification, it is likely that the states will entrust most of the control functions to administrative agencies. The bureaucracy, rather than the judiciary, will flesh out the legislative enactments. Among the advantages of delegating authority to carry out a weather modification regulatory program to an administrative agency are:

(1) administrative expertise;
(2) continuity of the administrative regulatory program;
(3) flexibility; and
(4) completeness of control.

In theory at least, administrative agencies are headed and staffed by experts. Thus, a weather modification regulatory agency would have as its head or heads persons who have expert knowledge about cloud seeding and its consequences. Appropriations for the operations of such an agency would be large enough to permit it to employ meteorologists, hydrologists, engineers, and other technical staff members who could carry out its regulatory program with the highest degree of professional excellence.

The difficulty is that not always are experts appointed or elected as agency heads. Frequently, and this is particularly true on the state level, selection is a matter of politics in which the qualifications of the commissioner or other bureaucrat are a secondary consideration. Moreover, typically these agencies have not been provided with sufficient funds to employ enough high-grade professionals to carry out their program in an effective fashion. Nevertheless, an administrative staff usually provides more technical expertise than can be found in a courtroom or legisla-

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101 *But* see Scenic Hudson Preservation Conf. v. FPC, 354 F.2d 608 (2d Cir. 1965), *cert. denied*, 384 U.S. 941 (1966).

102 The "case or controversy" requirement is examined in C. WRIGHT, LAW OF FEDERAL COURTS §§ 12-15 (2d ed. 1970).

tive body.[103]

If judges are to be called upon to determine liability for cloud seeding, they will deal with such cases on a very intermittent basis. There will be no continuity of a regulatory program. An administrative agency, on the other hand, is an on-going entity which has constant contact with the fields involved. It can promote and react to developments, for example, in storm modification or in the area of streamflow augmentation. This possibility of making and following long-term plans makes administrative control by state regulatory agencies a very attractive possibility. Even though such agencies are subject to occasional changes of direction and political upheaval, their programs basically have a type of continuous supervision not found in judicial regulation.[104]

Administrative agencies can become afflicted with ossification and hardening of the arteries. They may become rigid and set in their ways.[105] But usually they are a flexible means of providing public control over areas of human activity. This is particularly true when legislative guidelines are sufficiently broad to permit an agency to adopt shifts in position. Thus, where technological advancement in cloud seeding dictates the need for change in agency policy, the state weather modification agencies would be in a position to provide a flexible legal response.

As has been indicated above, judicial control over weather modification is necessarily incomplete. Administrative control can be very broad. Agencies can be delegated rulemaking powers.[106] They can obtain quasi-judicial power enabling them to adjudicate disputes.[107] And they can be and have been given licensing and other supervisory powers.[108]

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[103] Coons, *Air Pollution and Government Structure*, 10 ARIZ. L. REV. 48, 56-64 (1968).

[104] W. GELLHORN & C. BYSE, ADMINISTRATIVE LAW CASES AND COMMENTS 1-7 (1960).

[105] John Galbraith, in something of an overstatement, has commented upon this tendency of administrative agencies:

> Regulatory bodies, like the people who comprise them, have a marked life cycle. In youth they are vigorous, aggressive, evangelistic, and even intolerant. Later they mellow, and in old age—after a matter of ten or fifteen years—they become, with some exceptions, either an arm of the industry they are regulating or senile. J. GALBRAITH, THE GREAT CRASH 171 (1955).

[106] Several state weather modification control agencies have been given and have exercised rulemaking powers. *See, e.g.*, Ariz. State Land Dep't Rules and Regs. Governing Weather Control, Cloud Modification and Rain Making, ch. VI; La. Dep't of Agriculture and Immigration, Rules and Regs. of Weather Modification; Nev. Dep't of Conservation and Natural Resources, Instructions for Applying for License to Engage in Operations to Modify Natural Precipitation by Artificial Means, Oct. 25, 1961; S.D. Weather Control Comm'n, Rules and Regs., May 4, 1953; Tex. Water Development Bd., General Instructions for Weather Modification Operations, Instructions for Applying for License to Engage in Weather Modification Operations, Instructions for Preparing Application for Permit for a Weather Modification Operation, and Instructions for Preparing Completion Report by Licensee of a Weather Modification Operation (1967); Wash. State Dep't of Water Resources, Res. 67-1, 67-7, and 67-10 (1967).

[107] *See, e.g.*, PA. STAT. ANN. tit. 18 § 1114 (Supp. 1969); W. VA. CODE ANN. § 29-2B-13 (Supp. 1969).

[108] In Montana the licensing board can issue a permit for a weather modification

Questions have been raised concerning the advisability of putting into the hands of a group of governmental employees such complete control. In an effort to alleviate this problem in other areas, legislators have circumscribed administrative control by limiting the powers delegated and otherwise exercising legislative oversight, and by providing for judicial review of administrative activity. Also, executive control over administrative agencies has been utilized.[109]

Professional Regulation

Administrative control may take the form of professional regulation; *i.e.*, state law may provide for licensing of personnel involved in cloud seeding operations. Licensing prior to performance of operations by the licensee is an effective strategy for regulation of weather changing; but who should perform the licensing function? Should this power be delegated to an existing state agency, a specialized weather modification agency created by the state, or to a special weather modification division within an existing agency? All three approaches have been utilized by states.[110] Another possibility is participation by private organizations in certifying competency. Such groups as the American Meteorological Society or the Weather Modification Association could play a role here.[111]

Licensing criteria now in effect differ from state to state. Generally, though, there are three types of qualifications: licensees should have technical competency,[112] they should be persons of professional integrity,[113] and they should have the financial resources to carry out projects successfully.[114] Unfortunately, irrelevancies have a tendency to creep in as unnecessary criteria. An illustration in the field of weather changing is the Wyoming requirement that a weather modification license applicant be previously licensed by the State of Wyoming as a "registered professional engineer."[115]

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operation if, among other things, it "has held an open public hearing in the area to be affected as to such issuance." MONT. REV. CODES ANN. § 89-318(6) (Supp. 1969).

109 See L. JAFFE, JUDICIAL CONTROL OF ADMINISTRATIVE ACTION (1965); L. JAFFE & N. NATHANSON, ADMINISTRATIVE LAW CASES AND MATERIALS 174-80 (1961).

110 See R. DAVIS, *supra* note 94, at 16-19, for chart on licensing requirements.

111 *See* Williams, *Professional Standards in Weather Modification*, 1 WMA 33 (1969).

112 *E.g.*, MONT. REV. CODES ANN. § 89-315 (Supp. 1969); NEV. REV. STAT. § 544.140 (1967); TEX. REV. CIV. STAT. ANN. art. 8280-12, § 9 (Supp. 1969); WASH. REV. CODE ANN. § 43.37.100 (1965).

113 Existing state laws do not spell out this requirement. However, in some states agencies are delegated authority to set licensing rules, and, acting under such power, could provide that licenses will not be issued to persons with proven lack of professional integrity. LA. REV. STAT. ANN. § 37-2207 (1964); S.D. COMPILED LAWS ANN. § 38-9-13 (1967).

114 *E.g.*, COLO. REV. STAT. ANN. § 151-1-6(B) (1963); FLA. STAT. ANN. § 373.301 (1960); ORE. REV. STAT. § 558.050 (1967). Pennsylvania goes so far as to require bonding. PA. STAT. ANN. tit. 3, § 6(5) (Supp. 1969).

115 WYO. STAT. ANN. § 9-271 (Supp. 1969). Wyoming also requires that appli-

Professional licensing is most effective when the appropriate agency is empowered to determine whether applicants in fact possess the requisite qualifications set forth by statute or administrative regulation. Some existing provisions concerning licensing do not, however, delegate such power. Applicants merely list their alleged qualifications; but no one passes on whether they are competent, honest, and solvent.[116] Laws of this sort are essentially mere registration provisions and have only limited usefulness.

If administrators do possess the power to pass on professional qualifications, there should be some guidance given them concerning the means by which they will determine whether applicants measure up to the criteria. Judging competence is ticklish business. Not all meteorologists are qualified to perform all kinds of weather alteration operations. Consequently, a college degree in meteorology dos not assure competence. Neither does experience in one field of weather modification, say snowmaking from cap clouds, guarantee that the modifier would also be competent to seed hurricanes. Testing applicants, coupled with reliance upon college credentials or practical experience, would be the most effective means of determining capability as a weather modifier.

Licensing should take into account differences among types of weather manipulation. Perhaps licenses could be limited to specific types of activities and issued only upon demonstration of competence in those areas. Also, there are differences between states and areas in the country; hence, snowmaking in the Upper Colorado River Basin is not the same kind of operation as warm fog dispersal in California or snowmaking in New England. Thus, there might be some justification for requiring licensing in each of the states where a modifier operates. It should be noted, however, that the basic principles of cloud physics do not change with political boundaries. On the balance, a national licensing system might be preferable.

In any weather alteration operation many people will be involved who need not be licensed. The truck driver, the pilot, the radar operator, the stenographer—none of these people need to have professional licenses as weather modifiers. However, where more than one person is actually involved in the modification activity, more than one person ought to be licensed. It is not enough to have one licensee fronting for the entire operation. If an individual is directly involved in modification, he should be licensed.

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cants possess a "showing of qualification in the atmospheric sciences." *Id.*

Weather modification is not the only field of professional licensing into which irrelevancies as qualifications have intruded. W. GELLHORN, INDIVIDUAL FREEDOM AND GOVERNMENTAL RESTRAINT 125-40 (1956).

116 *E.g.*, CAL. WATER CODE § 404(b) (West 1956). The rainmaking statute of Idaho purports on its face only to require registration of "producers of artificial rainfall." IDAHO CODE ANN. § 22-3201 (1968).

Operational Regulation

In several states operational permits are required in addition to or in lieu of professional licensing.[117] The Arizona law, for example, has a section reading:

> Any individual or corporation who proposes to operate weather control or cloud modification projects or attempts to artificially induce rainfall shall, before engaging in any such operation, make application to the state land department for a license to engage in the particular weather control or cloud modification operation contemplated.[118]

This provision does not, however, undertake to define what constitutes a "weather control" project. Air conditioning the mall of a large shopping center is one species of weather control with which the law may not be concerned. But what of fog dissipation and smudging citrus groves? The legislature likely did not even consider the possibility of fog in Arizona; and it specifically exempted from the law use of weather modification equipment "owned by the owner, lessee or licensee of real property used for agricultural purposes on the property for his exclusive benefit."[119] The problem nevertheless remains: demanding operational permits without adequate definition of what constitutes "weather modification" leaves areas of uncertainty. Statutes should spell out whether they embrace unintentional modification and what types of deliberate efforts to change the weather are covered.

Operational permit requirements pose many issues similar to those raised in matters of professional licensing. Are projects merely registered, or do agencies have the power to pass on whether they will or will not be undertaken? What should be the criteria for issuance of such permits? What procedure should be followed to determine whether applicants meet the requirements for receipt of a permit? Should all types of weather modification activities be handled in the same fashion, or should seeding for some purposes be treated differently? Some laws allow for shortcut procedures in emergencies.[120] Fog modification permits might well be handled by an agency other than the body dispensing rainmaking authorization.

One of the reasons for requiring an operational permit is to give the general public notice of impending modification activities and to provide persons affected an opportunity to present their views before a decision is made concerning whether an operation conforms to legal requirements. Notice requirements in most states speak in terms of notice by publica-

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117 *See* LEGAL GUIDELINES, *supra* note 94, at 20-25, for chart on permit requirements.

118 ARIZ. REV. STAT. ANN. § 45-2402 (1956).

119 ARIZ. REV. STAT. ANN. § 45-2406 (1956).

120 *E.g.*, CAL. WATER CODE §§ 413, 413.5 (West 1956); MONT. REV. CODES ANN. § 89-314 (Supp. 1969) (exemption only from fees); PA. STAT. ANN. tit. 3, § 9 (Supp. 1969) (exemption only from publication requirement).

tion.[121] This is not always an effective means for informing the public. Some states have statutory provisions calling for hearings at which the public can present its views.[122] Full scale hearings on cloud seeding permit applications could become onerous both to the applicants and the agencies. Nevertheless there should be procedures through which the positions of persons other than permit applicants can be received and considered.

Some of the state agencies require reporting weather modification activities.[123] Reporting is one means of ascertaining compliance with permit and professional licensing requirements. It also provides for acquisition of information which might be helpful in furthering technological development. States vary as to what information must be reported and as to whether the modifier must evaluate his project. A line should be drawn somewhere between seeking too little information and burdening modifiers by demanding reporting of unnecessary information.

Since the repeal of a requirement for centralized reporting on the federal level,[124] state reporting requirements are filling a void in the field of weather modification regulation. Reporting to both state and federal officials could become burdensome; but even if the federal requirement is reimposed, state regulatory agencies have a legitimate interest in receiving reports of activities. Information obtained through reporting helps keep them advised about compliance with state law.

Contractual Control

Administrative regulation of weather manipulation can be accomplished through the power of the purse. A state, acting through appropriate agencies, can become the proprietor of weather modification operations. State proprietorship could be organized to use government employees to operate projects or to hire contractors to run them. Should government personnel perform cloud seeding, the state (or its subdivisions) as proprietor would control such in-house efforts. To the extent that state and local governments would finance weather modification activities performed by outside groups, they would be able to exercise power over the activities of such organizations. Within certain constitutional bounds, they could set the conditions of employment of their contractors;[125] and

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[121] *E.g.*, CAL. WATER CODE §§ 407-10 (Supp. 1968); FLA. STAT. ANN. §§ 373.331 to .371 (1960); NEV. REV. STAT. §§ 244.160 to .180 (1967); WASH. REV. CODE ANN. §§ 43.37.120 to .140 (1965).

[122] *E.g.*, MASS. ANN. LAWS ch. 6, § 72 (1966); MONT. REV. CODES ANN. § 89-318(6) (Supp. 1969).

[123] *See* LEGAL GUIDELINES, *supra* note 94, at 58-61, for chart on reporting requirements.

[124] Formerly the NSF required reporting. 45 C.F.R. §§ 635.1-.7 (1968), *issuance authorized by* 42 U.S.C. § 1862 (1964). But by virtue of the Act of July 18, 1968, Pub. L. No. 90-407, § 11, 82 Stat. 360, the Foundation's authority to require reporting was repealed. For the new regulations, see 33 Fed. Reg. 12654 (1968).

[125] Federal procurement law is filled with statutory and administrative provisions

they could use their very considerable powers of financial persuasion to see that the conditions were met.[126]

The laws of some jurisdictions provide specifically for participation of state agencies in weather alteration activities. For example, the Nevada Department of Conservation and Natural Resources "may conduct weather modification research programs."[127] And in New Hampshire any "agency of the state may, with the approval of the governor and council . . . engage in . . . weather modification . . . ."[128] In other states interpretation of powers given to state departments may permit them to employ weather modifiers to help them perform their statutory duties. Thus, an aeronautics commission may have power to hire meteorologists to clear airport fogs if it possesses authority to establish means of reducing hazards to airport operations.[129]

State regulation of weather modification by contract has certain advantages:

(1) It is comparatively easy to administer;
(2) It provides a source of funds; and
(3) It makes possible a means of enforcing payment for receipt of weather modification benefits.

When a governmental entity sponsors weather modification, only a limited number of persons from the bureaucracy are required to fill overtly regulatory roles. The regulation will be more or less automatic on a sort of a "you do business with us our way" basis. Men who do business with the government will usually "turn square corners."[130]

Payment for state-supported weather modification can come from the general state treasury or from special funds. The states can delegate their taxing power and borrowing power to agencies or subdivisions. As illustrations of this, there are the provisions in the Dakotas for mill levies by counties,[131] and portions of the Nebraska statute give bonding and taxing powers to weather modification districts.[132] Existing state and local entities may also have access to such governmental powers. This makes it possible for them to accumulate larger sums of money to expend for

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which set forth contract provisions placing limits on contractors. *See, e.g.*, such "boilerplate" provisions as the disputes clause, 31 C.F.R. § 1-7.101-12; termination clause, 41 C.F.R. § 1-8.704-1(a); contingent upon appropriations clause, 41 U.S.C. §§ 11, 12; renegotiation clause, 50 App. U.S.C. §§ 1191-1233 (Supp. 1967); and equal opportunity clause, 41 C.F.R. § 1-12.803-2.

126 It is noteworthy that since the repeal of NSF's power to require reporting most of the modifiers who have voluntarily reported have been federal contractors. Interview with Peter H. Wycoff, Program Director for Weather Modification, NSF, Jan. 28, 1969.

127 NEV. REV. STAT. ANN. § 544.030 (1967).

128 N.H. REV. STAT. ANN. § 432.1 (1968).

129 Note the parallel reasoning in 25 CALIF. ATT'Y GEN. REP. 164 (1955).

130 Rock Island, A. & L.R.R. v. United States, 254 U.S. 141, 143 (1920).

131 N.D. CENT. CODE §§ 2-07-06 to -07 (Supp. 1969); S.D. COMPILED LAWS ANN. § 10-12-18 (Supp. 1969).

132 NEB. REV. STAT. § 2-2444 (Supp. 1967).

weather modification activities than may be possible through private means. However, it should be kept in mind that private organizations can and have raised adequate funds for some projects. Public utilities have financed snowmaking,[133] and airlines have sponsored fog dispersal.[134]

Most beneficiaries of cloud seeding will bear at least part of the cost of state programs. Hail suppression work in South Dakota has been paid for by mill levy upon the property owners in the area benefited.[135] Funds for payment of fog modifiers by airport authorities can be raised through use of the normal landing fees or fuel tax exactions. Customers of irrigation districts can be required to pay for incremental water produced by snowmaking.

There is, however, the problem of the freeloaders.[136] Persons outside those counties which raise funds for hail modification might also benefit from expenditure of the funds. Moreover, even those who pay might be receiving a partial subsidy. Weather modification has been heavily subsidized through governmental payments for experimentation and development.[137] Of course, in response to this, it might be noted that the community as a whole ought to bear part of the cost because the public at large has benefited.

Allocation of Benefits and Redistribution of Losses

The operational permit system brings about some allocation of benefits from weather modification activities. Exercise of administrative discretion in issuing or denying permits acts as a device for granting or withholding the potential benefits from storm modification. However, the problem is more complicated in connection with precipitation management. This is particularly true of weather shifts designed to increase runoff. The mere grant of a permit to seed clouds does not necessarily guarantee to a downstream water user on whose behalf the weather modification is undertaken that he will receive any benefits at all. He may have to contend with upstream riparians for the right to use the water.

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133 *See, e.g.*, Eberly, *Weather Modification and the Operations of an Electric Power Utility: The Pacific Gas and Electric Company's Test Program*, in HUMAN DIMENSIONS OF WEATHER MODIFICATION 209 (W. Sewell ed. 1966).

134 Beckwith, *Impacts of Weather on the Airline Industry: The Value of Fog Dispersal Programs*, in HUMAN DIMENSIONS OF WEATHER MODIFICATION 195 (W. Sewell ed. 1966).

135 E. BOYD, SUMMARY OF CLOUD SEEDING OPERATIONS IN SOUTH DAKOTA DURING 1968, 10, 11, 13 (1969). *See also* THE FARMER, Aug. 3, 1968, at 28, 37.

136 Financing problems have brought a halt to many seeding operations. *See, e.g.*, G. PAVELIS, AGRICULTURAL IMPLICATIONS OF WEATHER CONTROL 8-13 (1955).

137 Projected federal financing is set forth annually in the reports of the Interdepartmental Committee for Atmospheric Sciences (ICAS), which reports to the Federal Council for Science and Technology, an agency within the Executive Office of the President. ICAS is composed of representatives of each of the federal agencies which have an interest in weather modification. The most exhaustive ICAS report is H. NEWELL, A RECOMMENDED NATIONAL PROGRAM IN WEATHER MODIFICATION (ICAS Report No. 10a, Nov. 1966).

Many states have adopted a permit system for distribution of ground and surface water resources.[138] These existing water resources administrative agencies may well be authorized under their present legislative charters to allocate runoff from weather modification undertakings. A serious problem in the fair distribution of such waters would be measurement. When the water allocation agency is not the same state board as the weather modification agency, there exists a potential for conflict between the two groups. In some jurisdictions, however, administrative power governing weather modification is lodged in the state agency already empowered to allocate other water resources.[139] This solution is quite sensible in the area of precipitation management. However, water resources agencies may not be the proper place for administrative power to grant permits for such things as storm modification.

State administrative agencies could also be given power to determine losses caused by weather manipulation operations and to order payment of damages or suspension of operations. Legislation could provide a framework on which they would judge whether losses are compensable. They could consider whether the modifier fell below the standard of professional care, whether the cloud seeding caused the losses complained of, and the extent of damages brought about by the modification activities. Expert administrators well-versed in the technology could render justice in an effective manner.

Pennsylvania's most recent weather modification statute (which has been copied by West Virginia) provides for administrative control over damage compensation. It stipulates that:

> Any licensee who caused a drought as determined by the board shall compensate farmers for damages. Any licensee who by causing heavy downpours or storms which cause damage to lands as determined by the board shall compensate farmers and property owners for such damages.[140]

Although this statute is ambiguous it has the germ of a good idea. Weather modification boards could be authorized to hear cases between private individuals or between the government and private claimants. A multitude of existing state boards in other areas of economic regulation possess similar powers and perform their functions effectively.

THE ROLE OF STATES IN REGULATION OF WEATHER MODIFICATION

Regulation of weather modification may be the kind of undertaking which the federal government can perform more effectively than can

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138 *See* Hutchins, *supra* note 40, at §§ 20-25.

139 *E.g.*, Arizona, California, Montana, Texas, and Washington.

140 PA. STAT. ANN. tit. 3, § 1114 (Supp. 1969); W. VA. CODE ANN. § 29-2B-13 (Supp. 1969).

state governments. The federal government acting either as proprietor or regulator of weather alteration possesses many advantages the states do not. In spite of this, we are now in a situation where the federal government has talked a lot about weather modification[141] but has done little by way of regulation.[142] The states, on the other hand, have enacted regulatory measures. Several states now have almost 20 years of experience in regulating weather modification.[143] Others, while their regulatory programs are comparatively new, have entered the field and are gaining useful insight into regulatory problems. There are advantages as well as disadvantages in state weather modification control.

STATE ADVANTAGES

One of the benefits of our federalized system of government is that the experience of each of the states is available for use as a model by the other states. An experiment in regulation in one state which succeeds can be copied in other states; a failure will warn other states against attempting to reach the same goals by the same means. States can undertake a variety of programs differing from state to state, and from all this mix, the best can be selected.[144]

There are parts of the country in which there is no present need for regulation of weather modification quite simply because no weather modification is taking place. States in such areas have not enacted legislation. On the other hand, it is in those jurisdictions where modifiers are the most active that we find the most active regulators.[145]

State regulatory agencies have at least the potential of being closer to those persons subjected to regulation than do federal agencies. Also, they are more susceptible to influence from the public at large. Thus, the voice of those affected by regulation may be more readily felt when regulation is undertaken on the state level.

STATE DISADVANTAGES

The principal disadvantages of regulating weather modification at the state level are those imposed by nature. Cloud systems recognize no state boundaries. Storms skip willy-nilly from state to state. Precipita-

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141 For a massive examination of the federal scene, see H. LAMBRIGHT, WEATHER MODIFICATION: THE POLITICS OF AN EMERGENT TECHNOLOGY (1969) (4 vols.). *See also* Lambright, *Weather Modification: The Politics of An Emergent Technology*, in PROCEEDINGS OF SECOND NAT'L CONF. ON WEATHER MODIFICATION 310 (1970).

142 At present there is no federal weather modification legislation in force.

143 *E.g.*, California and Colorado.

144 Elements of the California law appear in the Texas and Montana statutes. West Virginia unfortunately copied the Pennsylvania law.

145 There is justification for diversity in pollution control. Morison, *State and Local Regulation of Pollution*, 3 NAT. RES. L. 47 (1970). The same may be said for weather modification regulation.

tion and runoff ignore political boundaries. The consequence is that regulation by individual jurisdictions can only begin to cope with problems which are interstate in character.

There are also political disadvantages in state regulation. State legislatures are susceptible to lobbying. Unfortunately, in at least three states the legislature has responded to pressure with enactment of laws designed to end weather modification. Maryland for several years has had on its books an outright prohibition of weather manipulation within its boundaries.[146] Pennsylvania and West Virginia have statutes which are hostile to weather modification. Indeed, they flatly prohibit lightning suppression.[147] Moreover, they establish high financial responsibility requirements and authorize the imposition of very severe penalties for violations of the provisions of the acts.[148]

OPTIONS

Control of weather modification need not necessarily be accomplished in any particular manner. The various options available each have their strengths and weaknesses. Selection of one over the others might result in greater advances in the field or might hinder development; but no matter which option comes into being, it is quite likely that scientific, rather than legal, considerations will dictate advancement.

Federal Preemption

It is possible that the federal government may completely preempt the field of weather alteration legal control. This would, of course, minimize the problems of state boundaries, of coordination with states, and of conflicts among the states. It is, however, the kind of solution which may have little political appeal. Some role is likely to be reserved for the states.

Federal-State Coordination and Cooperation in Regulation

Most regulatory programs carried out primarily by the federal government have not been the sort that have preempted the field; rather, the states have been left a role sometimes large, sometimes small. Thus, in regulation of transportation, labor relations, and communications, the states have important regulatory powers even though there is federal primacy.

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146 One Maryland provision expired by its terms on September 1, 1967. It became effective on March 30, 1965. MD. ANN. CODE art. 66C, § 110A (1967). A subsequent prohibition was effective from July 1, 1968 to September 1, 1969. MD. ANN. CODE art. 66C, § 110A (Supp. 1968). The present prohibition extends to September 1, 1971. MD. ANN. CODE art. 66C, § 110A (Supp. 1969).

147 PA. STAT. ANN. tit. 3, § 1115(b) (Supp. 1969); W. VA. CODE ANN. § 29-2B-14(b) (Supp. 1969).

148 PA. STAT. ANN. tit. 3, § 1116(e) (Supp. 1969); W. VA. CODE ANN. § 29-2B-5(5) (Supp. 1969).

Should a federal weather modification agency be created, professional licensing and granting of permits could very well be entrusted to it. However, matters such as liability and property rights might be left to state determination. The federal program, in other words, need not necessarily occupy the entire field.

In many federal programs there is provision for cooperation with the states in carrying out regulation. Thus, the states are called upon to submit water pollution control standards for federal approval,[149] and state highway departments expend federal funds in construction of roads that must measure up to federal standards.[150] This kind of cooperation in regulation or operation of weather changing projects is quite possible. Currently the State of Washington is acting as a contractor with the federal government in a snowmaking project.[151] Future federal-state cooperation could follow a similar pattern.

Multi-State Regulation

a. Reciprocal Legislation

The problem of political boundaries which ignore meteorological and hydrological realities can be alleviated by states enacting reciprocal and cooperative legislation. Pennsylvania and West Virginia each have an identical provision which takes into account the law of their neighbors. It provides that nothing in their statute

> shall authorize any person to carry out a cloud seeding operation from Pennsylvania [and West Virginia] to seed in another state where such cloud seeding is prohibited.[152]

This obviously was enacted with the Maryland prohibition[153] in mind.

Colorado law stipulates that persons may not carry on weather modification operations within Colorado

> for the purpose of affecting weather in any other state which prohibits such operations to be carried on in that state for the benefit of Colorado or its inhabitants.[154]

New Mexico, whose statute followed that of Colorado, has a similar provision which obviously is a response to the Colorado enactment.[155] The New Mexico and Colorado laws are a type of negative reciprocal legislation.

States could stipulate that they would recognize licenses granted by other states, that they would permit persons authorized to seed in other

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149 33 U.S.C. § 466 (Supp. 1965).
150 23 U.S.C. §§ 101 *et seq.* (1966).
151 S. SHUMWAY, *supra* note 22.
152 PA. STAT. ANN. tit. 3, § 1115(a) (Supp. 1969); W. VA. CODE ANN. § 29-2B-13(2) (Supp. 1969).
153 *See* note 146 *supra.*
154 COLO. REV. STAT. ANN. § 151-1-11 (1963).
155 N.M. STAT. ANN. § 75-37-12 (1968).

states to bring about effects in their jurisdiction, or that they would recognize ownership of runoff in their states as vested in persons who seeded clouds in other states.

b. Interstate Compact

One possible method of overcoming the problems posed by political boundaries would be for public officials of neighboring states to make informal agreements concerning weather alteration activities that have an impact in two or more states. Regional planning agencies have been established in this fashion.[156] Such organizations are born with a minimum of red tape, but possess little power to make decisions that are binding upon all parties concerned.

A second method is the interstate compact. Through this mechanism real regulatory powers can be given to an agency whose authority crosses state lines. During an earlier period in the nation's history compacts usually related to boundary disputes. Now, however, there has been a shift toward using the interstate compact as a device to cope with problems which single states cannot and Congress will not control. Numerous interstate authorities have been created by compacts. They have come into being as the result of the irrelevancy of state boundaries to the problems arising in the area which they cross.[157]

Thus far no efforts have been made to create interstate authorities for weather modification regulation. But there are existing compacts which may have a bearing upon the legal ramifications of weather alteration. Arguments have been advanced that some compacts which allocate waters of interstate streams may be interpreted to include division of water produced by cloud seeding.[158] It might also be asserted that an agency like the Port of New York Authority has the power to engage in fog dissipation,[159] or that other interstate agencies can undertake rainmaking operations.

In the fields of both water resources management[160] and air pollution control, states have entered into compacts which could serve as models for agreements creating interstate weather modification authorities. For example, acting under the authority of the Clean Air Act of 1963 which gave congressional consent to compacts for prevention and control of air pollution and establishment of enforcement agencies,[161] Indiana and Illi-

156 See discussion in Tobin, *The Interstate Metropolitan District and Cooperative Federalism*, 36 TUL. L. REV. 67 (1961).

157 Leach, *Interstate Authorities in the United States*, 26 LAW & CONTEMP. PROB. 666-68 (1961).

158 Pierce, *Legal Aspects of Weather Modification Snowpack Augmentation in Wyoming*, 2 LAND & WATER L. REV. 273 (1967).

159 *Cf.* N.J. STAT. ANN. § 32:107 (1963).

160 *See* DOCUMENTS ON THE USE AND CONTROL OF THE WATERS OF INTERSTATE AND INTERNATIONAL STREAMS (T. Witmer ed. 1956).

161 42 U.S.C. § 1857a(c) (1964).

nois entered into a compact setting up an interstate pollution control agency with enforcement powers.[162] Its provisions could be a source of information for draftsmen of a weather modification control compact.[163]

The process of creating a compact is one in which the interests of the states involved and the nation can all be considered. Compacts are frequently compromises between the state officials of the jurisdictions negotiating them. But should the elected legislators of a state feel that the agreement does not adequately protect the interests of their constituents, they can reject the compact, since the legislature of each state possesses a veto power. Also, Congress can assert considerable influence upon the states through its power to approve or disapprove a compact.[164] And federal administrative officials have at times let it be known that federal involvement in projects is contingent upon the states reaching a compromise by compact.[165]

Although not all interstate compacts make provision for an administrative structure for their operation,[166] it is now common for compacts to create or establish the means for setting up such an interstate body. In the field of weather changing, an interstate agency could be given not only operational authority, but also regulatory and supervisory power. Such an operating authority could become unresponsive to the states which authored it, but probably could be controlled by the federal government.[167]

A drawback to use of the compact device is the possibility of inflexibility. Unless a compact so provides, a state may not be able to withdraw from the arrangement. Congress may not be competent to revoke its approval. But Congress can enact legislation conflicting with compact provisions if the agreement involves a subject about which that body can legislate.[168] That is the case with weather modification. In addition, the state and Congress could negotiate a new compact with provisions differing from those of the old one.

State Primacy of Regulation

Except for some federal proprietorship in weather modification activities, there is today state primacy of regulation of weather alteration.

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[162] ILL. REV. STAT. ch. 111½, § 240.31 (1965); IND. ANN. STAT. § 55-4621 (1965). For discussion of this compact, see *A Model Interstate Compact for the Control of Air Pollution* 4 HARV. J. LEGIS. 369 (1967).

[163] The use of compacts to aid in legal control over pollution is discussed in Weakley, *Interstate Compacts in the Law of Air and Water Pollution*, 3 NAT. RES. L. 81 (1970).

[164] Congressional power rests upon U.S. CONST. art. I, § 10, cl. 3.

[165] *See, e.g.*, Meyers, *The Colorado River*, 19 STAN. L. REV. 1, 48 (1966).

[166] Corker, *Water Rights in Interstate Streams*, in 2 WATERS AND WATER RIGHTS § 133.2 (R. Clark ed. 1967).

[167] Comment, *Congressional Supervision of Interstate Compacts*, 75 YALE L.J. 1416 (1966).

[168] Corker, *supra* note 166, at § 133.4.

There is no doubt that this system has its defects, but the fact that we have used it as our legal framework for weather changing testifies to its advantages. It is fair to say that this system in general has not unduly hampered the growth of weather modification. Unfortunately, neither has it fostered the field; and that is what is needed.