

The art of weather modification is an ancient one, as ancient as man's desire to control the weather. Man prayed to the gods for good weather, and for protection against bad weather. He chanted and danced; he smoked special pipes; he shot arrows at the clouds; he hung fish around tribesmen's necks; he sacrificed virgins; he even buried beloved ones neck-deep in sand with the hope of receiving the Almighty's tears of sympathy. He resorted to medicine-

men and their magic stones. He devised rainmaking ceremonies, as well as rain-stopping ceremonies in case the former proved too successful.

In section one, this article will address four fundamental questions necessary for understanding weather modification in international law: (1) What is meant by weather modification; (2) To what end is the weather modified; (3) How is the weather modified; and (4) What is the present state of the art. This general background will provide the canvas for a more detailed painting of weather modification and international law.

In section two, the entry of weather modification into the international domain will be examined to justify development of an international law of weather modification. The presentation of hypothetical cases capable of causing international disputes will be coupled with the assertion that the state of the art of weather modification, as evidenced in US cases, is not yet congenial to the establishment of cause and effect in law.

Section three will attempt to pinpoint the substance and scope of an international law of weather modification. The essential question here will be to examine the extent of States' rights to modify the weather. In this respect an examination of the concepts of *ad coelum*, and *ferae naturae* as the bases for States' claims to ownership, and usufructory rights in the corpus of the atmosphere will be presented against private and public law backgrounds. In international law analogies taken from riparian and air pollution law will be applied to weather modification.

Section four will ask whether international law is capable of resolving weather modification disputes. To offer a two-tiered answer to such a question, this section will look for where the law of weather modification is buried. In this regard an examination of case law and "soft" law will reveal that the

# An International Law of Weather Modification

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principle of *sic utere tuo ut alterum non laedas* is a duty of self-restraint attached to States' rights to modify the weather as a matter of customary international law. It is submitted that, in principle, international law is capable of resolution of weather modification disputes; this is limited, in fact, by the inability to establish in law a link between causation (in the acts of a modifier) and effect (unwanted injury to another).

## UNDERSTANDING WEATHER MODIFICATION

### 1. *Definition*

Weather modification activity is taken to mean that which *deliberately* produces artificial changes in the composition, behavior, or dynamics of the atmosphere.<sup>1</sup> The operative constituent of this definition is *deliberateness* which is attached to weather modification activities such as cloud seeding, hail and lightning suppression, fog dispersal, and hurricane diversion and dispersal. The attribute of *deliberateness*, hence, precludes a host of human activities that are shown to *inadvertantly* produce artificial changes in the composition, behavior, or dynamics of the atmosphere: e.g., deforestation, agriculture, urbanization, burning of fossil-fuels, transportation, and energy production.

### 2. *Weather Modification: How?*

a) *Deliberate Modification* Some description of cloud physics is helpful to comprehension of weather modification; all of the aforementioned modification activities involve destabilization of clouds' microstructure.

Clouds are formed when air containing water vapor rises, expands under the lower pressures at higher altitudes, and cools until the temperature falls below the dew point and air becomes saturated with vapor. The excess vapor then condenses onto some of the wide variety of airborne particles present in the atmosphere, such as salt, dust, or chemicals. A small fraction of these particles readily absorb or retain moisture and promote condensation.

Weather modification techniques aim to destabilize the natural microstructure of the clouds by adding (i.e., seeding) condensation nuclei, ice nuclei, a change in temperature, or by increasing the droplet size.

The temperatures of clouds, above or below the freezing point of water, dictate different procedures for modification.<sup>2</sup> Warm clouds, contributing to

1. This definition of the United State National Academy of Sciences (1966 Report) is incorporated into Article 1 (a) of Canada-US Agreement on the Exchange of Information on Weather Modification Activities, 26 March 1975, reprinted in 14 *International Legal Materials* 589. (May 1975).

2. Information about seeding warm and cold clouds, as well as an excellent review of the science of weather modification, is presented in A. Gregory McKenzie, "Weather Modification: A Review of the Science and the Law," 6 *Environmental Law* 387, (1975) (Hereinafter cited as McKenzie).

most ground fog, are said to be modifiable by addition of condensation nuclei; addition of water droplets; or by an increase in the collision frequency of the droplets. Cold clouds, prime candidates for precipitation enhancement, are said to be modifiable either by the injection of crushed frozen carbon dioxide (dry ice) directly into the clouds, enhancing the ice-crystal population, or by the introduction of a particle into the cloud which will closely approximate the characteristics of ice crystals.

The active agents used in weather modification<sup>3</sup> include silver iodide, dry ice, polyelectrolytes, propane, charged water droplets, lithium chloride, hexadecanol, 1-5-dihydroxynaphthalene, and combinations of silver iodide with other liquids or solids. Aside from the above, chaff (metallic fibers), dispensed from aircraft, is used in lightning suppression, compressed air in cold fog modification (experimentally), and corona discharge in warm fog suppression programs. Due to its crystalline characteristics, similar to ice, silver iodide is said to be the most satisfactory chemical substance.<sup>4</sup> Furthermore, silver iodide can be distributed by ground-based generators at a lower cost than by airborne seeding.<sup>5</sup>

Deliberate weather modification is not limited to rainmaking or rain-stopping, the former having received more publicity. Other forms of modification include hail and lightning suppression, hurricane diversion, and fog dissipation.<sup>6</sup> In hail suppression, the clouds are over-seeded with silver iodide. These condensation nuclei then begin to compete with the clouds' natural ice crystals, thus decreasing the available supply of super-cooled water. Such competition presumably prevents hailstones from growing to a size that can survive the fall without melting. In lightning suppression, it is hoped that seeding clouds would prevent clouds' rapid increase in height, size, and electrical charge. In hurricane diversion, one seeds clouds so as to decrease wind intensity; in fog dissipation, the primary concern is to disperse fog by precipitation.

*b) Inadvertant Modification.* While deliberate weather modification involves activities intentionally destabilizing the microstructure of weather, many human activities inadvertently affect the micro- or macrostructure of weather

3. Information about the active agents is taken from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Environmental Monitoring and Prediction, *Weather Modification Activities for Calendar Year 1975*. Part I: Summary of Weather Modification Reporting Program. Rockville, MD: Environmental Modification Office, June 1976. (Herein cited as EMO) p. 11.

4. In 1975, silver iodide generators were used in 15 ground-based projects, and 14 aircraft seeding activities in the US.

5. McKenzie, *supra* note 2, at 394.

6. Information about hail and lightning suppression, hurricane diversion, and fog dissipation is taken from McKenzie, *supra* note 2, at 395-397.

phenomena. Deforestation and agriculture have been shown to affect the weather as much as air pollution arising out of urbanization and emissions from transportation and other forms of energy utilization. For example, weather changes result from deforestation by altering the amount of vegetation; this increases the quantity of dust particles in the air, increases the albedo (the reflection of sunlight by airborne particles), and, to that extent, reduces the efficiency of the transpiration process of the remaining plants. Deforestation also tends to alter wind patterns across the land.<sup>7</sup>

The harm done to the environment by urbanization and associated features, such as transportation and energy production, cannot be dismissed; unintended by-products of these activities not only pollute the environment, but also destabilize naturally-occurring weather phenomena. The witty speculation that Buffalo's 1976-77 winter was brought about by industrial pollution may very well be conclusively demonstrated by science.

### 3. *Weather Modification: Why?*

The answer to "why one deliberately modifies the weather" rests amidst a wide variety of beneficial applications of the science. One uses the term "beneficial" in a loose sense for, obviously, weather modification can be used to inflict harm deliberately on another, e.g., as a weapon of war. On the other hand, otherwise beneficial modification can bring unintended damage to those relying on non-modified weather, or upset the ecological order to an extent irreparable. This section will speak of the peaceful uses of weather modification, and its use as a weapon of war.

*a) Peaceful Uses.* The beneficial contribution of weather modification, in its peaceful application, is to minimize the detrimental effects of naturally-occurring weather phenomena on life and property. Tornados killed an average of 230 people a year in the US between 1916 and 1952.<sup>8</sup> The Moroto typhoon on September 21, 1934, killed more than 3,000 people and destroyed 45,600 houses in Japan.<sup>9</sup> On September 21, 1935, a hurricane with winds reaching 250 mph, the highest ever recorded, hit the Florida Keys and killed 408 people.<sup>10</sup> Thirty-five years earlier, a hurricane had ripped through Galveston, Texas, killing 6,000 people.<sup>11</sup> In 1972, Hurricane Agnes, striking the Atlantic coast

7. *Id.* at 398.

8. Office of Research and Development of the Central Intelligence Agency, "A Study of Climatological Research as it Pertains to Intelligence Problems," (August 1974), in the Impact Team, *The Weather Conspiracy*. New York: Heron House Publishing International Ltd., 1977. Appendix I, at 151.

9. *Id.* at 153.

10. *Id.* at 148.

11. *Id.*

between June 19 and 22, disinterred 550 bodies from a cemetery and deposited them, some still in coffins, three miles away.<sup>12</sup> In terms of dollars, damages resulting from either phenomena are not negligible. In the US alone, from 1965 to 1970, the average annual damage due to hurricanes stood at \$500 million.<sup>13</sup> A 1971 study of 41 airports found that interruptions of service because of fog cost airlines and airports \$15 million; the cost to passengers was an additional \$28 million.<sup>14</sup> Agricultural losses due to hail average some \$300 million annually.<sup>15</sup>

In view of the above, the *raison d'être* of peaceful application of weather modification hardly needs reiteration. However, it must be borne in mind that just as natural phenomena have social and economic impact on man, weather modification cannot be devoid of social and economic consequences either.<sup>16</sup>

*b) Weapon-of-War Uses.* The fundamental objective of the peaceful application of weather modification techniques is to abate or to avoid loss of life or property resulting from the weather. It can, however, be applied as a weapon of war,<sup>17</sup> and such uses are hardly dependent on future technological developments. During the Vietnam War, the US Department of Defense spent some \$40 million on a seven-year cloud-seeding program, in an attempt to waterlog the Ho Chi Minh trail, thereby hindering enemy infiltration into South Vietnam.<sup>18</sup>

The prohibition of weather modification as a weapon of war has become a concern of the US, the USSR, and the United Nations.<sup>19</sup>

12. *Id.*

13. Robert G. Fleagle, *et al*, *Weather Modification in the Public Interest*. Seattle: American Meteorological Society and University of Washington Press, 1974, p. 6.

14. *Id* at 25. The annual loss to airlines because of fog was estimated at \$75 million.

15. *Id.*

16. For a brief discussion of the social and economic impact of weather modification see Robert G. Fleagle, *et al*, *supra* note 13 at 31-40. Also see James A. Crutchfield, "Economic Evaluation of Weather Modification," Robert G. Fleagle, ed., *Weather Modification: Science and Public Policy*. Seattle and London: University of Washington Press, 1969, at 105.

17. For a discussion of weather warfare see Ray Jay Davis, "Weather Warfare: Law and Policy," 14 *Arizona Law Review* 659 (1972).

18. For details see Deborah Shapley, "Weather Warfare: Pentagon Concedes 7-Year Vietnam Effort," 184 *Science*. 7 June 1974.

19. On July 11, 1973, the US Senate passed Resolution 71 (Cong. Rec., 93rd Cong., 1st Sess., S 13101-02) calling upon the US to enter into agreement with the members of the UN, prohibiting the use of environmental modification techniques as a weapon of war. On July 3, 1974, the US and the Soviet Union issued a joint statement in Moscow, pledging to undertake "most effective measures possible to overcome the dangers of the use of environmental modification techniques for military purposes." On August 7, 1974, the USSR requested the inclusion of the matter on the agenda of the 29th session of the General Assembly. On September 24, 1974, the US House of Representatives opened hearings on a House resolution containing a similar treaty proposal as the

#### 4. *Weather Modification: The State of the Art*

After more than three decades, the theory of weather modification has advanced rapidly. Despite widespread experimental and operational programs, the technique is plagued by limitations.

The following examples may elucidate: little success has been realized in the modification of warm clouds.<sup>20</sup> In theory, upsetting cold cloud stability involves only the introduction of more ice crystals than would naturally occur. Such seeding can be done by injecting dry ice, or by introducing ice crystal substitutes into cloud systems. The former alternative is limited because of the cost of airborne seeding; the latter, using silver iodide as ice crystal substitutes is, more widely used. However, ground-based delivery of silver iodide is limited because the seeder is unable to monitor the number of silver iodide particles which actually infiltrate the cloud.<sup>21</sup> In lightning suppression, some evidence indicates that seeding a thundercloud may actually increase lightning strikes.<sup>22</sup>

### INTERNATIONAL LAW AND WEATHER MODIFICATION

The question must be raised as to why weather modification should be a subject of international law. The answer can be explored on two levels: on the one hand, issues raised by weather modification are of international character. By 1974, some sixty States had experimented with it.<sup>23</sup> On the other hand, dispute arising from weather modification must be resolved by recourse to international law. No State can modify the weather for its own purposes without affecting other States.

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Senate Resolution 72 (*Weather Modification as a Weapon of War*, hearings before the Subcommittee on International Organizations and Movements, Committee on Foreign Affairs, US House of Representatives, on H.R. 116 and 329, 93rd Cong., 2nd Sess., September 24, 1974). In 1976 the Working Group of the Conference of the Committee on Disarmament of the UN (CCD), based on the joint US/USSR drafts (UN General Assembly *Official Records*, 30th Sess., Supp., No. 27, A/10027, Docs. CCD 471 and CCD 472) prepared a draft convention on the "prohibition of military or any other hostile use of environmental modification techniques" (Report of CCD, Volume I, General Assembly *Official Records*, 31st Sess., Supp., No. 27, A/31/27, Volume I, Annex I).

On May 18, 1977, the US Secretary of State and the Soviet Minister of Foreign Affairs signed a document in Geneva banning weather modification as a weapon of war.

20. McKenzie, *supra* note 2, at 393.

21. *Id.* at 394.

22. McKenzie, *supra* note 2, at 396.

23. Those countries include: Argentina, Australia, Canada, France, Italy, India, Iran, Israel, Japan, Kenya, PRC, Phillipines, Rhodesia, South Africa, South Korea, Switzerland, Tunisia, UK, USSR, US, West Germany, and Zaire. For details of activities in Canada, India, Kenya, PRC, Rhodesia, South Africa, USSR, US, and Zaire see EMO, *supra* note 3, Part I and Part II: Selected Domestic and Foreign Weather Modification Information.

The role of international law, as addressed in this article, is to settle one of two kinds of situations of immediate concern to States. First, a State may undertake weather modification within its jurisdiction or control, in the *res communis*, or in the *res nullius*, that would prove to have effects in another State. Second, a State may undertake weather modification within its jurisdiction or control, or in the *res communis*, that would prove to have effects in the *res communis* in which other States nevertheless have a vested interest. This article will restrict itself to the legal framework within which transboundary effects of weather modification, undertaken by one State and felt in another, can be settled.

Having espoused the belief that "no country can afford to be indifferent to extensive weather control activities, no matter where or by whom they are undertaken,"<sup>24</sup> it is incumbent upon public international law not only to regulate the standards of weather modification, whatever the activity and the extent of such activity, but also to provide legal principles capable of resolving future disputes. Although weather modification is currently more a concern of municipal law, public or private in a limited number of States, it cannot be denied that many matters presently reserved to municipal law "will become proper subjects of international law which may gradually come to encompass the whole range of regulated human activities."<sup>25</sup> Weather modification has already entered the domain of international concern.<sup>26</sup>

It appears highly appropriate to give examples of disputes which could arise in international law as a result of weather modification:

- Cloud Y that naturally passes through States A and B is seeded by A while passing through A's airspace, for example, enhancing precipitation on A. State B, the natural recipient of Cloud Y's rain, is precluded from receiving its normal rainfall.
- State A seeds a hurricane that is believed to cause damage in State A. The hurricane changes course and, moving through State B, causes damage in State B.

24. Ivan A. Vlasic, "The Relevance of International Law to Emerging Trends in the Law of Outer Space," Richard A. Falk & Cyril E. Black, eds., *The Future of International Legal Order*, Vol. II: Wealth and Resources. Princeton, N.J.: Princeton University Press, 1970, at 265, pp. 302-3.

25. Wolfgang Friedmann, *The Changing Structure of International Law*. New York: Columbia University Press, 1964. p. 152.

26. See Howard J. Taubenfeld, "Weather Modification and Control: Some International Legal Implications," 55 *California Law Review* 493 (1967). Also, see Rita F. Taubenfeld & Howard J. Taubenfeld, "Some International Implications of Weather Modification Activities," 23 *International Organization* 808 (1969). Also, see Edith Brown Weiss., "International Responses to Weather Modification," 29 *International Organization* 805 (1975).

27. Lowell Ponte, "The Risks of Weather Tempering," *The National Observer*, 2 April 1977. p. 1

- State A suppresses a hailstorm. Flash floods occur in A, cross the border, and cause damage in State B.
- State A begins hail suppression. The storm accelerates entering State B, causing flash floods.

The above permutations may be labeled *acts of commission*. There are, however, *acts of omission*, for example:

-Hurricanes occur in a consistent pattern through States A and B. State A decides, for its own purposes, to divert, or disperse, them so as to minimize their damaging potential along the path located in its jurisdiction. State B, the lower riparian, relying on A's consistent behavior, realizes that the area that was once on the path of the hurricanes can now be made habitable and cultivated. State A, for its own purposes, abandons the hurricane project. Hurricanes resume their original path, causing extensive damage to the new settlement in State B.

There have been several situations where weather modifications undertaken by one State have been objected to by downwind States. Israel and Rhodesia have been accused of rain-rustling by their hostile neighbours. In 1973, Honduras and El Salvador accused the US of stealing their rain by seeding hurricanes off the coast of Florida.<sup>27</sup> It must be noted that the extent of dispute over weather modification is not confined to cases of deprivation of or unwanted subjugation to weather activity. The agents used for modification may become the center of a dispute, with aggrieved parties objecting to polluting affects of those agents.

In matters involving weather modification, proving cause and effect is practically impossible.<sup>28</sup> It is advanced that the major limitation in all cloud modification activities is "the inability to maintain controlled conditions and isolate artificially generated results from the naturally occurring fluctuations."<sup>29</sup> The scientific inability to establish cause and effect poses serious legal questions of causation and proof. In the late 1940's, science was thought to have created a legal vacuum. It is submitted that the vacuum is not in the law, but rather in the very same science that created that vacuum. In bridging the gap between an act of a modifier, and the loss suffered by those injured, one cannot expect law to prove a connection between acts done and consequences suffered. Science must demonstrate such a connection. Only then would law step in to provide remedy to a victim. That is not only desirable as a basis for assessing damages after the fact, but also for predicting irreparable or unacceptable damage for injunctive purposes.

28. The Impact Team, *supra* note 8, at 75.

29. McKenzie, *supra* note 2, at 397.



Litigation involving weather modification is by no means new. In 1916, Charles Hatfield, hired by the City of San Diego, engaged in a 27 day chemical-mixing ritual. On the 28th day, 2.5 inches of rainfall washed out a dam, causing loss of life and property. A \$1,000,000 suit was filed against the city. Hatfield took to the road, and the city succeeded in having the case dismissed on grounds of *act of God*.<sup>30</sup>

There has been no dispute involving weather modification in international law. Should one arise, the plaintiff, in the person of a State, would carry the burden of proof, linking cause with effect. The science of weather modification, as presently understood, would not provide the plaintiff with credible evidence. Consider the following:

It is 1973, and drought is ravaging Central America. Honduras and El Salvador accuse the United States of stealing their rainfall by weakening hurricanes that traditionally bring smaller rainstorms into the Gulf of Mexico and Caribbean Sea, hence to Central America. We have seeded no hurricanes since 1971, the United States replies, but even if we had, there is no proof that the seeding had any effect or that Central America lost a single drop of rain. Moreover, look at North Africa, where in 1973 more than 200,000 people were dying in the Sahel drought. The Sahelian and Central American droughts probably had a common cause; the expanding mass of cold air over the North Pole region that has been subtly pushing all the weather patterns of the Northern Hemisphere toward the Equator for the past 30 years. The defense rests.<sup>31</sup>

One need not look to scenarios such as this one to see the difficult position of a plaintiff in proving that the defendant's actions caused the former damage. A brief examination of US cases<sup>32</sup> involving weather modification may illustrate science's link with the process of rendering justice. In 1950, a plaintiff petitioned to have rain-making activities banned in the area of his summer resort. The Court permitted cloud-seeding even if the plaintiff were injured, holding that the possibility of damage from the modification activities was

30. See "Who owns the Clouds?" 1 *Stanford Law Review* 43 (Nov. 1948), at 43-44. Events that are "not of human origin and not controllable by human power" are commonly referred to as an *act of God*. They have traditionally included lightning, storms, perils of the sea, earthquakes, inundations, sudden death, and illness. For reference to American and English cases applying the concept, see Vaughn C. Ball, "Shaping the Law of Weather Control," 58 *The Yale Law Journal* 213 (Jan. 1949).

31. Pontc, *supra* note 33.

32. Discussion of cases from 1950-1968 is taken from Fleagle, *et al.*, *supra* note 13, at 43-45; and Robert S. Hunt, "Weather Modification and the Law," Fleagle, ed., *supra* note 16, at 125-128. Post-1968 cases are taken from EMO, Part II, *supra* note 23, at 44-45.

speculative.<sup>33</sup> In a 1954 case a plaintiff could not prove to the satisfaction of an Oklahoma jury that property damages he incurred were due to defendant's cloud-seeding operations.<sup>34</sup> In 1956, a Washington court, after granting a temporary injunction banning hail suppression for one season, heard expert testimony and refused to make the injunction permanent because it was not convinced that cloud-seeding caused the floods of which the plaintiff complained.<sup>35</sup> In *Adams et al. v. The State of California* (1964)<sup>36</sup> the plaintiffs claimed damages in the millions of dollars on grounds that cloud-seeding by Pacific Gas and Electric Company caused a flash flood of the Feather River. The Court denied money damages and, contrary to the testimony of plaintiffs' expert witness, it found that the effects of cloud-seeding were limited to Lake Almenor which had not spilled before or during the flood. In *Pennsylvania Natural Weather Association v. Blue Ridge Weather Modification Association* (1968)<sup>37</sup> the plaintiffs petitioned for injunction against hail suppression on grounds *inter alia* — that cloud-seeding interferes with rights of landowners to receive precipitation in its undisturbed, natural state. The Court found for the modifier because there was no proof that plaintiffs were deprived of any water as a consequence. In a Caro, Michigan, case, *Reinbold v. Sumner Farmers, Inc. and Irving P. Krick, Inc.* (1974), the Court denied an injunction against further seeding, and did not sustain plaintiff's claim for damages on grounds that a legal cause was not demonstrated.

The above cases point to the conclusion that plaintiffs have not been able to make a tenable claim linking modification activities with damages. Plaintiffs' arguments fell because of the lack of adequate scientific accompaniments to the evidence produced before the courts. However, in one case, in Littlefield, Texas, *Farmers and Ranchers for Natural Weather v. Atmospheric, Inc.* (1974), the Court, although ruling for the modifiers, was convinced by expert testimony that seeding had not reduced precipitation as plaintiffs complained.

In view of the above, could modifiers ever lose a case? The answer must be explored on four levels: First, a modifier has yet to lose a case because of a plaintiff presenting incontestable evidence proving cause and effect. Second, in one case modifiers have lost only because of a township ordinance prohibiting weather modification, where potential pollution was cited as one of the dangers posed by cloud-seeding.<sup>38</sup> Third, modifiers have lost because of a failure to produce evidence that modification would not reduce precipitation on

33. *Slutsky v. City of New York*. 97 N.Y.S. 2d 238 (1950).

34. *Samples v. Irving P. Krick, Inc.* Civ. Nos. 6212, 6223, and 6224, W.D. Okla., 1954.

35. *Auvil Orchard Co. v. Weather Modification Inc.* Case No. 19268, Sup. Ct., Chelon County, Wash., 1956.

36. Docket No. 10112, Sutter County Sup. Ct., 1964.

37. Fulton County Ct., Common Pleas, 1968.

38. *Township of Ayr v. Fulk* (1968), Pennsylvania.

plaintiffs' land, thereby making an injunction permanent.<sup>39</sup> Fourth, modifiers have lost because of injunctions covering at least one season.<sup>40</sup>

Although the above cases belong to US municipal law, they more than adequately reflect the greatest challenge to an international law of weather modification: scientific limitations of proving cause and effect, and legal limitations linking acts done and damage suffered.

### INTERNATIONAL LAW OF WEATHER MODIFICATION

In this section emphasis will be placed upon the state of the international law of weather modification. Weather modification law is part of general international environmental law. In order to comprehend the legal foundation of weather modification, understanding one fundamental question is indispensable: what right does a State have to modify the weather?

Every study that addresses itself to the law of weather modification attempts to answer the following questions: (a) who owns the clouds; and (b) who has a *right to use* in the clouds?<sup>41</sup> To answer these questions in international law, an understanding of them in municipal, private and public, law is essential. For that purpose, examples will be drawn from US municipal law.

#### 1. *Municipal Law*

a) *Who Owns the Clouds?* It has been suggested that at a very early date man took many of the God-given objects from the negative community, (community of objects not subject to private ownership), by seizing them. Occupation subsequently led to the development of *right to use* and to ownership. Objects that were not seized were said to have been either valueless or beyond physical control.<sup>42</sup> The early civil law writers considered two such objects, air and wild animals,<sup>43</sup> common to all as a matter of natural law. They were regarded as being incapable of possession short of capture and hence considered common property prior to capture. As long as they remained so, no

39. *Southwest Weather Research, Inc. v. Duncan*, 319 S.W. 2d 940 (Tex. Civ. App., 1958); and *Southwest Weather Research, Inc. v. Rounsaville*, 320 S.W. 2d 211 (Tex. Civ. App., 1958). In these cases, consolidated for purposes of appeal, the court issued a temporary injunction restraining hail suppression in the area of court's jurisdiction, until it could be shown that modification would not reduce precipitation on plaintiffs' land. The appellate court modified this ruling to apply only to activities over plaintiffs' land. The Texas Supreme Court affirmed. No evidence was introduced by the modifier, and in effect the injunction became permanent.

40. See for example: the two Texas cases, *id.*; and the Washington case, *supra* note 35.

41. For discussion of the views in the 1940s, *supra* note 30. For more recent discussions, see McKenzie, *supra* note 2.

42. Note, *supra* note 30, at 46 citing Pothier, *Traité du Droit de Propriété*, No. 21 (referring to Institutes of Justinian).

43. Other such objects include running water and the high seas.

one had any private property rights in them.<sup>44</sup> It must be noted that there is a difference between *air* and *airspace*. The Romans, when speaking of air as common property, did not mean airspace. Airspace was considered *res commercium* (capable of transaction), whereas air was considered *res extra commercium* (incapable of transaction).<sup>45</sup> Airspace refers to the physical area above the surface: Air is understood to be the body of the earth's atmosphere.

In resolving the question of ownership, recourse is often made to the Latin maxim *cujus est solum ejus est usque ad coelum et ad inferos* (he who owns the soil owns everything above and below, from heaven to hell)<sup>46</sup> and to common law elements of ownership in *ferae naturae*. The object of ownership is the corpus of the atmosphere which includes individual drops, particles, and components of the atmosphere. The *ad coelum* theory purports to establish that owning the land carries with it ownership of the corpus of the atmosphere in the airspace. There appears to be, however, two limitations to such a proposition. First, unlike mineral resources which underlie the land and belong to the land-owner because of *ad inferos*, clouds are transient. Second, the *ad coelum* theory does not set a concrete limit to the heavenly extension of ownership rights in objects existing in one's air-space. The advent of the Air Age began to invalidate the figurative meaning of the *ad coelum* theory. The extent of ownership of the airspace has been reduced to that "necessary or convenient to the enjoyment of the land."<sup>47</sup> The transient nature of the corpus of the atmosphere, coupled with upward limitations on the ownership of the airspace, appears to deny a landowner an *ipso facto* and *ab initio* ownership in the corpus of the atmosphere appearing overhead. What the *ad coelum* theory provides, however, is that he may assert a usufructory right in the clouds when they enter his airspace.

The corpus of the atmosphere being transient, how is one to assert a usufructory right while it passes through one's airspace? It is here that the concept of wild animals, *ferae naturae*, is advanced. An animal, *ferae naturae*, does not belong to a landowner just because it frequents his property, be it land, or airspace. Ownership in animals *ferae naturae* begins at the time of capture and possession, and if they regain their liberty one's ownership in them ceases.<sup>48</sup> The closest *ferae naturae* analogy to the corpus of the atmosphere is

44. McKenzie, *supra* note 2, at 403-404.

45. The distinction is made by Samuel C. Wiel, *Water Rights in the Western States*, 3rd ed. 1911—cited by McKenzie, *supra* note 2, at 404.

46. For a brief discussion of the maxim see Clarence E. Manion, *Law of the Air: Cases and Materials*. Indianapolis: The Bobbs-Merrill Company, Inc., 1950, at 1-4.

47. For the American case that rejected the theory of ownership to the heavens as a "figure of speech" see *Hinman v. Pacific Air Transport* 84 F. 2d 755 (9th Cir. 1936), cited in Manion, *supra* note 46, at 21.

48. It is understood that one's property in *ferae naturae* does not cease should they have *animus revertendi*.

birds which are both airborne and transient. Assertion of title to birds on the basis of their presence in a jurisdiction alone has been rejected.<sup>49</sup> However, if there is any attempt to capture *ferae naturae* in order to acquire possession and to establish ownership, it is to be so done as not to cause an action in trespass, i.e., on one's property. It appears, *prima facie*, that if animals *ferae naturae* can be captured, possessed, and ultimately owned the corpus of the atmosphere can also be captured, possessed, and ultimately owned. However, the literature refutes this proposition, but for the wrong reasons. It has been stated that the clouds, unlike animals *ferae naturae*, are incapable of being reduced to possession, thus becoming private property.<sup>50</sup> Such contentions seem based on two propositions: clouds are fugitive and vague in nature;<sup>51</sup> and clouds cannot be possessed because of physical difficulties.<sup>52</sup> Such statements are not legal arguments, however, for determining the non-ownership of the corpus of the atmosphere; they are statements of science. Science has indeed enabled man to occupy, to use, or to control physically the objects which once belonged to the negative community. However, there is a non-scientific explanation for the irreducibility of the corpus of the atmosphere to private ownership. The question is whether the corpus of the atmosphere is incapable of being owned because the necessary technology is lacking, or because it is legally common to all. If it is indeed the former, then the ownership of clouds would depend on science, and hence nothing is inherently in the negative community. If it is the latter, then ownership of the corpus of the atmosphere is impossible by a prior rule of law regardless of human abilities. *It is submitted here that irreducibility of the corpus of the atmosphere to private ownership depends upon a prior rule of law.* As stated previously, air, wild animals, running water, and the sea were regarded by the early civil law writers as common to all by natural law. Thus, private ownership in the corpus of the atmosphere is simply irrelevant.

49. Justice Holmes in *Missouri v. Holland*, 252 U.S. 416 (1920) stated: "To put the claim of the State upon title is to lean upon a slender reed. Wild birds are not in the possession of anyone; and possession is the beginning of ownership. The whole foundation of the State's rights is the presence within their (sic) jurisdiction of birds that yesterday had not arrived, tomorrow may be in another State and in a week a thousand miles away."

50. Hunt, *supra* notes 16 and 32.

51. Note, *supra* note 30 at 49 states that clouds are "vague and fugitive" in nature, and that they are not capable of being occupied. It concludes that: "Trying to assert 'legal title' to a cloud would be ridiculous. A Cloud may naturally dissipate. It constantly changes shape, location, content, and size; it may divide into two or more clouds; it may merge with other clouds; it may evaporate entirely."

52. McKenzie, *supra* note 2, at 407-408 proclaims that the doctrine of *ferae naturae* "should have no application in weather modification law. The difficulty in effectively reducing the corpus of the atmosphere to possession prior to the time those particles and molecules form precipitation is nearly impossible. An air-tight container would be required for such an undertaking, and the size of this container would be prohibitive in large-scale operations."

b) *Usufructory Rights in the Corpus of the Atmosphere*. Private ownership in the corpus of the atmosphere being ruled impossible, the question arises as to the legal foundations of its private use.

The corpus of the atmosphere is common property. Therefore, its use, a function of proprietorship, is also common to all. In this respect a landowner possesses a *right to use* in the corpus of the atmosphere which frequents his property. The corpus of the atmosphere has been properly analogized to running waters. No one owns the corpus of a river. However, riparians enjoy a natural right to use the water based on their abutment to the water course, one that is not lost by non-use. Non-riparian appropriators also enjoy a *right to use* in the water, one that is acquired by continued use but may be lost by prolonged non-use.

The concept of natural rights entitles riparians to "the continued full flow of the stream, not perceptibly diminished in quantity or quality."<sup>53</sup> The application of quantity-quality criteria accomodates water utilization, replacing the natural rights concept with a doctrine of reasonable use. The right to use a stream is therefore not absolute but relative: its exercise should not interfere with others' rights to use the same stream because all riparians have equal *rights to use*. The same degree of reasonableness governs the exercise of usufructory rights regarding the corpus of the atmosphere.

In public law, under the doctrine of "public trust," the sovereign holds common property in public trust, and is empowered, subject to its own limitations, to protect and to regulate the use of common property for the benefit of its citizens. To legitimize the regulation and the protection of the corpus of the atmosphere *vis-a-vis* other sovereigns and its own citizenry, a claim of public ownership is set forth. By 1973, six states in the US had declared ownership of water in the clouds.<sup>54</sup> These declarations can be viewed to derogate from the principles of common ownership of objects that belong to no one individual. These objects are now to be regarded as common property of equal sovereigns, and not of one alone.<sup>55</sup> The declarations of the partial

53. Hunt, *supra* note 32, at 120.

54. The six states which claim sovereignty over the moisture in the atmosphere are Louisiana, Nebraska, New Mexico, North Dakota, South Dakota, and Wyoming (Fleagle, *et.al*, *supra* note 13, at 42). For example, "Wyoming enacted legislation in 1951 to treat water in clouds within the State's boundaries like the water in its streams: for the use of its residents and the State's best interests. This in effect gave the ownership of the clouds, and the water in them, to the State" (Rodney Gerik, "Legal Aspects of Weather Modification in Texas," 25 *Baylor Law Review* 501 [1973] at 502).

55. During the winter of 1976-77, unprecedented rainmaking activities in Colorado, Utah, California, Washington, and Oregon were undertaken in the hope of alleviating drought and snow shortage. In the ensuing debate against the operators, environmentalists and scientists, several warnings of possible legal action concerning the ownership of clouds were aired. In February 1977, the Attorney General of Idaho threatened to sue the State of Washington (Peter Gwynne, "The Cloud-Coaxers," *Newsweek*, 14 March 1977, p. 58).

sovereigns in the US, based in essence on the theory of *ad coelum* and *ferae naturae*, may well bow to the supervening sovereign, the Federal Government, which holds all common property in trust for the benefit of its citizens. It can be summarized then: (a) ownership in the corpus of atmosphere in private law is impossible because of a prior rule of law; (b) the corpus of the atmosphere is common property in which all have usufructory rights; and (c) ownership in the corpus of the atmosphere has been claimed by some federal states in public law.

## 2. International Law

a) *Who owns the clouds?* The fact that no State in the international community has claimed ownership in the corpus of the atmosphere within its jurisdiction<sup>56</sup> facilitates discussion of the question of who owns the clouds. As in private law, the legal bases of States asserting ownership or usufructory rights in the corpus of the atmosphere are the *ad coelum* and *ferae naturae* theories.

The sovereignty of a State over airspace above its territory is complete and exclusive.<sup>57</sup> In this respect, the theory of *ad coelum* has fewer physical limitations than it does in municipal law. The sole determinant of the vertical extent of a State's airspace is the decision of the State. However, the objects of weather modifications, i.e., clouds, occur naturally at a level well within the bounds of customary international law, as well as within the conventional limits of the atmosphere. What is of interest is not whether a State has ownership of the corpus of the atmosphere in its airspace; rather it is whether the corpus of the atmosphere within its airspace can be subject to ownership. As shown in municipal law cases, the theory of *ad coelum* has no application to objects frequenting the airspace; it remains insufficient to provide the State with *ipso facto* and *ab initio* ownership in the corpus of the atmosphere. The question must resort to an international law of animals *ferae naturae*.

Under the international legal precedent, established in the *Behring Sea Fur-Seals Arbitration*,<sup>58</sup> the fact that animals breed in or frequent the "territory" of a State does not provide an exclusive property right or special jurisdiction over them elsewhere, even on the high seas. Applied to clouds, this means no State can claim ownership in the corpus of the atmosphere frequenting its airspace, or prohibit others from exercising usufructory rights in it as it moves from one

56. UNGA Res. 3171 (XXVIII) on Permanent Sovereignty Over Natural Resources, 17 December 1973, makes reference only to natural resources on land within international boundaries, in the seabed, in the subsoil thereof, within national jurisdiction and in the superjacent waters.

57. Article 1, Convention on International Civil Aviation, signed at Chicago, 7 December 1944, entry into force 4 April 1947. 15 UNTS 295.

58. For the text of Convention Relating to Fur-Seals in Behring Sea (US and GB), 9 May 1892, and the Award of 1893, see I Malloy, *Treaties, Conventions, International Acts, Protocols and Agreements Between the United States and Other Powers 1776-1909*, 1910, at 746. For a discussion of "property and possession" in the fur-seals, see Hersch Lauterpacht, *Private Law Sources and Analogies of International Law*. London: Longmans, Green and Co. Ltd. 1927, at 225.

State to another. The corpus of the atmosphere is common to all, an object of an international negative community, much like *ferae naturae*, international water courses, and the high seas. All States have certain rights attached to such objects. In the case of territorial seas (the most restrictive legal regime of the seas), other States enjoy a right of innocent passage. In the case of *ferae naturae*, other States have a right to reduce them into possession only within their jurisdictions, or where no State has exclusive jurisdiction, e.g., the high seas. The precepts of natural servitude in the case of international water courses also precludes any one State from owning the corpus of a stream just because it passes through its territory. In the case of air, States are entitled to reasonably pollution-free air. With such rights existing for others, exclusivity (positive) of ownership is unsustainable. The corpus of the atmosphere is common property in which rights are only those of *usufruit*.

*b) Usufructory Rights in the Corpus of the Atmosphere.* In the case of municipal law, it was found that the sovereign holds common property in public trust regulating use for the benefit of its citizens.<sup>59</sup> In a world of horizontally organized sovereign centers of power, i.e., States, the supervening authority is primarily positive international law, whose existence and whose writ are at the mercy of State consent. Thus far there is no specific body of laws regulating weather modification activities, i.e., exercise of usufructory rights in the corpus of the atmosphere. However, there is much in extant international law that can be applied to weather modification by way of analogy: international riparian law, and international air pollution law.

Riparian rights and the right to natural diffusion of the air, reasonably free from dust, smoke, or other pollution are only two of the natural rights attached to ownership of land.<sup>60</sup> International riparian law does not recognize the ownership of the corpus of a stream by one State. That is precisely why riparians enjoy equal rights to use the stream and are limited to a reasonable use of the water. An upper riparian, having a dominant position relative to the lower riparian, has the physical power to deprive the lower riparian of a continued flow of water, or to diminish its quality or quantity. Based upon the concept of territorial sovereignty, attempts are sometimes made to represent the exercise of the power of denial as a legal right, so as to avoid responsibility for injury. The "Harman Doctrine" was one such attempt toward recognizing that usufructory rights in the corpus of a stream held in co-tenancy with other riparians did not exist. That doctrine, relying on a supposed *lacuna* in positive international law, has no validity in international law. Lauterpacht states:

59. Fleagle, *et al.*, *supra* note 13, at 42 report that in 1973 the number of states in the US, having weather modification regulations, stood at twenty-nine. Only Maryland had banned all weather modification activities.

60. Hunt, *supra* note 32, at 120. Other rights include the right to lateral and subjacent support of land, the right to natural drainage, and the right to use the land for any reasonable purpose.



... it is a rule of International Law that no State is allowed to alter the natural conditions of its own territory to the disadvantage of the natural conditions of the territory of a neighbouring State. For this reason a State is not only forbidden to stop or divert the flow of a river which runs from its own to a neighbouring State, but likewise to make such use of the water of the river as either causes danger to the neighbouring State or prevents it from making proper use of the flow of the river on its part.<sup>61</sup>

In the *Lake Lanoux* case,<sup>62</sup> an arbitral tribunal found that France's diversion project was unobjectionable because the project provided Spain with water compensating for the water that France intended to divert, a flow normally received downstream by Spain.

The standard of reasonable use, an expression of co-equal usufructory rights in the corpus of a stream, has been reiterated in the 1966 "Helsinki Rules": reasonable and equitable share in the beneficial uses of the waters, determined by taking all relevant factors into account.<sup>63</sup>

Entitlement to natural diffusion of the air, reasonably free from dust, smoke, or other pollution, is another natural right attached to the ownership of land. The *Trail Smelter Arbitration* decision held that:

Under the principles of international law...no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes on or to the territory of another or the properties or persons therein, when the case is of a serious consequence and the injury is established by clear and convincing evidence.<sup>64</sup>

This can be taken as affirming that Canada has a usufructory right in its use of the air, including pollution, that carries into the US. It also affirms that the US has a right to receive that air reasonably free from dust, smoke or other pollution. The right to pollute the air (Canada), and the expectation to receive air free of pollution (US) are expressions of usufructory rights in the air common to both countries, delimited by the precepts of reasonable use (Canada) and reasonable expectation (US).

61. Hersch Lauterpacht, *Oppenheim's International Law*, 8th ed. Volume I: Peace. New York: David McKay Company Inc., 1955 at 474-5.

62. *Affair du Lac Lanoux* (France-Spain), 16 November 1957, 12 UNRIAA, at 281. Translated in 53 AJIL: 156 (1959).

63. ILA, Report of 52nd Conference, Helsinki, 1966, at 477. The "Helsinki Rules" are best considered *lex ferenda* and as a statement of the teachings of highly qualified publicists.

64. 3 UNRIAA, at 1965.

The precepts of riparian rights and air pollution law when applied to weather modification suggest: (a) a State has a usufructory right in the corpus of the atmosphere; (b) a State must be cognizant of and recognize the existence of other States' usufructory rights; and (c) a State must limit its exercise of the usufructory right to reasonable use so as not to cause damage to other States.

CONCLUSION: IS INTERNATIONAL LAW CAPABLE OF  
RESOLVING WEATHER MODIFICATION DISPUTES?

The state of an international law of weather modification is as thin as clouds themselves. There exists only one treaty regarding weather modification: the US-Canada Agreement on the Exchange of Information on Weather Modification Activities.<sup>65</sup> The Agreement recognizes in its preamble, the desirability of developing an international law relating to weather modification activities which have transboundary effects. Article 7 of the Agreement, however, points out that "nothing herein relates to or shall be construed to affect the question of responsibility or liability for weather modification activities, or to imply the existence of any generally applicable rule of international law."

There are, however, some salient features to the Agreement. First, it recognizes that, due to geographic proximity and diversity of weather modification activities in both countries, activities carried out by either Party or its nationals may affect the territory of the other. Second, it provides for consultation and exchange of information prior to the commencement of weather modification "activities of mutual interest." The Agreement does not require transmittal of proprietary information or that which is prohibited from disclosure by law. By virtue of the consultation and exchange of information, as limited as it may be, the Agreement provides adequate opportunity for protests by either Party. Furthermore, such a provision may prove helpful in alleviating some of the burden that rests on the shoulder of the plaintiff, proof and causation. Third, and most important, is the recognition that both Parties have vested interests in the weather, and have mutual interests in preventing man-made cloudbursts from causing injury to life and property. It is on this basis that both Parties have brought out of their respective reserved domains the weather modification "activities of mutual interest." The Agreement defines "activities of mutual interest" as:

Activities carried out in or over the territory of a Party within 200 miles of the international boundary; or such activities where conducted, which, in the judgment of a Party, may significantly affect the composition,

65. Of March 1975. Reprinted in 14 *ILM* 589 (May 1975).

behavior, or dynamics of the atmosphere over the territory of the other Party.

Aside from the above, there exists an effort on the part of the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) to establish principles of conduct regarding weather modification. In November 1975, an informal meeting of WMO and UNEP convened in Geneva, Switzerland, to consider international legal principles and guidelines in conjunction with scientific advances in weather modification. It was recognized that:

Even though the present state-of-the-art of weather modification is not yet adequate to permit developing formal legal instruments for regulating activities, it is feasible to begin to establish certain principles.<sup>66</sup>

The UNEP has construed the following strategy for weather modification:

Consultation towards the development of legal provisions to ensure that weather modification experiment and operations within the jurisdiction or control of States do not damage the environment of other States or areas beyond the limits of national jurisdiction; consultations with WMO and other scientific and legal experts on the development of general principles and operating guidelines on weather modification.<sup>67</sup>

To conclude from the above, the state of the international law of weather modification lacks enumeration of specific wrongs. As long as there exist no specific wrongs, enumeration of principles is the source of guidelines for States. Only when specific weather modification effects can be predicted and analyzed will principles be replaced by more specific, guidelines for State behavior.

Absent a substantive law of weather modification, international law has recourse to three tools for settling weather modification disputes: (1) analogies drawn from the customary international law of rivers; (2) extension of environmental laws such as air pollution to cover weather modification; and (3) general principles of law common to (1) and (2) despite the limitations that *stare decisis* imposes on international law. Riparian law and air pollution have been the subjects of discussion above. Here, an attempt will be made to demonstrate that the principle *sic utere tuo ut alterum non laedas* not only finds application to weather modification but also to riparian rights and air pollution. The principle *sic utere tuo* (do not use that which is yours to injure

66. EMO II, *supra* note 23, at 47.

67. Governing Council, 5th Sess., Nairobi, 9-25 May 1977, "Compendium of Approved Objectives, Strategies and Concentration Areas for the Environment Programme," UNEP/GC/Information 1, 24 January 1977, at 4.

another) will be shown to be a rule of customary international law, independent of the nature of State activities.

Lauterpacht argues that:

The major part of the law of torts is nothing else than the affirmation of the prohibition of abuse of rights. It is largely the result of a compromise, by reference to requirements of justice and social needs, between the conflicting principles *sic utere tuo ut alterum non laedas* and *qui utitur jure suo alterum non laedit*.<sup>68</sup>

Whatever the merits of *abus de droit* as a principle of law importable into international law, it appears to say nothing of the specific content and extent of certain rights. It merely says that, "whatever these rights are, they must not be used in such a manner that its anti-social effects outweigh the legitimate interests of the owner of the right."<sup>69</sup> It is at best "a way of measuring and interpreting legal rights and obligations."<sup>70</sup> Most of the so-called abuses of right can be explained as specific wrongs, needing no general principle to sustain them.<sup>71</sup> The question has been raised whether *sic utere tuo* is not merely a restatement of *abus de droit*. It is submitted that such a proposal is incorrect. First, abuse of rights is too vague to be considered a custom and there are too many discrepancies in municipal law systems to constitute it as a general principle of law.<sup>72</sup> *Sic utere tuo*, on the other hand, is not only an established rule of customary international law, it is also a general principle common to all legal systems. Second, to discover that there has been an abuse of right recourse must be made to an authority which can establish such an abuse. The principle of *sic utere tuo*, however, is one of self-restraint which limits State action short of causing injury to other States.

Abuse of rights is said to be a compromise between the conflicting principles of *sic utere tuo*, and *qui utitur jure suo alterum non laedit* (one who stands on his right cannot injure another). Lauterpacht's assertion is misconceived. From a theoretical perspective the principle of *qui utitur jure suo* cannot be deemed to give rise to tort. It is hardly conceivable that one who stands on his right can possibly injure someone else. It can only be injurious to another when that right is a relative one.<sup>73</sup> The principle does not say much about the exercise of

68. Hersch Lauterpacht, *The Function of Law in the International Community*. 1927. Hamden, Connecticut: Archon Books 1966, at 295.

69. Friedmann, *supra* note 25, at 198.

70. *Id.* at 199

71. Georg Schwarzenberger, *A Manual of International Law*, 5th ed. New York: Frederick A. Praeger, 1967, at 106-107.

72. *Id.* at 106-107.

73. Support for this writer's assertion can be found in the "note Doctrinale" appended to the

that right; but it is precisely here that the principle of *sic utere tuo* functions to delimit the extent of a permissible exercise of that right. At this point the relative or absolute character of the right becomes of secondary importance; it is the result of the exercise of the right that assumes primary importance. Thus, conceptually, the principles of *sic utere tuo* and *qui utitur jure suo* are *not conflicting, but complementary*. The former seems to place a limit on the exercise of a right, whereas the latter is more concerned with the right itself. For example: a State may have a right to modify the weather; yet the exercise of that right is limited to a point at which it would cause injury to another State. The principle *sic utere tuo* provides the duty of self-restraint which is attached to *qui utitur jure suo*.

International law has had numerous occasions to affirm the concept of *sic utere tuo*; as noted above. The decision in the *Trail Smelter Arbitration* held that no State has the right to use its territory to cause injury to another State.<sup>74</sup> In one dissenting opinion in the *French Nuclear Tests Case*, specific reference was made to the principle of *sic utere tuo* as decisive in establishing France's responsibility had the case been considered on the merits.<sup>75</sup> In the *Corfu Channel Case*, the Court also adopted the concept of *sic utere tuo*.<sup>76</sup>

discussion of *Affair de la Fermeture de Buenos-Ayres* (Great Britain-Argentina), Award of 1 August 1870 (cited in A. de Lapradelle and N. Politis, *Recueil des Arbitrages Internationaux*, 1923, vol. II: 1856-1872, at p. 637). Great Britain had urged that Argentina, by failing to notify it of the blockading of Buenos-Ayres was responsible for the idemnification of losses suffered by British cargo ships. The Arbitor, President J.J. Perez of Chile, decided in the favour of Argentina, espousing its view that 'Mais en temps de guerre, il n'est pas de même: l'urgence peut s'imposer pour le salut de l'Etat; la fermeture risquera de manquer son but si elle n'est pas immédiate; les necessites de la guerre rendent légitime le mal cause au com merce neutre'. The Argentine defense was that 'les préjudices resultant de l'ignorance de cette mesure ne sont pas imputable a celui qui l'a prise, car, ayant fait usage de son droit; il n'a offensé personne: *qui jure suo usitur nemini facit injuriam*. . .'. The reporters, Lapradelle and Politis, comment that, "Le principe de jurisprudence universelle qui couronne le raisonnement de l'arbitre est trop vague pour être toujours vrai. Pour que l'usage du droit ne soit pas source de responsabilité, il faut que le droit dont il est fait usage soit un droit absolu, inconditionne, qu'il ne receive aucune limite du chef du droit d'autrui".

74. See *supra* 63 note.

75. *Nuclear Test* (Australia v. France), Judgement of 20 December 1974, *I.C.J. Reports*, 1974, p. 253. The dissenting opinion of De Castro (at pp. 388-390) recognized that the rule invoked in *The Trail Smelter* is now part of customary international law.

76. *Corfu Channel Case*, Judgement of 9 April 1949, *I.C.J. Reports*, 1949, p. 4. The oft-cited part of the decision (at p. 22) reads:

"The obligations incumbent upon the Albanian authorities consisted in notifying, for the benefit of shipping in general, the existence of a minefield in Albanian territorial waters and in warning the approaching British warships of the imminent danger to which the minefield exposed them. *Such obligations are based, not on the Hague Convention of 1907, No. VIII, which is applicable in time of war, but on certain general and well recognized principles, namely, elementary considerations of humanity, even more exacting in peace than in war; the principle of the freedom of maritime communication; and every*

The concept of *sic utere tuo* also appears in two instruments relating to weather modification, one explicitly and the other by inference. The US-Canada Agreement recognizes that weather modification activities by either party may affect the territory of the other.<sup>77</sup> The Scandinavian Convention on the Protection of the Environment<sup>78</sup> has defined "environmentally harmful activities" in terms of nuisance, and, by the inclusion of *etc.* at the end of a list of enumerations of such activities, has left the door open to include weather modification. Article 3 of the Convention, although including a requirement of "exhaustion of local remedies," recognizes that nuisance could be caused by another state. The notion of *sic utere tuo* is also implied insofar as the instrument provides remedy for foreign victims of such transboundary nuisance; and by definition, such obligation rests on the fact that if one causes nuisance to another, then one must avail oneself of orderly legal processes to remedy the wrong.

Further reiterations of the concept appear in at least three declarations relating to general environmental legal principles. Principles 21 and 22 of the Stockholm Conference on the Human Environment<sup>79</sup> reiterate and enlarge the rule invoked in *The Trail Smelter*; they are an embodiment of *sic utere tuo*. Principle 21 holds that:

States have, in accordance with the Charter of the United Nations and the principles of international law, the Sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that the activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 22 provides that:

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*State's obligation not to allow knowingly its territory to be used for acts contrary to the rights of other States.*" (emphasis mine)

It appears that laying mines in one's territorial waters is a right, compatible with the concept of sovereignty. The absence of notification makes the act subject to *sic utere tuo*. The decision is compatible with a maritime *abus de droit* case, *Affair de Portendik*, Award of 30 November 1843, where France was held responsible for the damages suffered by certain British ships because of France's un-notified blockade of Portendik (reported in Lapradelle and Politis, *supra* note 72, 1905, Vol. I: 1798-1855, at 512). The element of "knowingly" in *Corfu* seems traceable to the element of "permitting" in *The Trail Smelter*. It may be argued that the existence of "malicious intent" gives rise to liability for intentional invasions in trespass and nuisance. It also seems that *sic utere tuo* includes acts that engage State responsibility for intentional invasions, liability resulting from negligence, and strict liability.

77. See *supra* 64 note.

78. Denmark-Finland-Norway-Sweden: Convention on the Protection of the Environment, Stockholm, 19 February 1974. Reprinted in 13 *ILM* 591, 1974.

79. UN Conference on the Human Environment, Final Document, adopted 16 June 1972. Reprinted in 11 *ILM* 1416 (November 1972).

States shall cooperate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.

Article 44 of the Declaration on African Cooperation, Development and Economic Independence<sup>80</sup> states that African countries are always guided by the principles adopted at the Stockholm Conference. The Declaration of the Council of European Communities and of the Representatives of the Governments of the Member States,<sup>81</sup> in Article 6 of Part I, Title II (Principles of a Community Environment Policy) reaffirms that States should give care to ensure that activities carried out in one State do not cause any degradation of the environment in another State.

To conclude, the principle of *sic utere tuo* is a principle of customary international law. The principle being established, is international law really equipped to deal with an international weather modification dispute? From the point of view of a specific body of laws, the answer is no. From the point of view of general principles the answer is more positive. The resolution of an international weather modification dispute on the basis of *sic utere tuo* depends on two fundamental prerequisites. In the language of *The Trail Smelter Arbitration* the harm must be of serious consequence, and injury must be established by clear and convincing evidence. In this respect, it is essential that the state-of-the-art of weather modification develop to an extent that it may enable a plaintiff to demonstrate cause (act of modifying state) and effect (convincing evidence of injury of serious consequence).

80. Of 28 May 1973. Reprinted in 12 *ILM* 996 (July 1973).

81. Meeting in the Council, 22 November 1973, on the Programme of Action of the European Communities on the Environment. Reprinted in 13 (1) *ILM* 164, January 1974.